Vascular Flora of Ketona Dolomite Outcrops in Bibb County, Alabama

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ABSTRACT

Explorations since 1992 in Bibb County, Alabama, have revealed an extraordinary, undescribed glade community developed over the Ketona Formation, an unusually pure dolomite. Eight new endemic taxa were found: *Castilleja kraliana*, *Coreopsis grandiflora* var. *inclinata*, *Dalea cahaba*, *Erigeron strigosus* var. *dolomiticola*, *Liatris oligocephala*, *Onosmodium decipiens*, *Silphium glutinosum*, and *Spigelia gentianoides* var. *alabamensis*. In assessing systematic relationships of the *Erigeron* and *Silphium*, two additional undescribed taxa, not of Bibb County, were discerned, *E. strigosus* var. *calcicola* and *S. perplexum*. Seven state records were discovered: *Solanum pumilum*, last collected in 1837 and presumed extinct; *Astrolepis integerrima*, disjunct from Texas; *Paronychia virginica*, bridging a gap between Arkansas and Virginia; *Baptisia australis* var. *australis*, *Rhynchospora capillacea*, *R. thornei* and *Spiranthes lucida*. More than 60 plant taxa of conservation concern occur on or near these glades, marking them as one of the most significant reservoirs of botanical diversity in the eastern United States.

INTRODUCTION

The eastern United States has been well explored botanically. New species continue to be described every year, but mostly in difficult groups like *Carex* L. and *Isoëtes* L., and are usually "split" out of recognized species. The discovery of endemic plant communities with multiple undescribed species mostly occurs in remote regions of South America, Africa, or Southeast Asia.

In 1992 the United States Fish and Wildlife Service contracted with the first author to conduct a status survey in Alabama for *Arabis georgiana* Harper. As a part of efforts to explore comparatively inaccessible habitats, Allison organized a canoe trip in Bibb County, Alabama, with three friends: the second author and Jim and Debi Rodgers of Senoia, Georgia. By the end of the first morning (May 30), canoe travel had led to the discovery of several previously undocumented populations of *Marshallia mohrii* Beadle & F. Boynt., a federal Threatened species, on rocky places along the banks of the Little Cahaba River.

At midday, we noticed a strongly sloping, rocky area dominated by herbaceous vegetation, above the right bank of the Little Cahaba River. As we explored the site, it soon became apparent that it supported plant communities distinct from the well studied ones on flat, limestone outcrops ("cedar glades") in Tennessee, Kentucky, Alabama, and Georgia [see ASB Bulletin, vol. 33, no. 4 (1986), for a collection of articles on cedar glades, and Castanea, vol. 59, no. 3 (1994), on the closely related topic of "barrens" vegetation]. Although some of the woody species we saw on glades near the Little Cahaba were typical of calcareous glades and barrens (e.g., *Juniperus virginiana* L., *Quercus muehlenbergii* Engelm.), there were others that would have marked this as a distinctive glade community even in winter, such as *Pinus palustris* P. Mill. and *Sabal minor* (Jacq.) Pers., and particularly two shrubs in the Euphorbiaceae, *Leptopus phyllanthoides* (Nutt.) G. L. Webster and *Croton alabamensis* E. A. Sm. ex Chapman var. *alabamensis*. The herbaceous component, moreover, included a surprising number of unfamiliar taxa, along with recognizable rarities such as *Marshallia mohrii*. It was clear that this was a natural community that deserved further study.

Upon consulting the most recent statewide Alabama geological map (Szabo et al. 1988) we found that the locations of these glades all fell within a particular mapping unit, Ketona Dolomite. We discovered most of the localities that were not visible from a canoe by studying 1:24,000 topographic maps (on which glades often show as irregular white blotches within green areas) or through examination of infrared aerial photographs. The latter were available for inspection at the USDA Natural Resources Conservation Service office in Centreville, the county seat. Within regions on the photographs that corresponded to the Ketona Formation, as mapped by Szabo et al. (1988), we identified dozens of localities that had a similar appearance to that of known glades. By the time we completed the ground checking of these, we had found approximately 40 sites, defined as outcrops with characteristic flora and separated from each other by at least 0.2 km. For each glade we concocted a name and recorded the endemic, rare, or characteristic Ketona Glade species present.

PHYSICAL CHARACTERISTICS OF HABITAT

This ecosystem is apparently restricted to outcrops in Bibb County, Alabama, of the Ketona Formation, an unusually pure dolomite of Upper Cambrian age (Rheams 1992). These are all within a zone about 18 km long and at most about 0.8 km wide, within the southern "fringe" of the Ridge and Valley Physiographic Province (Figure 1).

Glades developing on the Ketona Dolomite (Ketona Glades) vary in size from about 0.1 hectare to at least 5 hectares and have a general appearance (Figure 2) resembling the cedar glades developed over limestone or dolomite in Alabama, Georgia, Kentucky, and Tennessee, though they are seldom as level as "classic" cedar glades. The terrain is mostly gently sloping or rolling, but varies from flat to sometimes very strongly sloping. There are patches of exposed bedrock, thin-soiled areas dominated by grasses and other herbaceous vegetation, variously sized islands and peninsulas of woody vegetation where soil has accumulated to greater depth, and marginal ecotones where the glade grades into the surrounding forest. In many areas the bedrock projects above the surrounding surface as low boulders or ledges.

We collected a sample of topsoil from an open area on each of four glades and submitted them through the Cooperative Extension Service of Georgia (University of Georgia/Georgia Department of Agriculture) to the state Soil Testing Laboratory for routine analysis. These tests indicated that the soil derived from the weathering of Ketona Dolomite is very high in magnesium and calcium but low in phosphorus and potassium. The soil reaction is mildly alkaline, with a pH range from 7.4 to 7.6.

The climate of central Alabama is characterized by mild winters, with temperatures often falling below freezing at night but seldom remaining so all day, and warm, humid summers. The physical environment of the Ketona Glades, given its lower latitude, is presumably somewhat milder in winter and warmer in summer than the regions to the north in which glades occur.

BIOLOGICAL COMMUNITIES

The flora of the Ketona Glades is distinguished from those found in other glade, barren, or prairie habitats by containing eight endemic taxa, plus a number of species that are otherwise rare or unknown from glade habitats, along with many taxa well known to frequent such places.

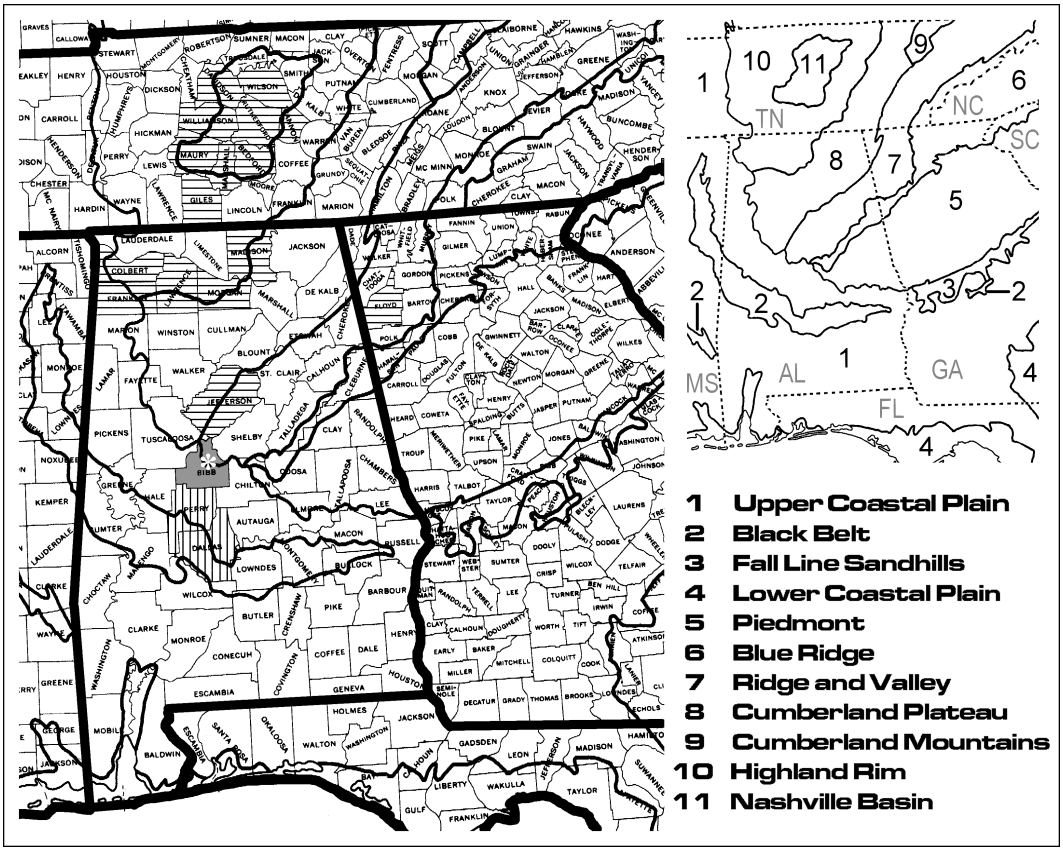

Figure 1. Left: county map of Alabama and portions of some nearby states; Bibb County, Alabama shaded in gray, with general location of Ketona Dolomite Glades marked with a white asterisk; horizontal hatching = known county distribution of *Erigeron strigosus* var. *calcicola*; vertical hatching = county distribution of *Silphium perplexum*. Right: guide to boundaries of states (dotted lines) and physiographic regions demarcated at left. Base map derived from Physical Map of the Southeast, copyright 1967 by Wilbur H. Duncan.

The dominant grass species of the open glade is *Schizachyrium scoparium* (Michx.) Nash, but it usually does not achieve great density and is an aspect dominant only late in fall and winter, when the strong forb component is muted. Other characteristic plants of this community include *Agalinis purpurea* (L.) Pennell, *A. tenuifolia* (Vahl) Raf., *Allium canadense* L. var. *mobilense* (Regel) M. Ownbey, *Amsonia ciliata* Walt. var. *tenuifolia* (Raf.) Woods., *Andropogon gerardii* Vitman, *A. virginicus* L., *Asclepias viridiflora* Raf., *Callirhoë alcaeoides* (Michx.) Gray, *Castilleja* Mutis ex L. f. sp. nov., *Cnidoscolus stimulosus* (Michx.) Engelm. & Gray, *Coreopsis grandiflora* Hogg ex Sweet var. nov., *Dalea* L. sp. nov., *Erigeron strigosus* Muhl. ex Willd. var. nov., *Fimbristylis puberula* (Michx.) Vahl, *Gaura filipes* Spach, *Hedyotis nigricans* (Lam.) Fosb., *Hypoxis hirsuta* (L.) Coville, *Isoëtes butleri* Engelm., *Leavenworthia exigua* Rollins var. *lutea* Rollins, *L. uniflora* (Michx.) Britt., *Leptopus phyllanthoides*, *Liatris* Gaertn. ex Schreb. sp. nov., *L. cylindracea* Michx., *Linum sulcatum* Riddell var. *sulcatum*, *Lobelia spicata* Lam., *Marshallia mohrii*, *Mecardonia acuminata* (Walt.) Small var. *acuminata*, *Minuartia patula* (Michx.) Mattf., *Mirabilis albida* (Walt.)

Figure 2. Ketona Dolomite glade, Bibb County, Alabama, April 1994. Woody aspect dominant is *Juniperus virginiana*, the herbaceous dominant, *Amsonia ciliata* var. *tenuifolia*.

Heimerl, *Nothoscordum bivalve* (L.) Britt., *Onosmodium* Michx. sp. nov., *Oxalis priceae* Small ssp. *priceae*, *Paronychia virginica* Spreng., *Penstemon tenuiflorus* Pennell, *Polygala boykinii* Nutt., *P. grandiflora* Walt., *Rhynchospora colorata* (L.) H. Pfeiffer, *Rudbeckia triloba* L. var. *pinnatiloba* Torr. & Gray, *Ruellia humilis* Nutt., *Sabal minor*, *Salvia azurea* Lam., *Schoenolirion croceum* (Michx.) Wood, *Scutellaria parvula* Michx., *Silphium* L. sp. nov., *Solidago ulmifolia* Muhl. ex Willd., *Spigelia gentianoides* Chapman in A. DC. var. *alabamensis* K. Gould, *Spiranthes magnicamporum* Sheviak, *Sporobolus junceus* (Michx.) Kunth, *Tetragonotheca helianthoides* L., and *Yucca filamentosa* L. Also frequent is a moss, *Pleurochaete squarrosa* (Brid.) Lindb. *Amsonia ciliata* var. *tenuifolia* is often abundant and dense enough to be an aspect dominant in spring, and *Rudbeckia triloba* var. *pinnatiloba* is occasionally an aspect dominant in summer.

Plants of marginal ecotones or isolated patches where deeper soil has accumulated include *Acer leucoderme* Small, *Asclepias verticillata* L., *Berchemia scandens* (Hill) K. Koch, *Bignonia capreolata* L., *Blephilia ciliata* (Pursh) Benth., *Carex eburnea* Boott, *Carya pallida* (Ashe) Engl. & Graebn., *Celtis tenuifolia* Nutt., *Cercis canadensis* L., *Croton alabamensis* var. *alabamensis*, *Delphinium carolinianum* Walt. ssp. *carolinianum*, *Echinacea purpurea* (L.) Moench, *Fleischmannia incarnata* (Walt.) King & H. E. Robins., *Forestiera ligustrina* (Michx.) Poir., *Frangula caroliniana* (Walt.) Gray, *Heliopsis helianthoides* (L.) Sweet var. *gracilis* (Nutt.) Gandhi & Thomas, *Hypericum frondosum* Michx., *Ipomopsis rubra* (L.) Wherry, *Juniperus virginiana*, *Lithospermum canescens* (Michx.) Lehm., *Oligoneuron rigidum* (L.) Small, *Phlox amoena* Sims ssp. *amoena*, *Pinus echinata* P. Mill., *P. palustris*, *P. taeda* L., *Quercus muehlenbergii*, *Rhus aromatica* Ait., *R.*

copallinum L., *Salvia lyrata* L., *S. urticifolia* L., *Scutellaria alabamensis* Alexander, *S. incana* Biehler var. *punctata* (Chapman) C. Mohr, *Sida elliottii* Torr. & Gray, *Sideroxylon lycioides* L., *Silene regia* Sims, *Solanum pumilum* Dunal, *Symphyotrichum laeve* (L.) A. & D. Löve var. *concinnum* (Willd.) Nesom, *S. patens* (Ait.) Nesom, *S. shortii* (Lindl.) Nesom, *Thaspium barbinode* (Michx.) Nutt. var. *chapmanii* Coult. & Rose, *Toxicodendron radicans* (L.) O. Ktze., and *Viola walteri* House.

A lichen, *Psora rubiformis* (Ach.) Hooker vel aff., and several ferns are mostly restricted to exposed rocks, usually elevated above the surrounding surface: *Asplenium resiliens* Kunze, *Cheilanthes alabamensis* (Buckl.) Kunze, *C. lanosa* (Michx.) D. C. Eat., and *Pellaea atropurpurea* (L.) Link. Weathered Ketona Dolomite is dark gray in color, due to one or more unidentified crustose lichens.

A sizeable proportion of the species mentioned in the preceding paragraphs of this section are regularly found on and around limestone glades (or cedar glades; we use the terms interchangeably). In numbers of endemics, numbers of outcrops and in their aggregate area, cedar glades are best developed in the Nashville Basin of Middle Tennessee (Quarterman 1950). The characteristic cedar glade flora is also well established on glades found in northwestern Alabama and northwestern Georgia, as well as in some southeastern states more remote from Alabama, especially Kentucky, but also Virginia and West Virginia (Baskin and Baskin 1986, Bridges and Orzell 1986). Despite having many widespread calciphilic and/or xerophytic plant taxa in common, the Ketona Dolomite Glade flora is distinct from that of cedar glades, not only because of the endemic or other characteristic elements present in the Ketona Glade flora and absent from limestone glades, but conversely, by the sizeable number of endemic or characteristic elements of the limestone glade flora that are missing from the Ketona Glades. Cedar glade taxa occurring in both Middle Tennessee and northern Alabama that are absent or essentially so from the Ketona Glades include *Allium cernuum* Roth, *Astragalus tennesseensis* Gray ex Chapman, *Astranthium integrifolium* (Michx.) Nutt., *Dalea gattingeri* (Heller) Barneby, *Delphinium carolinianum* Walt. ssp. *calciphilum* Warnock [*D. virescens* auct. non Nutt.], *Eurybia hemispherica* (Alexander) Nesom [*Aster hemisphericus* Alexander], *Grindelia lanceolata* Nutt., *Heliotropium tenellum* (Nutt.) Torr., *Hypericum dolabriforme* Vent., *H. sphaerocarpum* Michx., *Lobelia appendiculata* A. DC. var. *gattingeri* (Gray) McVaugh, *Oenothera triloba* Nutt., *Onosmodium molle* Michx. ssp. *molle*, *Pediomelum subacaule* (Torr. & Gray) Rydb., *Ratibida pinnata* (Vent.) Barnh., *Rudbeckia triloba* L. var. *triloba*, *Sedum pulchellum* Michx., *Symphyotrichum priceae* (Britt.) Nesom [*Aster priceae* Britt.], *Talinum calcaricum* Ware, *Verbena simplex* Lehm., and *Viola egglestonii* Brainerd.[*] Furthermore, the dominant grass species of the Ketona Glades is *Schizachyrium scoparium*, a perennial, while the dominant grass of cedar glades is *Sporobolus vaginiflorus* (Torr. ex Gray) Wood, an annual that is rarely found on Ketona Glades except in places disturbed by humans.

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[*] We found a few of these on Ketona Glades as seeming recent introductions, most notably the cedar glade endemic *Pediomelum subacaule*, which has colonized a very small portion of a single large glade, close to a rough road crossing it. Similarly, the only known Ketona Glade occurrence of a characteristic but non-endemic cedar glade plant, *Verbena simplex*, is in the bed of a rough road crossing a different glade.

Baskin et al. (1994) attempted to resolve inconsistencies in the use of such terms as "glades," "barrens," and "limestone prairies" that have been used in discussing openings, dominated by grasses and forbs, that are developed over calcareous bedrock. They devised over a dozen criteria useful for assigning such places to one of three general categories: limestone glade, xeric limestone prairie, or barrens. The Ketona Glades fail several to many criteria for each of their three categories, but come closest to the "xeric limestone prairie" class. Since they differ from limestone prairies by developing over dolomite rather than limestone, by containing multiple endemics, and by supporting two species of *Leavenworthia*, the simplest course would be to establish a fourth category to accommodate the Ketona Glades.

NOTEWORTHY ELEMENTS OF THE FLORA

The Ketona Glade habitat exhibits an islandlike distribution, mostly in a single broad arc, with a region near the center of the arc where the outcrops are more numerous and where all of the larger glades occur. Species richness of sites corresponds well to models of island biogeography. All of the endemic and characteristic species can be found in the core area, and three of the endemic taxa are restricted to it. In general, the larger the glade, the greater the diversity of taxa it supports. An anomaly is *Astrolepis integerrima* (Hook.) Benham & Windham, which we found on none of the largest glades, but instead only on one moderate-sized and one small glade.

The Alabama Natural Heritage Program (ALNHP) maintains a database of information about plants, animals, and natural communities of Alabama, with an emphasis on those that are threatened with severe decline. Such threatened elements of biological diversity are "tracked," meaning that known occurrences are individually mapped and described in the ALNHP database. As we explored Bibb County habitats, we were continually surprised by new additions to the list of ALNHP-tracked elements found in the county. By 1995, we had recorded and reported to ALNHP a total of well over 600 individual rare[*] vascular plant element occurrences, representing a diverse array of taxa of conservation concern. Once incorporated into the ALNHP database, this information was used to set priorities for protection of sites critical to the conservation of this concentration of rare species. Results to date of protection efforts are discussed near the end of the body of this paper, under "Conservation Status."

Endemic Taxa

Eight new endemic taxa, all found during our initial field season (1992), are the most distinctive elements of the flora. Two of these, an *Onosmodium* (Boraginaceae) and a perennial variety of *Erigeron strigosus* (Asteraceae), are strongly characteristic of Ketona Glades, abundant at virtually every site. A well marked variety of *Coreopsis grandiflora* (Asteraceae) and a somewhat inconspicuous species of *Dalea* (Fabaceae) are also frequent, but neither reaches the glades near the western periphery of the Ketona Glade region. Near the center of this region, where the glades are most numerous and achieve their greatest areal extent (and the flora is best developed), all of these

[*] For purposes of this paper, taxa referred to as "rare" are defined as those formally recognized by ALNHP as being of conservation concern (tracked elements).

are joined by an endemic variety of *Spigelia gentianoides* (Loganiaceae), and a new, yellow-flowered species of *Castilleja* (Scrophulariaceae). On the glades in the very heart of the region, nested within the area where the ranges of all the others overlap, we found the rarest and most distinctive of the new taxa, a remarkable species of *Liatris* (Asteraceae). Finally, we found one Bibb County endemic whose range extends slightly beyond the Ketona Glades proper: an odd, densely glandular *Silphium* (Asteraceae), which occurs on the majority of Ketona Glades and also in rocky areas along Bibb County streams, where it grows over dolomite or limestone.

Comparison of these undescribed taxa with their putative nearest relatives, in the herbarium and in the field, led the first author to the conclusion that the theoretically closest relatives of both the new *Silphium* species and of the new variety of *Erigeron strigosus* were themselves previously unrecognized taxa in need of description. Their formal description is effected herein, so that the Ketona Glade endemics may be placed in their full systematic context. Supplementary information about these non-Ketona Glade taxa as well as color imagery of the Bibb County endemics can be found on the senior author's Web page (http://www.mindspring.com/~jallison/).

Next to the new *Liatris* and *Spigelia* L., a yellow-flowered *Castilleja* has the most restricted range of the Bibb County Ketona Glade endemics, found only on the glades near the Little Cahaba River and on one a little east of the Cahaba River.

It is a pleasure to be able to name a plant for Robert Kral of Vanderbilt University, in recognition of his many significant contributions to the botany of the southeastern states and to the taxonomy of some very difficult groups.

Castilleja kraliana J. Allison, sp. nov. TYPE: Alabama: Bibb County, ca. 15.7 km NE of Centreville, ca. 0.6 km NW of Bulldog Bend Bridge. "Bulldog Glade," Ketona Dolomite outcrop ca. 0.6 km N of the Little Cahaba River, 15 Apr 1998, *James R. Allison 10466* (holotype, NY; isotypes: AUA, BRIT, GA, GH, JSU, MICH, MO, TENN, UNA, US, VDB). Figure 3.

Inter species sectionis Euchromae (Nutt.) Benth. *sensu Pennellii* (Pennell 1935), *rosula sub anthesi plerumque persistenti et foliis non infrequenter lobatis ad C. coccineam* (L.) Spreng. *accedens sed calycibus brevioribus* (*ad* 1.8 cm *longis*) *et bracteis brevioribus* (*ad* 2.1 cm *longis*) *nunquam rubris generatim integris ab illa recedens.*

Annual or biennial herb, (1.6) 2–4 (4.9) dm tall from a basal rosette that usually persists into anthesis. *Stems* 1–several, erect, simple or few-branched, purple, gray-purple or brown, sulcate, especially upward, with an indument of short, glandular hairs and long, spreading, jointed, mostly eglandular hairs, becoming denser towards the inflorescence, more or less glabrescent below. *Leaves* with indument like that of the stem, especially along the margins and the conspicuous veins, the basal ones green or more often suffused to varying degrees with red, oblanceolate to obovate, 2–6 cm long, (0.6) 0.8–1.2 (4.3) cm wide, entire or sometimes with 1 or 2 rather small (to 4.5 mm long) lateral lobes, apices obtuse to broadly rounded or occasional extremes acute or subtruncate, the cauline ones mostly (3) 6–10 (12), normally green but sometimes the lower suffused with red, 1.1–6.5 cm long and 0.2–2.2 (2.6) cm wide, linear to linear-lanceolate or -oblanceolate or rarely elliptic, the lowest sometimes obovate, entire or with 1–4 (5) narrow, lateral lobes to 1.8 cm long, usually acute at the apex, occasionally with an axillary fascicle of greatly reduced leaves.

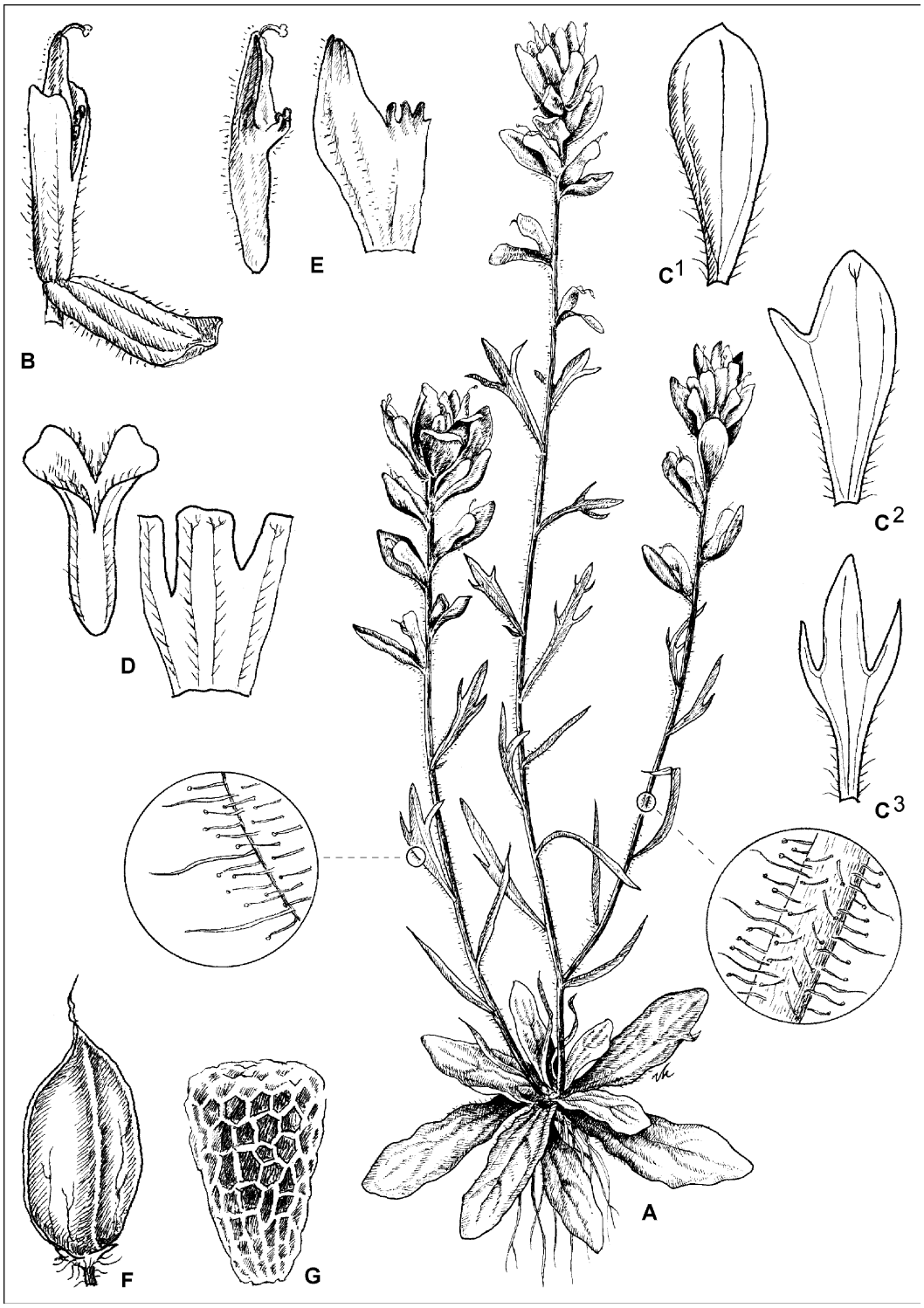

Figure 3. *Castilleja kraliana*. A. Habit, ×1/2, details showing hairs on stem and leaf. B. Flower, ×1 1/2, bract deflexed to show calyx. C. Some variations in bract shape, ×2, the usual shape at top. D. Calyx, ×1 1/2, dissected at right. E. Corolla, ×1 2/2, dissected at right. F. Capsule, ×3. G. Seed, ×25.

Inflorescence racemose, (2.2) 4–18.5 (24) cm long, dense and short at first, loosening and lengthening with age, most of the coloration coming from the bracts and calyx segments. *Flowers* nearly sessile, on pedicels at most about 1.5 mm long; bracts at anthesis shorter and broader than the upper leaves, obovate or less often oblanceolate, 1.1–2.1 cm long, entire or sometimes with 1 or 2 lateral lobes to 3 mm long, broadly rounded at apex, yellow (rarely orange) throughout or yellow (orange) distally and otherwise green, pubescent proximally, ciliate with long and short hairs proximally and with short hairs distally, after anthesis becoming more leaflike (becoming greener, lengthening to as much as 2.8 cm, lateral lobes, when present, particularly accrescent, to 7 or even 10 mm long); calyx (1.3) 1.5–1.8 cm long, slightly longer than to distinctly shorter than the lower lip of the corolla, the abaxial cleft 5.7–7.0 mm deep, the slightly shallower adaxial cleft 5.0–6.5 mm deep, the fused portion green and the lobes pigmented like the bract apices, proximally with spreading, short and long, glandular and pointed hairs, the clefts ciliate, the cilia longer proximally, shorter distally and becoming minute on the apices; corolla (1.5) 1.7–2.3 cm long, yellowish green or often the galea margins and sometimes the teeth of the lower lip yellow; upper lip (galea) (5.2) 6–7 mm long, straight, exceeding the lower lip by about 5 mm, distally puberulent, proximally at least the keel and usually also the veins puberulent, lower lip slightly inflated, eciliate, the lateral teeth 0.7–1.9 mm long, the central tooth 0.5–1.3 mm long; stamens 4, each with 2 anther-sacs, the larger 1.0–1.2 mm long, the smaller 0.8–1.0 mm long; style light yellowish green, the stigma capitate, bilobed, exserted (0.4) 1.8–4 (7) mm beyond the upper lip. *Fruit* a somewhat obliquely ellipsoid to narrowly obovoid capsule, (0.75) 1.1–1.2 cm long, the apex short-beaked; seeds numerous in each capsule, 1–1.4 (1.6) mm long, yellowish, the seed coat deeply reticulate with (7) 8–10 (12) cells in each longitudinal row. Chromosome number unknown.

Flowering (March) April–June (July), a single plant seen in flower in mid-November, fruiting late April–July.

English Name: Cahaba Paintbrush.[*]

Paratypes. Alabama: Bibb Co., (topotype) 1 May 1993, *A. and S. 7575*[**] (AUA, DUKE, FLAS, JSU, UNA, USCH); 12.5 km NNE of Centreville, "Eastside Glade," 2 May 1993, *A. and S. 7584* (GA, GH, MICH, MO, NY, UNA, US); 13.6 km NE of Centreville, "Double Glade South," 26 Apr 1993, *A. and S. 7559* (AUA, DUKE, JSU, TAMU, UNA); 14.0 km NE of Centreville, "Starblaze Glade Southwest," 26 Apr 1993, *A. and S. 7555* (AUA, GA, GH, MICH, MO, NY, UNA, US, VDB); 14.6 km NE of Centreville, "Goat Glade South," 14 Jun 1992, *A. and S. 6725* (AUA, UNA); 14.9 km NE of Centreville, "Goat Glade North," 26 Apr 1993, *A. and S. 7549* (GA, NY, US); 15.1 km NE of Centreville, "Pinkroot Glade West," 25 Apr 1993, *A. and S. 7545* (GH, JSU, MO).

Castilleja kraliana usually grows in full sun, occasionally in partial shade at the edges of glades or of wooded islands within them.

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[*] The creation *de novo* of vernacular names is done with reluctance, a concession to an unfortunate trend that shows no tendency to abate.

[**] To conserve space in referring to collections, usually we cite only a fraction of our multiple collections of a given taxon, and abbreviate our names to the first letter of our surnames, except for formal designation of types or where ambiguity might result.

The calyx morphology of *Castilleja kraliana* indicates a close relationship to *C. coccinea* (L.) Spreng. It differs most importantly by its bracts, which are mostly entire, bright yellow and at most about 2 cm long. In *C. coccinea* the bracts are deeply lobed, red or rarely yellow, and mostly more than 2 cm long. The latter's calyx and corolla also average larger than in *C. kraliana*, though there is overlap in the ranges (due to a reduction of flower size late in anthesis in *C. coccinea*).

We have observed one population of *Castilleja coccinea* composed entirely of yellow-flowered plants, on a glade in Izard County, Arkansas (*A. and S. 8877*, UARK; *A. 10478*, DUKE, GA, GH, MICH, MO, NY, UARK, US; *A. 10859*, UARK). These plants, with larger flowers than *C. kraliana* and with consistently deeply lobed bracts, appeared to differ only in bract and calyx coloration from red-flowered plants of *C. coccinea*. Like *C. kraliana*, these yellow-flowered plants produced a red pigment, normally evident only in the rosette leaves. In neither case, therefore, would it seem that the yellow coloration of the inflorescence is due to a mutation interfering with the production of red pigment. Rather, the red pigment normally so characteristic of *C. coccinea* has been sequestered in the rosettes and sometimes the lower leaves of these plants.

The divergence between *Castilleja kraliana* and *C. coccinea* is apparently related to a difference in pollinators, with red-flowered *C. coccinea* pollinated by hummingbirds, while *C. kraliana*, as is usual with yellow-flowered *Castilleja*, is pollinated by bees (Chuang and Heckard 1991, Duffield 1972). Indeed, we saw and photographed a (putative) *Bombus* sp. "working" the flowers of *C. kraliana*. Presumably, *C. kraliana* is derived from *C. coccinea*, with the divergence due to a shift in pollinators, though the reverse could instead be true. According to label data seen in several herbaria, additional entirely yellow-flowered populations, referred to *C. coccinea*, are known. It would be a useful project, never more feasible than it is today, to ascertain whether these populations are all genetically more closely related to each other, or whether a shift in pollinators has occurred repeatedly in that species and some yellow-flowered populations are more closely related to red-flowered populations of the same region than to other, more distant, yellow-flowered ones.

The change in pollen vectors (whatever the direction) has been accompanied by significantly more morphological divergence from typical *Castilleja coccinea* in the Bibb County plants than in the yellow flowered populations referable to *C. coccinea*, and thus the Bibb County plant is afforded species status here. The two species also appear to be allopatric, with the nearest known population of *C. coccinea* two counties to the east (a Coosa County specimen at AUA).

At the westernmost glade where *Castilleja kraliana* occurs, "Eastside Glade" (about 0.3 km east of the Cahaba River), we found that some of the plants had bracts and calyces orangish-tinged, and that some had slightly more deeply lobed bracts than is usual for the species. The single population under discussion is not only the westernmost population but is also the most geographically isolated population (about 2.2 km from the nearest of the other populations, while none of the latter is more than 0.6 km from another population). Perhaps one or more undetected populations of the widespread *C. coccinea* occur or occurred within the valley of the Cahaba River, and a past hybridization event resulted in the infusion of some *C. coccinea* alleles into the comparatively isolated population of *C. kraliana* closest to the river. Another hypothesis is that *C. coccinea* was once an element of the flora of the Ketona Glades, and the process of its replacement by *C. kraliana* is virtually, but not absolutely, complete.

An odd variant of *Coreopsis grandiflora* proved to be a characteristic summer wildflower of all but the more geographically peripheral Ketona Glades. Aside from the comparatively late anthesis (typical *C. grandiflora* enters anthesis in late spring), their remarkable leaning habit was the first attribute that impressed us about these plants, which otherwise seemed clearly assignable to *C. grandiflora*. Given the severity of the habitat, one might attribute the peculiar habit to environmental factors. However, plants of *C. grandiflora* growing in the drought-prone, nutrient-poor soil of other outcrop-types grow stiffly erect. Like many plants of harsh habitats, it is only when the latter are brought into the more hospitable conditions of the garden that they become "leggy." Upon further study, another distinctive characteristic of the Ketona Glade *Coreopsis* became clear, a marked tendency for the leaves to have fewer divisions.

Coreopsis grandiflora Hogg ex Sweet **var. inclinata** J. Allison, var. nov. TYPE: Alabama: Bibb County, ca. 12.0 km. NNE of Centreville, ca. 1.0 km WSW of the mouth of Pratt Creek. "Pratt Glade West," Ketona Dolomite outcrop ca. 0.08 km N of Pratt Creek, 15 Jul 1999, *James R. Allison 12086* (holotype, US; isotypes: AUA, BRIT, DUKE, FLAS, FSU, GA, GH, IBE, JSU, MICH, MO, NCU, NY, TAMU, TENN, UARK, UNA, USCH, VDB). Figure 4.

Inter varietates C. grandiflorae Hogg ex Sweet, *foliis inferioribus caulis plerumque simplicibus aut tripartitis, segmentis eorum linearibus vel linearibus-oblongis, et sub anthesi caulibus procumbentibus vel leniter ascendentibus differt.*

Perennial herb, from short rhizomes, glabrous except for marginal cilia. *Stems* usually several, (2.4) 3.3–5.7 (6.6) dm long, finely striate-sulcate, ascending to reclining at maturity, green or maroon, or brown with age, at anthesis usually with at least 6 nodes with persistent leaves. *Leaves* normally opposite, very gradually reduced above, mostly 4.2–15 cm long (including the proximally ciliate petiole), ciliate or eciliate, lowest leaves usually simple, mostly 4–11 mm wide, withered by anthesis; within a few nodes upward from the base leaves remaining simple or becoming 3-lobed, the lateral lobes narrower than and less than the length of the central lobe, mid and upper cauline leaves remaining simple or more often pinnately divided into mostly 3 or 5 linear to linear-lanceolate segments (0.7) 1.0–6.0 mm wide, some of these occasionally with one or more small additional lobes, margins otherwise entire. *Inflorescence* a solitary, terminal head or more often several (–9) heads in a terminal corymb, its branches with leaflike basal bracts, peduncles 11.5–17 (19) cm long, sometimes with 1 or a pair of variably positioned, linear bracteoles, often 1 or a few heads pedunculate from medial leaf axils. *Heads* mostly 2.2–5.8 cm wide; involucre campanulate, biseriate and dimorphic, phyllaries conspicuously pale-margined, the outer usually 8, green, linear-lanceolate, (5.5) 6.5–8.0 (9.5) mm long, 1.4–2 mm wide at the base, erect in early bud, ascending and often with recurved apices at anthesis, often reflexed in fruit, the inner phyllaries appressed, golden yellow, lance-ovate, acute, (7.1) 8.7–11 (12.1) mm long, 1.9–3.7 mm wide; rays neutral, 7 or 8, sunflower yellow, mostly 1.5–2.2 cm long, mostly 4-toothed, sometimes these with 1 or 2 smaller, secondary teeth; disk yellow, 0.9–1.4 cm across, the narrowly campanulate florets numerous, (4) 5-lobed, (2.8) 3.1–4.5 (5) mm long, lobes (0.5) 0.7–0.8 mm long; chaff linear-subulate, scarious-margined proximally, 6–7 mm long, 0.5 mm wide. *Pappus* a pair of deciduous, ovate, erose scales, 0.3–0.5 mm long, as wide as long or nearly so. *Fruit* an incurved, flattened achene, the larger, inner ones mostly broader than high (including a pair of well developed, lateral wings), body dark brown,


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papillose, 1.4–1.8 mm across, the inner face with a callus at base and apex, the wings tan to reddish brown, usually entire, each 0.6–0.9 mm wide. Chromosome number unknown.

Flowering late June and July, sporadically until frost, fruiting July–frost.

English Name: Ketona Tickseed.

Paratypes. Alabama: Bibb Co., 12.5 km NNE of Centreville, "Eastside Glade," 26 Sep 1992, *A. and S. 7223* (UNA); 14.0 km NE of Centreville, "Starblaze Glade Southwest," 24 Jun 1998, *J. Allison and T. McQuilkin 11013* (AUA, DUKE, JSU, UNA); 14.3 km NE of Centreville, "Starblaze Glade Northeast," 6 Sep 1992, *A. and S. 7121* (JSU); 14.9 km NE of Centreville, "Brown's Dam North Glade West," 15 Aug 1998, *A. 11331* (GA, MO, NY, UARK, UNA, US, VDB); 15.3 km NE of Centreville, "Desmond's Glade," 17 Jul 1999, *A. 12092* (AUA, BRIT, DUKE, FLAS, FSU, GA, GH, JSU, MICH, MO, NY, UARK, UNA, USCH, VDB); 17.3 km NE of Centreville, "Enchanted Glade," 15 Aug 1998, *J. Allison and M. Moffett 11320* (AUA, GA, UNA); 17.8 km NE of Centreville, "Alligator Glade," 19 Aug 2000, *A. 12502* (AUA, GH, JSU, MO, NCU, NY, TAMU, UARK, UNA, US, VDB).

Coreopsis grandiflora var. *inclinata* is a plant of full sun. In view of this fact, and given its time of flowering and root system lacking any apparent specialization for water storage, it is an amazingly drought-resistant herb. Although all of central Alabama had suffered near record-breaking drought and heat for the preceding several weeks, the *Coreopsis* was still flowering in late July 2000, though the glades seemed more parched than at any other time during the study.

The low, sprawling habit of *Coreopsis grandiflora* var. *inclinata*, so unlike that of the other varieties, appears to be an adaptation both to recurrent low soil moisture levels and to a difference in population density and community structure. It is a plant of open, somewhat shallow-soiled areas on the Ketona Glades, where it is normally found as scattered, reclining individuals facing little competition, either from others of its kind or from taller vegetation. Other varieties, by contrast, whether on outcrops or on roadsides, often grow in dense, showy patches where they face greater competition, both intraspecific and from diverse, many potentially shading, species. There the erect form has adaptive value in competing for light, both for photosynthesis and for enhanced visibility of flowers to pollinators. Even though the heads of var. *inclinata* are usually borne within 2 dm of the substrate, the sparseness of taller vegetation leaves the flowers well exposed and easily perceived by the visitor, whether human or insect. Given the severely drought-prone habitat where it is found, the adaptive value of var. *inclinata*'s peculiar habit, at least to an entomophilous species, is clear: a plant that is able to grow low to the ground and yet still attract pollinators can subsist with less moisture than an erect form more exposed to the drying effect of winds.

Examination of herbarium specimens was of limited value in understanding the patterns of variation of outcrop populations of *Coreopsis grandiflora*, particularly in evaluating the differing taxonomies espoused by Edwin Smith (1976) and Arthur Cronquist (1980). According to

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Figure 4. *Coreopsis grandiflora*. A–F, var. *inclinata*. A. Habit (shown as more erect than is natural, so as to fit the page), ×4/10. B. Frontal and rear views of head, ×9/10. C. Fruiting head, side view, ×1 1/2. D. Left: disk flower, with ovary and pappus scales; right: receptacular bract (pale); both ×9. E. Achene, frontal view, ×9. F–H, stems, pre-anthesis, drawn from specimens (UNA) collected 24–26 April 1999, ×1/4. F. Bibb County, Alabama, type locality, *A. 11841*. G. Var. *grandiflora*, Bibb County, Alabama, Co. Rd. 24, *A. 11846*. H. Var. *harveyana*, Izard County, Arkansas, Ark. Hwy. 5, *A. 11835*.

Smith, Alabama and other states east of the Mississippi have three varieties: var. *grandiflora*, var. *saxicola* (Alexander) E. B. Sm., and var. *harveyana* (Gray) Sherff. Variety *saxicola* is distinguished primarily by possessing fimbriate achene-wings, and var. *harveyana* by having median and upper leaves with very narrow segments. Cronquist recognized only vars. *grandiflora* and *saxicola*. The normally entire achene-wings of the Ketona Glade plants indicate no close affinity to var. *saxicola*, and the latter is excluded from the following discussion.

To arrive at a better understanding of patterns of variation in *Coreopsis grandiflora*, we made repeated visits, at different times during the growing season, to several populations each of vars. *grandiflora*, *inclinata*, and *harveyana*, including several Arkansas populations of the latter on Ozarkian glades, where var. *harveyana* is one of the dominant herbaceous plants. Had our studies been limited to the herbarium, we probably would have agreed with Cronquist's taxonomy, and might have remained uncertain about the distinctiveness of the Ketona Glade populations.

Herbarium specimens of herbaceous plants like *Coreopsis grandiflora* are virtually always of flowering or fruiting material. This is entirely understandable, but in rare instances serves to obscure the differences among taxa, such as those in which the leaf morphology is most distinctive *prior* to anthesis. Such is the case with the plants under discussion. Varieties *grandiflora*, *harveyana*, and *inclinata* are strikingly different in leaf morphology a few weeks prior to flowering (see Figure 4), but the lower leaves are usually withered by the time of anthesis, and so the differences become less apparent. In variety *harveyana* there is an abrupt narrowing of leaf segments above the lower nodes, while vars. *grandiflora* and *inclinata* have the segments very gradually narrowed upward; leaves of var. *inclinata* differ from other varieties by having fewer divisions. The tendency for the lower leaves to be withered by anthesis is especially pronounced in var. *inclinata*, because it also differs from varieties *grandiflora* and *harveyana* by entering population-wide anthesis more than a month later than they do. This phenological difference, combined with the reduced degree of leaf dissection, reclining habit, and restricted distribution, is sufficient to justify recognition of the Ketona Glade populations at the infraspecific level, at the very least. The senior author is not convinced of the utility of distinguishing more than one infraspecific level, and is predisposed to use the subspecies to represent that rank. However, the varietal rank is employed here, and later in *Erigeron strigosus*, to conform best with the currently prevailing infraspecific taxonomy of these groups (e.g., Smith 1976, Cronquist 1980, USDA 2000).

A further difficulty in interpreting variation in *Coreopsis*, both in the herbarium and in the field, is frequent hybridization. The crossing experiments of Smith (1976) have shown that varying, often high degrees of interfertility exist among the various taxa, and it would seem that in many cases the chief isolating mechanisms are either spatial (allopatry or differences in habitat preference) or phenological (e.g., in the Piedmont of Alabama and Georgia we have observed *C. auriculata* L., *C. lanceolata* L., and *C. grandiflora* to be sympatric but with staggered peak anthesis, in the sequence given). The disruption of natural community boundaries by logging and other land-disturbing activities has apparently brought into close contact many species of *Coreopsis* (as well as *Helianthus* L., *Silphium*, etc.) that were formerly effectively isolated by differing ecological preferences, and apparent hybrids and hybrid swarms are the result. In *Coreopsis*, many of the species seem pre-adapted to conditions now found along highway and other rights-of-way. Such places often support populations of plants that seem to combine characters of different taxa.

In the case of *Coreopsis grandiflora* var. *inclinata*, we found putative hybrids with *C. pubescens* Ell. at two sites (*A. and S. 7633*, AUA, UNA, VDB; *A. 11933*, JSU, UARK, UNA), one where a road was built across a glade, the other a glade disturbed in the past by logging. The narrow, pubescent, little-divided leaves caused Allison to key the earlier collection originally to *C. pubescens* Ell. var. *debilis* (Sherff) E. B. Sm., and to report, in error, that taxon to the Alabama Natural Heritage Program as present in Bibb County.

A low, sprawling habit is also exhibited by an endemic species of *Dalea*, one of the finds of the original canoe expedition. Acquainted with the Baskin and Baskin (1984) paper discussed below, we assumed upon first seeing the *Dalea* that we had rediscovered a species known only historically from Bibb County, *D. gattingeri*. A duplicate from our first collection, labeled as *Dalea gattingeri*, was sent to Robert Kral, who determined it instead to be *Petalostemon purpureum* (Vent.) Rydb. [= *D. purpurea* Vent.], a finding we found difficult to accept, based on our experience with the latter species. Once the first author compared Bibb County material with his own collections from elsewhere of *D. gattingeri* and *D. purpurea*, he concluded that the Bibb County plant could not be conspecific with either of those taxa. After consultation of the literature, particularly Wemple (1970) and Barneby (1977), it became clear that the Ketona Glade plant differed from any entity previously described. It is morphologically closest, not to any species already mentioned, but to a Texas endemic, *D. tenuis* (Coult.) Shinners.

Dalea cahaba J. Allison, sp. nov. TYPE: Alabama: Bibb County, ca. 20.5 km NE of Centreville. "County Road 10 Glade," Ketona Dolomite outcrop ca. 2.0 km ENE of the mouth of Four Mile Creek, 1 May 1994, *James R. Allison and Timothy E. Stevens 8236* (holotype, NY; isotypes: AUA, DUKE, FSU, GA, GH, JSU, MICH, MO, UNA, US, VDB). Figure 5.

Ab aliis speciebus seriei Purpurearum (Rydb.) Barneby, *sectionis Kuhnisterae* (Lam.) Barneby, *combinatione caulium decumbentium cum spicis fructiferis brevibus* (*longitudine maxima* 2.8 cm), *bracteis interfloralibus persistentibus inter calyces et dorsaliter pubescentibus per longitudinem carinae praeter corpus abrupte glabrum* (*quamquam ciliatum*) *supra positionem latissimam, et ovariis fructibusque dense pilosulis super saltem dimidium distale distinguenda.*

Perennial herb, from a thick (ca. 1 cm), elongate (normally longer than the aerial portion), sparingly branched, dark brown root, in age forking at or just below ground level. *Stems* usually several, 1.7–6.5 (7) dm long, usually decumbent or weakly ascending, striate-ribbed, pale green, stramineous, or somewhat reddish or purplish, glabrous or distally thinly pilosulous with spreading-ascending or somewhat appressed, weakly curved to sinuous hairs mostly less than 0.3 mm long, either simple or more often branched proximally (or some short, sterile branches also produced above the middle of the stem), the fertile branches monocephalous. *Leaves* aromatic in life, green, often drying gray-green, petiolate, scarcely bicolored, punctate beneath, rachis and lower (rarely both) surfaces of leaflets thinly strigillose, the hairs on the petiolules more divergent; stipules subulate or the lower lance-acuminate, 1.5–3.5 mm long, primary cauline leaves 1.5–3.7 cm long (including petiole), with broadly margined rachis and 3 or 5 linear or rarely linear-oblanceolate, acute, flat and marginally inrolled or tightly involute leaflets that are 0.5–2.0 cm long, the terminal one slightly the longest, on petiolules 0.5–0.8 mm long, the leaves of axillary spurs shorter, with

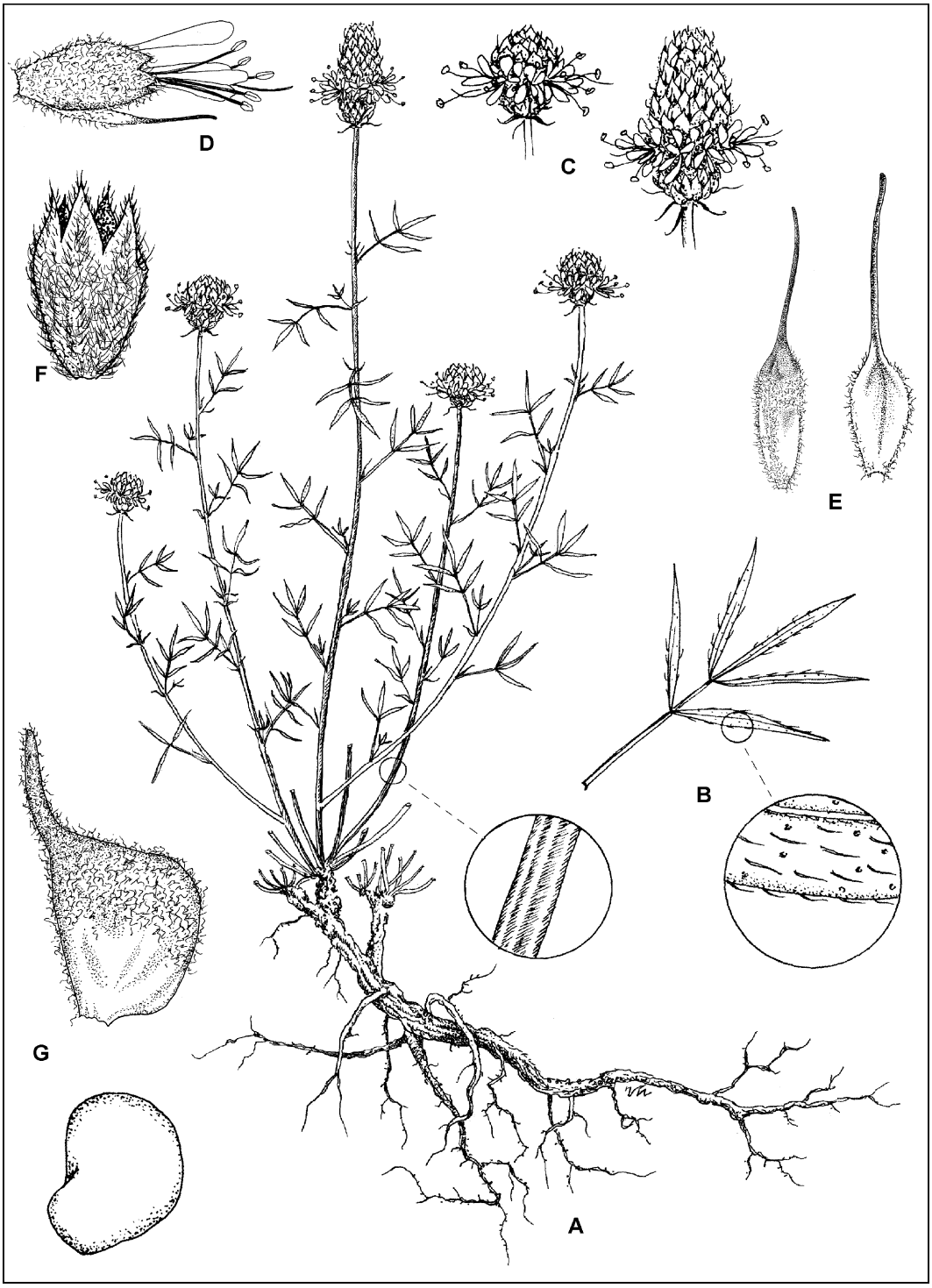

Figure 5. *Dalea cahaba*. A. Habit (shown as more erect than is natural, so as to fit the page), ×1/3, detail showing sulcate stem. B. Leaf, ×2, detail showing lower surface. C. Two spikes, ×1, one globose, one cylindrical. D. Flower, with interfloral bract, ×4 1/2. E. Bracts, ×9, interfloral (left) and basal (right). F. Calyx, ×6 1/2. G. Pod (upper) and seed (lower), both ×12 1/2.

much smaller, otherwise similar leaflets. *Inflorescence* a spike on a peduncle (1.5) 2–8.5 cm long (rarely a single flower borne a few mm below the rest), dense in bud, loosening only slightly during and after anthesis, globose to somewhat conelike, becoming oblong-cylindroid or subglobose, without petals (7) 9–12 mm in diameter, the densely pilosulous axis 0.5–2.2 (2.8) cm long; bracts disjointing only with the fruiting calyx, caudate, dimorphic, the lowest 4–7 mm long, the body obovate or lance-obovate, the curving, subulate tail accounting for half or more of the total length, glabrous or pilosulous, the inner ones oblanceolate, 3.5–5 mm long, the tail accounting for about half of the total length, densely tomentulose along the keel and margins, at about the middle of the body the pubescent area extending toward the margins, distally glabrous (except for cilia) beginning 0.5–0.75 mm below the tail; calyx 4–5 mm long, 10-ribbed, densely and very shortly tomentulose, the hairs sinuous, interwoven, oriented in different directions on the same calyx, up to 0.35 mm long or the proximal a little longer, calyx tube subsymmetrically obovoid, 2.5 mm long, not recessed behind banner, glandless, the teeth subdimorphic, the 3 dorsal ones lance-acuminate, (1.7) 2–2.5 mm long, the ventral pair lance-ovate- to ovate-acuminate, (1) 1.4–2 mm long; petals rose-purple, eglandular; banner 3.5–5.3 mm long, the claw 1.5–2.8 mm, the ovate blade 2.0–2.5 mm long, 1.7–1.8 mm wide, hooded at the broadly rounded to slightly emarginate apex, broadly cuneate to broadly and shallowly cordate at the base; epistemonous petals 3.5–4.4 mm long, the blades oblong or oblong-lanceolate, 2.5–3.0 mm long, 1.1–1.8 mm wide, broadly rounded to rounded-truncate at apex, base broadly cuneate, claw 1.0–1.4 mm long; androecium 6–7 mm long, the column 2.2–2.6 mm long, the filaments free for 4–4.5 mm, the connective gland-tipped, the yellow or orangish anthers (0.7) 0.9–1.2 mm long. *Fruit* a pod, obliquely semi-obovoid in profile, 3.2–4.4 mm long, including the persistent style; the ventral suture nearly straight, the dorsal convexly arched, the style-base eccentrically terminal, the valves in proximal third hyaline and glabrous, distal two-thirds thinly papery, tomentulose; seed brown or olivaceous, 1.9–2.2 (2.4) mm long, (1.2) 1.5–1.7 mm wide at the middle. Chromosome number unknown.

Flowering May–June; fruiting June–September.

English Name: Cahaba Prairie-clover.

Paratypes. Alabama: Bibb Co., (topotype), 2 May 1998, *A. 10649* (AUA, BRIT, DUKE, FLAS, FSU, IBE, JSU, TAMU, UNA, US, USCH); "Pratts Ferry. Aug.," *H.*[?] *J. Smith* s.n. (UNA); 11.9 km NNE of Centreville, "Pratt Glade West," 19 Jul 1992, *A. and S. 6876* (AUA, GA, JSU, UNA); 12.2 km NNE of Centreville, "Westside Glade West," 14 Jun 1993, *A. and S. 7753* (GA, NY, UNA, US); 14.7 km NE of Centreville, "Brown's Dam South Glade III," 28 May 1994, *A. et al. 8338* (AUA, GA, MO, NY, UNA, US, VDB); 14.8 km NE of Centreville, "Riverbend Glade," 13 Jun 1993, *A. and S. 7718* (AUA, JSU, UNA);15.3 km NE of Centreville, "Desmond's Glade," 7 Jun 1998, *A. 10900* (MO, NY, TENN, US).

Dalea cahaba is present on all of the larger glades but is absent from the smaller ones found near the western periphery of the glade region. Like *Coreopsis grandiflora* var. *inclinata*, it is a true heliophyte, flowering only in exposed situations.

As cited among the paratypes, at least one historical collection of *Dalea cahaba* exists. Baskin and Baskin (1984) refer to three previously unannotated 19th Century Alabama collections at the University of Alabama (UNA), labeled by their collectors as *Kuhnistera gattingeri* Heller. The Baskins found them all to be *Petalostemon gattingeri* (Heller) Heller [this and the preceding *=Dalea*

gattingeri], determinations concurred with by the late Duane Isely. Smith's Bibb County collection is, in fact, *D. cahaba.*[*]

Aside from the strongly diagnostic transverse band of pubescence on the otherwise glabrous or glabrescent bodies of the interfloral bracts, *Dalea purpurea* is very different in aspect from the other three taxa discussed here, since it is commonly an erect or strongly ascending plant with polycephalous stems [branched above the middle, each branch terminating in a spike, as figured in Barneby (1977) and Isely (1990)]. A wide-ranging species, its populations geographically closest to Bibb County are on chalk glades [Mohr's (1901) "bald prairies," as at Gallion] of the Black Belt region of the Gulf Coastal Plain of Alabama and Mississippi, where it is a common plant. Conversely, *D. cahaba*, *D. gattingeri*, and *D. tenuis* have a decumbent to weakly ascending habit combined with stems ordinarily branched only below the middle. Rare, decumbent forms of *D. purpurea* have been reported (Wemple 1970, Barneby 1977), nevertheless referable to that species on the basis of bract pubescence and branching pattern.

Dalea gattingeri is a plant of limestone glades of higher latitudes than Bibb County, with its nearest known localities more than 135 km to the north, in Morgan County, Alabama (Kral 1983). It differs markedly from *D. cahaba* and *D. tenuis* by its longer, often sinuous spikes (mostly more than 2.5 cm long, reaching as much as 7.5 cm), which loosen during and after anthesis, partially exposing the axis (at least in pressing) and accompanied by the loss of most of the interfloral bracts. Though its spikes are long, its peduncles are short, only 0–3 cm long, while those of *D. cahaba* and *D. tenuis* are seldom less than 3 cm long. The antrorse calyx pubescence of *D. gattingeri* resembles somewhat that of *D. purpurea*, but its interfloral bract pubescence pattern is more like that of *D. cahaba* and *D. tenuis*, except that the tail is pubescent or at least distinctly ciliate, rather than essentially glabrous. Furthermore, *D. gattingeri* often has 7 or sometimes even 9 leaflets, as shown in its photograph in Duncan and Duncan (1999), rather than the maximum of 5 found in *D. cahaba* and *D. tenuis*.

Dalea tenuis shares with *D. cahaba* a decumbent habit, permanently dense and conelike spikes mostly less than 2.5 cm long [Barneby 1977, though Wemple (1970) gives the length to 4.4 cm], and a similar pattern of bract pubescence. Morphologically, *D. tenuis* stands apart from the three other species here discussed by the distinctly retrorse pubescence of the calyx tube, the almost totally

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[*] The locality on Smith's label, "Pratts Ferry" (a locality well known to botanists then and today), given the practice of collectors of the 19th Century, must be interpreted as a very general locality. Smith's collection undoubtedly came from one of the Ketona Glades, the nearest of which is only 11 km away. A second collection cited in Baskin and Baskin (1984) as *Petalostemon* [*Dalea*] *gattingeri*, by Charles Mohr, was collected at or near Gallion, Hale County, in the Black Belt, which would be far south of all other populations and the only collection ever made from the Coastal Plain. While the UNA specimen appears, indeed, to be taxon *gattingeri*, as annotated by the Baskins and by Isely, the (unannotated) duplicates of Mohr's Hale County collection seen at MO and US are both, instead, *Dalea purpurea*. The latter species can still be found in the vicinity of Gallion (*A. and S. 6902*, UNA), where it occurs with *D. candida* Michx. ex Willd. (*A. and S. 6901*, UNA). The simplest explanation is that a mixup occurred: one of Mohr's northern Alabama specimens of *D. gattingeri* (e.g., the Russell County collection cited by the Baskins) came to be mounted in error with a label belonging instead to his Hale County *D. purpurea* collection. Therefore, *D. gattingeri* should not be considered an element of the Coastal Plain flora, based on the available evidence.

glabrous ovary (pilosulous only at the style-base), and by its long peduncles (as much as 15 cm long, vs. a maximum of 8.5 cm in *D. cahaba*). *Dalea cahaba* has ovaries and pods that are densely tomentulose on at least the distal two-thirds and a distinctive calyx pubescence, the hairs more appressed than in its relatives, and peculiar in varying from antrorse to retrorse in orientation on the same calyx, sinuous and interwoven, the result a comparatively disheveled calyx vestiture. A further difference is found in the calyx teeth, which are often about as pubescent as the calyx body in *D. cahaba*, usually glabrous or thinly pilosulous (though ciliate) in *D. tenuis*.

A genetic comparison of *Dalea cahaba* and related species would be desirable, to assess whether the morphological similarities to the Texas endemic (*D. tenuis*) reflect common descent (indicated by greater genetic similarity to *D. tenuis*) or convergence (greater similarity to *D. gattingeri*).

An *Erigeron* L. that appeared to be a variant of the widespread and often weedy *Erigeron strigosus* proved to be one of the most characteristic plants of the Ketona Glades, absent only from one of the smallest outcrops, near the western periphery of the glade region. The distinctiveness of the Ketona Glade plant was apparent right away, due to the clumps of erect or strongly ascending and unusually narrow leaves found around the bases of most of the flowering stems. When we removed plants from the substrate, it was clear that most of the basal rosettes were terminal to short rhizomes.

Erigeron strigosus Muhl. ex Willd. **var. dolomiticola** J. Allison, var. nov. TYPE: Alabama: Bibb County, ca. 12.4 km NNE of Centreville. "Westside East Glade," Ketona Dolomite outcrop ca. 0.4 km W of the mouth of Pratt Creek, 10 Jun 2000, *James R. Allison 12396* (holotype, NY; isotypes: AUA, BRIT, DUKE, FLAS, FSU, GA, GH, IBE, JSU, MICH, MO, NCU, TAMU, TENN, UARK, UNA, US, USCH, VDB). Figures 6 and 7.

Ab varietatibus descriptis E. strigosi Muhl. ex Willd. *duratione vulgo perenni, et foliis, etiam radicalibus, linearibus vel linearibus-oblanceolatis et plerumque minus quam* 3.5 mm *latis differt.*

Perennial herb, with short rhizomes that bear tufts of overwintering leaves at the upturned ends, mostly (3.4) 5.5–8.0 (8.9) dm tall. *Stems* (1–) several (–9), usually maroon at the base, upwards maroon or more often green, becoming brown with age, several- (usually pale-) ribbed, with strigillose or weakly ascending short hairs, the hairs sparse low on the stem, becoming moderately dense in the inflorescence and often very dense below the heads. *Leaves* ciliate and very sparsely to moderately strigillose, firm, the basal erect or ascending, becoming nearly prostrate after frost, linear, tapering to indistinct petioles that are usually purplish proximally, at least in youth, their blades distally remotely and shallowly few-toothed or entire, (2.5) 4.0–15.5 cm long (including petiole) and 1–3.5 (6) mm wide, the cauline leaves well spaced (internodes mostly more than 2 cm long), linear-oblanceolate or more often linear, gradually reduced above, very rarely with an axillary fascicle of a few greatly reduced ones, entire or the lower remotely and shallowly few-toothed. *Inflorescence* a diffuse panicle of several to numerous heads; peduncles sparsely bracteate, the bracts linear and mostly less than 2 cm long; involucre 2.8–3.0 (4) mm high, phyllaries unequal, the outer shorter (1.1–1.5 mm long vs. 2–2.3 mm), acute or short-acuminate, sparsely strigillose, with brown midrib and light greenish or yellowish margins that are distally minutely glandular-erose; ligules numerous,

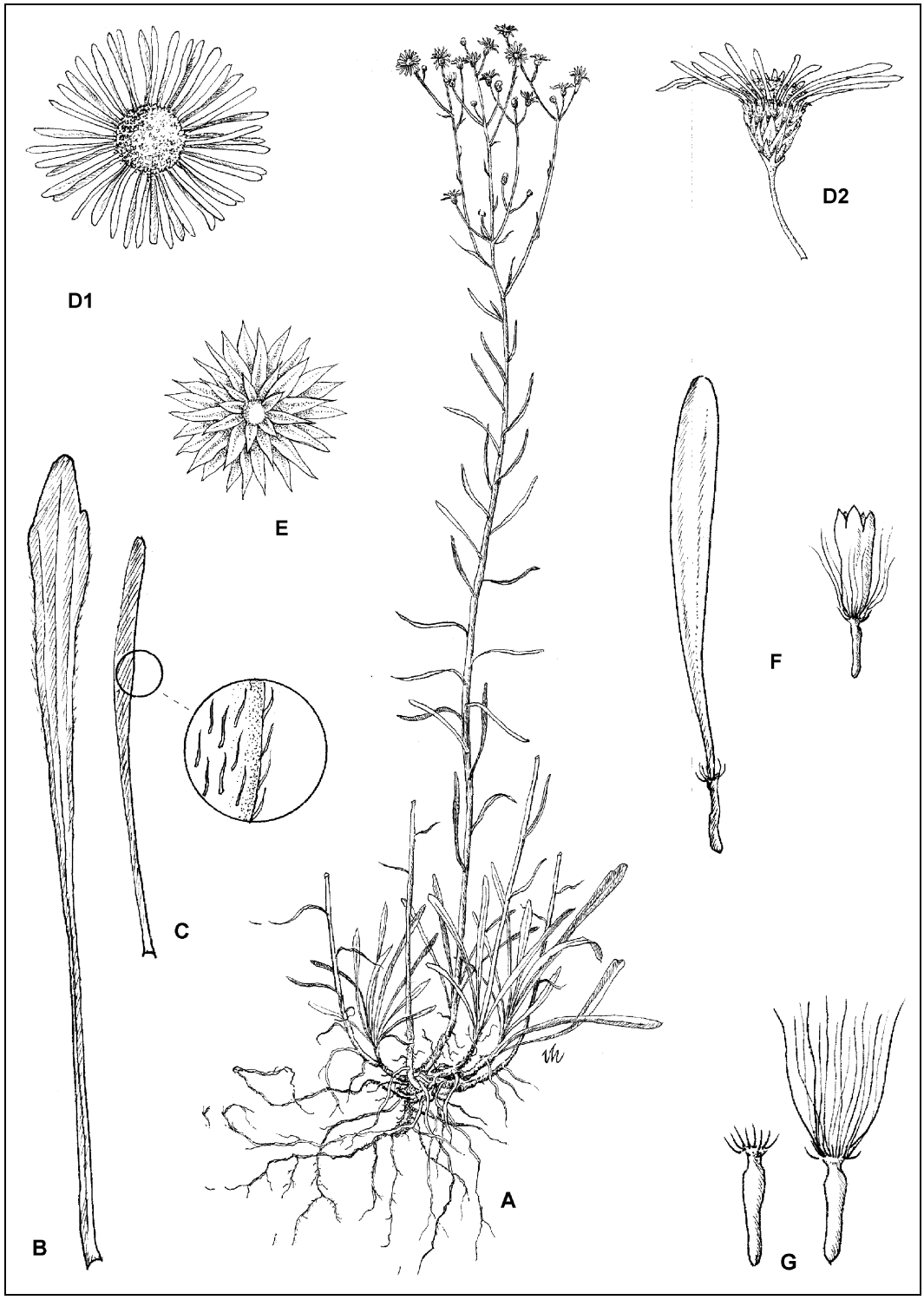

Figure 6. *Erigeron strigosus*. A-G, var. *dolomiticola*: A. Habit, ×1/4. B. Rosette leaf, ×3. C. Mid-cauline leaf, ×3, detail showing upper surface. D. Head, ×3, two views. E. Pressed involucre, exterior view, ×4. F. Ray flower (left) and disk flower (right), both with ovary and ×10. G. Achenes, ×10, of ray flower (left) and disk flower (right).

white, occasionally tinged with lavender, 0.6–0.9 mm wide, mostly 4–6 (7) mm long; disk 5.4–6.0 mm broad, the disk-corollas 1.1–1.7 mm long, the lobes about 0.2 mm long. *Pappus* double, the outer setose-squamellate, the inner of very fragile bristles, the bristles lacking in the pistillate (ray) flowers. *Fruit* a hairy, 2-nerved achene, 0.8 mm long. Chromosome number unknown.

Flowering late May until frost, fruiting June–frost.

English Name: Cahaba Daisy Fleabane.

Paratypes. Alabama: Bibb Co., 6 miles N of Centreville/Brent, Hwy. 5, Ketona Dolomite glade, 7 Jun 1996, *John R. MacDonald 9532* (VDB); 8.9 km NNW of Centreville, "Highway 219 Glade," 25 Jun 1998, *A. 11020* (GA, GH, MICH, MO); 10.0 km NNE of Centreville, "Schultz Creek Church Glade East," 4 Sep 1993, *A. and S. 7947* (GA, UNA); 12 km NNE of Centreville, "Lady-tresses Glade South," 23 May 1999, *A. 11922* (AUA, JSU, UNA); 17.3 km NE of Centreville, "Enchanted Glade," *J. Allison and M. Moffett 11321* (AUA, JSU, UNA, VDB); 17.8 km NE of Centreville, "Alligator Glade," 19 Aug 2000, *A. 12501* (AUA, DUKE, GA, GH, JSU, MICH, MO, NCU, NY, UNA, US); 20.5 km NE of Centreville, "County Road 10 Glade," 24 May 1999, *A. 11935* (AUA, GA, JSU, NY, UNA).

Erigeron strigosus var. *dolomiticola* usually occurs as scattered individuals or small groupings, in full sun or at glade margins where it receives full sunlight part of the day. Occasionally it grows more densely and can be an aspect dominant in late spring and summer

The Ketona Glade endemic seemed clearly aligned with *Erigeron strigosus* and *E. annuus* (L.) Pers. in having disk flowers with a double pappus, with an outer series of setose scales and inner series of capillary bristles, and with ray flowers bearing only the scales. The tufts of remarkably narrow radical leaves seemed distinctive, approached in slenderness only by the very narrowest-leaved extremes of *E. strigosus* Muhl. ex Willd. var. *beyrichii* (Fisch. & C. A. Mey.) Torr. & Gray ex Gray, as found in xeric habitats such as sand ridges (e.g., *A. 11852*, GA, NCU, NY). Unlike those of the latter, rosettes of the Ketona Glade plants were terminal to rhizomes, which seemed a clear indication of perennial duration (also evidenced by the occasional persistence of dried stalks of flowering stems from the previous year). The persistence of these rosettes into fall and then winter (when they became lax) was final proof that the plant was perennial and therefore unlike described varieties of *E. strigosus*, which are considered annual or biennial (Cronquist 1947, USDA 2000). As no significant difference was found in the flowers of the Ketona Glade endemic from those of var. *beyrichii*, the decision was to describe this entity as a new variety, using the rank best conforming with the currently accepted infraspecific taxonomy of *E. strigosus*.

Late in October of 1992, Allison traveled to Middle Tennessee to visit the herbarium at Vanderbilt University, confer with Robert Kral, and make collections from cedar glades of *Onosmodium molle* ssp. *molle* and especially *Dalea gattingeri*, for comparison with their Bibb County congeners. Growing on virtually every glade visited were populations of *Erigeron strigosus*, like var. *dolomiticola* of manifestly perennial duration: green, healthy-looking and obviously overwintering rosettes were connected by rhizomes to flowering stems that were clearly senescing, though many still with some flower-heads (Figure 7). These rosette leaves were consistently wider than those of var. *dolomiticola*, though not achieving the maximum width seen in the rosettes of the (annual) varieties *strigosus* and *beyrichii*. These cedar glade populations also had leaves, stems, and involucres more sparsely pubescent than is usual in other varieties.

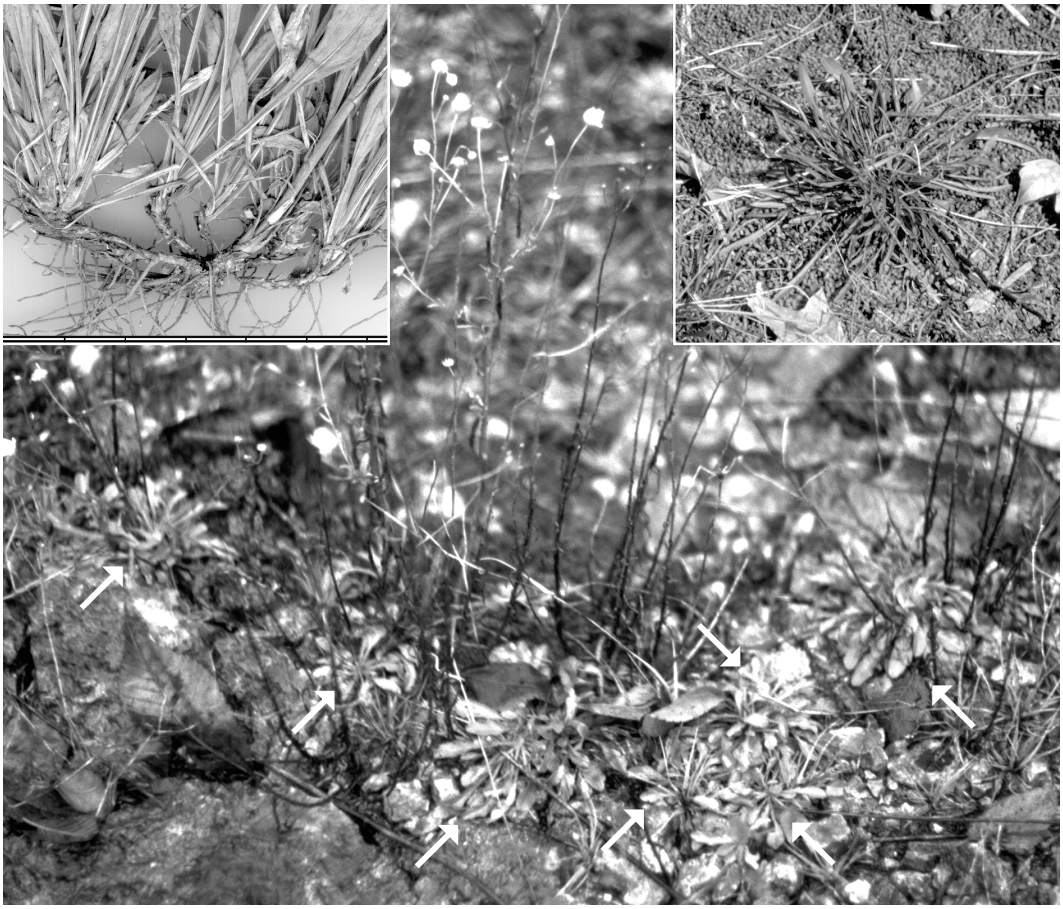

Figure 7. Center, *Erigeron strigosus* var. *calcicola*, late autumnal (post light frosts) aspect with overwintering basal rosettes well developed (indicated by arrows); Marshall County, Tennessee, 27 October 1992. Upper left, detail from pressed specimen (Morgan County, Alabama, *A. 12444*, US) of var. *calcicola*, with multiple rhizomes, each terminated by a rosette (scale at bottom in 1 cm intervals). Upper right, much narrower rosette leaves of var. *dolomiticola* (in prostrate, winter condition); Bibb County, Alabama, 29 December 1992.

Subsequently, we found additional perennial *Erigeron strigosus* populations, virtually glabrous like those on Middle Tennessee cedar glades, on and near many limestone glades in northern Alabama and on a single glade in northwestern Georgia. Surprisingly, we found no populations on any of the multiple glades visited in Catoosa County, Georgia, where glades are the most numerous in that state and the characteristic cedar glade flora is well developed. The plant was also absent from glades in Bullitt County, Kentucky, visited by Allison. It should be sought on other glades in that state.

As these sparsely strigillose, broad-leaved populations are of perennial duration, have been found only in a particular habitat (shallow soil over limestone), and have a much more restricted range, they should not be considered typical *Erigeron strigosus* var. *strigosus* (nor the weakly differentiated var. *beyrichii*). As they have consistently wider rosette leaves, are endemic to a different type of rock outcrop, and are allopatric with the narrow-leaved perennials corresponding

to var. *dolomiticola*, neither should they be referred to the Ketona Glade taxon. Therefore, they are described here as a new variety, *E. strigosus* var. *calcicola*.

Erigeron strigosus Muhl. ex Willd. **var. calcicola** J. Allison, var. nov. TYPE: Tennessee: Rutherford Co., ca. 18.7 km E of Murfreesboro, ca. 3.7 km NNW of Readyville; limestone glade west of Tassey Rd., ca. 0.2 rd. km N of crossing of Andrews Creek, 22 Jul 2000, *James R. Allison 12431* (holotype, NY; isotypes: DUKE, GA, GH, MO, NCU, TENN, UNA, US, VDB). Figure 7.

Planta perennis ut in varietate dolomiticola J. Allison *sed ad saxum calcareum crescens, et foliis radicalibus perspicue laterioribus* (*plerumque plus quam* 3.8 mm *latis*) *ab illa varietate distinguenda.*

Similar to the annual (or sometimes biennial) var. *strigosus* but (1) less pubescent (mid-cauline leaves glabrous, except for cilia and often some well spaced, strigillose hairs on the midvein, the rosette leaves sometimes sparsely strigillose); (2) a perennial (given normal precipitation) with overwintering basal rosettes; with (3) a more restricted range (northern Alabama to northwestern Georgia and central Tennessee) and (4) a restricted habitat (endemic to limestone outcrops). In addition to the often slightly larger involucres and usually less diffuse and more conspicuously bracteate inflorescence that cause it to resemble var. *strigosus*, it differs from the perennial var. *dolomiticola* by having wider, more sparsely strigillose leaves, with those of the rosettes (3.2) 3.8–15 (21) mm wide, and in growing only over limestone, rather than dolomite.

Flowering (late April) May–frost, fruiting late May–frost.

English Name: Limestone Daisy Fleabane.

Paratypes. Alabama: Colbert Co., 14.8 km SSE of Tuscumbia. Littleville, jct. Lynwood Ave. and Durward Dr., 19 Aug 2000, *A. 12513* (UNA). Franklin Co., Isbell, limestone barrens, 27 May 1972, *R. Kral 46739* (MO, VDB). Jefferson Co., 13.5 km NE of Birmingham, Murphree Rd., Ketona, 5 Oct 1993, *A. and S. 8026* (UNA). Lawrence Co., 17.8 km WNW of Moulton, Co. Rd. 39, formerly Co. Rd. 7, 25 May 1999, *A. 11948* (AUA, UNA, US, VDB). Madison Co., 6.8 km SE of Huntsville, lower slope of Monte Sano, 20 Aug 2000, *A. 12516* (JSU, NCU, UNA). Morgan Co., 6.3 km WSW of Falkville, State Crusher Rd., 23 May 2000, *A. 12444* (AUA, DUKE, FLAS, FSU, GA, GH, JSU, MICH, MO, NCU, NY, UNA, US, USCH, VDB). Georgia: Floyd Co., 12.4 km SW of Rome, Cunningham Rd., 4 May 1999, *J. Allison and R. Ware 11859* (GA, GH, MO, NCU, NY, US). Tennessee: Bedford Co., 6.3 km ESE of Shelbyville, US Hwy. 41A, 22 Jul 2000, *A. 12438* (FSU, GH, MICH, NY, TENN, US, USCH, VDB). Cannon Co., 8.7 km WNW of Woodbury, Tassey Rd., 22 Jul 2000, *A. 12429* (NY, TENN, VDB). Davidson Co., 20.0 km SE of Nashville, Tenn. Hwy. 171, 12 Oct 2000, *A. 12591* (TENN, VDB). Giles Co., 6.7 km SSW of Pulaski, Donahue Rd., 12 Oct 2000, *A. 12587* (AUA, BRIT, DUKE, FLAS, FSU, GA, GH, MICH, MO, NCU, NY, TAMU, TENN, US, USCH, VDB). Marshall Co., 17.4 km N of Lewisburg, Tenn. Hwy. 99, 22 Jul 2000, *A. 12439* (GA, NCU, TENN, VDB). Maury Co., 19.0 km NE of Columbia, US Hwy. 431, 22 Jul 2000, *A. 12440* (NY, TENN, US, VDB). Williamson Co., 17.4 km SSE of Franklin, Tenn. Hwy. 247 and I-65, 22 Jul 2000, *A. 12441* (TENN, VDB). Wilson Co., 19.8 km SSW of Lebanon, Fall Creek Rd., 22 Jul 2000, *A. 12434* (MICH, NY, UNA, US, TENN, VDB).

As an aid in understanding the differences among southeastern varieties of *Erigeron strigosus*, Cronquist's (1980) key may be brought up to date by the following modifications:

1 Plants annual or rarely biennial, of various, often ruderal habitats.
  2 Heads tiny, the involucres only 2–3 mm high; inflorescence diffuse and subnaked, the peduncles often flexuous; coastal states, chiefly on Coastal Plain, from New Jersey to Florida and Texas . . . . . var. *beyrichii*.
  2 Heads averaging larger, the involucre (2.5) 3–4 mm high; inflorescence not diffuse, or if so, then somewhat leafy; widespread, but seldom on Coastal Plain south of Virginia . . . . . var. *strigosus*.
1 Plants normally perennial (sometimes killed prematurely by severe drought), of shallow soil over calcareous rock.
  2 Rosette leaves linear-oblanceolate, less than 3.5 mm wide; cauline leaves sparsely to moderately strigillose; growing over dolomite in Bibb County, Alabama . . . . . var. *dolomiticola*.
  2 Rosette leaves oblanceolate to narrowly obovate or spatulate, more than 3.8 mm wide; cauline leaves glabrous (but ciliate) except along the midvein; growing over limestone in northern Alabama, northwestern Georgia, and Middle Tennessee . . . . . var. *calcicola*.

Morphologically transitional to *Erigeron annuus* (Cronquist 1947, 1991) is a fifth variety, var. *septentrionalis* (Fern. & Wieg.) Fern. It can readily be distinguished from the other four varieties by its longer, spreading stem pubescence and by the longer, more distinctly flattened hairs of its involucre, characters it shares with *E. annuus*. Although not mentioned by Cronquist (1980) in his treatment of Asteraceae of the Southeast, var. *septentrionalis* reportedly ranges from Tennessee and Arkansas northward and westward (USDA 2000).

In the perennial varieties, *calcicola* and *dolomiticola*, as long as soil moisture levels are adequate, offsets are produced throughout the growing season by means of short, slender horizontal rhizomes that become upturned and produce secondary rosettes.* If soil moisture and temperature conditions (and perhaps day length?) continue to be favorable, these rosettes bolt into flowering stems and additional offsets are produced. Those rosettes that have been produced but have not yet bolted by the end of autumn persist through the winter and bolt the following spring, as do additional offsets produced during the winter months.

The shallow soils in which the newly described perennial varieties grow are susceptible to desiccation during occasional summer droughts. Though these varieties are rather drought tolerant, under very low levels of soil moisture rosette development is suppressed or greatly reduced. Mortality is sometimes quite high (e.g., during the severe droughts of 1999 and 2000), but even in summers of normal rainfall, we observed some flowering plants that lacked secondary rosette development. If all their rosettes have withered, such plants presumably will not overwinter. Probably these were plants whose microhabitats had become unfavorable for continued growth or were older plants that had exhausted their capacity for rosette proliferation. It would be interesting

* After offsets are well developed their connection to the flowering stem is lost fairly quickly, and care should be taken, in making collections, to minimize breakage of the fragile rhizomes.

and informative to track the development of individually marked or mapped plants over several years.

Erigeron strigosus var. *dolomiticola* seems never to stray from its Ketona Glade habitat, exhibiting none of the weediness so characteristic of the annual varieties. Variety *calcicola*, however, can often be found on road shoulders or lawns in the vicinity of cedar glades, provided limestone is close to the surface. In such places the early successional conditions of the glade habitat are maintained or simulated by occasional mowing, a practice well tolerated by variety *calcicola* (which responds by flowering at a lower height) and by some of its weedier glade associates, such as *Croton monanthogynus* Michx. and *Verbena simplex*. During the prolonged drought of 2000 over the cedar glade country of northern Alabama and Middle Tennessee, such ruderal sites often yielded better specimens than the populations on the (desiccated) glades nearby, such as the paratype collection from Cannon County, Tennessee. Care must be taken in the identification of plants collected from such places as well as from disturbed areas on genuine cedar glades (such as where roads have encroached upon glade habitat). Variety *strigosus* is sometimes associated with var. *calcicola* under these conditions, and so it is very helpful that material of var. *calcicola*, even when lacking rosettes, is still readily distinguishable by the essentially glabrous cauline leaves. However, some plants intermediate between var. *calcicola* and *strigosus* in leaf width and in density of pubescence have been found in roadside glade habitats, suggesting probable introgression (e.g., *A. 12500b*, GA).

Erigeron strigosus was considered by Cronquist (1947) to be predominantly apomictic. Thus it might be expected to produce distinctive, relatively uniform races that appear to "breed" true but are essentially asexual. Certainly one should be cautious in describing new taxa within a group known to include apomicts. However, infraspecific taxa are currently recognized in the taxonomy of *E. strigosus* (e.g., USDA 2000). In this case there is a demonstrable difference in duration in varieties *dolomiticola* of dolomite glades and calcicola of limestone glades from that of previously described varieties of *E. strigosus*. This is correlated with particular habitats, habitats that surely have selected for physiological adaptations that are phenotypically invisible but undoubtedly present. This suggests more than a trivial genetic difference in the perennial glade endemics from the currently accepted varieties of *E. strigosus*.

Since Cronquist's (1947) monograph of the genus *Erigeron* north of Mexico, diploid, sexual populations of *E. strigosus* have been reported (Turner and Flyr 1966, Nesom 1978). The ploidy and breeding systems of the two new perennial varieties are unknown, but the annual duration of previously named varieties of *E. strigosus* is considered an advanced trait within the genus (Cronquist 1947). The discovery of perennial varieties raises the question of whether they represent "primitive," relictual forms of the species or are, instead, the result of a reversal of an existing (annual) condition as an adaptation to a new environment. If the perennial duration is primitive, the diploid condition should be correlated with it, as it is with a sexual breeding system rather than with apomixis (Nesom 1978). Neither of the papers reporting diploid counts was focused on *E. strigosus*, and they contained no infraspecific determinations for chromosome counts of that species (though vouchers were cited for all, so such determinations are feasible). They also did not discuss any correlation in *E. strigosus* of ploidy level with duration or morphology. In short, many unanswered questions remain about variation in the *strigosus* complex. Certainly a determination is needed of the ploidy level(s) of varieties *dolomiticola* and *calcicola*, as well as a careful assessment of the duration of the various diploid and polyploid cytotypes of *E. strigosus*.

As indicated earlier, a very peculiar *Liatris* is both the most distinctive and undoubtedly the rarest of the endemics. It is abundant on only a single glade and restricted to a handful of populations within an area of less than 1.6 km^2, the heart of the "core area" where the Ketona Glades are the most extensive and richest in rare taxa.

Liatris oligocephala J. Allison, sp. nov. TYPE: Alabama: Bibb County, ca. 14.2 km NE of Centreville. "Starblaze Glade Southwest," Ketona Dolomite outcrop ca. 0.3 km N of the Little Cahaba River, 18 Jul 1993, *James R. Allison and Timothy E. Stevens 7802* (holotype, GH; isotypes: AUA, BRIT, DUKE, FLAS, FSU, GA, IBE, JSU, MICH, MO, NCU, NY, TAMU, TENN, UARK, UNA, US, USCH, VDB). Figures 8 and 9.

Species corpore achenii sine setulis a congeneris diversa.

Perennial herb, (1.2) 2.5–4.8 (5.5) dm tall from a globose or rounded "corm" up to 3.5 cm in diameter, with 1–several stems, the corm in age short-branched at the summit, producing one or a few, close offsets. *Stem* green to yellowish, purplish, or brownish, striate-sulcate, to 2.5 mm thick, simple (very rarely with a slender branch from low on the main stem), glabrous below the peduncles, the latter glabrous or distally sparsely pilose with sinuous hairs 0.3–1.2 mm long. *Leaves* at the very base of the stem almost scalelike, broader and much shorter than the rest, usually deciduous or withered by anthesis, well developed leaves rigid, linear or the uppermost linear-lanceolate, slightly lustrous, punctate, 1.2–20 (23) cm long and 1.2–3 (4.5) mm wide, those of the lower stem much longer than those above the middle, or sometimes the submedial leaves the longest and then upwards abruptly reduced, leaf margins strongly ciliate with spreading, almost straight to curved or sinuous hairs 0.9–1.5 mm long (mostly ca. 1.1 mm), these sometimes glabrescent, the midrib, especially beneath, sometimes with similar, shorter, less spreading, more or less evanescent hairs. *Inflorescence* a solitary, terminal head or more often a subcorymbiform, essentially complanate, arrangement, to 9.5 (11) cm long and 7 (9.4) cm broad, of 2–7 (10) heads, sometimes with one or a few of these up to a few cm lower (sometimes one or a few additional heads lower still, these usually abortive); peduncles (0.5) 1.2–4 cm long, with or without a leaflike bract, 8–15 mm long, positioned 0.5–3.5 mm below the involucre. *Heads* campanulate-turbinate, mostly 1.5–2.2 cm long, (11) 14–21 (25) flowered, about equal in size or the central slightly larger; involucre 10–19 (23) mm high, (0.8) 1–1.7 (2.1) cm wide, phyllaries (14) 17–22 (25), appressed or merely a little loose at the tip, persistent, (5.3) 8.0–12.5 (14.0) mm long and (1.0) 1.5–3 (3.8) mm wide, imbricated in about 3 series, ribbed in part, the unribbed portion punctate, the outer ones lanceolate, like reduced leaves, green or purple, long-acuminate, ribbed only proximally, ciliate essentially to the base, inward a little broader, less acuminate, the ribbed portion progressively greater and the cilia more distally disposed, the innermost narrowing again, linear-oblong, short-acuminate; chaff never developed; outer flowers of the head tending to be bent outward approximately at mid-corolla, giving the heads a broad, flat top; corolla purple, (9) 11–12.5 (14) mm long, outer surface of tube with glandular punctations, inner surface of tube glabrous, lobes glabrous, very narrowly triangular, 1.6–2.2 (2.6) mm long; anthers distinctly included, apices (1.5) 3–4 mm below the sinuses of the corolla, appendages ovate; style and stigmas purple and glabrous. *Fruit* a several-ribbed achene, body dark brown, (3.2) 5.2–7 (7.3) mm long, 1.0–1.8 mm wide, glabrous. *Pappus* (7) 8–10 mm long, purplish (at least distally), barbellate, the barbels ca. 0.1 mm long. Chromosome number unknown.

Flowering late June–July (August), fruiting late July–September.

English Name: Cahaba Torch.

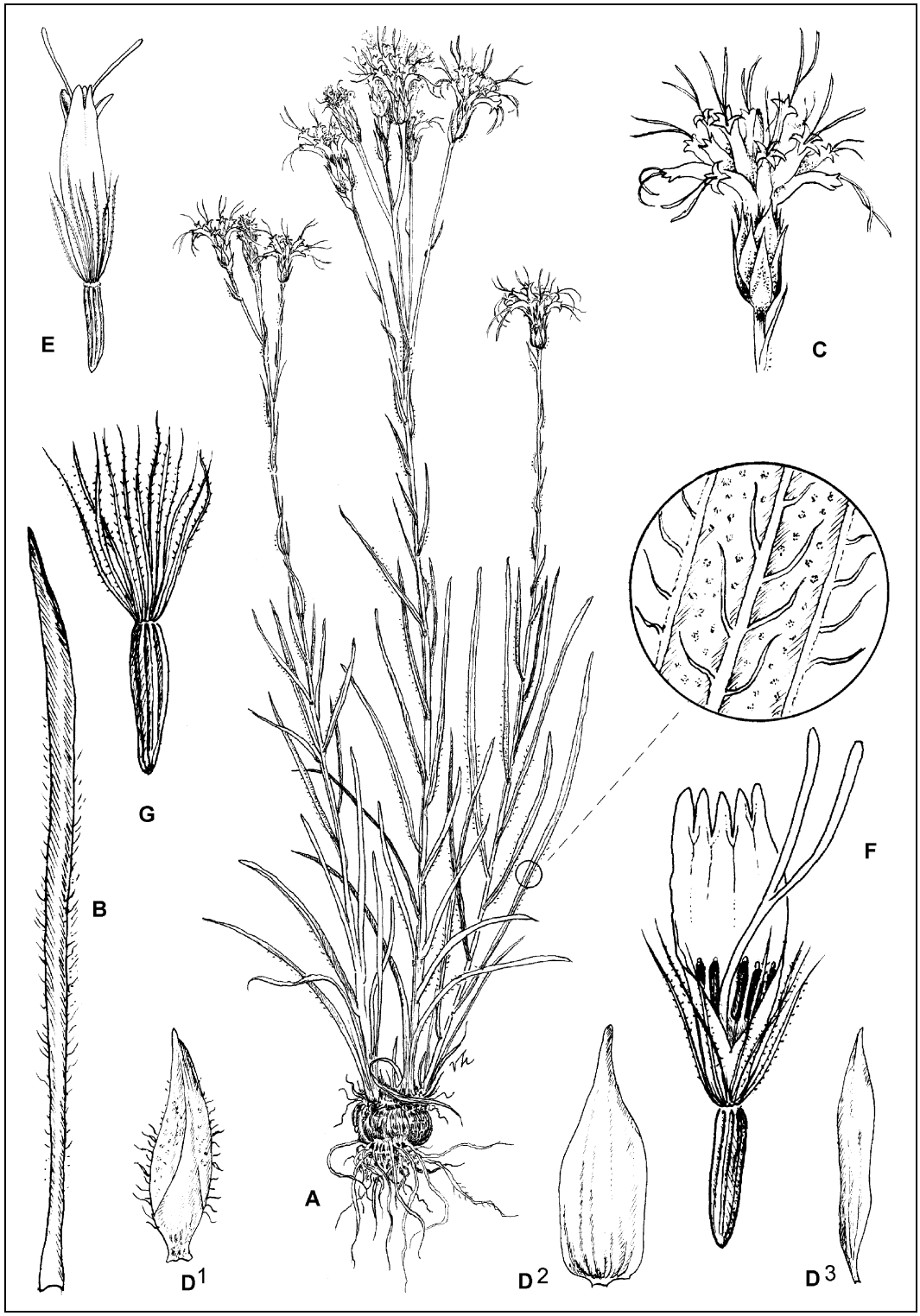

Figure 8. *Liatris oligocephala*. A. Habit, ×1/3, detail showing lower surface of leaf. B. Leaf, ×1. C. Head, ×1. D. Representative phyllaries, ×3, outer (left), medial (center), and inner (right). E. Flower, ×2. F. Dissected flower, ×4. G. Achene, ×4.

Paratypes. Alabama: Bibb Co., (topotype) 1 Nov 1993, *A. and S. 8134* (DUKE, JSU, VDB); 14.3 km NE of Centreville, "Starblaze Glade Northeast," 6 Sep 1992, *A. and S. 7119* (GH, MO, NY, UNA, US); 14.6 km NE of Centreville, "Goat Glade South," *A. and S. 7814*, 18 Jul 1993 (FLAS, FSU, USCH); 14.8 km NE of Centreville, "Brown's Dam South Glade III," 18 Jul 1993, *A. and S. 7820* (AUA, DUKE, GA, JSU, UNA); 14.9 km NE of Centreville, "Brown's Dam North Glade West," 18 Jul 1992, *A. et al. 6864* (AUA, UNA); 14.9 km NE of Centreville, "Goat Glade North," 3 Jul 1992, *A. 6787* (NY, US); 15.3 km NE of Centreville, "Desmond's Glade," 18 Jul 1993, *A. and S. 7817* (AUA, GA, GH, JSU, MICH, UNA, VDB).

Liatris oligocephala is found only on the sunniest, most exposed microhabitats, unlike *L. cylindracea*, which is able to tolerate moderate shade. The latter is actually a more characteristic plant of the Ketona Glades, found on virtually all but the easternmost site.

This new *Liatris* appears to be sufficiently distinctive to merit the establishment of a new series, perhaps even a new section, to accommodate it, but we will leave that decision to a future monographer. It is clearly a *Liatris* because of its globose "corm," epaleaceous receptacle, and the fact that it hybridizes with *L. cylindracea*. Past generic descriptions (e.g., Geiser 1946, King and Robinson 1987) however, must be revised because *L. oligocephala* is the only known *Liatris* lacking setulae on the ribs of its achenes. It is also the only *Liatris* that produces mostly one to three heads or at most a simple cyme. *Liatris cymosa* (Ness.) K. Schum. and *L. ohlingerae* (Blake) B. Rob. often have the heads arranged in a simple cyme, but vigorous individuals of both these species bear compound cymes (Geiser 1946). The two sections of the genus currently recognized were distinguished by L. O. Geiser (1946) by having a plumose vs. a barbellate pappus. If Geiser's sections are natural, the plumose pappus found in both *L. cymosa* and *L. ohlingerae* (Geiser 1946) would indicate that they are not closely related to *L. oligocephala*, which has a barbellate pappus.

Though the great majority of species of *Liatris* bear their heads in a spikelike or racemelike arrangement, true spikes and racemes are indeterminate. In the *Liatris* inflorescence, floral maturation begins at the apex and proceeds downwards (basipetal), and its determinate nature means that the common forms are, properly speaking, spiciform or racemiform cymes (Geiser 1946). Thus, the simple cyme of *L. oligocephala* would appear to be a primitive characteristic. To posit that the plant actually resembles an ancestral taxon that was a theoretical progenitor of both *Liatris* and the closely related *Carphephorus* Cass. would be too speculative, but *L. oligocephala* bears so similar an aspect in the field to that of *Carphephorus pseudoliatris* Cass. that real consideration was given to another choice of epithet: *Liatris pseudocarphephorus*. The lack of setulae on the achenes, however, make *L. oligocephala* a discordant element within the entire subtribe in which King and Robinson (1987) placed these genera, and absence of setulae may be a derived trait, unique to the species (autapomorphy).

When two or more species of *Liatris* grow in proximity and flower simultaneously, hybrids are often produced (Geiser 1946). Although anthesis in *Liatris oligocephala* begins prior to that of the syntopic and usually more abundant *L. cylindracea*, there is a limited period of overlap in flowering, and we detected hybrids between them on three glades. The hybrids were always found in close proximity to both parental species, and the latter are so different from each other in head arrangement that many hybrid plants were easily recognized as such. Much greater difficulty is encountered in trying to sort out F^1 plants from putative backcrosses.

In technical characters the hybrid differs from the parents by the intermediate length of the barbels of its pappus bristles, and with the ribs of the achenes bearing fewer setulae than in *Liatris cylindracea* (absent in *L. oligocephala*). Notable also is the intermediacy in shape of corolla lobes, in the degree of internal pubescence of the corolla (both the lobes and tube), and in the pubescence of the style and stigma. Intermediacy is expressed in other characters as well, including phyllary shape and the pubescence of stem, leaves, and phyllaries.

The aggregate number of individuals and populations of *Liatris oligocephala* is critically small. Therefore, interspecific hybridization should be recognized as a potential threat to its survival. At the very least, multi-year monitoring of the interaction between *L. cylindracea* and *L. oligocephala* should be a conservation objective. Ultimately, since there are many more Bibb County populations of *L. cylindracea* than of *L. oligocephala*, it might prove desirable to reduce or even eliminate *L. cylindracea* and their hybrid at the few glades where *L. oligocephala* occurs.

Despite some ambivalence about the practice of assigning unique epithets to nothospecies, we acknowledge that there is a tradition of doing so in certain genera, *Liatris* among them (see Geiser 1946). We therefore formally describe the two hybrids we found between species of *Liatris*, while resisting the impulse to do the same in similar cases involving species of *Coreopsis*, *Onosmodium*, and *Silphium*, where no such tradition exists.

The first of these hybrids is dedicated to the memory of John D. Freeman (1941–1997), noted *Trillium* expert, a positive influence on his numerous students at Auburn University, and one of the first in the state to call attention to the need for the preservation of threatened and endangered plants of Alabama.

Liatris ×freemaniana J. Allison, hybr. nov. TYPE: Alabama: Bibb County, ca. 14.5 km NE of Centreville. "Starblaze Glade Northeast," Ketona Dolomite outcrop ca. 0.6 km N of the Little Cahaba River; with both parental species, 18 Jul 1993, *James R. Allison and Timothy E. Stevens 7804* (holotype, AUA; isotypes: GH, MO, NY, UNA, US, VDB). Figure 9.

Planta inter L. cylindraceam Michx. *et L. oligocephalam* J. Allison *plus minusve intermedia, ex hybridatione harum specierum orta et his crescens; ab ambobus differt pappo subplumoso et corpore achenii intermedio numero setularum.*

Paratypes. Alabama: Bibb County, (topotypes) 6 Sep 1992, *A. and S. 7118* (DUKE, GA, JSU, MICH, USCH); 27 Sep 1992, *A. and S. 7237* (AUA, JSU, UNA); 1 Nov 1993, *A. and S. 8131* (US); 14.0 km NE of Centreville, "Starblaze Glade Southwest," 18 Jul 1993, *A. and S. 7801* (AUA, GH, MO, NY, UNA, US, VDB); 15 Aug 1993, *A. and S. 7878* (JSU, UNA, VDB); 1 Nov 1993, *A. and S. 8133* (NY); 14.6 km NE of Centreville, "Goat Glade South," 18 Jul 1993, *A. and S. 7813* (AUA, MICH, UNA).

The other *Liatris* hybrid detected during our surveys was found at sites where *L. cylindracea* occurs close to, though usually not intermixed with, *L. squarrosa* L. In neither Geiser (1946), King and Robinson (1987), nor the PLANTS Database (USDA 2000) is the hybrid *L. cylindracea* × *L. squarrosa* reported. While *L. cylindracea* is a characteristic species of the Ketona Glades. *L. squarrosa* is rarely found on them, and then usually in marginal ecotones. According to the PLANTS Database (USDA 2000), there are five accepted varieties within *Liatris squarrosa*. At the locations cited below, the *squarrosa* plants were all referable to var. *squarrosa* sensu Geiser (1946).

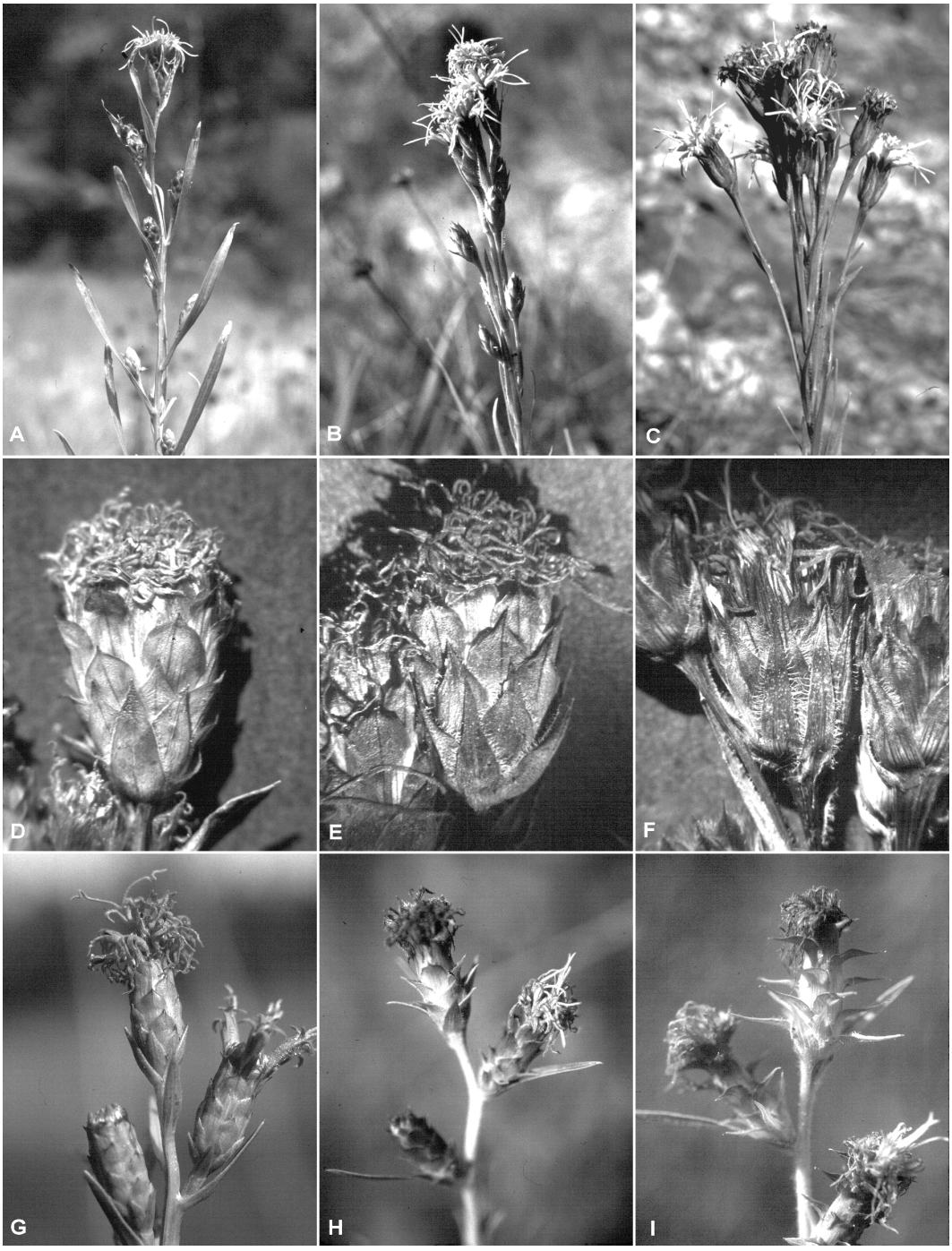

Figure 9. Hybridization in *Liatris*. A–C, photographs taken 13 July 1993 at the type locality of *L.* ×*freemaniana*, showing differences in head arrangement: A. *L. cylindracea*. B. *L.* ×*freemaniana*. C. *L. oligocephala*. D–F, pressed heads of same taxa, from collections (UNA) made 18 July 1993, showing differences in outer phyllary shape and in degree of ciliation: D. *A. & S. 7800*. E. *A. & S. 7801*. F. *A. & S. 7815*. G–I, photographs taken 19 August 1999 at the type locality of *L.* ×*macdanieliana*, showing differences in phyllary shape and orientation: G. *L. cylindracea*. H. *L.* ×*macdanieliana*. I. *L. squarrosa*.

This hybrid is dedicated to Sidney McDaniel, Professor of Botany at Mississippi State University, a keen observer and collector of the flora of the Southeast and of the Iquitos region of Peru, and mentor to many well trained students, with wishes for a speedy recovery from a recent serious injury.

Liatris ×macdanieliana J. Allison, hybr. nov. TYPE: Alabama: Bibb County, ca. 9.0 km NNW of Centreville. Occasionally mowed area adjacent to "Highway 5 Glade West," Ketona Dolomite outcrop just W of Ala. Hwy. 5 at jct. Ala. Hwy. 219. With *Liatris squarrosa*. *Liatris cylindracea* nearby on glade, 20 Aug 1994, *James R. Allison 8559* (holotype, US; isotypes: AUA, GH, IBE, MO, NY, UNA). Figure 9.

Planta ex hybridatione L. cylindraceae Michx. *et L. squarrosae* L. *orta et his crescens; forma divergentiaque bractearum involucrorum etiam pubescentia caulis et foliorum et involucrorum inter parentes media.*

Paratypes. Alabama: Bibb County, (topotypes) 2 Sep 1996, *A. et al. 9461* (AUA, FLAS, FSU, JSU, UARK, UNA, USCH); 17 Aug 1998, *A. 11343* (AUA, DUKE, GA, JSU, MICH, VDB); 19 Aug 1999, *A. 12166* (GA, GH, JSU, UNA); 8.9 km NNW of Centreville, "Highway 5 Glade East, "12 Aug 1993, *A. and S. 7862b* (US, VDB);19 Aug 2000, *A. 12509* (IBE); 13.6 km NE of Centreville, "Double Glade South," 17 Jul 1993, *A. and S. 7798* (NY, US); 31 Jul 1994, *A. and S. 8533* (AUA, JSU, UNA); 17 Jul 1999, *A. et al. 12095* (GH, MO).

A densely hispid *Onosmodium* was one of the most striking of several unfamiliar glade plants that we observed on the initial Memorial Day weekend canoe trip. As this took place a few weeks after the end of anthesis in this plant, we had to wait nearly a year to see it in flower. In the interim, its more uniform leaf pubescence seemed to rule out an identification as any of the various taxa that are considered allied to (e.g., Turner 1995) or conspecific with (e.g., Das 1965) *O. molle*. We were also able to determine early on that the Ketona Glade plant was not merely an extremely hispid form of the sympatric *O. virginianum* (L.) A. DC.: by rehydrating some blackened, withered corollas that had persisted on each, we were able to determine that the corolla lobes of the Ketona Glade plant were more broadly triangular than those of *O. virginianum*.

Onosmodium decipiens J. Allison, sp. nov. TYPE: Alabama: Bibb County, ca. 13.7 km NE of Centreville, "Fern Glade," Ketona Dolomite outcrop above the right (N) bank of the Little Cahaba River, 1 Nov 1993, *James R. Allison and Timothy E. Stevens 8139* (holotype, NY; isotypes: AUA, DUKE, GA, GH, JSU, MICH, MO, UNA, US, VDB). Figure 10.

Corollis flavidis et pilis longitudinis aequabilis intervenio in superficiebus ambabus foliorum sessilium O. virginianum (L.) A. DC. *accedens, sed lobis corollae tantum acutis et apicibus antherarum ad sinus corollae attingentibus ab illo recedens.*

Perennial herb, (2.6) 3–6.5 (8.4) dm tall, brittle when dried, coarsely hairy, the hairs whitish or in youth drying golden. *Stems* 1–several arising from a rootstock, green becoming yellowish, erect or ascending, 3–8 mm in diameter, often branching above the middle, densely hispid, the straight or somewhat falcate, pustular-based hairs (2) 3–5 mm long, those at base of stem sometimes

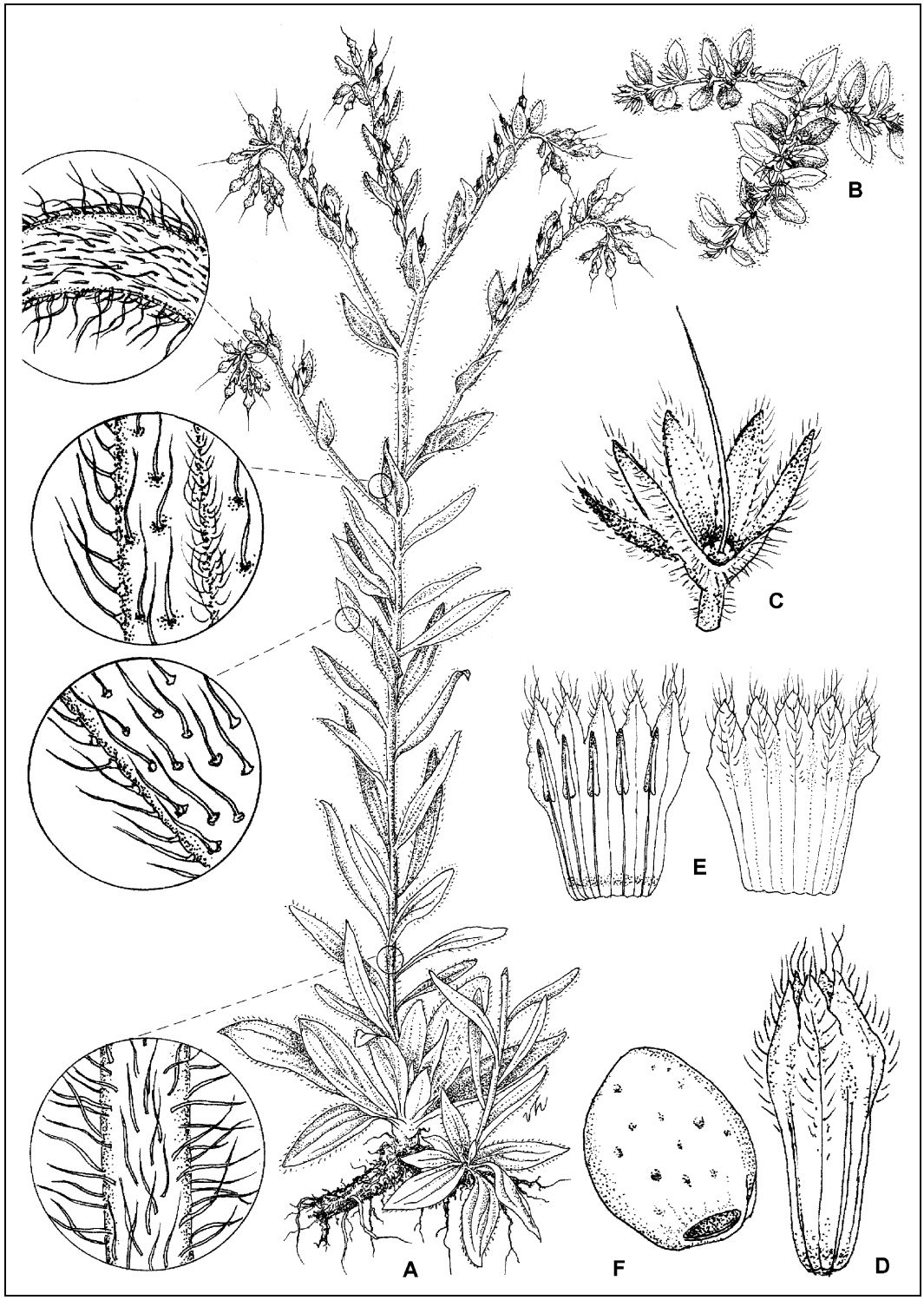

Figure 10. *Onosmodium decipiens*. A. Habit, ×1/3, with details showing hairs on (top to bottom) inflorescence axis, lower leaf surface, upper leaf surface, and lower stem. B. Portion of infructescence, viewed from above, ×1/3. C. Calyx with ovary and style, ×5. D. Corolla, ×5. E. Two views of dissected corolla, ×3 1/3. F. Nutlet, ×10.

deciduous with age but leaving distinct scars. *Leaves* proximally clustered in a conspicuous basal rosette, within a few nodes upwards usually distinctly reduced and spaced, thereafter only very gradually reduced, sessile or sometimes tapering to a subpetiolar base, nearly always 5-nerved, nerves and blade surfaces densely hispid with hairs ca. 2 mm long that have conspicuous pustular bases which are transparent at first and then white with age, the hairs along the nerves on the lower surface oriented perpendicular to the nerves, those of the upper surface weakly antrorse-ascending, nerves of both surfaces also with shorter, antrorse hairs; rosette leaves spreading or weakly ascending, (4.5) 6–14 cm long, 0.9–2.8 cm wide, oblanceolate to spatulate, with a round or obtuse apex, withering only after anthesis; cauline leaves spreading or somewhat ascending, 4–9.5 cm long, 0.9–3.2 cm wide, oblanceolate to elliptic, obtuse or acute. *Inflorescence* (6) 10–31 cm long, of few to several scorpioid cymes, the cymes short and congested early in anthesis, then lengthening and loosening, ultimately (2.5) 3.9–20.5 cm long on a peduncle (0.3) 0.5–4 cm long; bracts elliptic to ovate, accrescent, to 11 mm long and 3 mm wide in flower and 8–45 mm long, 2.5–20 mm wide in fruit; pedicel to 4 mm long in flower and 10 mm long in fruit; sepals at anthesis 4.2–7.5 mm long, 0.5–1.0 mm wide, somewhat accrescent, linear-lanceolate, pubescent, abaxial hairs ascending, ca. 1 mm long, adaxial hairs appressed, 0.3–0.5 mm long, margins ciliate with hairs 1.5–1.7 mm long; corolla 7.3–11.0 mm long, pale yellow, lobes triangular, 2.1–3.0 mm long, 1.1–2.0 mm wide at the base, externally pubescent with hairs of two lengths, the longer hairs 1.2–2.0 mm long, usually straight or apically undulate or curled, the shorter ca. 0.5 mm long and extending down to the middle of the corolla; anthers 2.0–2.5 (2.7) mm long, apices reaching approximately to the corolla-sinuses; style 12–17 mm long. *Fruit* an ovoid nutlet, (1.8) 2.1–2.8 (3) mm long, lustrous white, often with brownish tinges in age, sparsely to abundantly pitted, tapered gradually to the truncate basal scar, scar (0.8) 1–1.2 mm across. Chromosome number unknown.

Flowering April–early May, fruiting June–August.

English Name: Deceptive Marbleseed.

Paratypes. Alabama: Bibb Co., N of Centerville [sic], limestone [sic] glades and bluffs above Little Cahaba River, 23 May 1993, *R. Kral 82507* (VDB); Limestone [sic] glades along Little Cahaba R., 9 Aug 1992, *R. Kral 81282* (VDB); N of Centreville, dolomitic outcrop by Ala. Hwy. 5, 29 May 1970, *R. Kral 39318* (AUA, JSU, VDB); 28 Jul 1972, *R. Kral 47850*, VDB); N of Centreville, 0.5 mile E of jct. AL 291 and AL 5, limestone [sic] outcrop in clearing, 13 May 1983, *R. D. Whetstone and K. E. Landers 13395*, JSU); 6 miles N of Centreville/Brent, Hwy. 5, Ketona Dolomite glade, 7 Jun 1996, *John R. MacDonald 9537* (VDB); 15.1 km NE of Centreville, "Brown's Dam North Glade West," 1 May 1994, *A. and S. 8235* (FLAS, FSU, GA, GH, MICH, MO, NY, TENN, UNA, US, USCH, VDB); 15.3 km NE of Centreville, "Desmond's Glade," 29 Apr 1994, *A. et al. 8215* (AUA, GA, JSU, UNA).

Among the endemics, only *Erigeron strigosus* var. *dolomiticola* and the new *Onosmodium* are characteristic elements of even the smallest Ketona Glades. While the *Erigeron* is absent only from a single glade near the western periphery of the glade "archipelago," *O. decipiens* is absent only from the very easternmost glade. Like the *Erigeron*, *O. decipiens* is a plant of full or partial sunlight, found on the open glade or sometimes along edges.

The literature (Gandoger 1918) contains a taxon named *Onosmodium alabamense*, described by the notorious Michel Gandoger (1850–1926), who, in the words of Correll and Johnston (1979), "named thousands of unacceptable species." From the scanty descriptive information provided, it

would seem that Gandoger's plant, with its "*stylus inclusus*" is not an *Onosmodium* at all, at least in the modern, post Mackenzie (1905) sense. The "*elongati lineares*" corolla lobes further disqualify Gandoger's name from possible application to the Bibb County plants.

Onosmodium decipiens exhibits characters alternately either of *O. molle* Michx. ssp. *hispidissimum* (Mackenzie) Boivin or of *O. virginianum*. Table 1 summarizes the principal differences among these three taxa of *Onosmodium*. Both leaf indument and maximum cauline hair length are ideal characters as they can be used throughout the growing season. The double indument of the leaf surfaces of *O. molle* ssp. *hispidissimum*, a shared trait of the several subspecies of *O. molle* (Das 1965), consists of short, appressed hairs beneath the longer, more spreading ones.

Table 1. Morphological comparison of three *Onosmodium* taxa

Character	*O. molle* ssp. *hispidissimum*	*O. decipiens*	*O. virginianum*
plant height	to ca. 12 dm	to ca. 6.5 (–8.4) dm	to ca. 5 dm
stem hair length	>2.5 mm	>2.5 mm	<2.0 mm
leaf indument	double	simple	simple
corolla color	white w/ greenish lobes	light yellow	light yellow
corolla lobes	nearly deltoid	nearly deltoid	acuminate
anther apices	at corolla sinuses	at sinuses	below sinuses
nutlet base	constricted	unconstricted	unconstricted

The new *Onosmodium* is apparently the only Ketona Glade endemic other than *Dalea cahaba* to have been collected prior to 1992 (see paratypes, above). Specimens at VDB from Robert Kral's 1970 and 1972 Bibb County collections, determined by him as *O. hispidissimum* Mackenzie, were examined by Jerry and Carol Baskin in 1982. They annotated the specimens as "*Onosmodium* cf. *virginianum* (L.) A. DC.," recognizing that while they could not be taxon *hispidissimum*, they also did not fit comfortably within *O. virginianum*. The specific epithet, *decipiens*, is an acknowledgment of the plant's "deceiving" morphology.

While the closely related *Onosmodium virginianum* is occasional in rocky places in the vicinity of the Ketona Glades, it never replaces *O. decipiens* as a component of the open glade. We found both species in close proximity at only a single site, with *O. decipiens* occupying the more exposed habitat of the open glade and *O. virginianum* limited to the glade-woodland ecotone. At this site we found plants of intermediate morphology, representing hybrids and putative backcrosses (*A. and S. 8231*, GH, NY, UNA, US). Unlike the situation with *Liatris oligocephala*, *O. decipiens* is too abundant locally, and hybridization with it seemingly too rare, for it to be threatened with genetic "swamping" by its more widespread congener.

Another conspicuous and unfamiliar species observed on glades during the initial canoe expedition was a leafy-stemmed, opposite-leaved herbaceous plant, clearly still some weeks from flowering, whose stem and leaves were so densely beset with gland-tipped hairs that they gave it a

sticky feel. Its overall look was suggestive of a *Silphium*, but consultation of readily available literature (e.g., Perry 1937, Cronquist 1980) gave no indication that any taxon so copiously glandular occurred in that genus. In a few weeks the plants began to flower and both their generic placement (*Silphium*) and their distinctiveness were manifest.

Silphium glutinosum J. Allison, sp. nov. TYPE: Alabama: Bibb County, ca. 17.8 km NE of Centreville, ca. 2 km NNW of the mouth of Alligator Creek. "Alligator Glade," Ketona Dolomite outcrop ca. 0.2 km W of Alligator Creek, 19 Aug 2000, *James R. Allison 12503* (holotype, GH; isotypes: AUA, DUKE, FLAS, FSU, GA, IBE, JSU, MICH, MO, NCU, NY, TAMU, UARK, UNA, US, USCH, VDB). Figures 11 and 12.

Species a congeneris combinatione capitulorum radiis vulgo tredecim cum indumento denso pro parte maxima glandulifero caulium et foliorum et involucrorum haud aegre distinguitur.

Perennial herb, fleshy-rooted from a short rhizome or nearly erect caudex, vegetative portion densely pubescent throughout with a mixture of long, stipitate-glandular hairs and mostly shorter, pointed, eglandular hairs, somewhat resinous-aromatic. *Stems* 1–several, (3.6) 8–15 (18) dm tall, unbranched except for inflorescence, (4) 5.5–10 (11) mm thick at base, finely sulcate, terete, yellowish green or sometimes maroon-tinted, especially near the base, nodes with persistent leaves at anthesis (4) 6 or 7 (10) below the branching of the inflorescence. *Leaves* opposite or rarely alternate, very rarely 3 at a node, dull, upper surface dark yellowish green, lower surface paler, margins ciliate; the lowest (at anthesis) the largest, ovate or lanceolate, larger blades 15–22 (24) cm long, 7–12 cm wide, coarsely and shallowly toothed, particularly toward the base, with winged petioles 6–15 (16) cm long, pubescent and ciliate like the blade (often proximally with longer, eglandular hairs); leaves upwardly gradually reduced in size, with shorter and more broadly winged petioles, becoming sessile and entire and grading into ovate or lanceolate (–broadly elliptic) bracts in the inflorescence. *Inflorescence* of (1) several to many (>30) heads in an open, broad (to 36 cm) panicle, the branches stiffish, the central peduncle of a main branch 6–13 (15) cm long (laterals shorter), straight (or curved early in anthesis and the heads nodding), bracteolate at the base or sometimes above the middle; involucre shallowly campanulate, 3–4.3 cm* broad, the phyllaries in about 4 series, mostly 19–23, 11–19 mm long and 5.5–11 mm wide, membranaceous, rather loosely overlapping, ribbed proximally, the outermost usually the longest, ascending or sometimes (especially those of the larger, central head of an inflorescence-branch), spreading and with margins and tips somewhat recurving, pubescent and ciliate like the leaves, lanceolate and acute, inwardly progressively reduced and passing through ovate to elliptic and obtuse and then oblanceolate with a broadly rounded apex, the innermost ca. 8 mm × 2 mm, the pubescence progressively more confined to the distal, dilated portion and the ribbed proximal area becoming proportionately greater; pales 9–11 mm long, linear-oblanceolate, apices distinctly obtuse, with both glandular and eglandular, scalelike pubescence; rays (8) 12–14 (16), usually 13, (1.7) 2.0–2.7 cm long, linear-elliptic, shallowly emarginate, pale yellow; disk mostly 1.4–2.2 cm broad, the numerous (>60) corollas tubular, greenish yellow, 6–7 mm long, with ascending, broadly triangular lobes. *Fruit* a

* Floral measurements are of early and mid-season heads; in this as with many plants, flowers are often reduced in size late in the season.

Figure 11. *Silphium glutinosum.* A. Habit, idealized, with lowest pairs of leaves persistent (these often withered by anthesis), ×1/6, detail showing lower leaf surface. B. Two views of head, ×3/4, upper with details showing hairs on peduncle and phyllary. C. Pale (chaff), ×6, with detail showing abaxial surface. D. Achene, ×3 1/2.

broadly ovate to orbicular achene, 6–8.5 mm long (excluding pappus teeth), with wing ca. 1.5 mm wide at the base of the sinus, the body appressed white-hairy and ciliate in the sinus, otherwise smooth or sparsely pale-strigillose, gray-brown when ripe. *Pappus* of two teeth 0.5–2.0 (3) mm long, rarely one or two smaller, narrower secondary awns persisting. Chromosome number 2n = 14 (*A. and S. 8107*, UNA).

Flowering June–October, fruiting July–frost.

English Name: Sticky Rosinweed.

Paratypes. Alabama: Bibb Co., 10.0 km NNE of Centreville, rocky bank of Little Schultz Cr., 15 Aug 1998, *J. Allison and M. Moffett 11326* (AUA); 12.1 km NNE of Centreville, "Lady-tresses Glade South," 22 Aug 1999, *A. 12170* (AUA, GH, NY, UNA, US); 13.5 km NE of Centreville, Six Mile Cr., "The Sinks," 15 Aug 1998, *J. Allison and M. Moffett 11324* (GA); 14.4 km NE of Centreville, "Beaver Glade," 11 Oct 1992, *A. and S. 7308* (UNA); 14.6 km NE of Centreville, "Goat Glade South," 8 Oct 2000, *A. 12564* (AUA, GA, GH, JSU, UNA, US, VDB); 14.9 km NE of Centreville, "Brown's Dam North Glade West," 16 Aug 1998, *A. 11329* (GA, GH, IBE, JSU, MICH, MO, NCU, NY, TAMU, UNA, US, VDB); 15.3 km NE of Centreville, "Desmond's Glade," 22 Jul 2000, *A. 12445* (AUA, DUKE, FLAS, FSU, GA, GH, IBE, JSU, MICH, MO, NY, TAMU, TENN, UARK, UNA, US, USCH, VDB).

In contrast with the other Ketona Glade endemics, *Silphium glutinosum* seems most vigorous in partial shade, though it will grow in full sun of the open glade. Perhaps it is no coincidence that it is also the only endemic taxon of the Ketona Dolomite glades that does not appear to be completely restricted to them. Besides on glades it can sometimes be found in rocky places along streams and occasionally along logging roads in the glade region. In view of this, it is somewhat surprising that it is absent from several glades occurring near the eastern and western extremities of the Ketona Formation in Bibb County.

Both the gradually reduced leaves, and heads usually with 13 rays[*] align this taxon with the *Silphium asteriscus* complex (e.g., *S. asteriscus* L., *S. trifoliatum* L. and their varieties). Like most *Silphium* species, *S. glutinosum* will sometimes hybridize with related species[**] when they grow nearby. The most common *Silphium* of roadsides and thin woods in the vicinity of the Ketona Glades is *S. trifoliatum* L. var. *latifolium* Gray. Where the glade-forest ecotone had been disturbed by logging or road construction, plants of apparently intermediate morphology were sometimes found (e.g., *A. and S. 7301*, UNA; *A. and S. 7869*, VDB). Such plants were also found in rocky areas along major streams of the Ridge and Valley in Bibb County, and were often more abundant than either parental species (e.g., *A. and S. 8022*, JSU).

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[*] Ray number is a particularly useful character in *Silphium* not only because it is an evolutionarily conservative trait but also because only the ray flowers have functional pistils. As a result, the ray number can easily be determined well after some or all of the rays have fallen, by counting the ovaries or achenes in a head, as long as none of the achenes have yet been lost.

[**] Species with leaves strongly basally disposed, when growing in close proximity, have been observed to hybridize with each other, e.g. *S. laciniatum* L. × *S. terebinthinaceum* Jacq. (*J. Allison and J. MacDonald 11339*, GA, GH, NY, US). Likewise, the several varieties of the leafy-stemmed *S. asteriscus* seem readily to cross with each other, as well as with *S. trifoliatum* var. *latifolium*.

Commonly, *Silphium trifoliatum* var. *latifolium* is essentially glabrous, but Bibb County populations, otherwise seemingly typical of the variety, usually have some spreading, transparent, hairs on the peduncles. The presence of such hairs on the putative hybrids, intermixed with shorter, glandular hairs, in combination with intermediacy of leaf shape, petiole length, and involucre morphology, seems proof that such plants are indeed of hybrid origin.

Another, much less common putative hybrid, we observed where the parental taxa grew in close proximity, was *Silphium asteriscus* L. var. *asteriscus* × *S. glutinosum* (e.g., *A. and S. 8474*, UNA; *A. and S. 8475*, VDB). As many as three genomes seem to have been involved in the formation of one plant seen along Little Schultz Creek, apparently *S. asteriscus* L. var. *angustatum* Gray × *S. trifoliatum* var. *latifolium* × *S. glutinosum*. Other putative hybrids of *Silphium* but not involving *S. glutinosum* were also seen, such as *S. compositum* Michx. × *S. laciniatum* L. (*A. 12508*, UNA). As all published chromosome counts in *Silphium* are diploid (Settle and Fisher 1970, Cronquist 1980, subsequent volumes of *Index to Plant Chromosome Numbers*), and given the frequency of hybridization in human-perturbed habitats, it appears that, among related taxa of *Silphium*, barriers to gene flow are chiefly ecological. Alteration of the landscape by humans appears to have disrupted these barriers, just as in *Coreopsis*.

Of course, taxa with overlapping periods of anthesis but different habitat preferences came into contact occasionally prior to widespread habitat manipulation by humans. It appears that under certain conditions, resulting hybrids may have outcompeted the parental species and founded populations that, over time, became stabilized in their morphology and appear now as fully independent taxa. One possible such taxon, of Tennessee and Kentucky, has been called *Silphium integrifolium* Michx. var. *gattingeri* Perry. Kral (1983) opined that these plants suggested a blending of *S. integrifolium* and *S. trifoliatum* var. *latifolium*. Upon examining specimens at VDB the rightness of Kral's interpretation seemed compelling, the large heads with many rays suggesting *S. integrifolium*, the petiolate lower leaves and smooth stems suggesting in turn *S. trifoliatum* var. *latifolium*. The lack of intermediacy in pubescence could be explained by the loss of *integrifolium* alleles in recombination, or recessiveness of *integrifolium* pubescence alleles. A hybrid origin for taxon *gattingeri* has not yet been proven, but support for this hypothesis is provided by a seemingly analogous situation in Alabama.

After showing Robert Kral *Silphium glutinosum* in the field in Bibb County, he called our attention to densely glandular specimens labeled *S. integrifolium* he had collected from the Black Belt province of Alabama, in Dallas County (*Kral 48820*, VDB) and Perry County (*Kral 47891*, VDB). The authors visited both of these populations, and "windshield surveying" along highways and back roads resulted in the discovery of well over a dozen additional populations of a densely glandular *Silphium* in those two counties. After comparison of living populations and preserved material of these plants with *S. integrifolium* and with *S. glutinosum*, we determined that a suite of characters exists that distinguish the Dallas and Perry County plant from either of those species.

The number of ray flowers consistently greater than 13 would cause these plants to key to *Silphium integrifolium* in, for example, Cronquist (1980), supporting Kral's determinations of his Dallas and Perry County collections. Plants truly conforming to that species, however, are known in Alabama only from two counties (Pickens and Sumter) on the Mississippi border, localities at least 80 km to the northwest of the glandular Dallas and Perry County populations.

Silphium integrifolium differs from *S. glutinosum* in many respects. The former is, under favorable conditions in the wild and in the garden (e.g., garden of Allison), a taller plant with nodes slightly closer together and therefore more numerous. Those leaves that persist until anthesis in *S. integrifolium* are normally sessile and, like the stem, eglandular. It also has a narrower inflorescence, on average with fewer but larger heads, these with consistently more numerous rays and phyllaries and with acute receptacular bracts (pales or chaff). The characters of lower leaf petiole length, plant height, and node number are evident in the field but not in the herbarium, as tall species such as *S. integrifolium* are virtually always represented there only by the inflorescence and a very few upper nodes ("top snatched"); the specimen shown in Settle and Fisher (1970) is typical in this regard.

Plants of the Dallas and Perry County *Silphium* are intermediate between *S. glutinosum* and *S. integrifolium* for some characters and for others resemble one or the other of those species (Table 2). It would be less than satisfactory to treat them as *S. glutinosum* × *S. integrifolium*, when they are allopatric with respect to both of those species and therefore have a present existence and future evolution independent of both, not to mention that the Dallas-Perry entity is only hypothetically of hybrid origin. To choose the alternative of making it a new variety (or subspecies) would require

Table 2. Morphological comparison of three *Silphium* taxa

Character	*S. glutinosum*	*S. perplexum*	*S. integrifolium*
plant height	mostly 8–15 dm	mostly 15–20 dm	often >15 dm
nodes below inflorescence	mostly 6 or 7	mostly 9–12	often 10 or more
stem and leaf glandular hairs	long	short	absent
lowest petiole length at anthesis	mostly 6-15 cm	mostly 5–8 cm	mostly 0 cm
inflorescence	open	open or ± congested	± congested
chaff apices	obtuse	obtuse to acutish	strongly acute
number of rays per head	(8) 12–14 (16)	(17) 19–23 (33)	(16) 21–34 (35)

selecting one or the other putative parental species as being of closer affinity, when there is, at least at present, no clear basis for choosing between them. As these populations are consistent in their morphology, are readily distinguished from all previously described taxa, and are sympatric with neither of the species they most closely resemble, they are described here as a new species, *Silphium perplexum*.

Silphium perplexum J. Allison, sp. nov. TYPE: Alabama: Dallas County, ca. 15.5 km SW of Selma and ca. 2.4 km WSW of Old Cahaba; S side Co. Rd. 2 at jct. Co. Rd. 9; prairielike openings over chalk, abundant, 18 Aug 1999, *James R. Allison 12153* (holotype, GH; isotypes: AUA, DUKE, FLAS, FSU, GA, JSU, MICH, MO, NY, UNA, US, VDB). Figure 12.

Figure 12. *Silphium perplexum* and its relatives. A–C, *S. glutinosum*, Bibb County, Alabama: A. Habit, including open inflorescence; "Desmond's Glade," 9 September 1993. B. Head, frontal view, with the normal 13 rays; "Goat Glade South," 14 June 1992. C. Head, lateral view, showing outer phyllaries the longest and with recurving margins; "Brown's Dam North Glade West," 3 July 1992. D–F, *S. perplexum*: D. Habit; Perry County, Alabama, Co. Rd. 6, 19 August 1999. E. Heads, frontal view, showing maximal no. of rays per head; same date and location as in D. F. Head, three-quarters view showing the species' comparatively "ordinary" involucre; Dallas County, Alabama, type locality, 18 August 1999. G–I, *S. integrifolium*: G. Habit, including more numerous nodes, Lowndes County, Mississippi, Alt. U.S. Hwy. 45, 9 August 1992. H. Heads, frontal view, with numerous rays; Sumter County, Alabama, Ala. Hwy. 17, 19 August 1999. I. Comparatively congested inflorescence, same date and location as in G.

A S. glutinoso J. Allison *caule et foliis et involucris glanduliferis accedit, sed radiis semper plus numerosis* (*plus quam* 16) *et caule pilis glandiferis brevioribus, et petiolis plerumque brevioribus recedit.*

Similar to *Silphium glutinosum* in having glandular hairs on the stem, leaves, involucres, and pales, but allopatric and growing over chalk rather than dolomite or limestone, differing morphologically as follows: *stems* averaging taller, mostly 15–20 (24.4) dm, to 13 mm thick at base; nodes usually more numerous, (7) 9 –12 (17); glandular hairs of herbage averaging distinctly shorter, about equal in length to the accompanying pointed hairs. *Leaves* more often lanceolate and upwardly more gradually reduced, larger blades as much as 30 cm long and 15 cm wide, petioles averaging shorter, at anthesis the longest at most 5–8 (10) cm long. *Heads* usually a little larger, involucre to 4.6 cm broad, the phyllaries more numerous, mostly 19–32 (35), 8–16 mm long, slightly more chartaceous, the outermost slightly shorter than the next interior, rays more numerous, (17) 19–23 (33), and a deeper yellow; pales with obtuse or acutish apices. Chromosome number: 2n = 14 (*A. and S. 8119*, GH, UNA).

Flowering July–October, fruiting August–frost.

English Name: Old Cahaba Rosinweed.

Paratypes. Alabama: Dallas Co., just N of Old Cahaba, chalk hills, 6 Oct 1972, *R. Kral 48820* (VDB); 19.8 km WNW of Selma, Co. Rd. 45, 14 Jul 1999, *J. Allison and A. Schotz 12080* (NY); 20.3 km WNW of Selma, Co. Rd. 88, 18 Aug 1999, *A. 12155* (AUA, GH, JSU, NY, UNA, US). Perry Co., dry roadside thickets near Marion, 1 Sep 1885, *J. D. Smith* s.n. (GH); S of Marion, Ala. Hwy. 5, just N of Washington Cr., prairie remnant, 29 Jul 1972, *R. Kral 47891* (VDB); 11.9 km SSE of Marion, Co. Rd. 12, 19 Aug 1999, *A. 12161* (AUA, GA, GH, JSU, UNA); 13.4 km SSW of Marion, Co. Rd. 15, 8 Oct 2000, *A. 12583* (AUA, GA, GH, JSU, MICH, MO, NY, UNA, US, VDB); 14.5 km SE of Marion, Co. Rd. 6, 19 Aug 1999, *A. 12160* (GH, UNA, USCH).

All of the known *Silphium perplexum* populations are within 13.5 km of the Cahaba River. The type locality is only about 1.3 km from that river, and about 76 km south of and downstream from a riverside population of the Bibb County endemic, *S. glutinosum* (of course, with meanders the actual length of river is considerably greater). It is easy to envision propagules of the latter being transported downstream by flood waters at a time when the range of *S. integrifolium* extended somewhat eastward of its present known extent, facilitating hybridization between two formerly allopatric species. The fact that *S. perplexum* extends over a greater geographic area than one of its putative ancestors, *S. glutinosum* (ca. 32.4 km across vs. 11.5 km), argues against its formation in the immediate past. In any event, it is certain that its formation preceded 1885 (see paratypes).

One factor that appears to have favored *Silphium perplexum* over many competing species is unpalatability to cattle. Where prairie habitats within its range have been subjected to grazing—and this would appear to be most, if not all of them—*S. perplexum* becomes very abundant, sometimes virtually the only plant standing.

As with *Silphium glutinosum*, we observed putative hybrids between *S. perplexum* and other species, especially in roadside populations. By far the most common hybrid was *Silphium asteriscus* var. *asteriscus* × *S. perplexum* (Dallas Co.: *A. and S. 8580*, VDB; *A. and S. 8570*, JSU, NY; *A. 12156* UNA; Perry Co: *A. and S. 8564*, AUA, US).

Spigelia gentianoides Chapman in A. DC. **var. *alabamensis*** K. Gould

During our initial exploration of the Ketona Glades, on May 30, 1992, Jim Rogers noticed a rather peculiar "gentian," with pink rather than the usual blue flowers. Upon returning home, Allison determined his collection, *A. et al. 6670* (UNA), to be not a species of *Gentiana* L. at all, but a plant named for its striking resemblance to one, *Spigelia gentianoides*.

Prior to 1992, *Spigelia gentianoides* had been collected from three counties in Florida (Calhoun, Jackson, Washington), all in the Panhandle (USFWS 1990). However, the majority of collections of this species date from the 19th century, mostly Chapman's own specimens. Only two, possibly three, Florida localities are known today to support it, and it was designated a federal Endangered species in 1990 (USFWS 1990).

Figure 13. *Spigelia gentianoides*. Left, var. *alabamensis*; Bibb County, Alabama, June 1993. Right, var. *gentianoides*; leaf margins in this plant curved rather than plane, a feature more characteristic of var. *alabamensis*; Calhoun County, Florida, May 1993.

During surveys in 1992 and 1993 we found *Spigelia gentianoides* at about 17 Ketona Glades, all close to the Little Cahaba River, populations totaling in aggregate several thousand individuals. After observations of populations in Calhoun and Jackson Counties, Florida, Allison recognized that the Florida plants (Figure 13) looked "different" in several respects, but reached no conclusion as to how many of the phenotypic differences seen would likely have a genetic basis (arguing in favor of taxonomic recognition) and how many might be attributed to the very considerable differences in habitat (arguing against separate taxonomic status).

The habitat of *Spigelia gentianoides* in the Florida Panhandle and where recently found in adjacent Alabama (by John MacDonald, Mississippi State Univ., pers. comm. 1999) is quite different, none of the sites there being at all rocky. Based on 1992 observations at extant sites in Calhoun and Jackson Counties, Florida, the original habitat of this species in Florida appeared to have been dominated by *Pinus palustris* and *Aristida stricta* Michx. A number of characteristic species of the longleaf pine-wiregrass community were persisting at the (Calhoun County) pine plantation site, due to periodic removal of the canopy and/or past episodes of fire. The visit to a Jackson County, Florida site, within Three Rivers State Park, revealed that many of these species appeared to have been lost there due to fire suppression, as a considerable hardwood component had developed.

A 1994 return visit by Allison to Three Rivers State Park resulted in the discovery of at least 100 flowering individuals in a portion of the park where the plant had not previously been known (Angus Gholson, pers. comm. 1994). The vigorous response to a preceding controlled burn by these plants, which probably had been languishing in a vegetative state, suggests that many, if not most, Florida populations of *Spigelia gentianoides* have been lost or are in the process of disappearing as a result of fire suppression. By contrast, the Ketona Glade habitat is probably maintained more by rockiness and edaphic conditions. However, occasional wildfire in the ecotones would have served to limit encroachment from the glade margins. Such a role in the past for wildfire in maintaining the Ketona Glade ecosystem is indicated by the persistence, in the forest matrix surrounding some of the glades, of longleaf pine and such wiregrass-country associates as *Sericocarpus tortifolius* (Michx.) Nees and, less commonly, *Carphephorus odoratissimus* (J. F. Gmel.) Herbert.

In 1995, Katherine Gould, then at the University of Texas and engaged in systematic studies of *Spigelia*, contacted Allison, who provided her with directions to some of the Ketona Glade populations of *S. gentianoides*. After study of these populations, she concluded that they were sufficiently distinct to merit taxonomic distinction and described them (Gould 1996) as *S. gentianoides* Chapman in A. DC. var. *alabamensis* K. Gould.

The primary morphological differences noted by Gould between vars. *alabamensis* and *gentianoides* can be summarized as follows (var. *alabamensis* character states given first): leaves with upwardly curved margins and a narrower shape, lanceolate to elliptic, ovate, or obovate, with cuneate or rounded bases, vs. leaves plane and with a broader shape, broadly ovate with rounded bases; cymes with mostly 2–4 flowers, vs. 3–8; larger flowers (sepals 8–11 mm long, vs. 4–6 mm; corollas 36–50 mm long vs. 25–30 mm; pistils 24–27 mm long, vs. 17–19 mm); and corollas that open fully at maturity, the lobes often becoming fully perpendicular to the tube, vs. corollas with lobes that barely separate at all in anthesis. According to James Affolter (State Botanical Garden of Georgia, pers. comm. 2000), all of these differences are maintained when both varieties are raised from seed to maturity in a common greenhouse. This demonstrates that these characters have a genetic basis, supporting recognition of the Ketona Glade populations as a distinct taxon.

Spigelia gentianoides var. *alabamensis* appears well adapted to areas of the Ketona Glades where exposed to full sun, with attendant extreme heat and drought, as well as to the partial shade of glade-forest ecotones. Although the plants may form extensive patches in deeper shade, *S. gentianoides* var. *alabamensis* flowers more prolifically at glade and forest-island margins where it is shaded for only part of the day. Its overall distribution over the glades is similar to that of *Castilleja kraliana* except that it does not reach the westernmost glade within the range of the latter.

State Records

Next to the newly described taxa, the most significant discoveries of the present study were seven species never before reported from Alabama. Two of these are characteristic elements of the Ketona Glades, a *Paronychia* found in open, exposed situations, and a *Solanum*, usually found in partial shade. The remaining five species are either too uncommon on the glades to be considered characteristic, or are plants of habitats peripheral to Ketona Glades.

Astrolepis integerrima (Hook.) Benham & Windham

On June 1, 1992, after the rest of the members of the original canoeing expedition had returned home, Allison visited by car and foot two glades that had been spotted from the canoes but not visited then due to time constraints. The prime new find there was of a fern, at first mistaken, due to its brown, inrolled leaves in drought response, for *Cheilanthes tomentosa* Link. Upon bending closer to make a collection (*A. 6695*, UNA, VDB), it was clear that it was not that species at all, but seemingly a smaller version of a fern Allison had found in 1980, disjunct in Meriwether County, Georgia, *Astrolepis sinuata* (Lag.) Benham & Windham.

Upon returning home, Allison determined the fern to be *Astrolepis integerrima* (Hook.) Benham & Windham, better known at the time as *Notholaena integerrima* (Hook.) Hevly. This fern is disjunct on the order of 1000 km to the east of populations in Texas. On the Ketona Glades it is a scarce plant of scanty soil accumulations on rock ledges and boulders. We were only able to find two small populations of this species, but possibly other populations occur on one or more of the comparatively inaccessible rock bluffs along the Little Cahaba River.

Baptisia australis (L.) R. Br. ex Ait. f. **var. *australis***

During our several canoe trips on the Little Cahaba River in the summer of 1992, we noted a rather glabrous *Baptisia* on gravelly bars and islands and on the river banks. As it was past flowering before our first expedition, it could not be conclusively identified. The following spring, after he took part in a canoe trip sponsored by The Nature Conservancy of Alabama, Chris Oberholster reported to us (pers. comm. 1993) that the flowers were blue, confirming our expectation that the plant was *Baptisia australis* (L.) R. Br. ex Ait. f. var. *australis*, known from the adjoining states of Georgia and Tennessee, but not from Alabama. We obtained a voucher on June 13, 1993 (*A. and S. 7724*, AUA, UNA).

The two other varieties of *Baptisia australis*, var. *minor* (Lehm.) Fern., of states west of the Mississippi River, and var. *aberrans* (Larisey) M. Mendenhall, have a different habitat, namely dry, rocky, calcareous glades and bluffs, usually far from water. Although *B. australis* var. *aberrans* is often a component of calcareous glades and barrens in the adjoining states of Georgia and Tennessee, it is absent from the Ketona Glades and, so far as known, from Alabama as a whole.

Only in a very few cases where the Ketona Glade habitat extends all the way down to the right bank of the Little Cahaba River is *Baptisia australis* var. *australis* found in association with some

of the characteristic elements of the glade flora. It is not, therefore, to be considered a species of the Ketona Glades, strictly speaking.

Paronychia virginica Spreng.

Early in our explorations of the Ketona Glades we found that an unfamiliar, presumptive *Paronychia* was a characteristic perennial species of open, xeric habitats on the more centrally located outcrops. Determination to species had to await anthesis, and on July 19, 1992 we were rewarded with the first flowers, confirming our suspicion that the plant was *Paronychia virginica* Spreng. (*A. and S. 6891*, UNA).

The newfound Alabama populations have considerable phytogeographic significance, as they bridge an enormous gap between Virginia and Arkansas. The fact that *Paronychia virginica* is considered rare in these and the other states where it has been found (Missouri, North Carolina, Oklahoma, Texas, West Virginia) and exhibits such wide gaps in its distribution, suggests that it is a relictual species. The local abundance of such relicts (e.g., *Silene regia*), in combination with the richness of endemics for so small a geographic area, is evidence that the Ketona Glades have supported natural communities similar to those of the present day for a very long time.

Rhynchospora capillacea Torr.

One of the first finds on the initial, canoe-based expedition of May 30, 1992, after *Marshallia mohrii* and *Spigelia gentianoides*, was of a wiry-leaved sedge in crevices at the very base of a strongly sloping glade above the Little Cahaba River. The plant proved to be *Rhynchospora capillacea* Torr. (*A. et al. 6676*, UNA, VDB), a range extension of over 400 km to the southwest from the nearest previous collection site in northeastern Tennessee (Campbell County). The species has not been seen in Tennessee in many years and is possibly extirpated (Robert Kral, pers. comm. 1992). The Bibb County population would be by far the southernmost known, but for the relatively recent discovery of a population in Kerr County, Texas (Jones and Jones 1990).

Rhynchospora capillacea has yet to be found anywhere in Alabama except the few m^2 of nearly bare rock just above the Little Cahaba River where we collected it. Because it has been found only in the glade-river ecotone of a single site, *R. capillacea*, like *Baptisia australis*, cannot be considered part of the characteristic Ketona Glade flora.

Rhynchospora thornei Kral

On June 21, 1992 we had the pleasure to show some of the glades we had discovered up to that time to Angus Gholson, Robert Godfrey and Robert Kral. One of the many high points of the day was the collection (*A. et al. 6754*, NY, UNA, US, VDB) of *Rhynchospora thornei* Kral, both a state record and the first collection of the species outside of the Coastal Plain.

This is among the most diminutive species of the genus, very similar to *Rhynchospora divergens* Chapman ex M.A. Curtis, a common but easily overlooked species primarily of the Coastal Plain. *Rhynchospora thornei* differs chiefly by having achenes with perianth bristles (Kral 1977). These bristles seem somewhat vestigial in nature, usually very short, unpigmented

(translucent), and easily detached. Plants collected (*A. and S. 7014, 7015*, VDB) from one Ketona Glade population differed from all previous collections in that the bristles are somewhat longer and more pigmented, but were determined by Robert Kral to be *R. thornei*.

Prior to the discovery of this species in Alabama, in the Ridge and Valley Province, this former federal Candidate (C2) species was known from only a half-dozen collections, all from the Coastal Plain and from three states: Florida, Georgia, and North Carolina (Richard LeBlond, N.C. Natural Heritage Program, pers. comm. 1995). It was found subsequently at Coastal Plain localities in Alabama, beginning later in 1992 with a chalk glade in Dallas County (*A. and S. 6921*, VDB). *Rhynchospora thornei* has since been found at additional Ridge and Valley sites in Cherokee County, Alabama (*J. Allison and A. Schotz 9519*, UNA, VDB) and Floyd County, Georgia (*A. 7776*, GA, VDB), suggesting that the geographic range of *Rhynchospora thornei* is not fully known.

On the Ketona Glades and elsewhere, *Rhynchospora thornei* is a plant of microhabitats that are usually moist during winter and spring, irrigated by seepage, but which may become quite dry in summer and fall. Another Bibb County habitat for the species, and one unlike any in which it had previously been found, is crevices and shallow soil accumulations in a rocky creek bed (*A. 6764*, AUA, VDB). There, *R. thornei* is exposed during low water but inundated for much of the winter and after heavy rains. Perhaps this moisture regime is not very different in effect from the few seepage areas on Ketona Glades where *R. thornei* grows.

Solanum pumilum Dunal

Thomas Nuttall (1834) described *Solanum hirsutum* Nutt., from material collected by Samuel Boykin (*Boykin* s.n., PH) from the vicinity of Milledgeville, Georgia. Boykin collected the *Solanum* again in 1837 (specimen at NY, cited in D'Arcy 1974), from near Columbus, Georgia.

Two decades previous to Nuttall's publication, Michel Felix Dunal (1813) had described a different *Solanum hirsutum* (and Roxburgh yet another, soon thereafter). Nuttall's name was therefore (doubly!) a later homonym and must be rejected. Dunal (1852) rectified the situation by renaming Boykin's plant *S. pumilum* Dunal.

Asa Gray (1878) reduced the taxon to a variety of *Solanum carolinense* L., resurrecting Nuttall's epithet at varietal rank, a disposition followed by William D'Arcy (1974). As this was a taxon known only from three old specimens, the conservative treatments of Gray and D'Arcy were entirely defensible.

As of 1992, the two collections by Boykin, three sheets more than a century and a half old, were still the only known material of this taxon, and the plant was regarded as probably extinct (*Shortia* Torr. & Gray, after all, was lost to science for less than 90 years). On April 26, 1993 we discovered small populations of this *Solanum* (Figure 14) on two outcrops of Ketona Dolomite near the Little Cahaba River (*A. and S. 7557*, NY; *A. and S. 7563*, US). Subsequent exploration revealed that this taxon occurs about the margins of many of these glades and on at least one small glade of a different dolomitic formation (*A. and S. 7651*, VDB).

On May 1, 1994 we visited some amphibolite outcrops approximately 57 km to the southeast of the Ketona Glades. West of the Coosa River, in Chilton County, Alabama, we found (*A. and S. 8239*, MO, NY, VDB) one moderate-sized population of *Solanum pumilum*, and east of the river, in Coosa County, one rather small population (*A. and S. 8241*, UNA).

Figure 14. *Solanum pumilum*. The first individuals of the species recorded anywhere since the 1830s; Bibb County, Alabama, "Nightshade Glade," 26 April 1993.

Other populations exist on Bibb County glades, but we saw many of these only in vegetative condition and they were not vouchered. After observing about 20 populations of this taxon, we have concluded that, though clearly related to *Solanum carolinense*, it should be recognized at the species level. Michael Nee, of the New York Botanical Garden, to whom we sent material of *S. pumilum* in 1998, concurred, writing (pers. comm. 1998), "its similarity to *S. hieronymii* and other spp. from Bolivia/Paraguay is striking, but obviously a good, distinct species."

There are multiple characters by which *Solanum pumilum* can be distinguished from *S. carolinense*, whereas the two varieties of *S. carolinense*, var. *carolinense* and var. *floridanum* (Shuttlw. ex Dunal) Chapman, reportedly can be distinguished only by leaf shape and, moreover, intergrade freely (D'Arcy 1974). *Solanum pumilum* differs from *S. carolinense* by (1) its smaller stature, less than 2 dm, vs. usually 3–10 dm; (2) stems without spines; (3) leaves rounded to obtuse at the apex, entire to shallowly sinuate, their prickles absent or few, weaker, and confined to the midvein [vs. mid- and late-season leaves acute, coarsely dentate (or deeply lobed in var. *floridanum*), prominently spiny on midvein and often also on secondary veins]; (4) corollas always pure white (usually lavender in *S. carolinense*, although white morphs—f. *albiflorum* O. Kuntze—are occasional); and (5) flowers sweetly fragrant, vs. odorless (pers. obs. of Allison over southeastern states from Arkansas to North Carolina) in *S. carolinense*.

Solanum carolinense is a common, native weed in the southern states (and beyond) and is found on a few Ketona Glades where there has been some disturbance, e.g. from road construction or lumbering activities. These plants are usually stunted by the extreme conditions prevailing on the

glades, and thus resemble *S. pumilum* in stature. In all other respects, most noticeably in having cauline prickles and upper leaves coarsely dentate, they are easily recognizable as *S. carolinense*.

Spiranthes lucida (H. H. Eat.) Ames

Like *Rhynchospora capillacea*, *Spiranthes lucida* is very rare as far south as Tennessee, its previous southern limit, and is thus far known in Alabama from a (different) single rocky place on the right bank of the Little Cahaba River. Allison discovered this, the latest of the state records, while canoeing the Little Cahaba River with Jim Affolter and David Handlay, on April 29, 1994. We could find only ten or so individuals, and the population was vouchered by photographic slides and prints the authors took the next day, *A. and S. 8224-p* (AUA, JSU, UNA, VDB). We revisited the site a month later, hoping to collect seed, but, perhaps due to a very dry May, the infructescences had senesced, apparently without perfecting any seed.

The single locality known is a ledge of dolomite just above the river, where a glade extends down to the water's edge and where *Spiranthes lucida* is associated with *Rhynchospora colorata* and *R. thornei*. It is probably slightly inundated at times in winter and after heavy rains. Like *Baptisia australis* var. *australis* and *Rhynchospora capillacea*, *Spiranthes lucida* is considered a peripheral element of the Ketona Glade flora.

Other Rarities

Noteworthy additional rare taxa found to date on one or more Ketona Glades include county records for another 16 taxa tracked by the Alabama Natural Heritage Program (ALNHP). Most notable were federally Endangered *Xyris tennesseensis* Kral (*A. and S. 7004*, VDB), previously known in Alabama only from a small population about 160 km to the northwest, and a current and a former Federal Candidate (C2) Species, *Symphyotrichum georgianum* (Alexander) Nesom (*A. and S. 7306*, VDB), and *Leavenworthia exigua* var. *lutea* (*A. and S. 7506*, VDB). The 13 other county record rarities were *Echinacea purpurea*, *Helianthus smithii* Heiser, *Isoëtes butleri*, *Leavenworthia uniflora*, *Mirabilis albida*, *Ophioglossum engelmannii*, *Orobanche uniflora* L., *Pediomelum subacaule*, *Ponthieva racemosa* (Walt.) C. Mohr, *Schoenolirion croceum*, *Spiranthes magnicamporum*, *Symphyotrichum laeve* var. *concinnum*, and *Veronicastrum virginicum* (L.) Farw. The identification of the *Spiranthes* is tentative: some or all of these plants may be referable to *S. cernua* (L.) L. C. Rich., "contaminated" with genes from *S. magnicamporum*, as reported from other states by Sheviak (1991).

We also found new, Ketona Glade locations, for another 18 rare taxa that others had collected previously somewhere in Bibb County. These taxa included federally Threatened *Marshallia mohrii*, which achieves its greatest abundance on these glades; *Silene regia*, a former federal Candidate (C2) species that had been feared extinct in Alabama; one current and two other former C2 species, *Arabis georgiana*, *Croton alabamensis* var. *alabamensis*, and *Rudbeckia triloba* var. *pinnatiloba*; and 13 additional taxa tracked by the ALNHP: *Callirhoë alcaeoides*, *Carex eburnea*, *Cheilanthes alabamensis*, *Enemion biternatum* Raf., *Gentiana villosa* L., *Leptopus phyllanthoides*, *Liatris cylindracea*, *Penstemon tenuiflorus*, *Polygala boykinii*, *Rhynchospora colorata*, *Scutellaria alabamensis*, *Sida elliottii*, and *Silphium trifoliatum* var. *latifolium*.

Davison and Schotz recently (1998) reported finding, on one of the large glades, two rare liverworts: *Plagiochasma crenulatum* Gott, new to the eastern United States, and *Cheilolejeunea clausa* (Nees & Mont.) Schust. It seems certain that still other botanical (and zoological?) rarities occur on these glades and await future detection.

Within about 100 meters of one or more Ketona Glades we recorded at least 16 other rarities, including *Melanthium woodii* (J. W. Robbins ex Wood) Bodkin, known previously in Alabama from a single population more than 240 km to the southeast, and three more former C2 species: *Jamesianthus alabamensis* Blake & Sherff, a species thought at the time to be endemic to a tiny area in Alabama more than 175 km to the northwest, and two plants named by the same botanist for their same discoverer, *Sedum nevii* Gray and *Neviusia alabamensis* Gray, the latter reported, at the time, from only 15 other populations. The remaining rarities found near one or more Ketona Glades were *Gentiana saponaria* L., *Hypericum nudiflorum* Michx., *Marshallia trinervia* (Walt.) Trel., *Melanthium latifolium* Desr., *Panax quinquefolius* L., *Parnassia grandifolia* DC., *Plantago cordata* Lam., *Phlox pulchra* (Wherry) Wherry, *Rhapidophyllum hystrix* (Pursh) H. Wendl. & Drude ex Drude, *Schisandra glabra* (Brickell) Rehder, *Silene caroliniana* Walt. ssp. *wherryi* (Small) Clausen, and *Zanthoxylum americanum* P. Mill.

Finally, Bibb County's trove of botanical rarities is by no means limited to plants found in the vicinity of Ketona Glades. Additional rarities that we encountered during our Bibb County explorations, but at distance from any of the Ketona Glades, included *Carex impressinervia* Bryson, Kral & Manhart, *Cladrastis kentukea* (Dum.-Cours.) Rudd, *Corallorrhiza wisteriana* Conrad, *Croomia pauciflora* (Nutt.) Torr., *Cystopteris bulbifera* (L.) Bernh., *Euonymus atropurpureus* Jacq., *Hymenocallis coronaria* (Le Conte) Kunth, *Pachysandra procumbens* Michx., *Phacelia dubia* (L.) Trel. var. *dubia*, and *Trillium decumbens* Harbison.

The ALNHP Tracking List is revised at intervals, and a few of the taxa named in these paragraphs have subsequently been removed from it, due at least in part to additional occurrences discovered in Bibb County.

ORIGINS OF THE FLORA

The Ketona Glades and their environs provide suitable habitat for more than 60 vascular or nonvascular plant taxa of conservation concern. This is an extraordinary number for a habitat that totals roughly only 100 hectares, marking these areas as one of the most significant reservoirs of botanical diversity in the eastern United States. While all of the factors responsible for the development of the unique Ketona Glade ecosystem may never be fully understood, especially the full phylogenetic histories of the strict endemics, enough is known to suggest some hypotheses.

It seems certain that edaphic factors, especially soil chemistry, have played a major role in the development of the characteristic Ketona Glade communities. In addition to the four samples of topsoil indicated previously as having been submitted to the state Soil Testing Laboratory of Georgia, we gathered samples from several other rock outcrop communities and submitted them also, for comparison. The results are summarized in Table 3. When compared to other outcrop soils, that of Ketona Glades is seen to be extremely high in the element magnesium. The Ketona Formation is, as stated earlier, an exceptionally pure dolomite, comparatively free of the usual

Table 3. Summary of routine soil analyses performed by Soil Testing Laboratory, Georgia Cooperative Extension Service[1]

State	County	Site Name	Parent Material	pH	P	K	Ca	Mg	Zn	Mn
AL	Bibb	Beaver Glade	Ketona Dolomite	7.6	19(L)[2]	088(L)	7227(A)	**999(H)**	04	048
AL	Bibb	Brown's Dam Glade	Ketona Dolomite	7.5	**62(M)**	092(L)	6245(A)	**999(H)**	04	044
AL	Bibb	Lady-tresses Glade	Ketona Dolomite	7.4	22(L)	069(L)	7091(A)	**999(H)**	02	015
AL	Bibb	Pinkroot Glade East	Ketona Dolomite	7.6	19(L)	084(L)	6986(A)	**999(H)**	02	025
GA	Catoosa	Chickamauga Battlefield National Military Park (cedar glade)	Chickamauga Limestone	7.7	08(L)	089(L)	**9999(A)**	352(H)	**01**	008
TN	Wilson	Cedars of Lebanon State Park (cedar glade)	Lebanon Limestone	6.9	09(L)	034(L)	7501(A)	084(L)	02	016
AL	Bibb	Pratts Ferry (thin soil over limestone in woods)	Lenoir Limestone	7.3	14(L)	101(L)	5500(A)	225(M)	05	058
AL	Autauga	Jones Bluff Prairie (chalk glade or "bald prairie")	Mooresville Chalk	**8.2**	**05(L)**	038(L)	**9999(A)**	**048(L)**	**01**	**002**
GA	Walton	Gum Creek Church Road Granitic Flatrock	Lithonia Granite-gneiss	**4.2**	10(L)	**011(L)**	1379(A)	069(L)	**10**	145
MD	Baltimore	Soldiers' Delight Serpentine Barren	serpentine	6.5	13(L)	075(L)	**0918(A)**	**999(H)**	08	075
AL	Chilton	Mitchell Dam Outcrop (amphibolite flatrock)	Mitchell Dam Amphibolite	6.0	21(L)	**124(L)**	2428(A)	577(H)	04	111
NC	Granville	Picture Creek Diabase Barren	diabase	6.1	12(L)	063(L)	2306(A)	**999(H)**	05	**150**
NC	Granville	Butner Diabase Glade	diabase	6.1	13(L)	060(L)	2696(A)	779(H)	06	077

[1] Georgia Soil Testing Laboratory, 2400 College Station Road, Athens, GA 30602-1542, (706) 542-5350.
[2] Abbreviations (letters in parentheses): (L) = low; (M) = moderate; (H) = high; (A) = adequate (as characterized by the Soil Testing Laboratory). Extreme values (including ties) are underlined and in bold type.

siliceous impurities that serve to dilute the levels of magnesium and calcium in a mineral otherwise composed almost entirely of $CaCO_3$ and $MgCO_3$, in a ratio of about 55:45 (Rheams 1992).

Of the soils sampled, only those derived from serpentine and diabase have comparable levels of magnesium. They differ critically in being acidic, while those formed from Ketona Dolomite have a mildly alkaline pH. The former also differ in containing much lower levels of calcium and much higher levels of heavy metals. Outcrop soils that have a pH greater than 7, in common with Ketona Dolomite soil, have lower levels of magnesium. In short, the Ketona Glades have a distinctive soil chemistry, in particular a combination of very high magnesium levels and mildly basic soil reaction. In addition, the shallowness of soil and high insolation values make the glades drought-prone in the extreme. The peculiar soil chemistry and low organic matter content of the Ketona Glades, in combination with extremely low soil moisture levels in summer, provide conditions that are hostile to ordinarily adapted plants. Such a habitat strongly selects for specialized adaptations, promoting endemism or, at the very least, ecotypic differentiation. And because the Ketona Formation is restricted to central Alabama, and outcrops of other rocks as high in magnesium, such as serpentine, are unknown in Alabama, at least as pavements (Adams et al. 1926), this community is isolated both geographically and edaphically. Our choice of the term "Ketona Glades" to refer to these places is due to our conviction that the chemical composition of the bedrock is chiefly responsible for the unusual plant assemblage.

Earlier, under "Biological Communities," we listed a number of characteristic plants of limestone glades that are absent or essentially so from the Ketona Glades. Some of these taxa may be unable to tolerate the presumably higher summer temperatures of glades at the latitude of Bibb County, while the propagules of others may simply have failed to reach the Ketona Glades. However, the distributions of several characteristic species of limestone glades (e.g., *Heliotropium tenellum*, *Hypericum sphaerocarpum*, *Ratibida pinnata*, and *Verbena simplex*) appear to skip over the Ketona Glades only to recur south of them, on chalk glades of the Black Belt region. This lends support to the theory that the absence of some limestone glade taxa from the Ketona Glades may be due to an inability to thrive in soil with such a high concentration of magnesium.

It is conceivable that some of the Ketona Glade endemics, such as the new *Dalea* or *Liatris*, may once have been more widespread, with a refugium in that portion of the Ridge and Valley that would likely have experienced the mildest climate during the Pleistocene. If so, it would seem that they were unable to compete within the new communities that developed over most of their former range as the climate subsequently moderated, and thus were unable to reclaim their former territory. Some elements of the flora seem clearly to represent relictual biota, such as *Paronychia virginica*, *Silene regia*, and *Solanum pumilum*, while others, such as *Astrolepis integerrima* and possibly *Liatris cylindracea*, appear to represent long-distance immigration.

Perhaps Ketona Glade communities once occurred outside of Bibb County, or possibly still exist and remain to be discovered. The Ketona Formation is not restricted to Bibb County, but is mapped (Szabo et al. 1988) as extending into Blount, Chilton, Shelby and, most extensively of all, Jefferson County. The formation takes its name from a place in the latter county, and Ketona is home to several quarries in the formation. The exceptional purity of the formation has made it valuable as a "flux" stone in the steelmaking process (Rheams 1992), and its abundance, combined with ready access to water and to deposits of iron ore and coal, is responsible for making Birmingham, the county seat of Jefferson County, a major steelmaking center. Our efforts to find any glades within

the extensive areas mapped in Jefferson County as Ketona Dolomite were, with one exception,* unsuccessful, for much of the area has been quarried, and most of the rest is occupied by commercial or residential development. Their comparative remoteness from Birmingham is probably all that has saved the Bibb County glades from a similar fate.

In summary, the existence of the extraordinary assemblage of plant taxa on the Ketona Glades of Bibb County, Alabama is best explained as resulting from a combination of strong selection for edaphic specialization, geographic isolation, freedom for many millennia from drastic climate change (fostering relictualism), chance long-range dispersal events, and placement within a rural setting where human impacts to the landscape have been comparatively moderate.

CONSERVATION STATUS

Over the several years since the discovery of the Ketona Glades, The Nature Conservancy of Alabama, U.S. Alliance Coosa Pines Corporation, and the Bibb County Commission have worked together cooperatively to permanently protect about 120 hectares of glades and surrounding hardwood and longleaf pine forest. Currently, many of the largest and highest quality glades are protected within the Conservancy's Bibb County Glades Preserve. The preserve also protects more than a mile of riverine and riparian habitat along the Little Cahaba River, which harbors many imperiled and narrowly distributed aquatic species, including rare snails, mussels, fishes, caddisflies and the spectacular shoals spider lily, *Hymenocallis coronaria* (Chris Oberholster, The Nature Conservancy of Alabama, pers. comm. 2000).

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* We did find a single very small, rather disturbed glade, actually in the vicinity of Ketona. The rock type of this glade has not been determined, but the color and weathering characteristics of the rock appeared to us more like those of limestone than of Ketona Dolomite, at least as the Ketona Formation is expressed in Bibb County. Floristically as well, this site had more in common with limestone glades to the north than with the Bibb County glades, with such elements as *Amphiachyris dracunculoides* (DC.) Nutt. [*Gutierrezia dracunculoides* (DC.) Blake, *Xanthocephalum dracunculoides* (DC.) Shinners; *A. and S. 8027*, UNA, VDB] and *Clinopodium glabellum* (Michx.) Kuntze, s. str. [*Satureja glabella* (Michx.) Briq., *Calamintha glabella* (Michx.) Benth.; *A. 11908*, UNA]. The latter, a state record (fide USDA 2000), is apparently disjunct at least 230 km from the cedar glade country of Middle Tennessee (cf. distribution map in Chester et al. 1997). Underscoring its stronger affinities with limestone glades to the north, this Jefferson County glade even supported a population of *Erigeron strigosus* var. *calcicola*.

CATALOG OF VASCULAR FLORA OF KETONA GLADES AND THEIR ENVIRONS

The following is an annotated list of taxa that we recorded from one or more Ketona Glades or their immediate vicinity. Except where indicated, nomenclature is that accepted at the time of writing by the PLANTS Database (USDA 2000). The names of taxa designated (at the time of writing or at any time during the study) to be of conservation concern by the Alabama Natural Heritage Program are preceded by an asterisk (*); names of taxa considered to be exogenous additions to the flora are indicated by a plus sign (+). For the most part, only uncommon or phytogeographically noteworthy taxa were recorded from surrounding areas, beyond glade-forest ecotones; these names are placed within curved brackets, { }. Synonyms that have been used in recent decades are provided within square brackets, [ ]. Finally, for those taxa of which we made specimens, we append the collection number of a voucher deposited (except where a different acronym is provided) at the herbarium of the University of Alabama (UNA).

PTERIDOPHYTES

ASPLENIACEAE

Asplenium platyneuron (L.) B.S.P.
Asplenium resiliens Kunze

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn

ISOËTACEAE

**Isoëtes butleri* Engelm., *A. and S. 7552*

OPHIOGLOSSACEAE

**Ophioglossum engelmannii* Prantl, *A. and S. 7646*

POLYPODIACEAE

Pleopeltis polypodioides (L.) Andrews & Windham var. *michauxiana* (Weatherby) Andrews & Windham [*Polypodium polypodioides* (L.) Watt var. *michauxianum* Weatherby]

PTERIDACEAE

{*Adiantum capillus-veneris* L.}

**Astrolepis integerrima* (Hook.) Benham & Windham [*Notholaena integerrima* (Hook.) Hevly, *Cheilanthes integerrima* (Hook.) Mickel], *A. 6695*
**Cheilanthes alabamensis* (Buckl.) Kunze, *A. 12574*
Cheilanthes lanosa (Michx.) D. C. Eat.
Pellaea atropurpurea (L.) Link

GYMNOSPERMS

CUPRESSACEAE

Juniperus virginiana L. var. *virginiana*

PINACEAE

Pinus echinata P. Mill.
Pinus palustris P. Mill.
Pinus taeda L.

ANGIOSPERMS

ACANTHACEAE

Ruellia humilis Nutt., *A. and S. 7787*
Ruellia strepens L.

ACERACEAE

Acer leucoderme Small

AGAVACEAE

Manfreda virginica (L.) Salisb. ex Rose [*Agave virginica* L., *Polianthes virginica* (L.) Shinners]
Yucca filamentosa L.

ANACARDIACEAE

Rhus aromatica Ait.
Rhus copallinum L.
Rhus glabra L.
Toxicodendron pubescens P. Mill. [*T. toxicarium* Gillis, *Rhus toxicodendron* L.]
Toxicodendron radicans (L.) Kuntze [*Rhus radicans* L.]

APIACEAE

{*Eryngium integrifolium* Walt.} (single locality), *A. and S. 8112*
Eryngium yuccifolium Michx. var. *yuccifolium*
Thaspium barbinode (Michx.) Nutt. var. *chapmanii* Coult. & Rose (variety not accepted in PLANTS [USDA 2000]), *A. and S. 7558*
Thaspium trifoliatum (L.) Gray var. *aureum* (L.) Britt.
Zizia aptera (Gray) Fern.

APOCYNACEAE

Amsonia ciliata Walt. var. *tenuifolia* (Raf.) Woods. [*A. ciliata* Walt. var. *filifolia* Woods.], *A. 10566*
Amsonia tabernaemontana Walt.
Apocynum cannabinum L.

AQUIFOLIACEAE

{*Ilex ambigua* (Michx.) Torr.}

ARALIACEAE

*{*Panax quinquefolius* L.}

ARECACEAE

*{*Rhapidophyllum hystrix* (Pursh) H. Wendl. & Drude ex Drude}, *J. Allison and C. Oberholster 7057* (VDB)
Sabal minor (Jacq.) Pers.

ASCLEPIADACEAE

Asclepias tuberosa L.
{*Asclepias variegata* L.}
Asclepias verticillata L.
Asclepias viridiflora Raf.
Asclepias viridis Walt.
Matelea gonocarpos (Walt.) Shinners, *A. 10898*

ASTERACEAE

Acmella oppositifolia (Lam.) R. K. Jansen var. *repens* (Walt.) R. K. Jansen [*Spilanthes americana* (Mutis) Hieron.] (single locality)
Ambrosia artemisiifolia L.
Brickellia eupatorioides (L.) Shinners [*Kuhnia eupatorioides* L.]
{*Carphephorus odoratissimus* (J. F. Gmel.) Herbert} [*Trilisa odoratissima* (J. F. Gmel.) Cass.], *A. and S. 7276* (VDB)
Chrysopsis mariana (L.) Ell. [*Heterotheca mariana* (L.) Shinners], *A. 12575*
{*Coreopsis auriculata* L.}
{*Coreopsis grandiflora* Hogg ex Sweet var. *grandiflora*} *A. 11330*
**Coreopsis grandiflora* Hogg ex Sweet var. *inclinata* J. Allison, *A. and S. 7223*
Coreopsis grandiflora Hogg ex Sweet var. *inclinata* J. Allison × *C. pubescens* Ell., *A. and S. 6719*
Coreopsis major Walt.
{*Coreopsis pubescens* Ell.} (seemingly only introgressants in vicinity of glades), *A. 11933*
**Echinacea purpurea* (L.) Moench, *A. 6782*
Erigeron annuus (L.) Pers.
Erigeron pulchellus Michx., *A. and S. 7551*

Erigeron strigosus Muhl. ex Willd. var. *beyrichii* (Fisch. & C. A. Mey.) Torr. & Gray ex Gray, *A. 12089*

**Erigeron strigosus* Muhl. ex Willd. var. *dolomiticola* J. Allison, *A. and S. 7947*

Eupatorium album L. var. *album*, *A. and S. 7881*

Eupatorium rotundifolium L., *A. 12446*

Fleischmannia incarnata (Walt.) King & H. E. Robins. [*Eupatorium incarnatum* Walt.], *A. 12573*

Gaillardia aestivalis (Walt.) H. Rock var. *aestivalis*, *A. 12568*

Helenium autumnale L.

Helianthus divaricatus L.

Helianthus hirsutus Raf., *A. et al. 7839*

Helianthus microcephalus Torr. & Gray, *A. and S. 8011* (VDB)

Helianthus resinosus Small [*H. tomentosus* auct. non Michx.]

**Helianthus smithii* Heiser, *A. and S. 8478*

Heliopsis helianthoides (L.) Sweet var. *gracilis* (Nutt.) Gandhi & Thomas [*H. gracilis* Nutt.], *A. and S. 7116*

Ionactis linariifolius (L.) Greene [*Aster linariifolius* L.]

*{*Jamesianthus alabamensis* Blake & Sherff}, *A. and S. 7128*

**Liatris cylindracea* Michx., *A. and S. 6877*

Liatris ×*freemaniana* J. Allison [*L. cylindracea* Michx. × *L. oligocephala* J. Allison], *A. and S. 7237*

Liatris ×*macdanieliana* J. Allison [*L. cylindracea* Michx. × *L. squarrosa* (L.) Michx.], *A. and S. 8533*

**Liatris oligocephala* J. Allison, *A. and S. 7119*

Liatris pilosa (Ait.) Willd. [*L. graminifolia* Willd.]

Liatris squarrosa (L.) Michx. var. *squarrosa*, *A. and S. 6892*

**Marshallia mohrii* Beadle & F. E. Boynt., *A. and S. 7720*

*{*Marshallia trinervia* (Walt.) Trel.}, *A. 6656*

Oligoneuron rigidum (L.) Small [*Solidago rigida* L.]

Packera anonyma (Wood) W. A. Weber & A. Löve [*Senecio anonymus* Wood, *S. smallii* Britt.]

Pseudognaphalium obtusifolium (L.) Hilliard & Burtt [*Gnaphalium obtusifolium* L.]

Rudbeckia fulgida Ait. var. *fulgida*, *A. and S. 7030*

{*Rudbeckia fulgida* Ait. var. *umbrosa* (C. L. Boynt. & Beadle) Cronq.}

**Rudbeckia triloba* L. var. *pinnatiloba* Torr. & Gray, *A. 11023*

Sericocarpus tortifolius (Michx.) Nees [*Aster tortifolius* Michx., *A. bifoliatus* (Walt.) Ahles], *A. and S. 7965* (VDB)

Silphium asteriscus L. var. *angustatum* Gray

{*Silphium asteriscus* L. var. *angustatum* Gray × *S. trifoliatum* L. var. *latifolium* Gray}

Silphium asteriscus L. var. *asteriscus* × *S. glutinosum* J. Allison, *A. and S. 8474*

Silphium compositum Michx., *A. and S. 6712*

Silphium compositum Michx. × *S. laciniatum* L. (two localities, one a glade-ecotone, the other a logging road near a glade), *A. 12508*

**Silphium glutinosum* J. Allison, *A. and S. 8107*

Silphium glutinosum J. Allison × *S. trifoliatum* L. var. *latifolium* Gray, *A. and S. 7301*

Silphium laciniatum L., *A. and S. 6714*

**Silphium trifoliatum* L. var. *latifolium* Gray

Smallanthus uvedalius (L.) Mackenzie ex Small [*Polymnia uvedalia* (L.) L.]

Solidago nemoralis Ait.

Solidago odora Ait.

Solidago rugosa P. Mill.

Solidago ulmifolia Muhl. ex Willd.

Symphyotrichum concolor (L.) Nesom [*Aster concolor* L.], *A. 12565*

**Symphyotrichum georgianum* (Alexander) Nesom [*Aster georgianus* Alexander, *A. patens* Ait. var. *georgianus* (Alexander) Cronq.], *A. and S. 7318*

**Symphyotrichum laeve* (L.) A. & D. Löve var. *concinnum* (Willd.) Nesom [*Aster concinnus* Willd], *A. 6757*
{*Symphyotrichum. oblongifolium* (Nutt.) Nesom} [*Aster oblongifolius* Nutt.], *A. 12580*
Symphyotrichum patens (Ait.) Nesom [*Aster patens* Ait.], *A. 12566*
Symphyotrichum pilosum (Willd.) Nesom [*Aster pilosus* Willd.], *A. and S. 7316*
Symphyotrichum shortii (Lindl.) Nesom [*Aster shortii* Lindl.]
Tetragonotheca helianthoides L.
Verbesina occidentalis (L.) Walt.
Verbesina virginica L.

BETULACEAE

Ostrya virginiana (P. Mill.) K. Koch

BIGNONIACEAE

Bignonia capreolata L. [*Anisostichus capreolata* (L.) Bureau]

BORAGINACEAE

Lithospermum canescens (Michx.) Lehm., *A. 10464*
Lithospermum tuberosum Rugel ex DC.
**Onosmodium decipiens* J. Allison, *A. and S. 8235*
Onosmodium decipiens J. Allison × *O. virginianum* (L.) A. DC. (single locality), *A. and S. 8231*
Onosmodium virginianum (L.) A. DC., *A. and S. 8232*

BRASSICACEAE

+Arabidopsis thaliana (L.) Heynh.
Arabis canadensis L.
**Arabis georgiana* Harper, *A. et al. 6681*
+Cardamine hirsuta L.
**Leavenworthia exigua* Rollins var. *lutea* Rollins, *A. and S. 7509*
**Leavenworthia uniflora* (Michx.) Britt., *A. and S. 8156*

BUDDLEJACEAE

Polypremum procumbens L.

CACTACEAE

Opuntia humifusa Raf. var. *humifusa* [*O. compressa* auct. non J. F. Macbr.]

CAMPANULACEAE

Campanulastrum americanum (L.) Small [*Campanula americana* L.]
Lobelia spicata Lam.

CAPRIFOLIACEAE

+Lonicera japonica Thunb.
Lonicera sempervirens L.
{*Triosteum aurantiacum* Bickn.} (single locality)
Viburnum rufidulum Raf.

CARYOPHYLLACEAE

{*Arenaria lanuginosa* (Michx.) Rohrb.}
Minuartia patula (Michx.) Mattf. [*Arenaria patula* Michx.]
**Paronychia virginica* Spreng., *A. and S. 6891*
**{*Silene caroliniana* Walt. ssp. *wherryi* (Small) Clausen}, *A. and S. 7591*
**Silene regia* Sims, *A. and S. 6886*

CELASTRACEAE

**{*Euonymus atropurpureus* Jacq.}, *A. et al. 9109*

CISTACEAE

Lechea mucronata Raf. [*L. villosa* Ell.], *A. 12088*

CLUSIACEAE

Hypericum densiflorum Pursh, *A. et al. 9463*
Hypericum frondosum Michx.

Hypericum hypericoides (L.) Crantz ssp. *hypericoides* [*Ascyrum hypericoides* L. var. *hypericoides*]
*{*Hypericum nudiflorum* Michx.}
{*Hypericum punctatum* Lam.}

COMMELINACEAE

Commelina erecta L.
{*Tradescantia hirsuticaulis* Small}

CONVOLVULACEAE

Calystegia catesbiana, s. str., *A. and S. 7562* (identification tentative)
Dichondra carolinensis Michx. [*D. repens* J. R. Forst. var. *carolinensis* (Michx.) Choisy]
Ipomoea pandurata (L.) G. F. W. Mey.
Stylisma humistrata (Walt.) Chapman, *A. and S. 6722*

CORNACEAE

Cornus florida L.

CRASSULACEAE

*{*Sedum nevii* Gray}

CYPERACEAE

Carex cherokeensis Schwein.
Carex crawei Dewey, *A. and S. 7576*
**Carex eburnea* Boott, *A. and S. 6717*
Carex laxiflora Lam., *A. and S. 7582*
Carex striatula Michx., *A. and S. 7577*
Fimbristylis puberula (Michx.) Vahl, *A. 6747*
**Rhynchospora capillacea* Torr. (single locality), *A. et al. 6676*
**Rhynchospora colorata* (L.) H. Pfeiffer [*Dichromena colorata* (L.) A. S. Hitchc.], *A. 6691*
Rhynchospora divergens Chapman ex M. A. Curtis, *A. 6793*
Rhynchospora globularis (Chapman) Small var. *globularis*, *A. and S. 7732*
Rhynchospora globularis (Chapman) Small var. *pinetorum* (Britt. & Small ex Small) Gale, *A. and S. 7147* (VDB)
**Rhynchospora thornei* Kral, *A. et al. 6754*
Scleria oligantha Michx.
Scleria verticillata Muhl. ex Willd. (single locality), *A. and S. 7964*

EBENACEAE

Diospyros virginiana L.

EUPHORBIACEAE

Cnidoscolus stimulosus (Michx.) Engelm. & Gray
**Croton alabamensis* E. A. Sm. ex Chapman var. *alabamensis*, *A. 6777*
Croton capitatus Michx.
Croton monanthogynus Michx.
Euphorbia commutata Engelm.
Euphorbia corollata L., *A. and S. 7976*
{*Euphorbia pubentissima* Michx.}
**Leptopus phyllanthoides* (Nutt.) G. L. Webster [*Andrachne phyllanthoides* (Nutt.) Coult.], *A. 6657*
{*Tragia cordata* Michx.}
Tragia urticifolia Michx.

FABACEAE

Amorpha fruticosa L., *A. et al. 6869*
*{*Baptisia australis* (L.) R. Br. ex Ait. f. var. *australis*}, *A. and S. 7724*
Centrosema virginianum (L.) Benth.
Cercis canadensis L.
Chamaecrista fasciculata (Michx.) Greene [*Cassia fasciculata* Michx.]
Crotalaria sagittalis L.
**Dalea cahaba* J. Allison, *A. and S. 6876*
Desmanthus illinoënsis (Michx.) MacM. ex B. L. Robins. & Fern.
Galactia volubilis (L.) Britt.
Orbexilum pedunculatum (P. Mill.) Rydb. var. *pedunculatum* [*Psoralea psoralioides* (Walt.) Cory var. *eglandulosa* (Ell.) Freeman]

**Pediomelum subacaule* (Torr. & Gray) Rydb. [*Psoralea subacaulis* Torr. & Gray] (single locality), *A. et al. 8177*
{*Rhynchosia reniformis* DC.}
Rhynchosia tomentosa (L.) Hook. & Arn.
Stylosanthes biflora (L.) B.S.P.
Tephrosia spicata (Walt.) Torr. & Gray
Tephrosia virginiana (L.) Pers.
+Trifolium campestre Schreb.

FAGACEAE

{*Quercus alba* L.}
Quercus austrina Small, *A. and S. 6735*
Quercus coccinea Muenchh.
Quercus hemisphaerica Bartr. ex Willd.
Quercus incana Bartr., *A. and S. 7586*
Quercus margarettiae Ashe ex Small, *A. and S. 7063*
Quercus marilandica Muenchh.
Quercus muehlenbergii Engelm.
Quercus nigra L.
Quercus shumardii Buckl.
Quercus stellata Wangenh.

GENTIANACEAE

*{*Gentiana saponaria* L.}
*{*Gentiana villosa* L.}, *A. and S. 7496*
{*Obolaria virginica* L.}
Sabatia angularis (L.) Pursh

HYDRANGEACEAE

Hydrangea quercifolia Bartr.

IRIDACEAE

Hypoxis hirsuta (L.) Coville, *A. et al. 6753*
Iris verna L.
Sisyrinchium atlanticum Bickn., *A. and S. 7589*

JUGLANDACEAE

Carya glabra (P. Mill.) Sweet
Carya pallida (Ashe) Engl. & Graebn., *A. and S. 7550*

JUNCACEAE

Juncus effusus L.
Juncus filipendulus Buckl., *A. and S. 6709*
Luzula bulbosa (Wood) Smyth & Smyth

LAMIACEAE

Blephilia ciliata (L.) Benth.
{*Collinsonia tuberosa* Michx.}
Isanthus brachiatus (L.) B.S.P. [*Trichostema brachiatum* L.]
+Lamium amplexicaule L.
{*Monarda fistulosa* L}
{*Monarda punctata* L.}
(+?)*Prunella vulgaris* L.
Pycnanthemum pycnanthemoides (Leavenworth) Fern.
Salvia azurea Michx. ex Lam.
Salvia lyrata L.
Salvia urticifolia L.
**Scutellaria alabamensis* Alexander, *A. and S. 7737*
Scutellaria incana Biehler var. *punctata* (Chapman) C. Mohr, *A. 12505*
Scutellaria parvula Michx. var. *parvula, A. and S. 7648*

LAURACEAE

Persea palustris (Raf.) Sarg.

LILIACEAE

Aletris farinosa L.
Allium canadense L. var. *canadense*
Allium canadense L. var. *mobilense* (Regel) Ownbey [*A. mutabile* Michx.], *A. and S. 7564*
{*Camassia scilloides* (Raf.) Cory}

*{*Melanthium latifolium* Desr.} [*M. hybridum* Walt.], *A. and S. 7794* (VDB)
*{*Melanthium woodii* (J. W. Robbins ex Wood) Bodkin} [*Veratrum woodii* J. W. Robbins ex Wood] (single locality), *A. and S. 7854*
{*Melanthium virginicum* L.} (single locality)
Nothoscordum bivalve (L.) Britt. [*Allium bivalve* (L.) Kuntze]
{*Polygonatum biflorum* (Walt.) Ell.}
**Schoenolirion croceum* (Michx.) Wood, *A. and S. 7588*
Trillium cuneatum Raf., *A. et al. 8775*
Trillium stamineum Harbison, *A. et al. 8776*
{*Uvularia perfoliata* L.}

LINACEAE

Linum sulcatum Riddell var. *sulcatum*, *A. et al. 6865*

LOGANIACEAE

Gelsemium sempervirens St.-Hil.
Mitreola sessilifolia (J. F. Gmel.) G. Don [*Cynoctonum sessilifolium* J. F. Gmel.]
**Spigelia gentianoides* Chapman in A. DC. var. *alabamensis* K. Gould, *A. 6688*
Spigelia marilandica (L.) L., *A. 6763*

MALVACEAE

**Callirhoë alcaeoides* (Michx.) Gray, *A. 11025*
**Sida elliottii* Torr. & Gray, *A. 8555*

MENISPERMACEAE

Cocculus carolinus (L.) DC.

MYRICACEAE

Morella cerifera (L.) Small [*Myrica cerifera* L.]

NYCTAGINACEAE

**Mirabilis albida* (Walt.) Heimerl, *A. 6759*

OLEACEAE

Chionanthus virginicus L.
Forestiera ligustrina (Michx.) Poir.
Fraxinus americana L.
Fraxinus quadrangulata Michx., *A. and S. 7734*
+*Ligustrum sinense* Lour.

ONAGRACEAE

Gaura filipes Spach, *A. 12397* (OKL)
Ludwigia microcarpa Michx.
Oenothera biennis L.
Oenothera fruticosa L. ssp. *glauca* (Michx.) Straley [*O. tetragona* Roth]
+*Oenothera speciosa* Nutt. (adventive from farther west)

ORCHIDACEAE

Hexalectris spicata (Walt.) Barnh., *A. and S. 7413*
**Ponthieva racemosa* (Walt.) C. Mohr, *A. and S. 7960* (VDB)
Spiranthes lacera (Raf.) Raf. var. *gracilis* (Bigelow) Luer [*S. gracilis* (Bigelow) Beck var. *gracilis*]
*{*Spiranthes lucida* (H. H. Eat.) Ames} (single locality), *A. and S. 8224-p*
**Spiranthes magnicamporum* Sheviak, *A. and S. 7437*

OROBANCHACEAE

**Orobanche uniflora* L. (single locality)

OXALIDACEAE

Oxalis priceae Small ssp. *priceae*, *A. et al. 6672*
Oxalis violacea L.

PASSIFLORACEAE

Passiflora lutea L.

PLANTAGINACEAE

*{*Plantago cordata* Lam.}
+Plantago lanceolata L.
Plantago virginica L.

POACEAE

Andropogon gerardii Vitman, *A. et al. 7837*
Andropogon glomeratus (Walt.) B.S.P.
Andropogon gyrans Ashe var. *gyrans* [*A. elliottii* Chapman], *A. et al. 8763*
Andropogon virginicus L.
Anthaenantia villosa (Michx.) Beauv., *A. et al. 9459*
Aristida lanosa Muhl. ex Ell., *A. and S. 7413*
Aristida longespica Poir.
Aristida purpurascens Poir., *J. Allison and C. Oberholster 7049*
{*Arundinaria gigantea* (Walt.) Muhl.}
Bouteloua curtipendula (Michx.) Torr.
{*Brachyelytrum erectum* (Schreb. ex Spreng.) Beauv.}, *J. Allison and T. McQuilkin 11014*
Bromus pubescens Muhl. ex Willd. [*B. purgans* auct. non L.]
Chasmanthium latifolium (Michx.) Yates [*Uniola latifolia* Michx.], *A. 12171*
Chasmanthium sessiliflorum (Poir.) Yates [*Uniola sessiliflora* Poir.], *A. 12173*
Dichanthelium (A. S. Hitchc. & Chase) Gould spp. [*Panicum* L. spp.]
Eragrostis spectabilis (Pursh) Steud.
Gymnopogon ambiguus (Michx.) B.S.P.
Melica mutica Walt., *A. 8174*
Muhlenbergia capillaris (Lam.) Trin.
{*Muhlenbergia sylvatica* Torr. ex Gray}, *A. 12581*
Panicum anceps Michx.
Panicum capillare L.
Panicum flexile (Gattinger) Scribn.
Panicum virgatum L.
Paspalum floridanum Michx.
Piptochaetium avenaceum (L.) Parodi [*Stipa avenacea* L.]
+Poa annua L.
Schizachyrium scoparium (Michx.) Nash [*Andropogon scoparius* Michx.], *A. and S. 8140*
Sorghastrum nutans (L.) Nash
Sphenopholis filiformis (Chapman) Scribn.
{*Sphenopholis obtusata* (Michx.) Scribn.}, *A. 8173*
Sporobolus clandestinus (Biehler) A. S. Hitchc., *A. and S. 7104*
Sporobolus junceus (Beauv.) Kunth
Sporobolus vaginiflorus (Torr. ex Gray) Wood
Tridens flavus (L.) A. S. Hitchc. var. *chapmanii* (Small) Shinners, *A. 12569*
Tridens flavus (L.) A. S. Hitchc. var. *flavus*

POLEMONIACEAE

Ipomopsis rubra (L.) Wherry, *A. et al. 6665*
Phlox amoena Sims, *A. 10563*
{*Phlox glaberrima* L.}
{*Phlox pilosa* L.}
*{*Phlox pulchra* (Wherry) Wherry}, *A. et al. 8343*

POLYGALACEAE

**Polygala boykinii* Nutt.
Polygala grandiflora Walt.

PRIMULACEAE

Dodecatheon meadia L.
Lysimachia ciliata L.
Lysimachia quadriflora Sims, *A. 6783*

RANUNCULACEAE

Anemone berlandieri Pritz. [*A. heterophylla* Nutt. ex Torr. & Gray], *A. and S. 7502*
{*Aquilegia canadensis* L.}
Clematis glaucophylla Small, *A. 6692*
Clematis viorna L., *A. et al. 8345*

Delphinium carolinianum Walt. ssp. *carolinianum*
**Enemion biternatum* Raf. [*Isopyrum biternatum* (Raf.) Torr. & Gray], *A. 6344*
Thalictrum thalictroides (L.) Eames & Boivin [*Anemonella thalictroides* (L.) Spach]
Trautvetteria caroliniensis (Walt.) Vail (two localities, one a wet glade-ecotone, the other along a spring-fed stream near a glade)

RHAMNACEAE

Berchemia scandens (Hill) K. Koch
Ceanothus americanus L.
Frangula caroliniana (Walt.) Gray [*Rhamnus caroliniana* Walt.]

ROSACEAE

+Aphanes microcarpa (Boiss. & Reut.) Rothm. [*Alchemilla microcarpa* Boiss. & Reut.]
Crataegus crus-galli L., *A. 11022*
Crataegus uniflora Muenchh., *A. et al. 9452*
**{*Neviusia alabamensis* Gray} (single locality), *A. and S. 8481*
Physocarpus opulifolius (L.) Maxim., *A. and S. 6711*
Rubus L. spp.

RUBIACEAE

Diodia teres Walt.
Hedyotis nigricans (Lam.) Fosb. [*Houstonia nigricans* (Lam.) Fern.], *A. 6798*
Houstonia caerulea L. [*Hedyotis caerulea* (L.) Hook.]
Houstonia purpurea L. var. *calycosa* Gray [*Hedyotis purpurea* (L.) Torr. & Gray var. *calycosa* (Gray) Fosberg], *A. and S. 7587*
Houstonia pusilla Schoepf [*Hedyotis crassifolia* Raf.]

RUTACEAE

Ptelea trifoliata L.
**{Zanthoxylum americanum* P. Mill.}, *A. and S. 7727*

SALICACEAE

Salix caroliniana Michx., *A. 11931*

SAPOTACEAE

Sideroxylon lycioides L. [*Bumelia lycioides* (L.) Pers.]

SAXIFRAGACEAE

**{Parnassia grandifolia* DC.} (single locality), *A. and S. 7436*

SCHISANDRACEAE

**{Schisandra glabra* (Brickell) Rehder} [*S. coccinea* Michx] (Brickell's basionym misattributed to Bicknell in PLANTS [USDA 2000]), *J. Allison and C. Oberholster 7044*

SCROPHULARIACEAE

Agalinis purpurea (L.) Pennell, *A. and S. 7230*
Agalinis tenuifolia (Vahl) Raf., *A. and S. 7029*
Aureolaria flava (L.) Farw.
Aureolaria pectinata (Nutt.) Pennell
Aureolaria virginica (L.) Pennell
Buchnera americana L., s. str.
**Castilleja kraliana* J. Allison, *A. and S. 7575*
Leucospora multifida (Michx.) Nutt., *A. et al. 8344*
Mecardonia acuminata (Walt.) Small var. *acuminata*
Pedicularis canadensis L.
**Penstemon tenuiflorus* Pennell, *A. 10561*
Seymeria cassioides (J. F. Gmel.) Blake

Seymeria pectinata Pursh
+*Veronica arvensis* L.
**Veronicastrum virginicum* (L.) Farw. (single locality), *A. 12504*

SMILACACEAE

Smilax bona-nox L.
Smilax glauca Walt.
Smilax smallii Morong, *A. 12577*

SOLANACEAE

Physalis heterophylla Nees, *A. and S. 7580*
Solanum carolinense L. var. *carolinense* *A. and S. 7590*
**Solanum pumilum* Dunal [*S. carolinense* L. var. *hirsutum* (Nutt.) Gray, accepted by PLANTS (USDA 2000)], *A. and S. 7644*

STYRACACEAE

{*Styrax grandifolius* Ait.}

ULMACEAE

Celtis tenuifolia Nutt. [*C. georgiana* Small], *A. and S. 7647*
Ulmus alata Michx.
{*Ulmus rubra* Muhl.}

VALERIANACEAE

Valerianella radiata (L.) Dufr.

VERBENACEAE

Callicarpa americana L.
Stylodon carneus (Medik.) Moldenke [*Verbena carnea* Medik.], *A. and S. 7657* (VDB)
Verbena simplex Lehm. (single locality), *A. 12395*

VIOLACEAE

{*Hybanthus concolor* (T. F. Forst.) Spreng.}, *A. 8175*
Viola bicolor Pursh [*V. rafinesquii* Greene]
Viola pedata L.
Viola walteri House, *A. and S. 7414*

VISCACEAE

Phoradendron leucarpum (Raf.) Reveal & M.C. Johnston [*P. flavescens* Nutt. ex Engelm., *P. serotinum* (Raf.) M.C. Johnston]

XYRIDACEAE

**Xyris tennesseensis* Kral, *A. and S. 7067*

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