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-tinted, 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 recently 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,
Figure 4.

*Inter varietates C. grandiflora* 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 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 axes. *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, papillose, 1.4–1.8 mm across, the inner face with a callus at base and apex, the wing 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.


*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.

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individuals facing little competition, either from others of its kind or from taller vegetation. Other varieties, by contrast, whether on outcrops or on roadways, 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 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

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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 Centre-ville. “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, GA, GH, JSU, MIC, 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 dorsali ter pubescentibus per longitudinem carinae praeter corpus abrupte glabrum (quamquam ciliatum) supra positionem latissimam, et ovariiis 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-oblong-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