

STUDIES IN THE VASCULAR FLORA
OF THE SOUTHEASTERN UNITED STATES. X

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ABSTRACT

As part of ongoing work on the *Flora of the Southeastern United States* (Weakley & Southeastern Flora Team 2023) and related projects, as well as for general floristic, conservation, and scientific work in eastern North America, it is essential to document taxonomic and nomenclatural changes and significant distribution records. Here, we propose six new species of graminoids (two *Rhynchospora*, three *Dichanthelium*, and one *Anatherum*)—five from fire-maintained pine savannas and embedded wetlands of the southeastern Coastal Plain and one from the floristically and ecologically related fire-maintained pine savannas of North Andros Island in The Bahamas. We provide rationale and documentation for the “taxonomic resurrection” of *Vaccinium ashei*, an economically important member of *Vaccinium* sect. *Cyanococcus*, based on morphology, estimation of ploidy level with flow cytometry, and phylogenomic analysis based on high-throughput DNA sequencing. We make four new combinations in *Convolvulus* to accommodate the inclusion of *Calystegia* in *Convolvulus* to resolve paraphyly. We also make six new combinations necessary to recognize sect. *Leptopogon* of *Andropogon* at generic rank, as *Anatherum*, based on the phylogenetic work of other researchers and the previously incomplete transfer of recognized species to *Anatherum*, providing the needed names to recognize this group of species in genus *Anatherum* in North American floristic treatments. We document the surprising discovery of *Carex lutea*, previously believed to be endemic to two counties in eastern North Carolina, in two counties in the panhandle of Florida, and a county in eastern South Carolina—discoveries aided by iNaturalist and Facebook. We document new states as being within the distribution ranges of additional species: *Quercus similis* (Florida), *Juncus brachycephalus* (Arkansas and Missouri), *Rhexia mariana* var. *mariana* (Ohio), *Asarum acuminatum* and *Elionurus tripsacoides* (Alabama), and *Mecardonia procumbens* (Georgia). Other important distributional records, many representing rediscoveries of conservationally significant, extant populations of plants previously considered of only historical occurrence in a state, are also reported: Alabama (*Arnica acaulis*, *Asclepias connivens*, *Berberis canadensis*, *Bulbostylis warei*, *Ctenodon viscidulus*, *Parnassia grandifolia*, and *Pinguicula pumila*) and Georgia and Florida (*Lobelia boykinii*).

RESUMEN

Como parte del trabajo en curso sobre la *Flora del Sudeste de Estados Unidos* (Weakley & Southeastern Flora Team 2023) y proyectos relacionados, así como para el trabajo florístico, de conservación y científico general en el este de Norteamérica, es esencial documentar los cambios taxonómicos y de nomenclatura y los registros de distribución significativos. Aquí, proponemos seis nuevas especies de graminoides (dos *Rhynchospora*, tres *Dichanthelium*, y una *Anatherum*) - cinco de sabanas de pino mantenidas por el fuego y humedales integrados de la Llanura Costera del sudeste y una de las sabanas de pino mantenidas por el fuego florística y ecológicamente relacionadas de la Isla Andros del Norte en las Bahamas. Proporcionamos fundamentos y documentación para la “resurrección taxonómica” de *Vaccinium ashei*, un miembro económicamente importante de *Vaccinium* sección *Cyanococcus*, basándonos en la morfología, la estimación del nivel de ploidía con citometría de flujo y el análisis filogenómico basado en la secuenciación de ADN de alto rendimiento. Realizamos cuatro nuevas combinaciones en *Convolvulus* para dar cabida a la inclusión de *Calystegia* en *Convolvulus* para resolver la parafilia. También hacemos seis nuevas combinaciones necesarias para reconocer la sección *Leptopogon* de *Andropogon* en el rango genérico, como *Anatherum*, basándonos en el trabajo filogenético de otros investigadores y en la transferencia previamente incompleta de especies reconocidas a *Anatherum*, proporcionando los nombres necesarios para reconocer este grupo de especies en el género *Anatherum* en los tratamientos florísticos norteamericanos. Documentamos el sorprendente descubrimiento de *Carex lutea*, que anteriormente se creía endémica de dos condados del este de

Carolina del Norte, en dos condados del panhandle de Florida y en un condado del este de Carolina del Sur, descubrimientos ayudados por iNaturalist y Facebook. Documentamos nuevos estados dentro del área de distribución de otras especies: *Quercus similis* (Florida), *Juncus brachycephalus* (Arkansas y Misuri), *Rhexia mariana* var. *mariana* (Ohio), *Asarum acuminatum* y *Elionurus tripsacoides* (Alabama), y *Mecardonia procumbens* (Georgia). También se informa de otros registros importantes de distribución, muchos de los cuales representan redescubrimientos de poblaciones existentes de plantas importantes desde el punto de vista de la conservación, que anteriormente sólo se consideraban históricas en un estado: Alabama (*Arnica acaulis*, *Asclepias connivens*, *Berberis canadensis*, *Bulbostylis warci*, *Ctenodon viscidulus*, *Parnassia grandifolia* y *Pinguicula pumila*) y Georgia y Florida (*Lobelia boykinii*).

INTRODUCTION

We here present a tenth volume of taxonomic descriptions, reassessments of taxonomy, generic transfers, rank changes, typifications, reassessments of nativity and establishment status in the regional flora, range records for native and non-native taxa, all related to the southeastern United States, as defined by the Southeastern Flora Project (Weakley & Southeastern Flora Team 2023), except for a new species of *Dichanthelium* from North Andros Island, The Bahamas, included because of the southeastern United States center of diversity of *Dichanthelium*. This tenth volume is contributed by thirty authors and follows similar conventions and philosophical approaches as the earlier volumes in the series, published from 2011 to 2023; the most recent, Weakley et al. (2023), has citations for the earlier eight. Primary authorship is cited for each section of this paper, as follows: *Lobelia* (JRC, WB, & AMJ), *Convolvulus* (ASW), *Carex* (DBP, LAM, BD, JBF, EAU, & ASW), *Rhynchospora* (PDMcM & RJL), *Vaccinium* (BAS, AAC, PM, & PWF), *Quercus* (ELH), *Juncus* (AJF & WMK), *Rhexia* (IC), *Mecardonia* (JRC & RLM), *Anatherum* I (ASW, ELB, RJL, SLO, BAS, & JKW), *Anatherum* II (BJB & ELB), *Dichanthelium* (RJL, BAS, & SCC), and Alabama records (NDY, AMC, CO, & TWB). These sections are citable based on the primary author(s) of the section.

CAMPANULACEAE

Rediscovery of *Lobelia boykinii* in Florida and recent records from Georgia

Primary authors: J. Richard Carter, Wilson Baker, & Amy M. Jenkins

Lobelia boykinii Torr. & A. Gray ex A. DC., a Coastal Plain endemic inhabiting cypress ponds and depression meadows, ranges from New Jersey southward to the Florida Panhandle and westward into southern Mississippi (Sorrie & Leonard 1999; Spaulding & Barger 2016; Weakley & Southeastern Flora Team 2023). Recently rediscovered in Delaware (McAvoy & Wilson 2014), it was known historically in Florida only from Okaloosa County (Kral 2915, 20 July 1956, FSU) and Jackson County (R.K. Godfrey 59540, 20 May 1960, FSU) records (FNAI 2021). A 2021 survey of herbarium records, historical sites, and suitable habitat in Florida revealed no extant populations, and the species was thought to be extirpated from the state (FNAI 2021). In 2023, while conducting a general floristic inventory of Livingston Place in Jefferson County, Florida, JRC and WB discovered a population of Boykin's *Lobelia* growing in an isolated ephemeral pond, as follows.

U.S.A. FLORIDA. Jefferson Co.: 30.637235°, -83.675062°; Livingston Place, pond #42, 1.67 mi E (heading 96.40°) of Big House, 6 Jun 2023, Richard Carter 26762 with Wilson Baker (VSC).

This *Lobelia boykinii* population, estimated at several hundred aerial stems, was locally abundant in shallow water along the margin of an isolated ephemeral pond, with *Nyssa biflora* Walter, *Cephalanthus occidentalis* L., *Hypericum myrtifolium* Lam., *H. harperi* R. Keller, *Rhynchospora careyana* Fernald, *R. tracyi* Britton, *Eleocharis equisetoides* (Elliott) Torr., *Carex verrucosa* Muhl., *Hymenachne hemitomon* (Schult.) C.C. Hsu, *Pontederia lanceolata* Nutt., *Sclerolepis uniflora* (Walter) Britton et al., *Bacopa caroliniana* (Walter) B.L. Rob., *Proserpinaca pectinata* Lam., *Juncus polycephalus* Michx., *J. effusus* L., *Pluchea baccharis* (Mill.) Pruski, *Eriocaulon decangulare* L., *Saururus cernuus* L., *Nymphaea odorata* Aiton, and species of *Sagittaria*, *Fuirena*, *Leersia*, and *Xyris*. The site was subject to regular and controlled use of fire and exhibited evidence of recent mechanical disturbance by a roller-chopper forestry implement. Owned and managed by Tall Timbers Research Station (TTRS), Livingston Place comprises about 9,000 acres consisting primarily of rolling uplands dotted with numerous and diverse karst ponds in a matrix of old-field woodlands, longleaf pine-wiregrass savanna, and agricultural land. Searches of numerous similar ponds on the property revealed no additional populations of *L. boykinii*. The

TTRS administration has been informed of the presence and significance of this population and is committed to its protection.

Additional recently vouchered populations in southern Georgia: **U.S.A. GEORGIA. Ben Hill Co.:** 31.68699°N, 83.05228°W, ca. 100 m W of jct. Hwy GA 206 and Broxton-Fitzgerald Hwy, powerline right-of-way along N side of hwy, open edge of isolated pondcypress-swamp-blackgum-myrtleholly pond, with *Taxodium ascendens*, *Nyssa biflora*, *Ilex myrtifolia*, *Sagittaria graminea*, *Ludwigia pilosa*, *Rhynchospora careyana*, *Juncus*, *Polygala cymosa*, *Pluchea*, *Lachnanthes carolinianum*, *Polygala cymosa*, plants locally abundant, stem hollow, 14 May 2017, R. Carter 22955 with F. Snow (VSC). **Coffee Co.:** 31.63508°N, 82.68967°W, Mark Mobley Road 2.86 miles east of junction with Hwy US 221, cypress pond immediately east of intersection of Mark Mobley Rd. and James Moore Rd, 16 May 2017, F. Snow s.n. (VSC). **Jeff Davis Co.:** 31.70563°N, 82.708°W, 1.23 mi S Denton jct. Hwy US 221/GA 135 and Georgia Ave, along E side Hwy US 221/GA 135, degraded isolated seasonally wet depression, bisected by hwy and inter-planted with loblolly pine, with *Pinus taeda*, *Nyssa biflora*, *Taxodium ascendens*, *Ilex myrtifolia*, *Acer rubrum*, *Persea palustris*, *Magnolia virginiana*, *Myrica cerifera*, *Amphicarpum muehlenbergianum*, *Ludwigia pilosa*, *Coreopsis nudata*, *Lachnanthes caroliniana*, *Scutellaria integrifolia*, *Juncus*, *Rhynchospora*, *Woodwardia virginica*, *Sphagnum*, plants locally abundant, stem ±succulent, 6 May 2017, R. Carter 22898 with B. Goulet (VSC). **Lanier Co.:** 31.13267°N, 82.97758°W, 0.53 mi SW jct. Hwy GA 168 and Hwy US 221, just S of milemarker 17, along E side Hwy US 221, pond cypress-swamp black gum-hypericum pond, with *Taxodium ascendens*, *Nyssa biflora*, *Hypericum fasciculatum*, *H. myrtifolium*, *Stillingia aquatica*, *Coreopsis nudata*, plants rare, but occasional locally, 3 May 2015, R. Carter 22320 with S.M. Carter (VSC). **Lowndes Co.:** 30.879893°N, 83.226586°W, just E of Valdosta, 0.70 mi ENE jct. Inner Perimeter Rd and Lakeland Hwy (Hwy US 221), powerline right-of-way along S side of hwy, open, seasonally wet flatwoods depression, with *Nyssa biflora*, *Taxodium ascendens*, *Pinus elliotii*, *Myrica cerifera*, *Hypericum fasciculatum*, *Eriocaulon decangulare*, *E. compressum*, *Rhynchospora careyana*, *Amphicarpum muehlenbergianum*, *Pluchea*, *Ludwigia pilosa*, *Proserpinaca pectinata*, *Utricularia radiata*, *Erigeron vernus*, *Scutellaria integrifolia*, *Solidago rotundifolia*, *Hyptis data*, *Centella*, *Lachnocaulon anceps*, plants occasional, 12 May 2016, R. Carter 22660 (VSC). **Terrell Co.:** 31.62882°N, 84.52612°W, 0.75 mi N of Terrell-Calhoun county line by Hwy GA 45, along E side of Hwy GA 45, open karst pond with *Panicum hemitomom*, *Cephalanthus occidentalis*, *Hypericum fasciculatum*, *Rhynchospora inundata*, *Isoetes*, plants occasional, in clusters, stem hollow, 11 May 2017, R. Carter 22919 with L. Musselman and C. Taylor (VSC).

CONVOLVULACEAE

New combinations in *Convolvulus* needed to treat *Calystegia* species

Primary author: Alan S. Weakley

All evidence suggests that *Calystegia* is phylogenetically embedded in *Convolvulus* (Stefanović et al. 2003; Williams et al. 2014; Wood et al. 2015; Mitchell et al. 2016). To render monophyletic genera in tribe Convolvuleae, either *Calystegia* should be subsumed into *Convolvulus* (and perhaps given section rank) or, alternatively, *Convolvulus* could be split into multiple monophyletic genera corresponding to major clades, with *Calystegia* then retaining genus rank as one of those clades. There seems to be no interest in following the alternative of splitting *Convolvulus*, and indeed, segregate genera would be difficult to diagnose morphologically. In their “foundation monograph of *Convolvulus*,” Wood et al. (2015) stated that “*Calystegia* may be distinguished from *Convolvulus* by its pollen (polypantoaperturate versus equatorially triaperturate), stigmas (globose versus linear/clavate) and bracteoles that are large and inflated and enclose the calyx in *Calystegia* whereas in *Convolvulus* they are typically small and often remote, large bracteoles only occurring in *Convolvulus scammonia* and *C. pseudoscammonia*.” They went on to state that:

Thus, *Calystegia* is a clearly defined subgroup within *Convolvulus* that has been treated at a more or less global-level by a single author [Brummitt]. For these reasons we decided to pursue a pragmatic approach excluding *Calystegia* from this monograph of *Convolvulus*. For those who would consider all taxonomy should be based on monophyletic taxa, this issue is readily resolved by re-naming all species of *Calystegia* as *Convolvulus*. The necessary combinations are already available for most of the taxa concerned.

We take this to indicate that Wood et al. (2015) “pragmatically” exclude *Calystegia* from their monograph of *Convolvulus* (considering its taxonomy relatively resolved by Brummitt and not wanting to reopen it in the context of the rest of *Convolvulus*), not from the genus. The phylogenetic tree in Mitchell et al. (2016) suggests that *Calystegia* is indeed monophyletic but is part of a slightly larger clade with *Convolvulus pseudoscammonia* K. Koch, *Convolvulus chinensis* Ker Gawl., and *Convolvulus scammonia* L. successively sister to *Calystegia*, suggesting that the few morphological characters used to recognize *Calystegia* accrued successively, complicating and obscuring the circumscription of and morphological basis for maintaining *Calystegia* at any rank.

For use in the *Flora of the Southeastern United States*, we therefore make necessary combinations to treat species often placed in *Calystegia* as members of *Convolvulus*. Brummitt’s (1965, 1980, 2023) taxonomic

approach in *Calystegia* was to employ many trinomials, grouping subspecies which he considered to be related within an umbrella species. Some of these subspecies are sharply delineated from one another morphologically or represent different lineages on separate continents—e.g., *Calystegia silvatica* (Kit.) Griseb. ssp. *silvatica* in Europe and *Calystegia silvatica* ssp. *fraterniflorus* (Mack. & Bush) Brummitt in North America. Other subspecies show some degree of (apparent) hybridization, intermediacy, or at least nondeterminability of herbarium specimens, both between the subspecies of a species and between the subspecies of one species and those of a different species. As a community, we lack molecular sampling at enough depth (either in samples per taxon or in sequences per sample) to make detailed hypotheses about the relationships of the consensus taxa recognized by Brummitt and others (primarily as subspecies). We therefore judge that the taxonomy established here will be more stable by being “flatter,” with the taxa all accorded species rank, without a premature attempt to imply degrees of relationship with a trinomial taxonomic system.

Convolvulus appalachianus (Brummitt) Weakley, **comb. et stat. nov.** BASIONYM: *Calystegia sepium* (L.) R. Brown ssp. *appalachiana* Brummitt, Kew Bull. 35(2):329–330. 1980. TYPE: U.S.A. WEST VIRGINIA [erroneously stated as Virginia in Brummitt (1980)]. Tucker Co.: Canaan Valley, near Dolly Sods, 900–1200 m, 1950, Allard 19748 (HOLOTYPE: US).

Convolvulus erraticus (Brummitt) Weakley, **comb. et stat. nov.** BASIONYM: *Calystegia sepium* (L.) R. Brown ssp. *erratica* Brummitt, Kew Bull. 35(2):330–331. 1980. TYPE: U.S.A. ILLINOIS. Richland Co.: ca. 10 mi [16 km] NE of Olney, 25 May 1925, Ridgeway, *Plants of the Lower Wabash Valley* 2397 (HOLOTYPE: MO)

Convolvulus neoangulatus Weakley, **nom. nov.** REPLACED SYNONYM: *Calystegia sepium* (L.) R. Br. ssp. *angulata* Brummitt, Kew Bull. 35(2):328–329. 1980. TYPE: U.S.A. IDAHO. Canyon Co.: Falk’s Store, 28 Jun 1910, J. Francis Macbride 318 (HOLOTYPE: MO; ISOTYPES: E, GH, NY, US).

The epithet “*angulatus*” is blocked for transfer to *Convolvulus* by *Convolvulus angulatus* (Lam.) Spreng., Syst. Veg., editio decima sexta 1:594. 1825[1824] (BASIONYM: *Ipomoea angulata* Lam., 1791, Tabl. Encycl. 1:464. 1791.)

Convolvulus neopubescens Weakley, **nom. nov.** REPLACED SYNONYM: *Calystegia pubescens* Lindley. J. Hort. Soc. London 1: 70–72, f. [p. 71]. 1846.

Lindley: “Raised from a small portion of the root found in a dead Paeony root, in Box No. 22, from Mr. Fortune’s mission in China.” The epithet “*pubescens*” is blocked for transfer to *Convolvulus* by *Convolvulus pubescens* (Lam.) Willd., Hort. Berol. 1:203. 1809 (BASIONYM: *Ipomoea pubescens* Lam. 1793, Tabl. Encycl. 1(2[2]):465. 1791[1793]. (11 Feb 1793)

CYPERACEAE

Discovery of disjunct populations of the Federally Threatened Golden Sedge (***Carex lutea***; sect. ***Ceratocystis***) and first reported chromosome counts of the species, aided by social media and iNaturalist.

Primary authors: Derick B. Poindexter, Lilly Anderson Messec, J. Brandon Fuller, Bob Dellinger, Eric A. Ungberg, Alan S. Weakley

As historically recognized, *Carex* sect. *Ceratocystis* is a circumboreal clade consisting of ca. 7+ species, 5 of which can be found in North America (Crins 2002), including *Carex cryptolepis* Mack., *C. flava* L., *C. hostiana* DC., *C. lutea* LeBlond, *C. viridistellata* Derieg, Reznicek & Bruederle, and *C. viridula* Michx. (broadly treated here but with multiple potential species and infraspecies included). Recent work by the Global *Carex* Group (2021) has expanded our interpretation of this group into a much larger and monophyletic “*Ceratocystis-Spirostachyae* Clade”—the *Spirostachyae* component with three species introduced in North America but confined in native distribution to the Old World (Crins 2002).

Of the taxa of sect. *Ceratocystis*, only *C. lutea* occurs in the southeastern United States south of New Jersey, montane Virginia, Ohio, Indiana, and Illinois. This species was described in 1994, and until recently, it was only known from Onslow and Pender counties, NC (LeBlond et al. 1994). On 23 January 2002, this species was officially classified as Federally Endangered, thereby granting it significant protection status, followed by a critical habitat designation in 2011 (Suiter 2022). Phylogenetic assessments by Derieg et al. (2008) found *C. lutea* to be sister to a putative novel species endemic to calcareous wetlands of the upper Midwest (e.g., Indiana, Michigan, and Ohio), later described as *Carex viridistellata* (Derieg et al. 2013). Despite its rarity and protection, no cytological data exists for *C. lutea*.

On March 28, 2021, an unknown sedge morphologically conforming to *C. lutea* was discovered in FL by Lilly Anderson Messec (LAM) and Nicole Zampieri while conducting field surveys in the Apalachicola



FIG. 1. Florida *Carex lutea* (Poindexter 21-46). Photo by Amy Jenkins.

National Forest; it occurred in a diverse roadside ditch and later was found in cypress-dominated basin swamps extending out into the wet pine flatwood edges of those swamps (Fig. 1). Puzzled by the sedge, LAM posted an image of it in the Florida Flora and Ecosystematics Facebook group with the query “Can anyone ID this *Carex* sp.?” leading to its identification to section within 30 minutes, and suggestions that it might be a disjunct population of *Carex lutea* within 35 minutes! Wanting to see the plants in live condition and “in habitat,” gather live material for DNA sampling and chromosome counts, and confirm the identification of this species with Federal Endangered status, a team of caricologists from the UNC Herbarium and Flora of the Southeast Project consisting of ASW, DBP, and EAU planned to make a visit to the Apalachicola National Forest population. On May 7, 2021, botanists and land managers from the Florida Native Plant Society, USDA Forest Service, Florida Natural Areas Inventory, UNC Herbarium, Southeastern Flora Project, Archbold Biological Station, and Florida Department of Agriculture and Consumer Services met on site; live materials

and voucher specimens were collected for genetic, morphological, and cytogenetic study, and management and inventory needs were discussed. Two later populations were discovered by Jenna Anis and Camille Eckelbin nearby, one on the Apalachicola National Forest and the other on the Lake Wimico Game Lands.

In a remarkable coincidence, a second unknown *Carex lutea* population was found by BD in April 2021 in Francis Marion National Forest. He photo-documented a population of a *Carex* unknown to him, adding it as an iNaturalist observation identified only to genus. On May 12, 2021, EAU was scanning iNaturalist observations of *Carex* not identified to species, and encountered BD's observation, immediately recognizing it, as well, as a likely new state record for *Carex lutea* (Fig. 2). BD, John Nelson, Bruce Sorrie, Richard Porcher, Samantha Tessel, Cecelia Dailey, and Jestin Clark conducted additional field work to confirm the identity. One small live collection was made by Samantha Tessel and deposited with DBP.

The coastal Carolina and Florida panhandle disjunction displayed by *C. lutea* is uncommon but not without precedent (see discussion). However, the ecological factors that drive this pattern are not well understood. Thus, further interrogation of these factors could significantly influence our ability to locate new populations and better protect the species from future decline.

With this in mind, we sought to accomplish three goals: 1) verify the identity of these populations with morphological assessment, 2) determine the chromosome number of the species, and 3) use Species Distribution Modeling (SDM) to accurately predict the new Florida population occurrences of *C. lutea* based solely on occurrence data from NC and to determine what environmental drivers are important to the species.

Collectively, this knowledge can then be used by conservationists and taxonomists to better understand the basic biology and biogeography of this globally rare (G2, Imperiled) species (NatureServe Explorer 2024).

METHODS

Morphological study.—We examined voucher specimens from the type locality of the species (Reznicek 8942, Pender Co., NC) and all known populations. Standard micrometer-based measurements of key reproductive structures were made to determine whether the novel populations differed significantly from the original North Carolina populations.

Chromosome study.—DBP grew and collected terminal staminate spikelets from the Florida and South Carolina populations. These were fixed in Carnoy I solution for 24 hours, then transferred to 70% ethanol. Anthers were extracted from material positioned in the intermediate zone between nearly open and closed flowers. These anthers were then stained with acetocarmine and squashed in Hoyer's mounting medium. We isolated multiple cells at metaphase with a trinocular Leica phase contrast microscope at 1000× magnification and imaged representative meiotic figures with a Canon Rebel T3i camera attachment.

Species distribution modeling.—JBF obtained publicly available occurrence data of 47 *Carex lutea* individuals from NC, SC, and FL (iNaturalist 2024). The SDM software MaxEnt was used for its robustness in handling small sample sizes of occurrence data and its ease of use in measuring environmental variable importance. Twenty bioclimatic variables—developed by researchers at the USGS specifically for ecological applications across the contiguous US—were used to create the SDMs (O'Donnel & Ignizio 2012). To test whether the disjunct population had differing explanatory environmental variables, four SDMs were established: all occurrences ($n=47$), NC only ($n=34$), SC only ($n=6$), and FL only ($n=7$). A jackknife test of variable importance was performed on each model.

RESULTS

Morphology.—Preliminary morphometric assessments of various characters (e.g., achenes, perigynia, pistillate and staminate scales, spikelet, peduncles, and bracts) did not deviate from the range of variation known for *Carex lutea*. Due to the lack of observable differences, further morphological study was not pursued.

Chromosomes.—Cytogenetic examination by DBP of the Florida and South Carolina populations revealed a consistent meiotic count of $n=34$ (Fig. 3, Fig. 4) for both localities (Fig. 5). While this count is a first for the species, it is not novel to the clade. Other members of sect. *Ceratocysis* have reported counts ranging from $n = (15-) 28$ to 36 (Rice et al. 2015).



FIG. 2. South Carolina *Carex lutea* (Tessel s.n.). Photo courtesy of Samantha Tessel.

Species distribution models.—The geographic distribution of the SDMs changed significantly depending on the population tested and this is most likely due to the significant difference between the number of occurrences for each population (Fig. 6B–D). When all occurrences are modeled together, the predicted geographic distribution spans a broad southeastern coastal plain distribution seen in many taxa of similar habitat preference, giving confidence in the model’s overall accuracy (Fig. 6A). Importantly, two explanatory environmental variables had the greatest percentage contribution and permutation importance across all models, precipitation of the warmest quarter and precipitation of the driest month, so the jackknife test results of only the model of all occurrences are presented (Table 1).

DISCUSSION

Biogeography.—One of the more notable biogeographic patterns observed in the southeastern United States is the disjunction between the Atlantic Coastal Plain (North and South Carolinas) and the Gulf Coast Panhandle of northwestern Florida (Sorrie & Weakley 2001; Weakley & Southeastern Flora Team 2023). *Carex lutea* adheres to this pattern; other species exhibiting similar habitat preferences and distributions show similar distributions (with variations), such as *Hypericum harperi* R. Keller, *Parnassia caroliniana* Michx., *Pilea tenuifolia* Michx., *Thalictrum cooleyi* H.E. Ahles, and *Rhynchospora thornei* Kral (Sorrie & Weakley 2001; Weakley & Southeastern Flora Team 2023). Understanding the environmental drivers behind why species occur where they do can directly help conservation efforts of rare species when integrated with decision-makers and conservationists in the field, and species distribution modeling (SDM) is an excellent tool to accomplish this (Villero et al. 2017). SDMs shed light on potential explanatory variables for this species and highlight areas of suitable conditions that should be surveyed for additional populations. The two explanatory variables most important to the model, precipitation of the wettest quarter and driest month, should raise alarms for policymakers and conservationists interested in protecting this species as current global climate

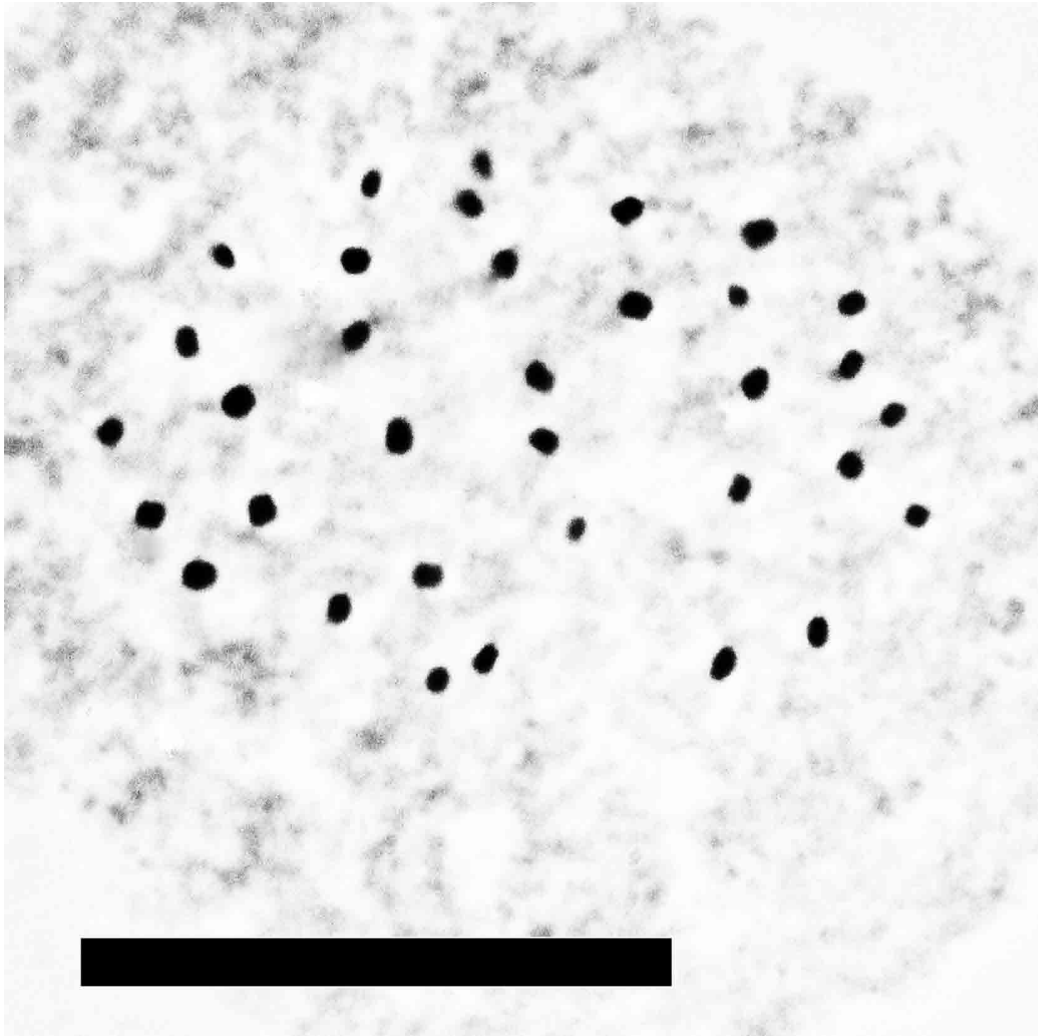


FIG. 3. Meiotic chromosome squash of Florida *Carex lutea* $n=34$, Poindexter 21-46, Liberty Co., FL, NCU).

trends continue to change seasonal precipitation patterns across the southeastern US (Konapala et al. 2020). Further sampling and common garden experimentation should be performed on the species to test the actual importance of the environmental variables shown to be important for these SDMs.

The role of social media and natural history apps in biodiversity discovery.—Our natural world, though under threat by catastrophic global change, has greatly benefited from the technological growth of science-based social media apps that facilitate the timely dissemination of identification-relevant species discovery aided by hyper-engaged communities of both amateurs and professionals. Many *Carex* and other genera in the Cyperaceae, Poaceae, and other families that are difficult or impossible to identify to species from unspecialized photography (because of technical, fine-scale and/or non-exposed characters), complicating the use of these platforms for such species. Nevertheless, iNaturalist and regional, botany-related pages and groups on Facebook catalyzed the identification and discovery of these novel populations of a very rare sedge!

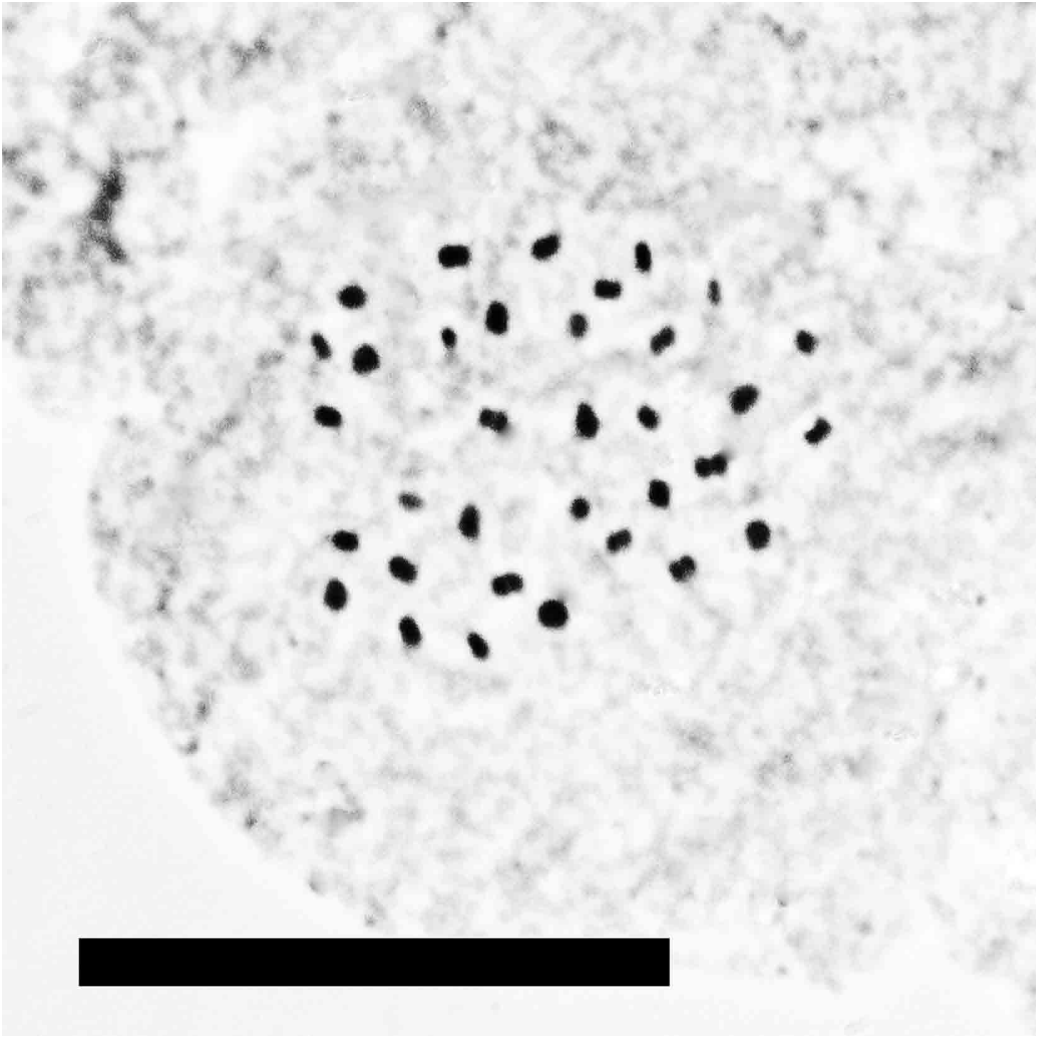


FIG. 4. Meiotic chromosome squash of South Carolina *Carex lutea* ($n=34$, Tessel s.n., Charleston Co., SC, NCU). Scale bar = 10 μm .

CYPERACEAE

Rhynchospora croatanensis, a new species from the outer Coastal Plain of North Carolina

Primary authors: Patrick D. McMillan and Richard J. LeBlond

Known from a single collection in Croatan National Forest, this distinctive member of *Rhynchospora* sect. *Rariflorae* (Gale) McMillan adds another species to the endemic-rich flora of the Cape Fear Arch region of the Carolinas (McMillan 2007). The plant is clearly related to *R. rariflora* (Michx.) Elliott and *R. stenophylla* Chapm. but differs from both by several characters of the inflorescence. This plant has been referred to as *Rhynchospora* sp. 2 in McMillan (2007) and as “*Rhynchospora species 1*” in LeBlond (2023).

Rhynchospora croatanensis LeBlond & P.D. McMillan, **sp. nov.** (Fig. 7). TYPE: U.S.A. NORTH CAROLINA. Croatan Co.: in Croatan National Forest Compartment 28, in wet ecotone of old growth longleaf pine forest and pocosin on Carolina bay rim northeast of Pringle Road at 2.0 mi N of NC 24, 20 May 1990, R.J. LeBlond 4676 (HOLOTYPE: NCU).

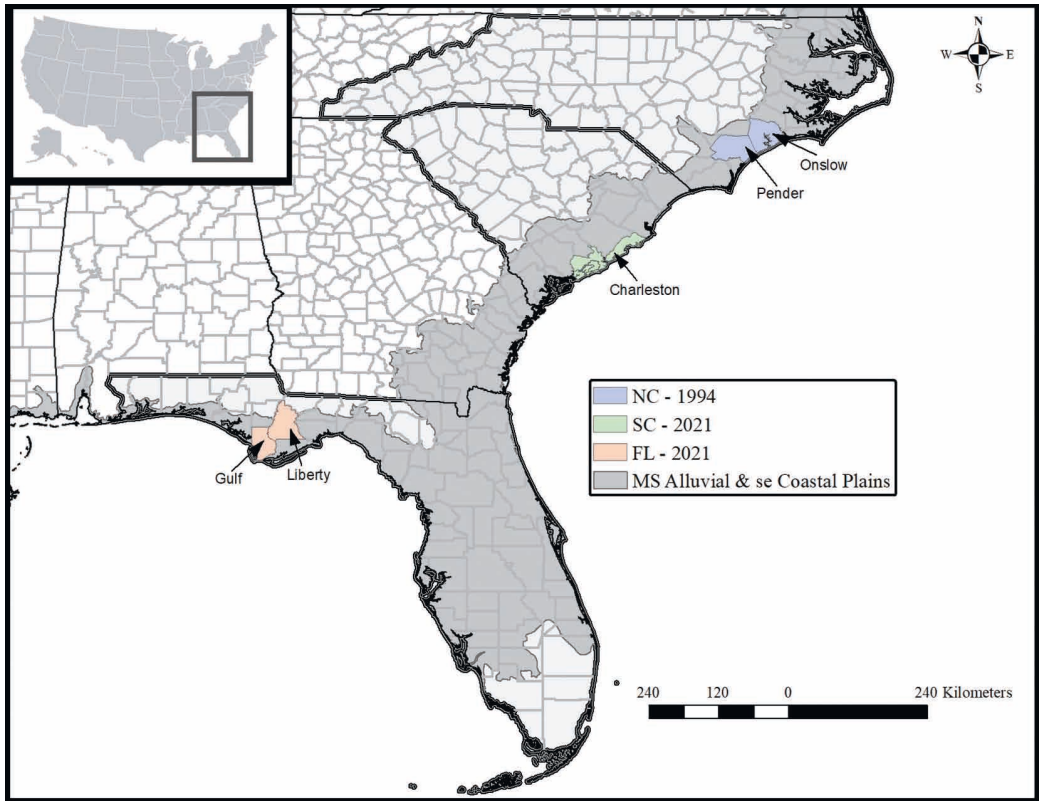


FIG. 5. Current county-level distribution of *Carex lutea* in North America.

Diagnosis.—*Rhynchospora croatanensis* differs from both *R. rariflora* and *R. stenophylla* primarily by having longer and wider achene bodies and tubercles, and more consistently aristate scales.

Description.—Plants perennial, short-rhizomatous. Culms erect, 10–30 cm long $\times$ 0.3–0.6 mm wide. Leaves filiform, involute, long-tapering to trigonous tip, shorter than culms, 0.2–0.4 mm wide. Flower clusters 1–2(–3), few-flowered, the spikelets on capillary branches to 10 mm long. Spikelets brown to tan, 1-fruited, 3–5 mm long, lanceoloid to broadly lanceoloid, acuminate. Fertile scales broadly lanceolate to broadly ovate, 2.7–3.5 mm long, acute to acuminate, and mostly short-aristate. Perianth bristles 6, antrorsely barbed, 0.81–1.41 mm (avg. 1.18 mm) long, from 0.53–0.91 (avg. 0.72) $\times$ as long as achene body, sparsely setose proximally. Achene body obovoid, lenticular, prominently transversely rugulose with 11–14 vertical striae of narrow rectangular alveolae, 1.40–1.80 mm (avg. 1.61) long $\times$ 1.20–1.65 mm (avg. 1.42) wide, 1.07–1.28 $\times$ as long as wide. Tubercle triangular-subulate, 0.79–1.53 mm (avg. 0.96) long $\times$ 0.81–1.20 mm (avg. 1.03) wide; basal $\frac{1}{4}$ of tubercle setulose-margined.

Discussion.—In vegetative features and overall stature, *Rhynchospora croatanensis* is very similar to *R. rariflora*, but it consistently displays a single achene per spikelet and larger achenes, slightly longer bristles, and much longer tubercles. The single achene per spikelet is a feature it shares with *R. stenophylla*. It lacks the sterile fusiform spikelets characteristic of *R. stenophylla*, and has shorter culms, larger achenes, longer tubercles and shorter perianth bristles. The tubercle of *R. croatanensis* is significantly longer and wider than in *R. rariflora* and *R. stenophylla* (see Table 2).

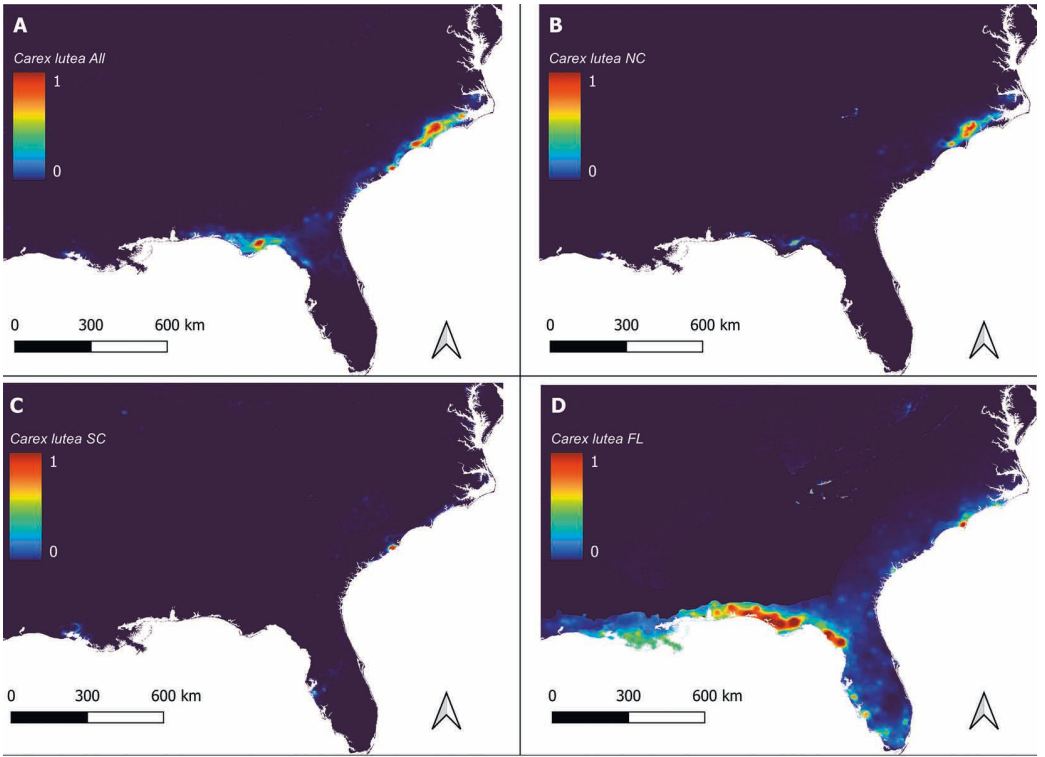


FIG. 6. Predicted species distribution of *Carex lutea* generated using MaxEnt and iNaturalist occurrence data. Distributions are based on probability of occurrence with a probability of 1 represented as red and a probability of 0 represented as dark blue with a color spectrum representing intermediate probabilities. White squares represent known occurrences and purple squares represent occurrences used to randomly test the model with all occurrences. **A.** All Occurrences **B.** NC only **C.** SC only **D.** FL only.

- The species of sect. *Rariflorae* are keyed as follows:
1. Fertile scale usually aristate; achene body 1.4–1.8 mm long × 1.2–1.65 mm wide; tubercle 0.8–1.55 mm long, 0.8–1.2 mm wide at base _____ **Rhynchospora croatanensis**
 1. Fertile scale rarely aristate; achene body (1)1.2–1.6 mm long × 0.9–1.3 mm wide; tubercle (0.3)0.4–0.95 mm long, 0.65–0.95 mm wide at base.
 2. Achenes (1)2–4 per spikelet; sterile fusiform spikelets absent to rare; fertile scale ovate, apex acute to rounded, 1.8–3.2 mm long; perianth bristles 0.35–1.15 mm long, 0.25–0.8 × as long as achene body; tubercle triangular, (0.3)0.4–0.75 mm long, 0.65–0.95 mm wide at base _____ **Rhynchospora rariflora**
 2. Achenes 1 per spikelet; sterile fusiform spikelets often abundant; fertile scale lanceolate, apex acute to acuminate, 3.5–4.5 mm long; perianth bristles 2.1–2.65 mm long 1.4–1.7 × as long as achene body tubercle triangular-subulate, 0.75–0.95 mm long, 0.65–0.75 mm wide at base _____ **Rhynchospora stenophylla**

Distribution and ecology.—*Rhynchospora croatanensis* is currently known from a single population in the outer Coastal Plain of North Carolina. No other collections of this species were found during the examination of *Rhynchospora* specimens at the following herbaria: CHARL, CLEMS, DUKE, FMU, GA, GH, LCU, NY, NCU, P., UC, US, USCH and WILLI. The plants were located at the edge of a relic Carolina bay rim within a large pocosin feature, in the ecotone of old growth Sandy Pine Savanna and High Pocosin (Deciduous Subtype) natural communities (Schafale 2023). Associates include *Ctenium aromaticum* (Walter) Alph. Wood, *Pinguicula caerulea* Walter, *Sarracenia flava* L., *Dionaea muscipula* J. Ellis, *Zenobia pulverulenta* (W. Bartram ex Willd.) Pollard, *Polygala ramosa* Elliott, and *Eriocaulon decangulare* L.

This species should be sought in similar habitat throughout the Cape Fear Arch region. It is likely

TABLE 1. Environmental predictors of all occurrences and their corresponding percent contribution and permutation importance.

Variable	Percent Contribution	Permutation Importance
Precipitation of Warmest Quarter	48.7	67.1
Precipitation of Driest Month	38.3	22.9
Annual Mean Temperature	9.7	0.1
Min Temperature of Coldest Month	1.6	0
Mean Temperature of Wettest Quarter	0.4	0.8
Precipitation of Coldest Quarter	0.4	0.7
Mean Temperature of Coldest Quarter	0.4	2.3
Isothermality	0.1	0
Mean Temperature of Driest Quarter	0.1	1.7
Annual Mean Diurnal Range	0.1	0.1
Precipitation of Driest Quarter	0.1	0.2
Mean Temperature of Warmest Quarter	0	0
Precipitation of Wettest Month	0	0
Precipitation of Wettest Quarter	0	0
Max Temperature of Warmest Month	0	0
Temperature of Warmest Month	0	0
Temperature Seasonality (CV)	0	0
Annual Temperature Range	0	0
Annual Precipitation	0	0
Temperature seasonality (SD)	0	0
Precipitation Seasonality (CV)	0	0

overlooked due to its similarity to other members of sect. *Rariflorae*, and by its slender habit and short stature in its dense herbaceous/low shrub habitat.

CYPERACEAE

Rhynchospora setosa (Cyperaceae), a new species from southern Mississippi.

Primary authors: Patrick D. McMillan and Richard J. LeBlond

This distinctive *Rhynchospora* in sect. *Chapmaniae* (Gale) Kükenthal is described from a pitcher-plant seepage slope in a longleaf pine forest in Jackson Co., Mississippi. The plant is very similar to *R. chapmanii* M.A. Curtis in sect. *Chapmaniae* and is likely closely related to it (McMillan 2007). Section *Chapmaniae* is currently treated as a member of *Rhynchospora* subgenus *Diplostylae* Benth. in LeBlond (2023), with “*Rhynchospora species 2*” as a nomenclatural placeholder for *R. setosa*. In McMillan, *R. setosa* is referred to as “*Rhynchospora* sp. 1.”

Rhynchospora setosa LeBlond & P.D. McMillan, **sp. nov.** (Fig. 8). TYPE: U.S.A. MISSISSIPPI. Jackson Co.: DeSoto National Forest, in seepage slope in longleaf pine forest near Dogleg Bog along John Smith Road, 26 Sep 1996, R.J. LeBlond 4644 & B.A. Sorrie (HOLOTYPE: NCU).

Diagnosis.—*Rhynchospora setosa* differs from *R. chapmanii* primarily by consistently present and long perianth bristles, longer and proportionately narrower achenes, and larger spikelet scales with longer awns (see Fig. 9).

Description.—Plants perennial, caespitose. Culms erect to ascending, 15–55 cm long, 0.5–0.7 mm wide, obscurely trigonous. Basal leaves awl-shaped proximally, subulate distally, to 3.5 cm long × 1.7 mm wide. Culm leaves 6–8, 2.4–7.2 cm long × 0.3–1.2 mm wide, flat, margins finely serrulate. Inflorescence terminal, solitary, broadly turbinate to hemispheric, 0.6–0.8 cm long × 0.8–1.4 cm wide, subtended by several setaceous bracts to 2.4 cm long. Spikelets strictly ascending, ovoid-aristate, light brown to pinkish-tan, with one achene. Scales 2.2–2.7 mm long × 0.85–0.95 mm wide, narrowly ovate to ovate-lanceolate, margins inrolled 0.2–0.4 mm on a side, midrib excurrent as prominent awn 0.5–0.9 mm long. Bristles (3)4, antrorsely scabrous, all on one side of achene, 0.8–1.2 mm long, 0.67–1.0 × as long as achene body. Achene narrowly elliptic to elliptic, lenticular, body 1.2–1.6 mm long × 0.8–1.0 mm wide, pale brown to whitish, darker distally, basally smooth to minutely striate. Tubercle deltoid-apiculate, 0.28–0.40 mm long × 0.44–0.61 mm wide at base.

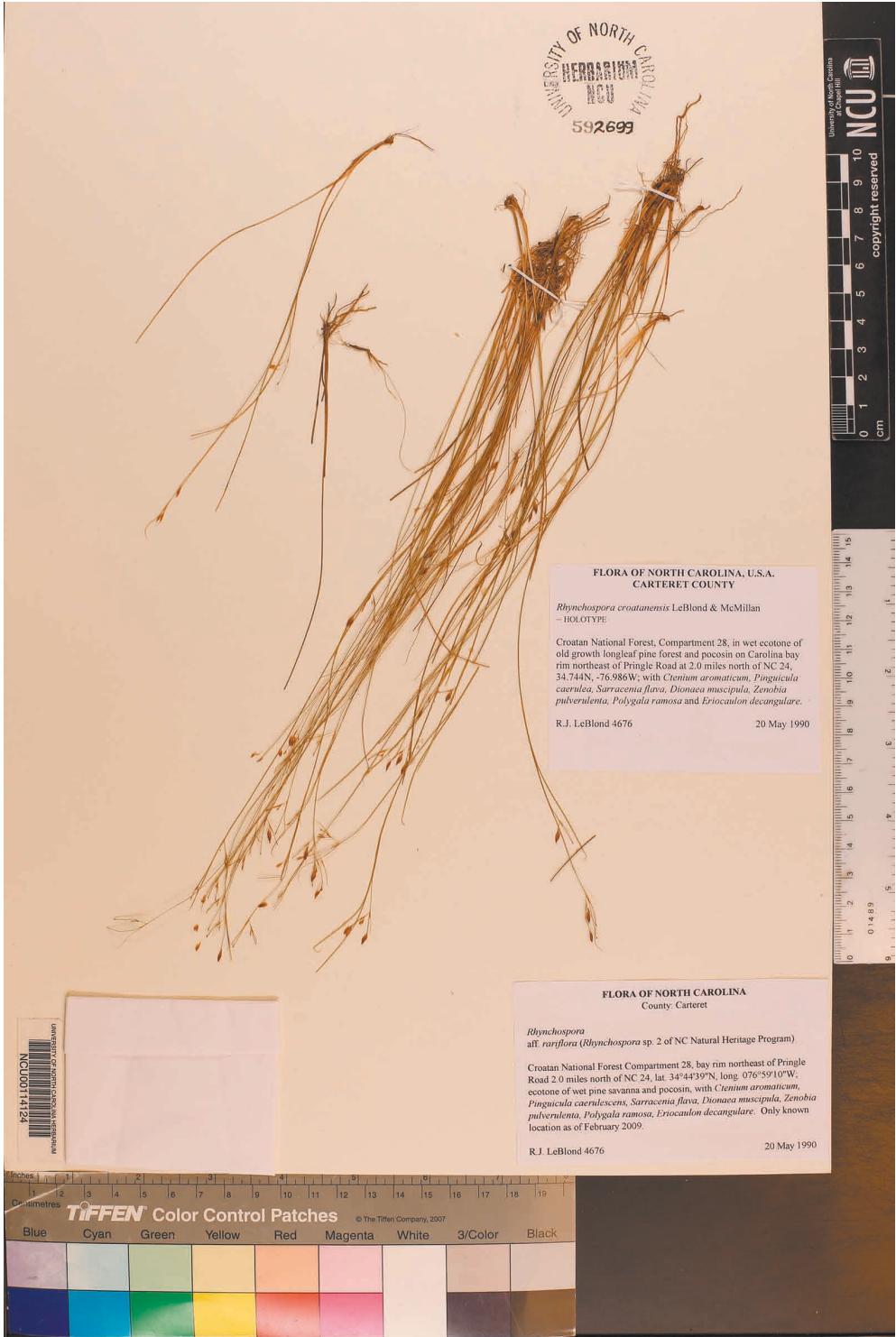


Fig. 7. *Rhynchospora croatanensis* holotype.

TABLE 2. Character comparison of *Rhynchospora croatanensis*, *R. rariflora*, and *R. stenophylla*.

character	<i>Rhynchospora croatanensis</i>	<i>Rhynchospora rariflora</i>	<i>Rhynchospora stenophylla</i>
culm length (cm)	10–30	to 60–60+	to 100
floral clusters	1–2(3)	1–4	1–2(3)
achenes per spikelet	1	(1)2–4	1
sterile fusiform spikelets	absent	absent to rare	often abundant
fertile scale shape	broadly lanceolate to broadly ovate	ovate	lanceolate
fertile scale length (mm)	2.7–3.5	1.8–3.2	3.5–4.5
fertile scale apex shape	acute to acuminate	acute to rounded	acute to acuminate
fertile scale apex projection	usually aristate	rarely aristate	rarely aristate
perianth bristle length (mm)	0.81–1.41	0.36–1.14	2.09–2.66
bristle to achene length	0.53–0.91	0.24–0.79	1.39–1.71
achene body length (mm)	1.40–1.80	(1.00)1.18–1.59	1.31–1.60
achene body width (mm)	1.20–1.65	0.9–1.29	0.96–1.15
achene length to width ratio	1.07–1.28	0.98–1.47	1.17–1.39
tubercle shape	triangular–subulate	triangular	triangular–subulate
tubercle length (mm)	0.79–1.53	(0.3)0.38–0.75	0.76–0.93
tubercle base width (mm)	0.81–1.20	0.66–0.93	0.65–0.75

Discussion.—This beaksedge is very similar to *Rhynchospora chapmanii* (see Table 3) and is likely closely related. It differs primarily in the consistently present and long perianth bristles, longer and proportionately narrower achenes, larger spikelet scales that are characteristically rolled inwards for 0.2–0.4 mm on a side, and with a long excurrent aristate midrib. Spikelet and achene coloration also appear to differ, but the sample size is small.

The species of sect. *Chapmaniae* in the U.S. are keyed as follows.

- 1. Leaves with a short taper at the tip, blunt to acute, but not long-acuminate; achene surface minutely pitted near the margin.
 - 2. Basal leaves 4–6 mm wide, ciliate, rosulate; scales acuminate, the midrib ciliate; bristles 6, < ½ the length of the achene ***Rhynchospora ciliaris***
 - 2. Largest basal leaves 2.5–3.0 mm wide, eciliate, not rosulate; scales aristate, the midrib eciliate; bristles 3–4, 1 or more equaling or exceeding the tubercle ***Rhynchospora solitaria***
- 1. Leaves long-acuminate at the tip; achene surface smooth or finely striate.
 - 3. Bristles (3) 4, on one side of achene, 2/3 to as long as achene body; achene body 1.2–1.6 mm long × 0.8–1.0 mm wide ***Rhynchospora setosa***
 - 3. Bristles absent or 1–3 rudimentary; achene body either 1.0–1.2 mm long × 0.8–1.0 mm wide or 1.4–1.8 mm long × 1.2–1.5 mm wide.
 - 4. Inflorescence composed of (1)–2–3 turbinate to ellipsoid clusters; spikelets pale reddish-brown, (2.7–)3.0–3.5 mm long; achenes usually 2 per spikelet ***Rhynchospora brachychaeta***
 - 4. Inflorescence composed of 1(–2) hemispheric to broadly turbinate cluster(s); spikelets white to pale brown, either 2.0–2.5(–3) mm or (3.5–)4.0–5.5 mm long; achenes 1 per spikelet.
 - 5. Base of plant not bulb-like, not enclosed in bladeless sheaths; spikelets 2–2.5(–3) mm long; achene 1.0–1.2 mm long, 0.8–1.0 mm wide ***Rhynchospora chapmanii***
 - 5. Base of plant bulb-like, enclosed in bladeless sheaths; spikelets (3.5–)4.0–5.5 mm long; achene 1.4–1.8 mm long 1.2–1.5 mm wide ***Rhynchospora pallida***

Distribution and ecology.—*Rhynchospora setosa* is currently known from a single population in the Gulf Coastal Plain of southern Mississippi. No other collections of this species were found during the examination of *Rhynchospora* specimens at the following herbaria: CHARL, CLEMS, DUKE, FMU, GA, GH, LCU, NY, NCU, P, UC, US, USCH and WILLI. The Mississippi plants were found in DeSoto National Forest on a seepage slope within a longleaf pine forest, with pitcher-plants prominent. This habitat is commonly known as a pitcher-plant bog or pitcher-plant prairie, occurring on sloping to nearly flat terrain. The natural community has been classified as a Seepage Meadow by NatureServe (NatureServe Explorer 2024), with a range extending from western Florida Panhandle to Mississippi. Associates include *Dichantherium chamaelonche* (Trin.) Freckmann & Ielong, *D. nudicaule* (Vasey) B.F. Hansen & Wunderlin, *Xyris drummondii* Malme, *Rhynchospora*

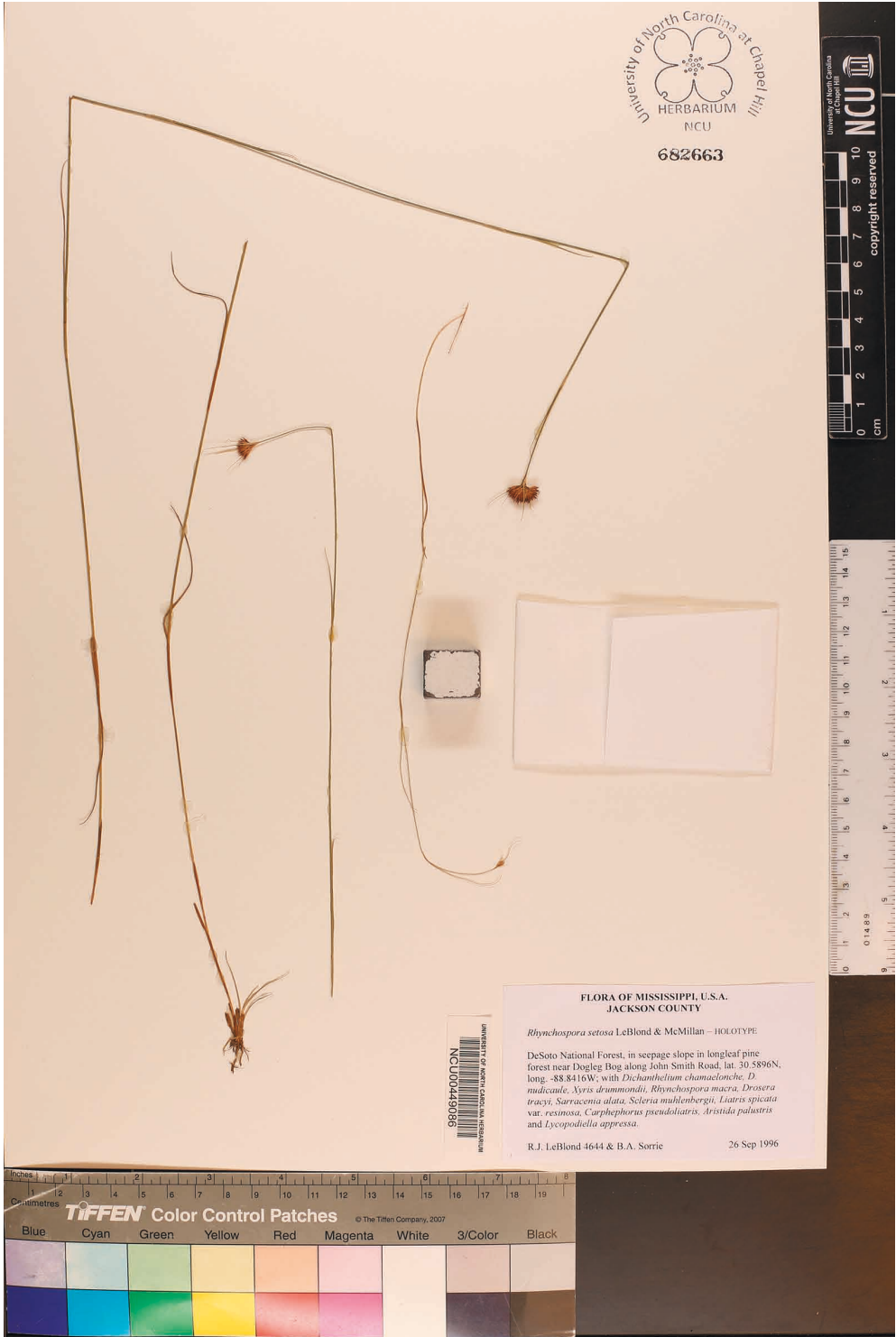


Fig. 8. *Rhynchospora setosa* holotype. Image by Shanna Oberreiter.

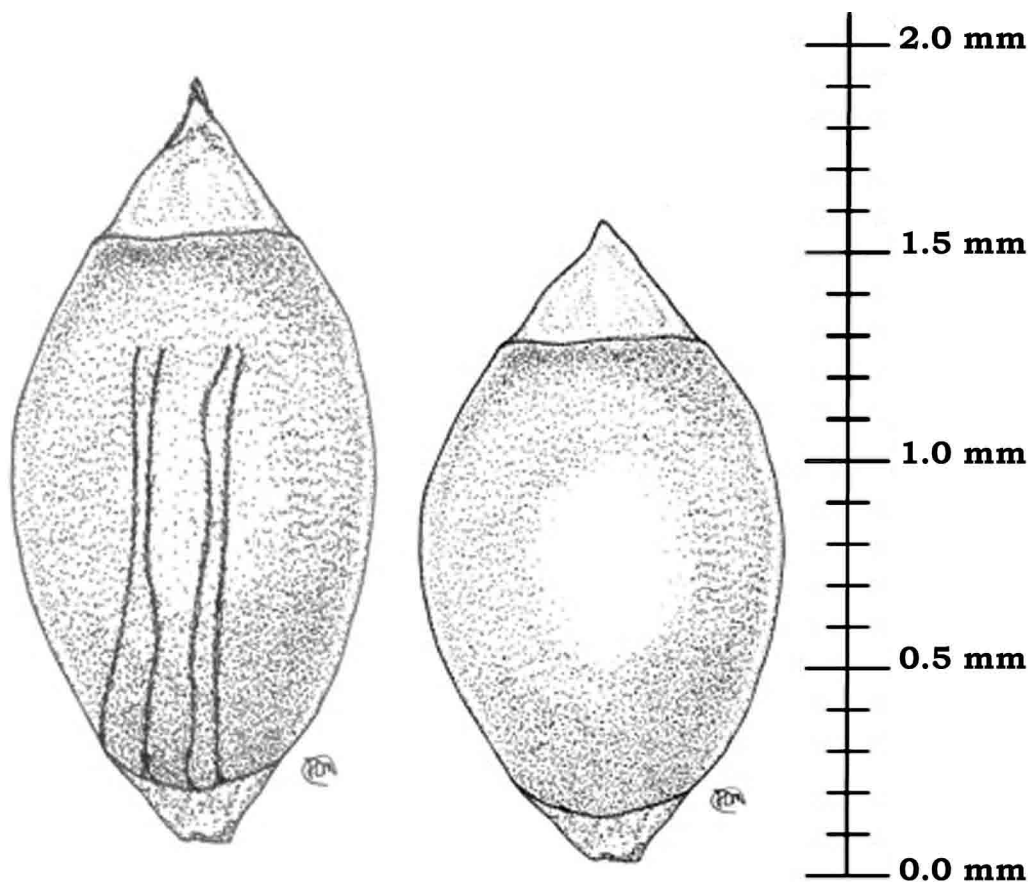


FIG. 9. Comparison of achene, tubercle and bristles of *Rhynchospora setosa* (left) and *R. chapmanii* (right). Illustration by Patrick D. McMillan.

TABLE 3. *Rhynchospora setosa* and *R. chapmanii* character comparison.

character	<i>Rhynchospora setosa</i>	<i>Rhynchospora chapmanii</i>
spikelet color	light brown to pinkish-tan	pale brown to whitish
scale awn length (mm)	0.5–0.9	0.4–0.6
perianth bristles	(3) 4	0
achene body shape	narrowly elliptic to elliptic	sub-elliptic (slightly obovate)
achene body length (mm)	1.2–1.6	1.0–1.35
achene body width (mm)	0.8–1.0	0.8–1.1
median length:width ratio	1.56	1.24
achene color	pale brown to whitish	pale brown to greenish

macra (C.B. Clarke ex Britton) Small, *Drosera tracyi* (Diels) Macfarlane, *Sarracenia alata* (Alph. Wood) Alph. Wood, *Scleria muhlenbergii* Steud., *Liatris spicata* (L.) Willd. var. *resinosa* (Nutt.) Gaiser, *Carphephorus pseudo-liatris* Cass., *Aristida palustris* (Chapm.) Vasey, and *Lycopodiella appressa* (Chapm.) Cranfill.

This species should be sought in similar habitat throughout the Gulf Coastal Plain. It is likely overlooked due to the similarity in appearance to the common and widespread *Rhynchospora chapmanii*. Though it is known only from this single occurrence, many other species associated with highly specific habitats, such as

herb-dominated seepage slopes, are known from only a handful of locations, and some are only known historically and may be extirpated in the wild.

ERICACEAE

Vaccinium ashei: a species to be recognized

Primary authors: Bruce A. Sorrie, Andrew A. Crowl, Paul S. Manos, & Peter W. Fritsch

INTRODUCTION

Vaccinium ashei J.M. Reade (*V. sect. Cyanococcus* A. Gray) was described as a new species in 1931 by John Moore Reade from plants collected mostly by William Willard Ashe in northern Florida, southern Georgia, and southeastern Mississippi (Reade 1931). The type specimen was collected near Niceville, Okaloosa County, Florida, by Ashe on 26 March 1927 (flower) and 2 June 1929 (fruit), with both specimens mounted on the same sheet. Reade's designated type was indicated as being in the "Ashe herbarium," with isotypes intended for distribution to GA and US. Reade provided a Latin diagnosis and a lengthy description. He considered the species to be most closely related to *V. fuscatum* Aiton and provided several points of difference. The *V. ashei* genome has formed the basis for the development of the "rabbiteye" blueberry, now widespread in cultivation (Luby et al. 1991).

As part of the first modern comprehensive taxonomic treatment of *Vaccinium* sect. *Cyanococcus*, Camp (1945) accepted *V. ashei* as a species with a geographic range in "Georgia, southern Alabama, and northern Florida; also possibly in South Carolina and Mississippi." In Camp's view, *V. ashei* is a segmental hexaploid resulting from hybridization and subsequent incorporation of the genomes of five other species of the section, and as such exhibits high morphological variation. From specimen annotation labels and the discussion in Camp (1945), however, this concept appears to include some plants of *V. virgatum* Aiton and *V. australe* Small (= *V. formosum* Andrews). Conversely, in a subsequent (and the latest) global treatment of the section, Vander Kloet (1988, 2009) combined *V. ashei* and all other so-called "highbush" members of sect. *Cyanococcus* into *V. corymbosum* L. sensu lato. This broad concept of *V. corymbosum* has been questioned by various authors (Uttal 1989; Luby et al. 1991; Weakley & Southeastern Flora Team 2023; Fritsch et al. 2024).

Of taxonomic works specific to the southeastern U.S., Small (1933) included *Vaccinium ashei* within *V. amoenum* Aiton (= *V. virgatum* to most authors), stating that it "seems to belong to ... a form with glaucous foliage [that] occurs in W Fla." Clark (1971, p. 225) accepted it, but noted that it is "probably a segregate of [*V. corymbosum*]." Ward (1974), in a treatment of *Vaccinium* for Florida, considered it "less of a taxonomic category than ... a philosophical concept" but nonetheless, out of deference to Camp's expertise, recognized it. Clewell (1985) and Godfrey (1988) both synonymized it within *V. corymbosum*. Uttal (1989) recognized a "*V. ashei* phase" within *V. virgatum*. Diamond and Freeman (1993, p. 630) accepted it along with four other species in the *V. corymbosum* complex. Luteyn et al. (1996) made no mention of the species, but probably included it within *V. corymbosum* along with many cited synonyms because Vander Kloet was the author of *V. sect. Cyanococcus* in that treatment. Wunderlin and Hansen (2011) included it within *V. corymbosum*. Most recently, Weakley and Southeastern Flora Team (2023) included it within *V. virgatum*. After Reade's paper, several specimens from Camden and Charlton counties, Georgia, were identified as *V. ashei*, thus extending the species range eastward. Except for these and a few more populations in southeastern Georgia/northeastern Florida, this range closely corresponds to the East Gulf Coastal Plain, an area of high biodiversity and endemism (Sorrie & Weakley 2001).

The differences in taxonomic treatments of *Vaccinium ashei* by the various authors considering its status—together with field observations suggesting that *V. ashei* is distinct in morphology from the other species of *V. sect. Cyanococcus* in the southeastern U.S.—prompted us to re-examine this problem. We used data from our field observations in the East Gulf Coastal Plain and surrounding areas, detailed examination of herbarium specimens, flow cytometry data to estimate ploidy, and high-throughput DNA sequence data for phylogenomic analysis. On this basis, we resurrect *V. ashei* as a species to be recognized. We provide diagnostic morphological characters, an updated description, *in-situ* photographs, and a distribution map of the species. A key

to the species of *V. sect. Cyanococcus* with the consistent presence of stipitate glands on the abaxial surface of the leaf blades, which includes *V. ashei*, is provided. We place the implications of our treatment in the context of both the evolution of *V. sect. Cyanococcus* and the endemism and biodiversity of the East Gulf Coastal Plain. We also provide a means to identify some individuals of presumed rabbiteye blueberry escapes from cultivation.

MATERIALS AND METHODS

Specimens from the following herbaria were examined in-hand: BRIT, DUKE, GA, IBE, MO, NCSC, NCU, NLU, SMU, and VDB, the data from which were augmented with our own field observations from throughout the U.S. Coastal Plain. Images of specimens from the following herbaria were examined online via the SERNEC data portal (<https://sernecportal.org/portal>): BAYLU, DSC, FSU, GH, KNK, MISS, MISSA, NY, PAC, RSA, USF, USMS, and VSC. Specimen citations followed by an asterisk were examined as an image only.

Our morphological description of *Vaccinium ashei* is based on our fieldwork and herbarium research. The syntype collected by Ashe at GA and the specimens examined by us formed the basis of the description. Characters were assessed with the use of standard herbarium dissecting scopes up to 64× magnification and were compared to those of other members of *V. sect. Cyanococcus* native to the Southeastern U.S. They include characters thought to be diagnostic of the species and those that are generally accepted standard descriptors for species of *Vaccinium*. *Vaccinium ashei* was compared with other species in *V. sect. Cyanococcus*, especially those consistently possessing stipitate glands on the abaxial surface of the leaves because they uniquely have this character in common with specimens of *V. ashei*. These glands are often not present in the first (usually small) few leaves on new branchlets (as noted by Camp 1945), and often the abaxial surface needs to be checked carefully for the presence of these glands because they can blend in with the leaf surface. The glands are consistently present in most mature leaves on the upper parts of branchlets. We based our species comparisons on the global treatment of Camp (1945) as modified by Weakley and Southeastern Flora Team (2023) with the caveat that further taxonomic work is necessary to better understand the number of species and their limits in the section (Fritsch et al. 2024).

Flow cytometry analysis.—We sampled 27 individuals of *Vaccinium sect. Cyanococcus* from natural populations for flow cytometry analysis including six individuals conforming to Reade's description of *V. ashei* (A.A. Crowl CY-203, CY-204, CY-206, CY-210, and CY-376, and P.W. Fritsch 2434) and one presumed rabbiteye blueberry escape from cultivation (P.S. Manos CY-321; see discussion of rabbiteye escapes below). We included four individuals of *V. virgatum* because it is the species that most closely resembles *V. ashei* morphologically. We also included single individuals from other species in the section. The analysis of flow cytometry followed Crowl et al. (2022). Leaf samples were dried in silica-gel desiccant immediately after collection in the field and sent to the Mountain Horticultural Crops Research and Extension Center (North Carolina, USA) within six months of collection. Approximately 1 cm² of dried tissue was finely chopped with 400 mL of nuclei extraction buffer (CyStain UV Precise P Nuclei Extraction Buffer, Sysmex Partec, Görlitz, Germany). The solution was incubated for up to 2 minutes at approximately 24°C and filtered through Partec CellTrics disposable filters (pore size of 50 µm). Nuclei were stained with 4',6-diamidino-2-phenylindole (DAPI) staining buffer (CyStain UV Precise P Staining Buffer, Sysmex Partec) and analyzed on a flow cytometer (Partec PA-II, Partec) to determine relative genome size. By comparing mean relative fluorescence of each sample with the internal standard *Pisum sativum* L. 'Ctirad,' (known genome size of 8.76 pg; Doležel et al. 2007), we estimated genome sizes and inferred ploidy for each sample.

Molecular data and phylogenomic analysis.—Molecular phylogenomic analysis was used to gain insights into the phylogenetic placement of *Vaccinium ashei* and to test its distinctiveness from populations of *V. virgatum* and other species of *V. sect. Cyanococcus*. For this analysis, we used the same samples that were used for flow cytometry analysis, except that only three *V. ashei* samples were used, and one sample of probably a rabbiteye blueberry escape from cultivation (see Taxonomic section). We also included a sample of *V. macrocarpon* Aiton of *V. sect. Oxyccoccus* (Hill) W.D.J.Koch as outgroup. DNA extractions followed a modified CTAB approach (Doyle & Doyle 1987). DNA concentrations were quantified with a Qubit 2.0 (Invitrogen,

Carlsbad, California, USA) and the Qubit dsDNA Broad Range Assay Kit as per the manufacturer's recommendations. Samples ranging from 100 to 3000 ng of DNA were sent to Arbor Biosciences (Ann Arbor, Michigan, USA) for library preparation and DNA sequencing. The Angiosperms353 v1 target capture kit (Johnson et al. 2019) was used for targeted enrichment of each sample. Sequencing was conducted with a NovaSeq S4 System (Illumina, San Diego, California, USA) with 2×150-bp chemistry. Consensus reads for target loci were assembled with HybPiper v2.0.1 (Johnson et al. 2016). Supercontig loci (including both intronic and exonic regions) were used in subsequent analyses.

Individual genes were aligned with MAFFT v7.245 (Katoh & Standley 2013). To reduce potential issues with missing data and poorly aligned regions, we removed columns from these alignments containing > 50% missing data. A concatenated alignment was then produced with the *pxcat* command in Phyx (Brown et al. 2017). Phylogenetic analysis of the concatenated alignment was performed with IQ-TREE (v1.6.9; Nguyen et al. 2015). The best-fit partitioning scheme was chosen with the PartitionFinder algorithm (Lanfear et al. 2014) and 1000 ultrafast bootstrap replicates were used to assess topological support.

RESULTS

Despite the several taxonomic treatments of *Vaccinium ashei* by various authors, evidence from our morphological observations indicate that it is one of the most readily recognized species within *V. sect. Cyanococcus*. Characters distinguishing *V. a shei* from *V. virgatum*, the only other hexaploid species in *V. sect. Cyanococcus* that shares a geographical range with *V. a shei*, and the only one that consistently shares the presence of globose-headed stipitate glands on the abaxial surface of the leaf blade, include those listed below [*V. a shei* (versus *V. virgatum*)]. Although by themselves these characters do not unambiguously distinguish the two species, in various combinations they are reliable. The characters that can be used for any particular specimen will depend on whether the plant in hand is flowering, fruiting, or sterile, or whether virgate flowering stems were collected.

1. Mature plants 1.0–4.5[–7.0] m tall (versus 0.3–2.5 m tall).
2. Current-year branchlets with trichomes to 0.10–0.34 mm long (versus 0.24–0.72 mm long).
3. Second-year branchlets glabrous or white-puberulent, glabrate, trichomes ± in lines and/or patches, often broken (versus glabrous or white-puberulent, trichomes ± in narrow to broad lines or surrounding stem, usually not broken).
4. Leaves coriaceous (versus chartaceous). This character is best observed *in situ* but is also often evident in herbarium material.
5. Living leaves distinctly bluish green above, greenish white or glaucous beneath (versus green to at most pale green, not glaucous). No other large-leaved member of the section in the Southeastern U.S. appears as bluish green in the field as *V. ashei*.
6. Abaxial surface of leaf blade with simple trichomes to 0.32–0.50(–0.60) mm long (versus 0.44–1.02 mm). The trichomes on the abaxial midvein of *V. a shei* also tend to be forward-curved (toward the leaf apex), whereas those of *V. virgatum* are often straight to slightly curved and erect (perpendicular to the midvein).
7. Stipitate glands on the abaxial surface of the leaf blade sparse to rarely moderately dense (versus nearly always moderately dense). These glands require magnification > 15× to see clearly. Within *V. sect. Cyanococcus*, only *V. myrsinites* Lam., *V. tenellum* Aiton, and *V. virgatum* consistently possess such glands. The heads of the glands in both *V. ashei* and *V. virgatum* are globose or ovoid whereas those of *V. myrsinites* and *V. tenellum* are ellipsoid to cylindrical (Vander Kloet 1983: fig. 15; Fritsch et al. 2024).
8. Inflorescences borne at most at several contiguous nodes along non-elongate or virgate distal portions of branches, never on elongate or virgate shoots (versus often additionally borne at many contiguous nodes along elongate or virgate shoots).
9. Hypanthium with glaucescence on at least some hypanthia or (observed *in sicco*, extreme eastern part of range) rarely completely without (versus without glaucescence).
10. Fruits 8–16 mm diam. (versus 4–12 mm).

Stipitate glands (with globose heads) are usually absent on the abaxial leaf surfaces of *Vaccinium elliottii* Chapm. and *V. fuscatum*, two other species recognized by Camp (1945) and Weakley and Southeastern Flora Team (2023) and whose ranges overlap that of *V. a shei* (see below); however, occasionally they are present. *Vaccinium ashei* is easily distinguished from *V. elliottii* by flowers with exserted styles (versus included). It can

be distinguished from individuals of *V. fuscatum* that possess the stipitate glands by coriaceous leaf blades (versus at most subcoriaceous), shorter stipitate leaf glands with round stipe in cross-section (versus flattened at base), and more narrowly urceolate flowers. In addition, *V. a shei* is a hexaploid, whereas *V. elliotii* and *V. fuscatum* are diploids.

Flow cytometry analysis.—Flow cytometry analysis indicated that all samples of *Vaccinium ashei* ($n = 6$), *V. virgatum* ($n = 4$), and a presumed rabbiteye escape from cultivation (*P.S. Manos CY-321*; see rabbiteye section below) are $2n=6x=72$ (hexaploids). Other ploidy levels recovered for sampled taxa of *V. sect. Cyanococcus* are indicated in Fig. 10.

Phylogenomic analysis.—Maximum likelihood analysis of the concatenated dataset resolved all populations of *Vaccinium ashei* as monophyletic and distinct from *V. virgatum* with maximum bootstrap support (Fig. 10). The *V. a shei* clade is inferred as sister to a clade comprising the Southeastern U.S. species *V. darrowii* Camp, *V. myrsinites*, and *V. tenellum*. The *V. virgatum* clade is sister to a clade of the “highbush” species (sensu Camp 1945; Weakley & Southeastern Flora Team 2023) *V. caesariense* Mack., *V. corymbosum*, *V. formosum*, and *V. fuscatum*, albeit with low support.

DISCUSSION

Genome size estimation from flow cytometry data suggests that all sampled specimens of the individuals corresponding to the morphology of *Vaccinium ashei* are $2n=6x=72$ (hexaploid). We additionally verified hexaploidy with flow cytometry for *V. virgatum*, and also for our sample of *V. altomontanum* Ashe from the southern Appalachians. The latter species is well separated morphologically from *V. ashei/V. virgatum*. The taxonomic distinction between *V. altomontanum*, *V. simulatum* Small, and their distinctness from *V. corymbosum* L. and *V. constablei* A. Gray has been unclear (Weakley 2023; Fritsch et al. 2024). However, ongoing investigation of this problem with morphology, ploidy estimates with flow cytometry, and phylogenomic analysis suggests that taxonomic recognition of *V. corymbosum*, *V. simulatum*, and *V. constablei* (possibly = *V. altomontanum*, whose type is missing) as distinct species is warranted (Fritsch, Crowl, Manos, in prep.). Regardless, our phylogenetic analysis indicates that *V. a shei* and *V. virgatum* are distinct lineages. Thus, to at least some degree, the similar morphology of these two hexaploid entities does not indicate synapomorphy, but rather plesiomorphy and/or homoplasy. This, combined with our morphological assessment, warrants the resurrection of *V. a shei* from synonymy, i.e., its recognition as an accepted species. Identification of the parental taxa involved in the formation of these hexaploid lineages will require more in-depth analysis. Below we provide an updated taxonomic treatment of *V. a shei* that accommodates our findings.

It is curious that *Vaccinium ashei* was described so recently, for in Reade’s time it had already been under cultivation, as noted in the protologue: “Near Pensacola [Florida] it is being cultivated under the name of ‘rabbit-eye huckleberry.’ Because of the large size of the fruit and its fine flavor, it seems to be a most desirable sort for cultivation on the sandy soils of the coastal plains region” (Reade 1931). Sharpe and Sherman (1970) in Ward (1974) noted even earlier removal, in the 1920s, of large numbers of *V. a shei* individuals taken from the wild and moved into plantations. As suggested by the existence of some 18 Ashe collections made from 1923–1931, it appears that *V. a shei* was rather common in the Florida panhandle and southeastern Mississippi. Also curious is the fact that we can find only two specimens labeled or annotated as *V. a shei* older than 1923 (“near Jacksonville,” 1894, A.H. Curtiss 4522 (MO, NY) and 4522C (NY); originally identified as *V. fuscatum* and annotated by Camp in 1942 as “part of the *V. a shei* complex”). Despite its unique characteristics, it appears that *V. a shei* was overlooked by botanists of the nineteenth century and first quarter of the twentieth.

From our data, the geographic distribution of *Vaccinium ashei* has now been confirmed as expanded from earlier estimates eastward to Camden and Charlton counties, Georgia, and westward to Washington County, Louisiana (Fig. 11). Except for the extreme eastern edge of the range, these boundaries fit within the East Gulf Coastal Plain, an area of high biodiversity and endemism (Sorrie & Weakley 2001). Recognition of *V. a shei* brings the number of vascular plant taxa endemic to the EGCP to 145, the most endemic-rich of all the phylogeographic areas within the North American Coastal Plain.

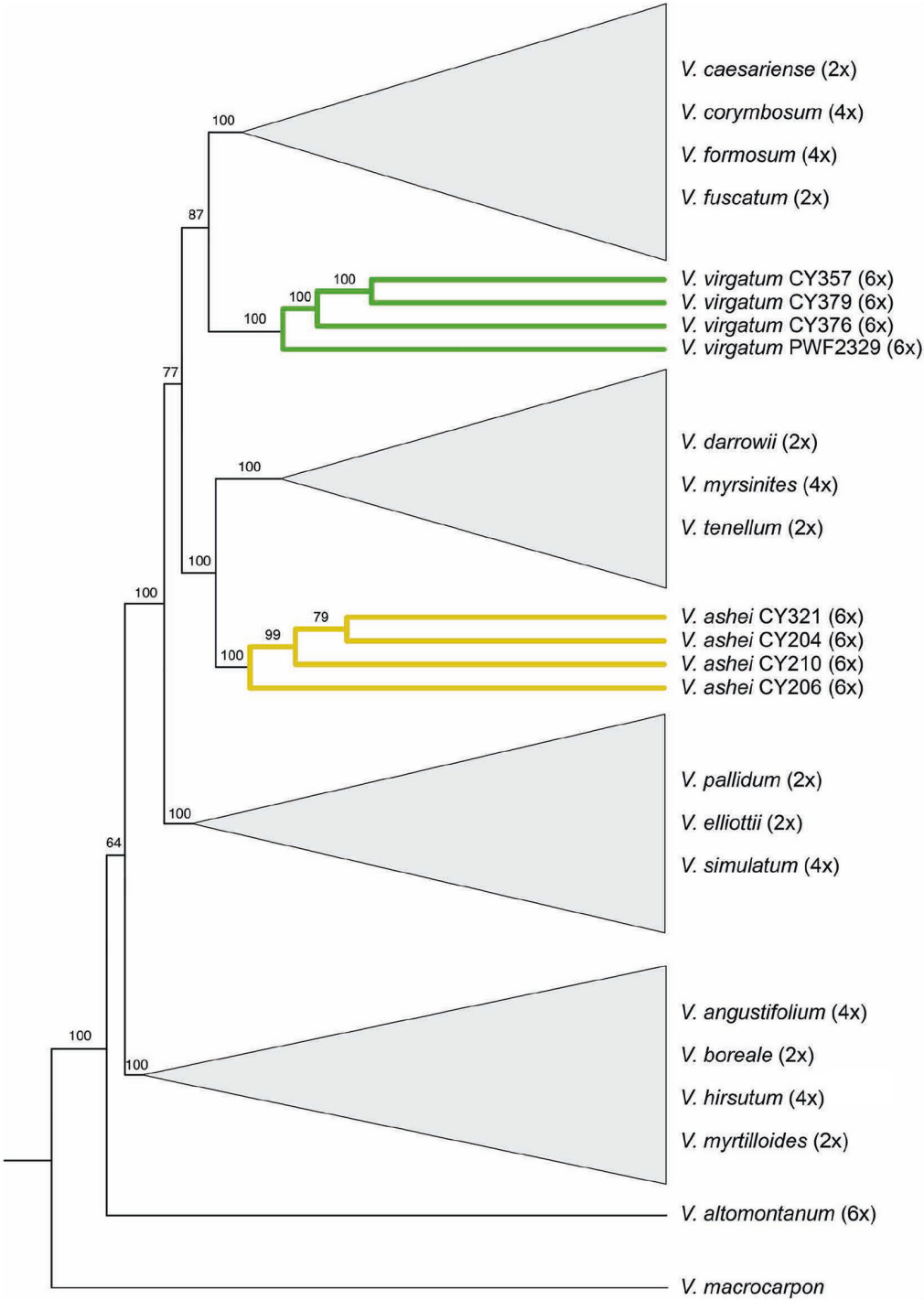


FIG. 10. Summary tree from a maximum likelihood analysis of *Vaccinium* sect. *Cyanococcus* with multiple samples of *V. ashei* (clade in yellow) and *V. virgatum* (clade in green) to assess the taxonomic distinctness of these species. Numbers above branches indicate bootstrap support values. Clades containing taxa which are not the focus of this study have been collapsed. Ploidy is indicated next to each sample/taxon.

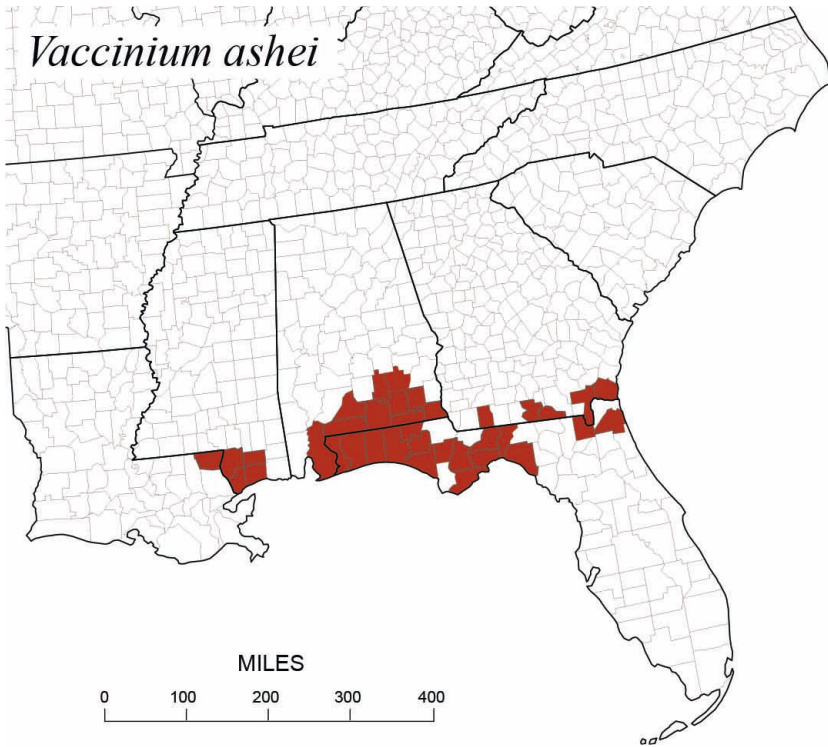


FIG. 11. Naturally occurring geographic distribution of *Vaccinium ashei*, mapped to the level of county.

Several collections of *Vaccinium ashei* from “near Jacksonville” [A.H. Curtiss 4522 (MO, NY) and 4522C (NY)] and Charlton County, Georgia [J.S. Harper 135a (NY)] appear to be without glaucescence on the abaxial side of the leaves and the hypanthium. This may be an artifact of the drying process. All other specimens observed have at least pale leaves abaxially and glaucescence on at least some hypanthia. Some specimens from Okaloosa County, Florida (J.K. Small & E.T. Wherry s.n. and 11716, all NY) have smaller leaves than normal but otherwise agree with *V. ashei*.

In two letters to J.K. Small written in 1928 and now each attached to respective duplicates of J.K. Small & E.T. Wherry 11716, sandy hills near Crestview, Florida (NY), Frederick Coville mentioned his original intent to publish the new species “*Vaccinium ocellare*” as distinct from *V. virgatum*. However, he expressed hesitation because of uncertainty in understanding the characters and taxonomic limits of *V. virgatum*, which he considered to be closely related, and ultimately did not publish the species. Our data show that Coville would have been fully justified in doing so. Coville explained in one of the letters that “*ocellare*” means with the appearance of an eye. He further explained that the fruit is black and large, looking like the eye of a rabbit and wanted to name the species after its common name of rabbiteye blueberry. Thus it is clear that this common name was being applied to plants of *V. ashei* in the wild (and by extension to wild-selections for cultivation). Only by the 1940s did cross-breeding with other species produce many of the rabbiteye blueberry cultivars used in commercial plantings today (Galletta & Ballington 1996).

TAXONOMIC TREATMENT OF VACCINIUM ASHEI

Vaccinium ashei J.M.Reade, *Torreya* 31:71. 1931. TYPE: U.S.A. FLORIDA. Okaloosa Co.: near Niceville, in small swamp with titi, *Cyrilla* etc., 26 Mar 1927, W.W. Ashe s.n. (LECTOTYPE, designated here: GA accession #275541, barcode #259756, flowering branchlet on sheet [lower element], Fig. 12. See also Fig. 13a–g for photographs of living plants illustrating diagnostic features of *V. ashei*.



FIG. 12. Lectotype of *Vaccinium ashei*.

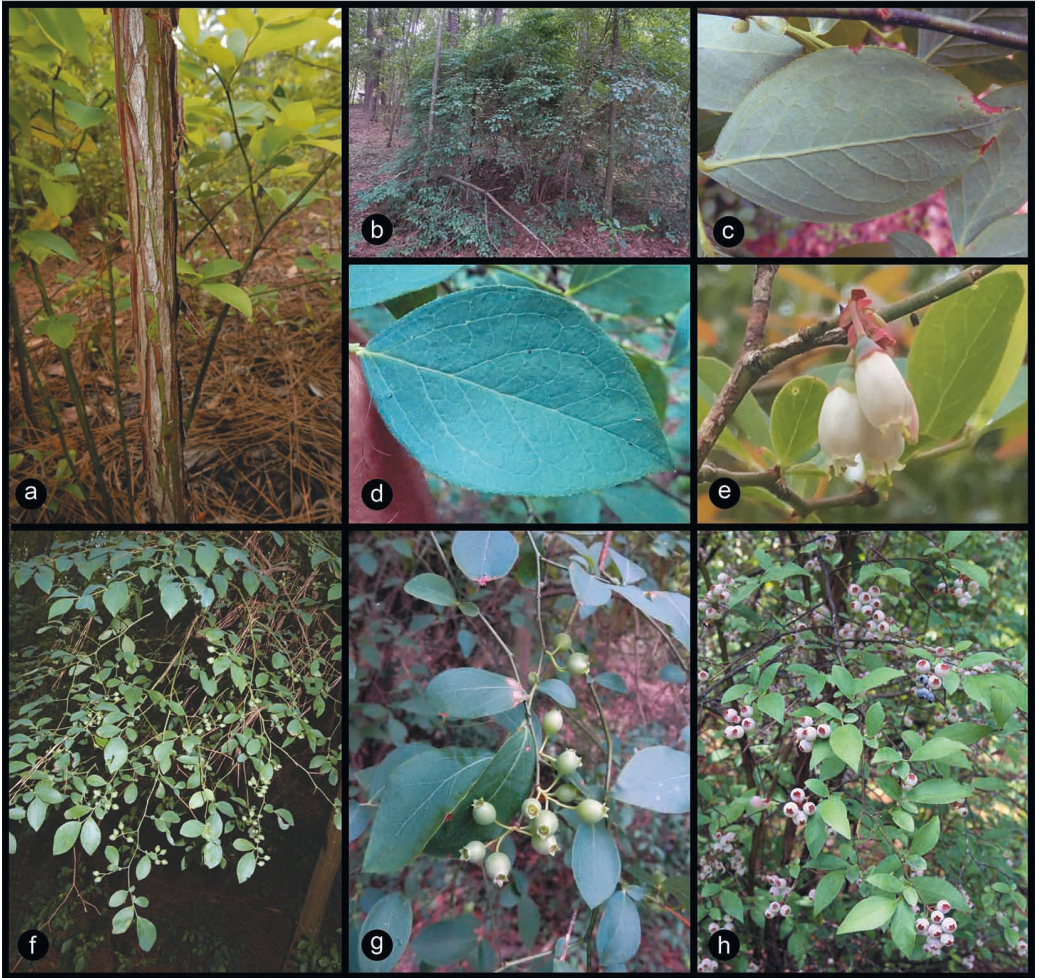


FIG. 13. a–g, *Vaccinium ashei*. a. stem and bark; b. habit; c. leaf, abaxial surface; d. leaf, adaxial surface; e. inflorescence; f. branchlets with immature fruit; g. branchlet with immature fruit; h. rabbiteye escape from cultivation, branchlets with maturing fruit. [Photos, a–d, f, g by P.W. Fritsch, e by A.A. Crowl, h by B.A. Sorrie; a, P.W. Fritsch 2395; b, d, f, g, P.W. Fritsch 2434; c, P.W. Fritsch 2433; e, A.A. Crowl CY-204; h, B.A. Sorrie 14145.

Reade (1931) described the type of *Vaccinium ashei* as follows: “The type material collected by W.W. Ashe near Niceville, Okaloosa County, Fla., consisting of both flowers, March 26, 1927, and fruit June 2, 1929, from the same plant, is in the Ashe herbarium. Co-type specimens in fruit are being deposited in the herbarium of the University of Georgia and in the National herbarium.” The “Ashe herbarium” may be at NCU, but we have located no type material there. The only type material we have located is at GA. W.H. Camp annotated this specimen as “ISOTYPES” in 1942 and “GA Herbarium Staff” annotated the specimen as isotype in 2017, but it is not clear if any of these individuals saw material that could be considered the holotype. Because the GA specimen constitutes the only type material that we have seen, and because there is no evidence of the existence of type material at the “Ashe herbarium,” whether that is NCU or a different herbarium, we have used the material on the sheet at GA for lectotypification. There are two elements on the sheet, one in flower and one in fruit, each collected at a distinct time and therefore each constituting a separate gathering; as such, these are syntypes. We designate the flowering specimen on the sheet as lectotype and presume that the date

of collection is the date indicated in the protologue, although only the fruiting date of 8 June 1929 is indicated on this sheet. Reade did not annotate this specimen, but because GA is Reade's herbarium, we presume that Reade saw it. We have not seen the specimen at US (presumably the "National herbarium" referenced by Reade).

Description.—Data from Reade (1931) that differ from our observations are indicated in brackets. **Shrubs**, deciduous, usually clumped and multi-stemmed, not clonal or (Camp 1945) clonal, 1.0–4.5[–6.0] (rarely –7, from Camp 1945) m tall, top-most branches often arched, distal portions drooping in fruit. Branchlets *in situ* green until ca. third or fourth year, older branchlets and stems gray to brown; eruptive periderm (split longitudinally and irregularly) common on third-year and older branchlets and stems. Current-year branchlets sparsely to densely white-puberulent, without stipitate glandular trichomes, trichomes in 2 narrow lines, straight to curved, 0.10–0.34 mm long; second-year branchlets glabrous or white-puberulent, glabrate, trichomes $\pm$ in lines and/or patches, often broken; outer vegetative bud scales 1.3–2.4 mm long, glabrous or occasionally puberulent. **Leaves** with petiole 0.5–2.2[–3.0] mm long, sulcate and/or margins narrowly winged to base, abaxially and adaxially pubescent, eglandular; leaf blade elliptic or narrowly elliptic to ovate or slightly obovate, often $\pm$ rhombic, (2.3–)3.4–7.9 $\times$ (0.9–)1.6–3.8[–4.3] cm, coriaceous, abaxial surface *in situ* dull, bluish green and glaucous, in sicco often pale tan-brown or brown, distinctly paler than adaxial surface, pubescent with white $\pm$ apically-oriented $\pm$ curved trichomes 0.32–0.50(–0.60) mm long borne along midvein at least from base to distal 1/3 and occasionally secondary veins, variously becoming less pubescent with age, sparsely to less often moderately stipitate-glandular along veins and occasionally on surface (stipitate-glandular trichomes 0.12–0.38 mm long, stipes usually not notably flattened, not notably flanged proximally, gland-heads orangish, reddish, or black, globose to ovoid), adaxial surface *in situ* bluish green and glaucescent, in sicco bluish green to brown to dark brown and glaucescent, glabrous except for ascending to erect $\pm$ curved eglandular trichomes along midvein, base cuneate to broadly cuneate, margins occasionally entire or usually crenulate-serrulate with each tooth tipped by a stipitate gland, sparsely to densely ciliate-pubescent at least proximally, narrowly revolute, tapering into petiole, apex [obtuse to] acute to slightly acuminate, sessile marginal glands present, 0.06–0.16 mm wide (width parallel to margin), marginal teeth (not including stipitate gland) when present oriented toward leaf apex with straight to outcurved outer edges and shallow and narrow to deep and broad sinuses. **Inflorescences** of axillary or pseudoterminal racemes, borne at most at several contiguous nodes along non-elongate or non-virgate distal portions of branchlets, 2- to 9-[to 10]-flowered, rachis 1–11 mm long, subtending bracts white often strongly flushed pink, obovate to subrotund, cucullate, glabrous (not stipitate-glandular), margins eciliate, pedicels glabrous, bracteoles white often strongly flushed pink, narrowly elliptic to narrowly rhombic, glabrous (not stipitate-glandular), margins eciliate. **Flowers:** emerging before leaves and continuing nearly to full leaf size; calyx hypanthium 0.6–2.3 $\times$ 1.3–3.3 mm, glabrous, with glaucescence on at least some hypanthia or (observed in sicco, extreme eastern part of range) rarely completely without; calyx limb 0.4–1.2 mm long; calyx lobes deltoid to $\pm$ hemispheric, 0.5–1.5 $\times$ 1.4–2.1 mm, with or without glaucescence, margins eciliate or slightly ciliate, apex acute to rounded; corolla white, occasionally tinged reddish [rarely striped with red], $\pm$ cylindrical, broadest in middle third, slightly constricted subapically, 6–10 $\times$ 3.5–6.5 mm, glabrous within and without, except often with sparse to dense short trichomes on inner lobes; stamens 6.4–8.0 mm long; filaments 2.6–4.4 mm, glabrous on surface, white-hirtellous marginally, trichomes to 0.70 mm long; anthers 3.8–4.9 mm long, thecae 1.5–2.0 mm long, tubules 2.1–3.0 mm long; style exserted, 8–10 mm long, glabrous. Fruits pastel green when immature turning pinkish pale green to wholly reddish, and black or purplish black at maturity, with or without glaucescence, subglobose, 8–16 mm diam., with sweet flavor; seeds ca. (20–) 23 to 44 in number, chestnut brown, 1.1–1.7 $\times$ 0.8–1.2 mm.

Distribution habitat, and floral phenology.—The natural geographic range of *Vaccinium ashei* is here considered to extend from extreme southeastern Louisiana east to extreme southeastern Georgia and extreme northeastern Florida. The natural habitats occur within the longleaf pine (*Pinus palustris* Mill.) ecosystem. Specimen labels yield the following habitat descriptors, generally ranging from moist or wet creek-sides and river margins to mesic pine-hardwood forests, mature pine forests, and dry pine-oak woodlands, margin of

the Okefenokee Swamp, bottomland woods by creek, sandy seepage along river, edge of hammock above creek, moist woods on slope above creek, moist *Magnolia*-spruce pine woods, *Magnolia*-pine creek bottomland, ecotone of stream head, wooded strip around pond, roadcut bank near creek, roadsides, mesic to moist longleaf pine slopes, cut-over longleaf pine, flat open pineland, open pine-live oak-laurel oak woods, well-drained mixed woods, oak woods on sandy ridge, and very sandy pine-live oak-myrtle oak woods. Flowering occurs from late February to mid-April; fruiting occurs from early June to mid-August.

Chromosome number.— $2n=6x=72$ (hexaploid).

KEY TO THE SPECIES OF *VACCINIUM* SECT. *CYANOCOCCUS* CONSISTENTLY
WITH STIPITATE-GLANDULAR LEAVES ABAXIALLY

For this key, we treat *V. amoenum* as conspecific with *V. virgatum*.

1. Plants 0.1–1.0 (–1.2) m tall; stipitate glands on abaxial surface of leaves with clavate- to ellipsoid-cylindrical heads.
 2. Plants deciduous; leaf blades $2.8\text{--}7.2 \times 0.9\text{--}3.4$ cm, chartaceous _____ ***V. tenellum*** ($2n=2x=24$)
 2. Plants evergreen; leaf blades $0.5\text{--}0.9 \times 0.3\text{--}0.5$ cm, coriaceous _____ ***V. myrsinites*** ($2n=2x=48$)
1. Plants $0.3\text{--}0.5\text{--}7.0$ m tall; stipitate glands on abaxial surface of leaves with obovoid to globose heads.
 3. Plants $0.3\text{--}2.5$ m tall; leaf blades chartaceous, abaxial surface *in situ* green to pale green, stipitate glands on abaxial surface usually moderately dense, simple trichomes $0.44\text{--}1.02$ mm long; hypanthium without glaucescence; fruits $4\text{--}12$ mm diam. _____ ***V. virgatum*** ($2n=6x=72$)
 3. Plants $1.0\text{--}4.5\text{--}7.0$ m tall; leaf blades coriaceous, abaxial surface *in situ* bluish green and glaucous, stipitate glands on a baxial leaf surfaces sparse to less often moderately dense, simple trichomes $0.32\text{--}0.50\text{--}0.60$ mm long; hypanthium usually with glaucescence, rarely apparently without; fruits $8\text{--}16$ mm diam. _____ ***V. ashei*** ($2n=6x=72$)

PRESUMED ESCAPES FROM CULTIVATION OF RABBITEYE BLUEBERRY

We encountered several herbarium specimens and plants in the field (which we vouchered as herbarium specimens; e.g., Fig. 13h) that are morphologically similar to *Vaccinium ashei* in most respects. In most of these specimens, however, the current-year stems are either glabrous (versus with some pubescence in *V. ashei* as circumscribed here) or more sparsely pubescent than those of *V. ashei* and the abaxial surfaces of the leaf blades are completely glabrous (versus always at least sparsely pubescent). Furthermore, they were collected either at the periphery of the range of *V. ashei* as here circumscribed or well outside this range. From this we conclude that these specimens likely represent escapes from cultivation of rabbiteye blueberry, whose genome is formed from that of *V. ashei* but in many modern cultivars also contains genetic material from one or more other species of *V. sect. Cyanococcus*. In particular, these plants could be escaped progeny of crosses between *V. ashei* and *V. constablei*, another hexaploid species but endemic to the central and southern Appalachians (Camp 1945; Manos et al. in prep.). Such crosses are known to have been conducted at various blueberry breeding facilities as early as the 1940s (Brightwell et al. 1949; Ballington et al. 1986, 2006). More recently, cultivars resulting from such crosses, and also those that include *V. corymbosum* L. or at least germplasm with that name as applied horticulturally, have been released into the market (Galletta & Ballington 1996; Ehlenfeldt & Rowland 2015; Ehlenfeldt et al. 2015). Leaf surface features, such as the presence or absence of simple trichomes, in the progeny of such crosses are rarely if ever described in the horticultural literature, rendering it unclear as to whether glabrous leaves specifically result from any such crosses. However, in the wild, both *V. constablei* and *V. corymbosum* may have completely glabrous leaves abaxially on occasion, and rabbiteye blueberry cultivars based on *V. ashei* that also include germplasm from either or both of these species might have been used in the development of these cultivars. The possibility that plants with glabrous leaves abaxially are escaped hybrid cultivars can be tested with genomic analysis.

Wright et al. (2023) hypothesized that plants collected from Prince George's County, Maryland, were either adventive natural populations of *Vaccinium virgatum* Aiton (with *V. ashei* considered a synonym) or escapes from cultivation of rabbiteye blueberry. If escaped, they likely originated from the nearby Beltsville Agricultural Research Center, where research on "*V. ashei*" was conducted for many years, presumably including crosses with other species. Based on our observations of one of these collections (see below), we consider it likely that these plants and the other presumed escapes cited below include a part of the genome that confers lack of leaf pubescence into the predominant *V. ashei* genome, thus enabling us to distinguish

these plants morphologically from native populations of *V. ashei*. Some of these specimens have thicker stems and larger leaves than those from the presumed native range of the species, possibly resulting from hybrid vigor in these individuals. Whether or not these escapes are hybrids could be tested by sampling the genomes of presumed escapes and comparing them to those of naturally occurring *V. virgatum* and other species of *V. sect. Cyanococcus*. One might then be able to assess whether these plants have genomes from more than one species, and if so, the species involved and their proportional genomic contributions.

Several specimens seen by us that occur outside the native range of *Vaccinium ashei* as circumscribed here [Alabama, Lee County, *P.W. Fritsch 2429* (BRIT, DUKE) from the Auburn University Campus; Georgia, Butts County, *C.L. Howel 0076* (NLU, VDB); Georgia, Clarke County, *D. Demaree 51237* (VDB); and Harris County, Georgia, *Sweeney 280* (GA [2 sheets], NLU), 312 (GA, NLU), and 313 (GA, NLU), all near Callaway Gardens but apparently not cultivated], have nearly the same level of leaf pubescence as plants in the native range. These plants could either be adventive plants of *V. ashei* or rabbiteye escapes with characters closer or equivalent to wild-type *V. ashei*. Other collections made from the same general locality on the Auburn University campus are similar to *V. ashei* but have glabrous leaves and on this basis we can more confidently recognize them as rabbiteye escapes.

Two specimens resembling *Vaccinium ashei* collected from Echols County, Georgia [*G.J. Galletta PI 346494* (7-17-15) (NCU, VSC*) and *G.J. Galletta PI 346496* (7-17-19) (NCU, VSC*)] lie within the natural range of *V. ashei* but have leaves that are completely glabrous on the abaxial surface, as in the presumed escapes from cultivation outlined above. Their leaves are also notably narrowly obovate, unlike those of natural *V. ashei*, and possibly indicate derivation from hybridization with *V. tenellum* or other species of *V. sect. Cyanococcus*.

One of the samples used for our phylogenetic analysis [North Carolina, Orange County, Occonee Mountain State Natural Area, *P.S. Manos CY-321* (BRIT)] has a glabrous abaxial leaf surface and is presumed to lie outside the natural range of *Vaccinium ashei*. As such, we consider it an escaped rabbiteye cultivar. The phylo-genetic grouping of the CY-321 sample together with the naturally occurring samples of *V. ashei* can be explained by the likely predominance of the *V. ashei* genome in rabbiteye cultivars. A follow-up study could attempt to detect in rabbiteye escapes the presence and strength of the genomic signature from *V. ashei* versus that of other species used in the development of rabbiteye blueberry cultivars.

Additional specimens examined from presumed naturally occurring populations of *Vaccinium ashei*.—**U.S.A. ALABAMA. Baldwin Co.:** Alabama Hwy. 12, 30°48'30"N, 87°38'35"W, Dogwood Creek Quad, sandy roadside in full sun, 23 Mar 2006, *A.R. Diamond 16191* (VDB); ca. 10 m W of county road 63, ca. 6 m N of county road 112 (Old Pensacola Road), Bay Minette, 82 m, 30.88946°, -87.73838°, longleaf pine forest, flat area, edge of forest along road, loam with thin leaf litter, dappled shade, shrub 1.8 m tall, leaves whitish green and glaucous beneath, dull whitish bluish green and slightly glaucous above, without stipitate-glandular trichomes on abaxial leaf surface, common, 4 May 2022, *P.W. Fritsch 2442* (BRIT, DUKE). **Coffee Co.:** Kingston, roadside Hwy. 52, 0.8 mi S of Covington County line, shrubs ca. 7 ft tall along edge of woods, 6 May 1997, *J.R. MacDonald 10372* (DSC*, DUKE*, KNK*, MISSA*, VDB). **Conecuh Co.:** Hwy. 29, ca. 5 mi SE of Evergreen at Old Beulah Cemetery, T5N, R11E, S36, Red hills area of Alabama, 28 Jun 1985, *A.R. Diamond 1095* (GA); US Hwy. 31 at Travis Bridge, Sepulga River, Red Hills area, T6N R13E S30, 17 Aug 1985, *A.R. Diamond 1518* (VDB); ca. 3 m. NE of Hacula, ca. 5 mi W of Samson, sandy creek bluff, high bush, 29 Mar 1986, *R. Kral 73200* (VDB); W side of Repton by US 84, small seep in pineland, shrubs 1.5–2 m, 17 Mar 2003, *R. Kral 93664* (VDB). **Covington Co.:** un-numbered dirt road 0.5 mi NE of US Hwy. 331, Covington Wildlife Management Area, T1N, R17E, S7, low sandy longleaf pine woods, common shrub, 8 Jul 2001, *A.R. Diamond 12504* (VDB); Brooks School Road (dirt), 0.89 mi N of the Conecuh County line, 294 ft, 31.4480000°, -86.678833°, dry sandy soil of a young pine plantation, 12 Jul 2011, *A.R. Diamond 22345* (VDB); along trail ca. 15 m W from SW edge of Buck Pond, ca. 0.25 mi S of jct. Tower Road and Road 34B, vicinity of Open Pond Recreation Area, Conecuh NF, 69 m, 31.08871°, -86.54340°, longleaf pine forest, along trail near edge of lake, damp salt-and-pepper-colored sand in partial shade, shrub 1.9 m tall, with clumped stems and other scattered clumps nearby, together ca. 10 m diam., stems green beneath, red above, leaves whitish green and glaucous beneath, dull whitish bluish green and glaucous above, immature fruit whitish green and glaucous, ca. 8 × 7 mm, ovoid, common, 3 May 2022, *P.W. Fritsch 2438* (BRIT, DUKE); Conecuh NF campgrounds off Ala. 24, pine flatwoods near pond, 20 Mar 1973, *G. Gonsoulin s.n.* (VDB); 4.5 mi E Wing on county road 4, high bush, sandy creekbank, 18 Apr 1970, *R. Kral 38742* (GA, VDB) [leaf margins entire]. by Ala. 54, ca. 4 mi E Florala, high bush of longleaf pine sand ridge, 16 Apr 1970, *R. Kral 38626* (VDB); around Open Pond, Conecuh NF, sandy peat of low areas, shrubs to 2 m, corollas white, 8 Apr 1988, *R. Kral 74587* (VDB); 9.4 mi S Libertyville by AI 55, pine-cypress-tupelo flats, highbush shrub, 26 Jul 1990, *R. Kral 78074* (VDB); around Open Pond, Open Pond Recreation Area, Conecuh NF, SW of Andalusia, high bush of sandy pineland, 28 Mar 1996, *R. Kral 85716* (VDB); Conecuh NF, Hwy. 24, 3.3 mi E of jct. Hwy. 137, roadside, 20 May 1998, *J.R. MacDonald 11255* (VDB); Yellow River, 0.25 mi W of Hwy. 55, woods bordering N bank, occasional shrub to ca. 8 ft tall, 10 Aug 1999, *J.R. MacDonald 13342* (DUKE*, MISS*, MO, USMS*); along county road 10 between Hacula

and Florida, in roadside hedgerow, large shrub, foliage somewhat pruinose-glaucous, reddish tinted, fruit large, black, 21 Jun 1997, R.W. Simmers 1997-6 (VDB); Conecuh NF, ecotone of drain N of county road 4, section 28, E of Bradley, 16 Jun 1998, B.A. Sorrie 9775 (NCU). **Dale Co.:** un-numbered dirt road just S of Black's Creek, 13°34'34"N, 85°38'56"W, Ariton Quad, red clay soil of pine woods, common, 20 Mar 2005, A.R. Diamond 14999 (VDB). **Escambia Co.:** E.O. Wilson Nature Adventure Park, ca. 0.14 mi N of parking area, ca. 42 m NW of pond, Brewton, border of flat seepy area, near edge of forest along dirt road, 26 m, 31.10432°, -87.07870°, loam under humus with thick leaf litter, dappled shade, broadleaved forest, shrub 2.4 m tall, 2 clumps ca. 2 m apart, leaves whitish green and glaucous beneath, dull whitish bluish green and glaucous above, very few stipitate-glandular trichomes on abaxial leaf surface, common, 4 May 2022, P.W. Fritsch 2441 (BRIT, DUKE); Conecuh River just W of East Brewton, sandy bottoms, high bush, 29 Mar 1981, R. Kral 66781 (VDB). **Geneva Co.:** roadside Debee Road near jct. highway 54, 0.8 mi N of hwy. 10 in Hacoda, occasional shrub with nearby *V. arboreum*, 28 Apr 1999, J.R. MacDonald 12743 (DSC*, DUKE*, IBE, VDB). **Houston Co.:** Roadside Hwy. 71, 0.1 mi from Dale County line (Little Choctawhatchee River), lower slope of sandhill woods near low wet woods of river, 24 May 1991, J.R. MacDonald 2002 (VDB). **Pike Co.:** W edge parking area of Troy University Arboretum, ca. 250 m S of entrance at Pell Avenue, ca. 120 m E of Park Street, Troy, 156 m, 31.79392°, -85.96235°, mixed pine/broadleaved forest in adjacent seepy area, flat area, open understory, dry beige sand with thin pine leaf litter in dappled shade, shrub 3.0 m tall, 1-stemmed, leaves dull pale green and slightly glaucous beneath, lustrous green and rugose above, immature fruit held upright, whitish green, slightly glaucous, limb dull red, appears to be natural (not cultivated), occasional, 2 May 2022, P.W. Fritsch 2433 (BRIT, DUKE); ca. 31 m N of service road to house at Troy University Arboretum, ca. 160 m S of Pell Avenue, ca. 74 m E of entrance road for the arboretum, Troy, 150 m, 31.79471°, -85.96199°, mixed pine/broadleaved forest, gentle slope toward pond, damp reddish beige clay loam with leaf litter, light shade, shrub 3.7 m tall, ca. 15 clumped stems, candalabraform, others in area shorter than this, leaves pale green beneath, lustrous bluish green and glaucous above, immature fruit whitish green, ovoid, glaucous, occasional, 2 May 2022, P.W. Fritsch 2434 (BRIT, DUKE).

FLORIDA. Baker County: near bridge over St. Mary River near Taylor, 19 Feb 1929 and 11 May 1929, W.W. Ashe E6759 (GA). **Bay Co.:** Flora of St. Andrews Bay, Fla., Plot 203, on sand ridge among hard woods, 22 Mar 1926, L. Haven 3490 (NY); 1 mi N of Bennett, above Moccasin Creek, edge of hammock, 9 Apr 1966, S. McDaniel 7372 (IBE [2 sheets]); ditto, S. McDaniel 7374 (IBE [2 sheets]); ditto, S. McDaniel 7374 (IBE [2 sheets]); 14 mi W of Wewahitchka, near Sandy Creek, corolla white, 24 Mar 1975, S. McDaniel 19790 (BAYLU*, IBE [2 sheets]), MO, VDB). **Calhoun Co.:** 5 mi NE of Youngstown, edge of bottomland forest, sandy soil, 3 Apr 1969, J. Taylor & C. Taylor 5253B (BRIT); **Columbia Co.:** ca. 5 mi NW of Lake City above Falling Creek, just below falls, moist woods on slope, large shrub 3 m tall, fruits borne erect, R16E, T3S, S1, 29 Apr 1966, D.B. Ward 5631 (GA, IBE, NCU). **Duval Co.:** Jacksonville, Fort Caroline National Monument and Timucuan Ecological and Historic Preserve, Fort Caroline, intersection of Monument Road and Fort Caroline Road, 22 Apr 2005, D.E. Giannasi & W.B. Zomlefer 1234 (GA). **Escambia Co.:** Pensacola, 6 Apr 1931, W.W. Ashe s.n. (GA); shrub in old abandoned clay pit opposite 5301 Blue Angel Parkway, oak, privet, and myrtle woods, 2.5 ft tall, 12 Mar 1995, S. Askew 11 (IBE); 1.3 mi NW of Beulah, magnolia-pine creek bottom, 28 Mar 1964, S. McDaniel 4068 (IBE, VDB). **Franklin Co.:** ca. 0.5 mi N of Bristol by FL Rte. 12, 21 Mar 1980, R.K. Godfrey 77516 (IBE); 5 mi E of East Point on Hwy. 98, border of slash pine forest and sandy pine ridge, 5 May 1971, R.L. Lazor 5204 (GA). **Holmes Co.:** US 90, 3.5 mi W of junction of route 181, 50 ft pine wooded area around periphery of 3 acre pond on S side of road, plants 1.5–2.1 m tall, leaves serrate, ovate, slightly glaucous beneath, fruit black, 11–12 mm, 26 Jun 1967, G.J. Galletta PI 346511 (7-31-1) (GA, IBE, NCU, VDB); US 90, 3.5 mi W of junction of route 181, 50 ft pine wooded area around periphery of 3 acre pond on S side of road, plants to 1.5 m tall, 26 Jun 1967, G.J. Galletta PI 346513 (7-31-2) (IBE, NCSC, NCU). **Jefferson Co.:** just NW of Ward Creek bridge, T2N, R4E, SE1/4 S15, along roadcut bank in heavily wooded area, frequent, 19 Mar 1982, L.C. Anderson 5739 (NCU); 4 mi N of Lamont, 23 Mar 1958, R. Kral 6335 (GA). **Leon Co.:** in a grove of sand live oak, *Quercus geminata*, on sandy ridge just above high water mark of pond, Lost Lake Recreation Area, Apalachicola National Forest, 1 mi W of Springhill Road, 14 Jun 1990, R.K. Godfrey 83888 (GA); 4.6 mi WSW of center of Tallahassee near Chain Lakes, sandy live oak woods 3 m shrub, fruit immature, slightly glaucous, 30 May 1967, S. McDaniel 9089 (IBE, MISS*, VDB); 3 mi N of Woodville, open ground near mixed woods, corolla white, 28 Mar 1966, R.A. Norris 680 (IBE, RSA*). **Liberty Co.:** beside Kent Road E of route 65 and NE of Hosford, in moist loamy sand of pine-oak woodland above streamlet, frequent large shrub, leaves sparsely glandular hairy abaxially, 30.41601°N, 84.77009°W, 7 Apr 2016, L.C. Anderson 29520 (MO, NY); Apalachicola NF, Hwy. 12, across from Forest Road 113 turnout, 6 ft tall, 30.163848°, -84.971966°, 1 Apr 2019, A.A. Crowl CY-203 (BRIT); Apalachicola NF, along Hwy. 65, 2–6 ft tall, 30.241688°, -84.868757°, 1 Apr 2019, A.A. Crowl CY-204 (BRIT); Telogia, along Hwy. 65, 100 m N of Telogia Baptist Church, 7 ft tall, 30.354447°, -84.818547°, 1 Apr 2019, A.A. Crowl CY-206 (BRIT). **Okaloosa Co.:** near Valparaiso, "V. n. sp.", 1927, W.W. Ashe s.n. (NCU); Lightwood Knob Creek, 8 Jun 1929, W.W. Ashe s.n. (GA, NCU); Tom's Creek, 8 Jun 1929, W.W. Ashe E6766 (GA); Niceville, 7 Apr 1931, W.W. Ashe s.n. (NCU [6 sheets]); near Niceville, 8 Jun 1929, W.W. Ashe E6755 (GA); near Niceville, 8 Jun 1929, W.W. Ashe E6756 (GA); Niceville, Juniper Bayou, 11 Jun 1929, W.W. Ashe E6758 (GA); Camp Walton, Five Mile Bayou, 25 Mar 1927 and 8 Jun 1929, W.W. Ashe E6761 (GA); Eglin Air Force Base, Road 787 and Boiling Creek, just S of Yellow River, Hardwood forest, 30.5783°, -86.9000°, 17 m, 8 Aug 2001, A.F. Bradley & J. Stone 912 (MO); Eglin Air Force Base, Kepner Pond, off Hwy. 85 N of 85-123 junction, pine and oak forest, 30.59083°, -86.53750°, 67 m, 7 Aug 2002, A.F. Bradley & J. Stone 1181 (MO); 1.9 mi W on dirt road off Fla. route 4, E side of small creek spanned by wooden bridge, plant ca. 2.7 m tall, 4 main stems, suckering somewhat, leaves broadly elliptic to ovate, serrate, glandular, glabrous above, yellow-green slightly glaucous on underside, 50–72 mm long, 25–49 mm wide, fruit dark blue with bloom, 11 mm diam., pleasant sweet flavor, not gritty, 26 Jun 1967, G.J. Galletta PI 346502 (7-28-1) (IBE, NCSC, NCU); 1.9 mi W on dirt road off Fla. route 4, E side of small creek spanned by wooden bridge, two plants, to 2.4 m tall, leaves lanceolate to oblanceolate, 26 Jun 1967, G.J. Galletta PI 346504 (7-28-2) (IBE [2 sheets], NCSC, NCU); 2.0 mi W on dirt road off Fla. route 4, oak woods on sandy ridge, plant 1.8 m tall, leaves elliptic, glabrous, and glandular, fruit dark, 9 mm diam., G.J. Galletta PI 346506 (7-29-3), 26 Jun 1976 (IBE, NCSC, NCU); 2.0 mi W on dirt road off Fla. route 4, oak woods on sandy ridge, clonal bush to 2.4 m,

stems pubescent, leaves slightly glaucous, pubescent and glandular, fruit dark blue with bloom, 26 Jun 1967, G.J. Galletta PI 346508 (7-29-4) (IBE, NCSC, NCU); 3.2 mi W on dirt road off Fla. route 4, plants 1.8–4.6 m tall, 26 Jun 1967, G.J. Galletta PI 346510 (7-30) (IBE, NCSC, NCU); Yellow River hills, W of Laurel Hill, open oak-pine woods, 2 Aug 1961, R.K. Godfrey 61280 (BRIT); open upland pine-deciduous woodland, 2 mi W of Laurel Hill, 26 Jun 1964, R.K. Godfrey 64380 (IBE); 2 mi N of Niceville along route 85, titi bottom, buds pink, 2 Apr 1966, R. Kral 26142 (BRIT, GA, IBE, VDB); 2 mi E of Holt, abundant along roadside, 2.5 m tall, 27 Mar 1964, S. McDaniel 4030 (BAYLU*, IBE [2 sheets], VDB [2 sheets]); 2 mi E of Crestview near Adams Creek, at base of hillside, 1.5 m tall, fruit black, 31 Jul 1964, S. McDaniel 4957 (IBE); Eglin Air Force Base, along the Shoal River at Gin Hole Landing, ca. 6.5 mi W of Florida State Rte. 85 off of Air Force Base Road 211, 40 m, 30°40'59"N, 86°38'58"W, shrub 2 m tall, fruits green, 2 Jun 1998, J.S. Miller & J. Stone 9458 (BRIT, MO); Eglin Air Force Base, 7.5 mi W of Florida State route 85 on Air Force Base route 211, 40 m, 30°39'51"N, 86°41'07"W, shrub 2 m tall, fruits green, 5 Jun 1998, J.S. Miller *et al.* 9543 (MO, BRIT); Crestview, Mar 1919, M.A. Sapp E7036 (GA); sandy hills near Crestview, 7 Apr 1925, J.K. Small & E.T. Wherry s.n. (NY [2 sheets]); ditto, 11716 (NY [2 sheets]). **Santa Rosa Co.:** near Milton, 1 Jul 1931, W.W. Ashe s.n. (NCU); river swamp, 1 mi W of Milton, 5 Aug 1954, E.S. Ford & L.E. Arnold 4154 (GA); just W of Wallace in Escambia River bottoms, high bush, 11 Apr 1964, R. Kral 19688 (SMU, VDB); 1 mi E of Harold, longleaf pine slope above *Chamaecyparis* thicket, ca. 4 m tall, 24 May 1964, S. McDaniel 4596 (IBE); ditto, much branched shrub ca. 3 m tall, 24 May 1964, S. McDaniel 4600 (IBE); 1.3 mi N of East Bay River on Fla. 87, 22 May 1976, J.C. Solomon 2310 (MO); Blackwater River SF, Forest Roads 1, 21, and 28, plants in mesic to moist pine slopes with *Ilex coriacea*, *Osmanthus americanus*, *Cyrilla racemiflora*, *Vaccinium arboreum*, multi-stem shrubs to 7 ft tall, frequent, 12 and 13 Jun 1998, B.A. Sorrie 9765 (NCU). **Taylor Co.:** Salem, slash pine-palmetto scrub, high bush, 17 Mar 1976, R. Kral 57335 (VDB). **Wakulla Co.:** end of Purify Bay Road, edge of St. Mark's National Wildlife Refuge, 8 ft tall, 30.090715°, -84.371436°, 2 Apr 2019, A.A. Crowl CY-210 (BRIT); by forest road leading to East River from near the entrance to St. Marks Wildlife Refuge, Lighthouse Road, pine flatwoods, plant forming a dense thicket ca. 5 m across, stems to 2 m tall, leaves slightly glaucous beneath, 24 May 1978, R.K. Godfrey 76513 (VDB). **Walton Co.:** Rocky Run, 23 Mar 1927 and 7 Jun 1929, W.W. Ashe E6763 (GA); Alaquia Creek, 26 Mar 1927 and 7 Jun 1929, W.W. Ashe E6764 (GA); along Rte. 183 near Knox Hill Baptist Church, on edge of woods, shrub to ca. 1.5 m tall, 19 Apr 1982, D.S. Correll & H.B. Correll 53755 (NY); Natural Bridge Road (dirt), 0.09 mi N of Walton County Hwy. 181, 192 ft, 30.990500°, -86.207927°, sandy wet drain, 3 Apr 2014, A.R. Diamond 24926 (VDB); Villa Tasso, 1 mi W of Choctaw Beach in very sandy pine-white oak-myrtle oak woods, 3 May 1967, S. McDaniel 8858 (MISS*). **Washington Co.:** 1 mi W of Hinsons Crossroads, dry open woodland, shrub ca. 2 m high, 3 Apr 1958, R.K. Godfrey 56372 (GA, SMU); 1 mi W of Millers Ferry, dry open woodland, shrub ca. 1 m high, 3 Apr 1958, R.K. Godfrey 56373 (SMU); W side of Orange Hill, 7 mi SE of Chipley, T3N R13W S2, 16 Oct 1972, D.B. Ward 8480 (IBE). **GEORGIA. Camden Co.:** Little Satilla River directly E of Waverly, 0.8 mi SW of Camden-Glynn county line, 26 Jun 1952, W.H. Duncan 13792 (GA). **Charlton Co.:** Okefenokee National Wildlife Refuge, Stephen C Foster State Park, along boardwalk, 30.82798°, -82.36294°, 5 ft tall, 27 Mar 2021, A.A. Crowl CY-376 (BRIT); Okefenokee Swamp at end of route 177, plant 1.8 m tall, 24 May 1967, G.J. Galletta PI 346498 (7-20-1) (VSC*, NCSC, NCU); Okefenokee Swamp at end of route 177, plant 1.8 m tall, 24 May 1967, G.J. Galletta PI 346499 (7-20-6) (GAS [2 sheets]*, NCU); Okefenokee Swamp, Chesser's Is., hammock, 6–7 ft high, bark smooth, light gray, 25 May 1930, J.S. Harper 135a (NY); near Toledo, 28 Jun 1930, H.M. McKay s.n. (GA, IBE). **Echols Co.:** 1 mi S of Lanier County line on US 29, flat open woodland, G.J. Galletta PI 346491 (7-17-6) (MO, NCSC, NCU, VSC*); 1 mi S of Lanier County line on US 29, flat open woodland, plant 2.1 m tall, leaves pubescent, serrate, obovate, to 41 mm long by 24 mm wide, G.J. Galletta PI 346493 (7-17-14) (NCSC, NCU, VSC*); 1 mi S of Lanier County line on US 29, flat open woodland, plant to 2.4 m tall, leaves pubescent, serrate, obovate, 46 mm long and 22 mm wide, G.J. Galletta PI 346497 (7-17-13) (VSC*). **Grady Co.:** high bush, sandy silt of bottoms, Tired Creek, by GA 93, S of bridge, S of Cairo, 15 Mar 2001, R. Kral 90647 (VDB); just E of GA 111, N side of Grady County Sheriff's Dept. bldgs., sandy loam of pine pocosin remnant, shrubs 1.5–2 m, 1 May 2001, R. Kral 90941B (VDB) [leaf margins entire and some leaves with secondary veins pubescent abaxially].

LOUISIANA. Washington Parish: 2 mi N of Sun, at edge of woods, shrub 7 ft tall, 12 Jun 1966, J.W. Thieret 23484 (BRIT). **MISSISSIPPI. Forrest Co.:** ca. 1 mi W of Hwy. 49 N of Hattiesburg (ca. 2 mi NW of 49-59 intersection), dry mixed woods, plants ca. 6–7 ft tall, 8 Oct 1972, K.E. Rogers 8819 (IBE, SMU). **Hancock Co.:** Bottoms, Caesar, 8 ft tall, 18 Jun 1953, D. Demaree 33471 (GH, USF*); 2 mi N of Kiln, cut-over longleaf pine woods, leaves and hypanthium glaucous, 8 Apr 1962, S. McDaniel 2914 (IBE). **Harrison Co.:** Lyman, up to 3 m tall, corollas pink, 19 Mar 1955, G.R. Cooley & A.S. Pease 3198 (MISSA*). **Jackson Co.:** S side of N part of Green Loop of Fontainebleau Trail, ca. 50 m W of N end of Red Loop Trail, ca. 0.28 mi NE of trail head, ca. 0.22 mi E of Hanshaw Road, Mississippi Sandhill Crane National Wildlife Refuge, 6 m, 30.40042°, -88.75364°, longleaf pine forest, along trail in flat longleaf pine savannah, woody undergrowth regenerating in most places, grayish white sand in dappled shade, shrub 1.2 m tall, clumped clone ca. 4 m diam. (extent), 2nd-year branchlets olive yellowish green, leaves whitish green beneath, green and slightly glaucous above, 2 clumps of plants seen, 24 Apr 2022, P.W. Fritsch 2394 (BRIT, DUKE); N side of N part of Green Loop of Fontainebleau Trail, ca. 115 m W of N end of Red Loop Trail, ca. 0.27 mi NE of trail head, ca. 0.19 mi E of Hanshaw Road, Mississippi Sandhill Crane National Wildlife Refuge, 6 m, 30.40061°, -88.75436°, longleaf pine forest, along trail in flat longleaf pine savannah, woody undergrowth regenerating in most places, grayish white sand in dappled shade, shrub 1.9 m tall, several stems clumped and then 4 more scattered within ca. 2 m diam. area, immature fruit not notably upright, whitish green, glaucous, with red limb, 2 clumps of plants seen, 24 Apr 2022, P.W. Fritsch 2395 (BRIT, DUKE). **Pearl River Co.:** Picayune, Hobolochitto Creek near US route 11, low magnolia-spruce pine woods, plant 1.5 m tall, 28 Mar 1982, S. McDaniel 25871 (IBE [4 sheets], MISS*, VDB). **Stone Co.:** ca. 4 mi SE of Wiggins, S34/27, roadside secondary area, ca. 1 m, sterile, apparently spread from cultivation, 30 Jul 1981, S. McDaniel 25255 (IBE; to us, the evidence that this is a cultivated escape is unclear; it has the pubescent midvein abaxially of *V. ashei* and falls within its apparent natural range); ca. 2 mi N of jct. state routes 15 and 26, well-drained mixed woods, 30 Jul 1981, S. McDaniel 25256 (IBE).

Specimens cited by Reade (1931) as *Vaccinium ashei* in the protologue but not found online or at herbaria searched.—**U.S.A. FLORIDA. Escambia Co.:** near Pensacola, 27 Mar 1927, W.W. Ashe s.n. **Okaloosa Co.:** Niceville, Juniper Bayou, 10 Jun 1929, W.W. Ashe s.n. **Santa Rosa Co.:** Hollyhead, 8 Jun 1929, W.W. Ashe s.n. **MISSISSIPPI. Pearl River Co.:** McNeill, 8 May 1930, W.W. Ashe s.n.; near Poplarville, 8 May 1930, W.W. Ashe s.n.

Specimens of *V. ashei* of uncertain provenance.—**U.S.A. FLORIDA?** Duval Co.?: near Jacksonville, dry oak woods, 20 Feb 1894, A.H. Curtiss 4522C (NY); near Jacksonville, low thickets, 3–8 ft high, 21 Feb and 10 May 1894 (“from different localities”), A.H. Curtiss 4522 (MO, NY). These collections may have been made in any one of various counties near Jacksonville, or even in Charlton Co., Georgia, and thus are not mapped here.

Specimens examined of presumed adventive plants of *Vaccinium ashei* and rabbiteye blueberries escaped from cultivation.—**U.S.A. ALABAMA. Geneva Co.:** high bush of edge of cypress-gum pind by Co. 4, 6.9 mi W jct. AL 167, 17 Jul 1992, R. Kral 81170 (VDB). **Lee Co.:** estate of Dr. H.P. Orr-Opelika, 15 Jul 1970, T.A. Burrough 058 (VDB); in the Forestry Plot off of Donahue Ave. near the lake in Auburn, 1 Apr 1973, B. Campbell 030 (VDB); along trail starting ca. 100 m E of boardwalk trail at Hog Pond, ca, 64 m S of Woodfield Drive, Auburn University, 194 m, 32.58796°, –85.49309°, mixed pine/broadleaved forest, along trail at edge of seepy area on very gentle slope, light shade, dry loam with thin leaf litter, occasional, shrub 3.0 m tall, multi-stemmed in 2 clumps, with other stems near these, one branchlet a 2.1-m-long erect “sucker” off the main stem, 2nd-year branchlets olive green, current-year branchlets green, leaves whitish green and slightly glaucous beneath, green and slightly glaucous above, immature fruit held upright, light green and slightly glaucous with red limb, 2 May 2022, P.W. Fritsch 2429 (BRIT, DUKE); Auburn University Forestry Plot covering an area from the hog pond circling around to Donahue Drive, small tree growing in groups, scattered throughout woods, 29 Jun 1971, C.J. Hayden III 067 (VDB). **GEORGIA. Butts Co.:** SE of Jackson, off GA Hwy. 42, Indian Springs State Park, along Hopetownyehoholo Creek below miniature golf course, shrub 1.5 m tall, 12 Apr 1987, C.L. Howel 0076 (GA, NLU, VDB). **Charlton Co.:** Scrub, sandy soil, Floyd’s Island, 29 Sep 1959, E. Cyper 236 (GA). **Clarke Co.:** P.O. Athens, low ridge, 5 ft tall, 750 ft, 6 Sep 1964, D. Demaree 51237 (VDB). **Echols Co.:** 1 mi S of Lanier-Echols County line beside trash barrel on US 129, and also at Norsworthy farm ca. 1 mi further S on same road, flat open woodland, obovate leaves, 24 May 1967, G.J. Galletta PI 346490 (7-17-2) (GA); ditto, G.J. Galletta PI 346492 (7-17-9) (MO, NCU, PAC*, VSC*); ditto, plant 1.8–2.1 m tall, leaves glaucous, serrate, oblanceolate, to 50 mm long by 18 mm wide, fruit very light blue, G.J. Galletta PI 346494 (7-17-15) (NCU, VSC*); ditto, G.J. Galletta PI 346496 (7-17-19) (NCU, VSC*). **Elbert Co.:** NE of Elberton, dirt road 115 off Hwy. 17, edge of deciduous woods, 9 Apr 1977, N. Craft Coile 446 (GA). **Harris Co.:** Beaver Pond, 16 Jul 1998, Crook 489 (GA); dam near entrance to Laurel Springs Dr., Callaway Gardens at Pine Mountain, 13 Jul 1972, S.B. Jones 22155 (GA); flora of Calloway Gardens, ca, 100 yds. S of the entrance to Dog 7 on Dog 7, common, successional forest, 6 Apr 1999, Sweeney 280 (GA [2 sheets], NLU); flora of Calloway Gardens, Callaway Airport, S side of runway, common margin of disturbed field, 6 Apr 1999, Sweeney 311 (GA); ditto, Sweeney 312 (GA, NLU); ditto, Sweeney 313 (GA, NLU). **Liberty Co.:** low sandy ridge, 11 mi E of Taylor, 27 Apr 1940, W.H. Duncan 2238 (GA). **Tattnall Co.:** just SW of Reidsville city limits, 26 May 2010, L.A. Jackson 29 (GA). **MARYLAND. Prince Georges Co.:** Drainage of Patuxent River, just below the NE end of SW-to-NE runway of the abandoned Beltsville Airport, 4 km NW of Bowie, 28 Sep 1999, M.T. Strong 2231 (GMUF GMUF-0023458). Other specimens cited in Wright et al. 2023 from this county have not been seen by us but we presume that they are also adventive or escapes from cultivation. **MISSISSIPPI. Jasper Co.:** T4N R10E S3 and 4 behind wildlife management area headquarters bldg., mature pine forest fairly open canopy mixed oak and hickory understory, periodic prescribed fire use, common open and disturbed areas, 16 Jun 1988, D.T. Carraway 80 (IBE); ditto, D.T. Carraway 81 (VDB); perhaps a mislabeling of D.T. Carraway 80 because the label data has an identification of *Cyperus pseudovegetus* Steud. **NORTH CAROLINA. Durham Co.:** Duke Forest off of Gate 10 entrance, 36.022586°, –78.982696°, 31 Mar 2016, P.S. Manos CY-010 (BRIT). **Harnett Co.:** pocosin, Spout Springs, 22 Apr 1970, R. Wyatt 103 (GA). **Orange Co.:** Oconeechee Mountain State Natural Area, intersection of Brown Elfin Knob Trail and Mountain Loop Trail, 36.063783°, –79.113196°, 7 Sep 2019, P.S. Manos CY-321 (BRIT). **Moore Co.:** beside trail on W side Heron’s Lake, Whispering Pines, edge of woods with *Quercus alba*, *Q. nigra*, *Acer rubrum*, *Pinus taeda*, *Ilex opaca*, leaves blue-green above, glaucous beneath, 35.270000°, –79.372222°, 17 May 2023, B.A. Sorrie 14145 (NCU). **SOUTH CAROLINA. Barnwell Co.:** Savannah River Site: along Patterson Mill Road, 10 Jun 1989, N. Coile 5348 (GA). **McCormick Co.:** Upland pine woods ca. 1 mi E of Modoc, 17 Apr 1970, W.H. Duncan 23376 (GA). **TEXAS. Smith Co.:** ca. 100 m SW of Blackhawk Creek and ca. 400 m (direct) from end of County Road 2235 E of TX-110, property of Ron & Ruth Loper, 115 m, 32.18574°, –95.18666°, mixed pine/broadleaf forest, in humus and clay over sand in sun, shrub two-stemmed at base, 2.4 m tall, current-year branchlets, leaves, and fruit pale glaucous, apparent escape from cultivation with possible parent Fritsch 2260, only one plant, 21 Apr 2021, P.W. Fritsch 2259 (BRIT, DUKE).

FAGACEAE

Quercus similis documented new to Florida (Leon County)

Primary authors: Ethan L. Hughes and Jenna Annis

A recent record discovered by the Florida Natural Areas Inventory (FNAI) is discussed, helping to provide a more complete understanding of the flora of Florida. The taxon discovered is reported as new to the flora of Florida. Voucher specimens were collected for the taxon and are currently at FNAI’s small herbarium, but they will be deposited at FSU. Specific locality information is not included; however, the taxon is currently on a state-managed conservation land. The habitat for the taxon is discussed, as well as the current distribution and rarity of the species.

Quercus similis Ashe. This represents the first documented population of *Q. similis* in Florida. The medium to large-sized trees occur sporadically in one population in Leon County and are within a relatively intact and expansive bottomland forest flat community. The species occurs in the very rare South Atlantic Mixed Oak-Pine Calcareous Flatwoods Forest of coastal Georgia (NatureServe Explorer 2024). Stands of this community in Georgia occur on the calcareous Meggett soil series. The habitat in Florida seems to lack the definite calcareous influence, though a portion of the known stand does occur on Meggett soil series. The habitat for the species extends from the base of *Pinus palustris* woodland (formerly) to the southern edge of the Ochlockonee River floodplain swamp. *Quercus laurifolia* Michx. dominates the canopy with lesser amounts of *Q. phellos* L., *Q. nigra* L., *Q. michauxii* Nutt., *Pinus taeda* L., *P. glabra* Walter, and *Liquidambar styraciflua* L. The understory is mainly composed of *Carpinus caroliniana* Walter var. *caroliniana*, *Ilex opaca* Aiton, *Crataegus marshallii* Eggl., *Sabal minor* (Jacq.) Pers., *Arundinaria tecta* (Walter) Muhl., *Elytraria caroliniensis* (J.F. Gmel.) Pers. var. *caroliniensis*, *Zephyranthes atamasco* (L.) Herb. and *Chasmanthium laxum* (L.) Yates. The largest individual observed (26.5" DBH), on a return trip in the winter of 2023-2024 to collect acorns, was growing on a bottomland forest ridge surrounded by floodplain swamp. Identifying other similar "oak flats" along the Ochlockonee River corridor and north Florida may yield more populations of this unique bottomland oak species.

Voucher specimen: **U.S.A. FLORIDA. Leon Co.: State Record.** Numerous small trees scattered through bottomland forest with evidence of previous logging; common associate species include *Quercus laurifolia*, *Q. michauxii*, *Q. nigra*, *Pinus taeda*, *Nyssa sylvatica*, *Carpinus caroliniana* var. *caroliniana*, *Crataegus marshallii*, *Sabal minor*, *Arundinaria tecta*, *Chasmanthium laxum*, *Dichanthelium commutatum* var. *commutatum*, and *Zephyranthes atamasco*. Lake Talquin State Forest [detailed locality information is withheld as species is tracked as S1 in Florida], 22 Jun 2023, Ethan Hughes 1 w/Jenna Annis (FSU).

JUNCACEAE

The addition of ***Juncus brachycephalus*** to the flora of Arkansas and Missouri

Primary authors: Aaron Floden and Wesley Knapp

Juncus L. (Juncaceae) is a widely distributed genus that includes approximately 315 species (Kirschner 2002). *Juncus* subg. *Septati* Buchenau in the Southeastern US includes several morphologically similar species that overlap in geographic distribution (Brooks & Clements 2000). *Juncus subcaudatus* (Engelm.) Coville & S.F. Blake is widely distributed in the northeastern US, down the Appalachian Mountains, and then scattered westward with an increase in population density reported in the Ozarks of Missouri and northern Arkansas (Kartesz/BONAP 2024). Engelm. (1866) did not attribute *J. subcaudatus* to Missouri. Steyermark (1963) published a Flora of Missouri that included a scattered distribution for *J. subcaudatus* in the state. Since then, the species has been included as a component of the Missouri flora without question regarding its identification or status. Tim Vogt (pers. comm. with AF) has questioned the attribution and identification of this species in the state and similar habitats in adjacent states. In comparisons to herbarium specimens from the type region of *J. subcaudatus* and northward, plants in the Ozarks have fewer than 10 flowers per head (typically 2–6), the branches are typically held at angles less than 45 degrees from the main culm, and occur in calcareous fens and seepages.

We have reinvestigated specimens from the Ozarks and have determined that many of these populations represent a disjunct center of distribution for *Juncus brachycephalus* (Engelm.) Buchenau rather than the more northern *J. subcaudatus*. Kartesz/BONAP (2024) also shows distribution of *J. brachycephalus* in adjacent Oklahoma, but specimens on SERNEC (2024) of *J. brachycephalus* from Oklahoma appear to be a mix of other species, none of which is *J. brachycephalus*. Tim Vogt and AF have examined plants in the field and have noted two distinct morphological forms in the Ozarks: one that is a large plant with reddish culm bases and diffusely branched inflorescences, and a second that is more typical for *J. brachycephalus* with strict inflorescence branches and greenish to pale culm bases. The former is also a larger plant that tends to sprawl and lower nodes of the culm root and behave like rhizomes. We here add *J. brachycephalus* to the flora of Arkansas and Missouri.

Specimens examined (explicit location information is not reported due to other rare species in the fen habitats): **U.S.A. ARKANSAS. Madison Co.:** 2 Sep 2009, T. Witsell 09-0397 (ANHC008044); **Marion Co.:** 14 Sep 2010, T. Witsell 10-0339 (ANHC008241); **Sharp Co.:** 15 Oct 2003, T. Witsell 03-1028 (ANHC006283); 14 Sep 2001, C. Reid 3190 (UARK050021); 14 Sep 2001, C. Reid 3190 (UARK050021); 15 Sep 2001, C. Reid 3272 (UARK051218). **MISSOURI. Bollinger Co.:** 26 May 1977, William L. Pflieger 593 (UMO); **Iron Co.:** 27 October 2021, A.E. Brant 9822 (MO); **Jefferson Co.:** 2 Sep 1990, George Yatskievych & Kay Yatskievych 90-373 (MO); Reynolds, 31 Jul 2023, A.E. Brant & Steve Schell 10423 (MO); 15 Sep. 2023, A.E. Brant 10578 (MO); **Shannon Co.:** 16 Aug 1979, Leroy J. Korschgen 593 (UMO); **Wayne Co.:** 4 Aug 2017, A.E. Brant 8501 (MO, MNH, NY, US); 31 Aug 2017, A.E. Brant 8584 (MNH, MO, NY); 6 Sep. 2017, A.E. Brant 8630 (MICH, MNH, MO, NCU, NY); 5 Oct 2017, A.E. Brant 8688 (MO); 25 Oct 2017, A.E. Brant 8711 & A.F. O'Donnell (MO); 31 Jul 2018, A.E. Brant 8896 (MO); 31 Jul 2018, A.E. Brant 8905 (MO); 14 Sep 2018, A.E. Brant 8930 (MO); 14 Sep 2018, A.E. Brant 8937 (MO).

MELASTOMATACEAE

Rhexia mariana L. var. *mariana* (Maryland Meadowbeauty) in Ohio

Primary author: Iris Copen

Rhexia mariana L. var. *mariana* (Maryland Meadowbeauty), in the family Melastomataceae, is a native herbaceous forb of Eastern North America reaching upwards of 8 dm in height. The species spreads by rhizome-like roots that create dense clonal colonies. During anthesis, the flowers have a bright corolla consisting of four pink petals surrounding a cluster of sharp-angled yellow falcate anthers and a single exerted pistil from an urn-shaped hypanthium. The stems are covered in bristle-like hairs and are rectangular in cross-section. The cross-sections have two long sides and two shorter sides that alternate at each pair of leaves (Nesom 2021) (Fig. 14). This species usually prefers open wetlands in sandy situations in areas that are often dominated by grasses and sedges (Weakley & Southeastern Flora Team 2023). *Rhexia mariana* var. *mariana* is widespread in Eastern North America, occurring from coastal Massachusetts to southern Florida, west to Texas, and north up the Mississippi, then deviating toward the Ohio River Valley, becoming scarcer farther from the Atlantic Coast, with a northern disjunct along Lake Michigan's eastern drainage basin. The species is rare in the states of Indiana (S1), Michigan (S1), Pennsylvania (S1), and West Virginia (S1), but comparatively more common in Kentucky (S5) (Kartesz/BONAP, 2024) (Fig. 15).

Maryland Meadowbeauty was first discovered in Ohio in Lawrence County on August 23, 2023. This county is at the southernmost point within the state and is separated from Kentucky by the Ohio River. The location of the *Rhexia* population is 6.7 miles from the Kentucky border and approximately 40 miles north of the nearest known population. It is located along a UTV trail in the Wayne National Forest under a small Virginia Pine (*Pinus virginiana* Mill.), in a small sandy clearing adjacent to an abandoned coal mining depression pond. A sampling of associated species occurring in the immediate vicinity of the *Rhexia* includes *Sphagnum fallax* (H. Klinggr.) H. Klinggr., *Diphasiastrum digitatum* (Dill. ex A. Braun) Holub, *Lorinseria areolata* (L.) C. Presl, *Pinus virginiana* Mill., *Alisma subcordatum* Raf., *Sagittaria australis* (J.G. Sm.) Small, *Sagittaria latifolia* Willd var. *latifolia*, *Sagittaria calycina* Engelm., *Sparganium americanum* Nutt., *Scirpus cyperinus* (L.) Kunth, *Eleocharis acicularis* (L.) Roem. & Schult., *Eleocharis obtusa* (Willd.) Schult., *Rhynchospora capitellata* (Michx.) Vahl, *Schoenoplectiella purshiana* (Fernald) Lye var. *purshiana*, *Juncus acuminatus* Michx., *Coleataenia anceps* (Michx.) Soreng ssp. *anceps*, *Kelloggloa verrucosa* (Muhl.) Lizarazu et al., *Leersia oryzoides* (L.) Sw., *Rhexia virginica* L., *Betula nigra* L., *Acer saccharum* Marshall var. *saccharum*, *Oxydendrum arboreum* (L.) DC., *Bidens connata* Muhl. ex Willd., *Eupatorium pilosum* Walter, *Eupatorium serotinum* Michx., *Euthamia lanceolata* (L.) Nesom, *Pseudognaphalium obtusifolium* (L.) Hillard & B.L. Burtt, *Solidago juncea* Aiton, *Symphytotrichum lanceolatum* (Willd.) G.L. Nesom var. *lanceolatum*.

Globally, *Rhexia mariana* var. *mariana* is considered a G5T5 species (NatureServe Explorer 2024) and is common throughout its coastal range, generally becoming more sparsely distributed inland. In Ohio, the species is known from a single, small population of what may be a single clonal individual covering approximately a square meter area (Fig. 16). It is sheltered by a leaning pine that protects this relictual occurrence from imminent extirpation due to All-Terrain Vehicle disturbance, which has likely claimed the rest of the population along with historic mining efforts. Despite the nearby *Rhexia virginica* L., no recognizable hybrids were seen in the area. The spiraled seeds of *Rhexia* spp. are dispersed through multiple means like wind and



FIG. 14. Image of an Ohio individual of *Rhexia mariana* var. *mariana*, in situ.

water, which can carry them a short distance (Kral & Bostick 1969). Longer distance dispersal is more likely from animals like waterfowl and deer. The possibility that the species is introduced in Ohio by either hiking, mining, or vehicle activity is distinct (Dodds 2022). Still, considering its distribution in every state around Ohio, it would appear more likely to be in the area than not. In addition, Lawrence County has several native southern species only occurring in that area for the state, i.e., *Ligusticum canadense* (L.) Britton, *Myriopteris lanosa* (Michx.) Grusz & Windham, *Penstemon canescens* Britton, *Piptochaetium avenaceum* (L.) Parodi, *Solidago sphacelata* Raf., and *Viola tripartita* Elliott (BONAP, 2024).

Voucher specimen: **U.S.A. OHIO. Lawrence Co.:** Two plants collected, Elizabeth Twp., Wayne National Forest, 23 Aug 2023, Iris Copen s.n. & Shaun Pogacnik (OS 0392714).

PLANTAGINACEAE

Mecardonia procumbens (Miller) Small documented for Georgia

Primary authors: J. Richard Carter and Randy L. Mears

This widely ranging tropical American species is known from the southwestern United States and eastward in Arkansas, Louisiana, Mississippi, Alabama, Florida, and South Carolina (Godfrey & Wooten 1981; Ahedor 2019; Weakley & Southeastern Flora Team 2023). It inhabits moist soils and wetland sites such as ditches,

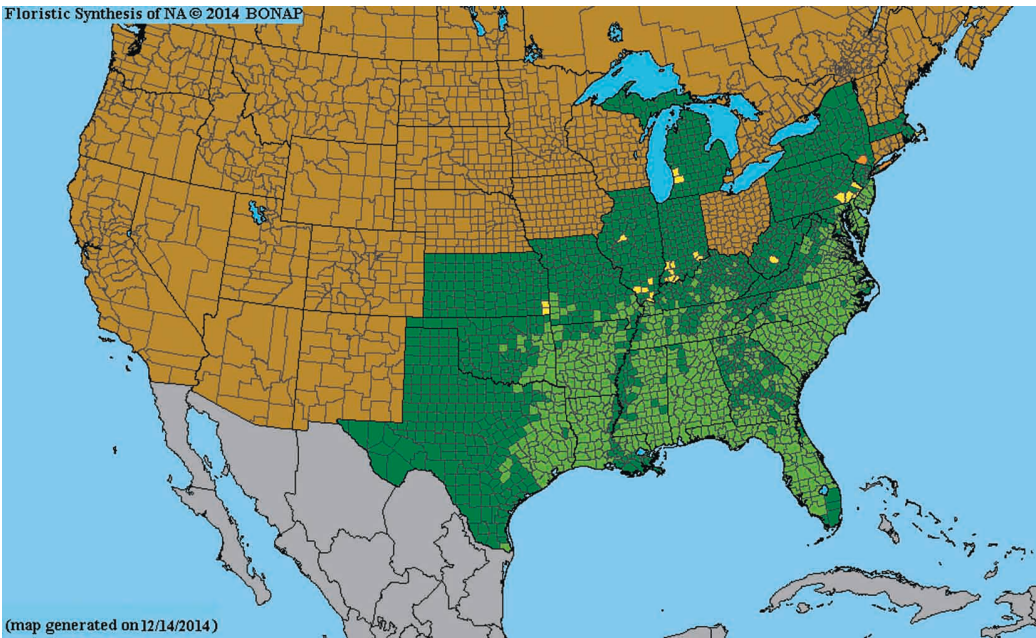


FIG. 15. BONAP map of the county distribution of *Rhexia mariana* L. in the United States.



FIG. 16. Image of Ohio's entire extant population of *Rhexia mariana* L. within a circle of ATV tracks.

ponds, streams, and moist shores (Small 1933; Godfrey & Wooten 1981; Weakley & Southeastern Flora Team 2023). Although cited for Georgia by Ahedor (2019), Weakley and Southeastern Flora Team (2023) do not include Georgia in the distribution of this species, nor could we find any vouchers of it for the state through SERNEC Data Portal (2024). Thus, we report the following record of *Mecardonia procumbens* from Georgia, substantiated by a voucher.

This low-growing prostrate-ascending herb with small yellow flowers was locally common and weedy in moist soil along a shallow ditch, where it was associated with *Typha latifolia* L., *Eleocharis quadrangulata* (Michx.) Roem. & Schult., *E. montevidensis* Kunth, *Phyla nodiflora* (L.) Greene, *Ptilimnium capillaceum* (Michx.) Raf., *Rhynchospora colorata* (L.) H. Pfeiff., *R. macrostachya* Torr. ex A. Gray, *Juncus effusus* L., *J. dichotomus* Elliott, *Pontederia cordata* Lour., *Hydrocotyle*, and *Leersia hexandra* Sw.

Voucher specimen: **U.S.A. Georgia. Camden Co.:** 30.91191°N, 81.71237°W; 0.52 mi S jct. Hwy US 17 and Groover Rd, along west side of Hwy. US 17, edge of shallow ditch with standing water, plants locally common, 27 Jun 2021, R. Carter 25545 with Randy Mears (VSC).

POACEAE

North American **Andropogon**: new generic concepts and new names in **Anatherum**

Primary authors: Alan S. Weakley, Edwin L. Bridges, Richard J. LeBlond, Steve L. Orzell, Bruce A. Sorrie, and Joseph K. Wipff

Vorontsova et al. (2023) made a compelling case for the recognition of *Andropogon* L. sect. *Leptopogon* Stapf at generic rank, as *Anatherum* P. Beauv., in order to make an important step towards the recognition of monophyletic genera in the subtribe Andropogoninae. Their phylogenetic results, along with those of other recent analyses (Arthan et al. 2017; Welker et al. 2020), suggest that the phylogenetic topology would allow members of sect. *Leptopogon* to be included in a monophyletic *Andropogon* typified by *Andropogon distachyos* L. (the conserved type of *Andropogon*, superseding via conservation the previously designated lectotype, *Andropogon virginicus* L.), if *Andropogon* were broadened to the same circumscription as the subtribe Andropogoninae, thus including genera such as *Schizachyrium* Nees, *Themeda* Forssk., *Hyparrhenia* Andersson ex E. Fourn., *Elymandra* Stapf, *Monocymbium* Stapf, and others; such a course seems retrogressive and unpopular. Vorontsova et al. (2023) also identified morphological features distinctive of *Anatherum* and discussed its center of diversity in the Americas.

For North America north of Mexico, the removal of species previously placed in sect. *Leptopogon* to genus *Anatherum* leaves *Andropogon gerardi* Vitman and *Andropogon hallii* Hackel as the only remaining members of *Andropogon* (Campbell 2003). These “big bluestem” species are apparently of allopolyploid origin, probably involving ancestors from two currently recognized genera (Nagahama & Norrmann 2012; Estep et al. 2014; Vorontsova et al. 2023); this suggests they may warrant removal from *Andropogon* as well, likely into a new genus, but we follow Vorontsova et al. (2023) in retaining them in *Andropogon* for now until definitive taxonomic solutions are developed. In the meantime, the generic distinction between *Anatherum* and “*Andropogon*” emphasizes the long-apparent substantial divergence between (on the one hand) sect. *Leptopogon* and the “big bluestems.”

In transferring species to *Anatherum*, Vorontsova et al. (2023) relied on “species concepts based on the taxonomic compilation by POWO (2013).” Regrettably, that source is not current with recent and substantial taxonomic work in the United States that resulted in clarification and recognition (or re-recognition) of additional distinctive taxa at species rank (Weakley & Southeastern Flora Team 2023; Bridges & Orzell 2018; Bridges & Orzell 2020; Weakley & Schori 2018; Weakley et al. 2011; Deshmukh et al. 2022). We therefore make the necessary transfers to *Anatherum* of these six taxa.

Anatherum campbellii (U.B. Deshmukh, M.B. Shende, & E.S. Reddy) E.L. Bridges & Orzell, **comb. nov.**

BASIONYM: *Andropogon campbellii* U.B. Deshmukh, M.B. Shende, & E.S. Reddy, Phytotaxa 530:111. 2022. Replacement name for *Andropogon decipiens* (C.S. Campbell) E.L. Bridges & Orzell (2020), nom. illeg., non *Andropogon decipiens* (Hackel) Domin, 1915. BASIONYM: *Andropogon virginicus* L. var. *decipiens* Campbell, Syst. Bot 11:290. 1986. TYPE: U.S.A. FLORIDA. Martin Co.: Jonathan Dickinson State Park, more or less open pine flatwoods, 16 Oct 1977, *Campbell 3870* (HOLOTYPE: GH; ISOTYPES: DUKE, FLAS, FSU, GA, MAINE, MISS, MISSA, TAES, TENN, USF, VDB).

See Bridges and Orzell (2020) for rationale and discussion of the recognition of this taxon.

Anatherum cretaceum (Weakley & Schori) Weakley & Schori, **comb. nov.** BASIONYM: *Andropogon cretaceus* Weakley & Schori, J. Bot. Res. Inst. Texas 12(1):57. 2018. TYPE: U.S.A. FLORIDA: Moist pine barrens, near Jacksonville, Nov 1878, A.H. Curtiss 2639b (LECTOTYPE: NY 1639478; ISOLECTOTYPES: MICH, MISSA 20012, MO 2465349).

See Weakley & Schori (2018) for rationale and discussion of the recognition of this taxon.

Anatherum dealbatum (C. Mohr ex Hack.) Weakley & LeBlond, **comb. et stat. nov.** BASIONYM: *Andropogon virginicus* var. *dealbatus* C. Mohr ex Hack. in A.L.P.P. de Candolle & A.C.P. de Candolle, Monogr. Phan 6:411. 1889. TYPE: U.S.A. ALABAMA. Mobile Co.: Mobile, 1884, Mohr s.n. (HOLOTYPE: W).

See Weakley et al. (2011) for rationale and discussion of the recognition of this taxon.

Anatherum eremicum (Wipff & Shaw) Weakley & Wipff, **comb. nov.** BASIONYM: *Andropogon eremicum* Wipff & Shaw, Phytoneuron 2018-73:2. 2018. TYPE: U.S.A. NEW MEXICO. Grant Co.: Mimbres Hot Springs, grass around the hot springs, 2 Nov 1851, C. Wright 2100 (HOLOTYPE: GH-image!; ISOTYPES: GH-image!, MO, NY, UC). New name at species rank for *Andropogon glomeratus* (Walter) B.S.P. var. *scabriglumis* C.S. Campb., Syst. Bot. 11:291. 1986.

See Wipff and Shaw (2018) and Campbell (1983, 1986) for rationale and discussion of the recognition of this taxon. Out of convenience, we here make the needed combination in *Anatherum* for this southwestern North American taxon.

Anatherum hirsutius (Hack.) Weakley & LeBlond, **comb. et stat. nov.** BASIONYM: *Andropogon macrourus* Michx. var. *hirsutior* Hack., in A.L.P.P. de Candolle & A.C.P. de Candolle, Monogr. Phan. 6:411. 1889. TYPE: U.S.A. ALABAMA. Mobile Co.: Mobile, 28 Oct 1884, Mohr s.n. (HOLOTYPE: W).

See Weakley et al. (2011) for rationale and discussion of the recognition of this taxon at species rank.

Anatherum tenuispathum (Nash) Sorrie & Weakley, **comb. et stat. nov.** BASIONYM: *Andropogon glomeratus* var. *tenuispathus* Nash, Flora of the Southeastern United States 61. 1903 (22 Jul 1903). LECTOTYPE: A.H. Curtis 5337; 30 Oct 1894; U.S.A.: FLORIDA: Duval Co.: low ground near river, Jacksonville (NY, designated by Campbell, J. Arnold Arbor. 64: 244, 1983); ISOLECTOTYPES: GA (2 sheets), GH, NY, W, designated by Campbell, J. Arnold Arbor. 64: 244, 1983).

See Sorrie (2020) for rationale and discussion of the recognition of this taxon.

POACEAE

The ***Andropogon elliottii*** complex: refined concepts and description of a cryptic species

Primary authors: Brett J. Budach and Edwin L. Bridges

Vorontsova et al. (2023) reestablished the genus *Anatherum* P. Beauv. for the former sect. *Leptopogon* Stapf within the broader genus *Andropogon* L. This required numerous new combinations for almost all North American *Andropogon*. While many of these combinations were made in Vorontsova et al. (2023), several recently described or elevated *Andropogon* species were left in need of new combinations within *Anatherum* P. Beauv. This need prompted a closer investigation of members of Campbell's (1983) concept of *Andropogon gyrans* Ashe and provided an opportunity to redefine concepts therein.

From *Andropogon subtenuis* Nash to *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg

Without much discussion, Campbell (1983) lumped *Andropogon subtenuis* Nash (1912) into his concept of *Andropogon gyrans* Ashe. It was not until recently that the name reappeared in Weakley's Flora of the Southeastern US (Weakley & Southeastern Flora Team 2023). There have been variable applications of the concept for *A. subtenuis* Nash, which lack obvious patterns and often do not match the type material. At one end of this concept are plants that do not match the type of *A. subtenuis* Nash and more closely resemble typical *A. gyrans*, with widened upper stem sheaths obscuring at least some racemes, but with extremely narrow basal leaves, glabrous basal leaf sheaths, and at least some exerted racemes. This application, as noted in Weakley and Southeastern Flora Team (2023), is assumed to include Campbell's "tenuous variant" of his concept for *A. gyrans*. However, we have found that Campbell's use of that designation was inconsistent with our contemporary applications of it. At the other end of the *A. subtenuis* Nash concept are plants that more closely match the *A. subtenuis* Nash type, lacking the wider stem sheaths and more obscured racemes of typical *A. gyrans*, but with similar dispersal unit characters and appressed-pubescent basal leaf sheaths. We believe that the former application of this concept is indeed patternable and descriptive of a true taxonomic entity while the latter only applies to a disturbance-induced growth form unique to cleistogamous grasses but is not taxonomically significant in and of itself.

The type specimen for *Andropogon subtenuis* Nash is clearly an example of a disturbance-induced anomalous growth form and not a taxonomically significant entity. With its long awns, long dispersal unit pubescence, wider leaf blades, and appressed-pubescent basal leaf sheaths, the type resembles typical *A. gyrans* material in every way aside from the extremely reduced stem sheaths and exerted racemes. This behavior of a typically cleistogamous grass shifting to chasmogamy in the presence of disturbance is not novel, indeed Campbell was aware of it (Campbell 1982). Hitchcock and Chase (1950) also mention the possibility of *Andropogon subtenuis* Nash being a reduced, chasmogamous form of *Andropogon elliottii* Chapm. (= *A. gyrans* Ashe). This is a phenomenon the authors have observed in other partially cleistogamous grasses, including *Sporobolus dandestinus* (Biehler) Hitchc. in north Florida and *Sporobolus compositus* (Poir.) Merr. in southwest Missouri, even though it is not well represented in the literature.

Following our examination of the type and interpretation of the potential for disturbance-induced anomalous growth forms, we believe that Campbell's choice to lump *Andropogon subtenuis* Nash into his concept for *Andropogon gyrans* Ashe was correct. As such, our concept of *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg includes the former *Andropogon subtenuis* Nash. Material recently identified as *Andropogon subtenuis* Nash using Weakley and Southeastern Flora Team (2023) could be either the anomalous, disturbance-induced growth form of *Anatherum gyrans* or the new species described below (*Anatherum subtile* Budach & E.L. Bridges).

From *Andropogon gyrans* Ashe 'tenuous variant' to *Anatherum subtile* Budach & E. Bridges

The concept of *Andropogon subtenuis* Nash as currently applied in Weakley and Southeastern Flora Team (2023) includes the named but not formally published concept of Campbell's "tenuous variant" of *Andropogon gyrans* Ashe. However, upon close study of Campbell's own annotations and descriptions, we found confusing applications. Campbell lumped *A. subtenuis* Nash into his concept of *A. gyrans* Ashe while maintaining the separate distinction of the "tenuous variant" of the same species in contrast to the "common variant." Clearly these concepts were not meant to be applied to the same material. To further complicate this issue, a close study of the material that Campbell annotated as the "tenuous variant" of *A. gyrans* Ashe shows a very wide range of habitats and morphological expressions, relying only on what we believe to be wildly variable and unreliable characters related to the visibility and exertion of the racemes and raceme sheaths. There is certainly overlap between entities annotated by Campbell as the "tenuous variant" and "common variant." There are also several Campbell-annotated sheets of what he called his "tenuous variant" that are clearly more like his "common variant" of *A. gyrans* Ashe and consistent with our updated concept of *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg. Peduncle length and whether an individual plant is fully cleistogamous (all racemes hidden within the raceme sheaths; raceme sheaths hidden within the stem sheaths) or mostly chasmogamous (many racemes at least partially exerted from their sheaths; raceme sheaths well-exerted from the stem sheaths) are highly variable and respond dramatically to extreme forms of disturbance. Intensive field experience in both burned and degraded habitats throughout the state of Florida has shown that a severe late-season burn or recent roller-chopping or mowing can induce extreme chasmogamy in material that corresponds to either Campbell's "common variant" or his "tenuous variant" of *A. gyrans* Ashe, and as such, it is not possible to perfectly and directly apply his "tenuous variant" concept to any one entity.

With that chaos of concepts and applications as a backdrop, we studied Floridian populations through meticulous field study of numerous individuals, with close attention paid to ecology and morphological responses to disturbances over time. An ongoing project studying growth and phenology responses to seasons of burning required the authors to locate and identify thousands of sterile vegetative individuals of over a dozen *Anatherum* species. This challenge allowed us to determine patterns in habitat and morphology that were initially unbiased by reproductive material or the use of existing keys and names. As the project proceeded, we were able to match these unbiased concepts with their reproductive characters and published names, and some striking patterns emerged. These patterns were repeatedly found in similar populations across numerous sites from the Florida panhandle to the Florida Everglades, helping construct more refined

species concepts built on the marriage of morphology to ecology and biogeography. The result is, in part, the following description of a cryptic species:

Anatherum subtile Budach & E.L. Bridges, **sp. nov.** (Fig 17). TYPE. U.S.A. FLORIDA. Highlands Co.: recently burned dry/dry-mesic flatwoods ecotone below scrubby sandhill savanna, Silver Lake Sandhill, Lake Wales Ridge Wildlife and Environmental Area, (27.5758324, -81.5263988), 20 Oct 2021, Budach 652 (HOLOTYPE: USF; ISOTYPES: FLAS, FSU, MO, NCU, NY, US).

Diagnosis.—Similar to *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg, differing in having glabrous basal leaf sheath faces, narrower basal leaf sheaths, narrower basal leaf blades, slightly narrower culms, slightly narrower upper stem sheaths, shorter rachis internodes, and shorter pedicels (Fig. 17).

Plants densely cespitose with very short, stout rhizomes. **Culms** (50–)60–80(–90) cm tall, (1.0–)1.3–1.7 (–2.0) mm in diameter at the midpoint, internodes glabrous and often glaucous at and just below the nodes, the branches slender, short, erect to ascending and often obscured by the widened upper stem sheaths. **Upper stem sheaths widened, the largest** (6.0–)7.2–9.0 (–10) cm long and (4.0–)4.7–6.3(–7.0) mm wide when flattened, often overlapping and obscuring at least some of the inflorescence units. **Basal leaf sheaths** smooth, glabrous, pale stramineous to dull yellow-green, narrow, (0.5–)1.4–2.6(–3.0) mm wide. **Basal leaf blades** erect to ascending, appearing yellow-green *in situ*, dull when pressed, 30–50 cm long, (0.6–)1.0–2.2(–2.8) mm wide (unfolded), difficult to unfold due to nearly complete folding of lamina, glabrous on the blade surfaces but with sparse to dense, ascending, stout marginal cilia concentrated near the base. **Ligule** thin-membranaceous, 0.6–0.8 mm long, very finely ciliate on the margin and dorsal surface, the cilia usually < 0.2 mm long. **Inflorescences** variable, mostly congested in the upper 1/3 of the fertile culm, with slender, erect to slightly flexuous branches concealed within and/or exerted beyond the widened upper stem sheaths, maximum branch order 1(–2), inflorescence units (3–)6–12(–15) per culm; inflorescence units often of two kinds: some with peduncles longer (up to 7.0 cm) and borne on long terminal stem branches such as to be long-exserted beyond both the widened stem sheaths and raceme sheaths, some with peduncles shorter (as short as 1 mm) and borne on short terminal stem branches such as to be completely obscured by both the widened stem sheaths and subtending raceme sheaths; the longer, exerted inflorescence form often absent but the shorter, obscured form always present; summit of terminal stem branches often with a dense callus of ascending whitish hairs. **Raceme sheaths** (3.2–)3.6–6.4(–7.8) cm long, some borne on longer stem branches and visible beyond the widened stem sheaths, others borne on shorter branches and obscured; the base sometimes partially obscured by the callus hairs on the summit of the subtending stem branch. **Peduncles** 0.2–5.0(7.0) cm long, ranging from fully included within the raceme sheath to slightly exerted beyond the raceme sheath summit. **Rames** in groups of 2–3(–4), terminal on each peduncle, (5.0–)5.3–5.7(–6.0) mm long, some remaining fully enclosed within the raceme sheaths while others fully exerted beyond the sheath summit; some plants with no exerted rames but all plants with at least some fully enclosed rames. **Rachis Internodes** (2.5–)3.0–3.8(–4.0) mm long, the pubescence 7.5–9.5(–10.4) mm long, the distal internode pubescence slightly longer than the proximal. **Sessile spikelets** (4.0–)4.2–4.8(–5.0) mm long, with 3.5–4.5 mm long callus hairs at the base, keels of lower glume scabrous from the midpoint, fertile lemma, including its awn, 19–24 mm long. **Pedicellate spikelets** absent or vestigial, with a pedicel (4.5–)4.6–5.6(–5.8) mm long, the pubescence (6.0–)6.2–8.8(–9.5) mm long, the distal pedicel pubescence slightly longer than the proximal.

In the flatwoods, pine savanna, and subtropical grassland landscapes of the extreme southeastern coastal plain, typically on hyperseasonal and highly acidic spodosols, we frequently found an entity that resembled a diminutive, narrow-leaved expression of *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg. It has very narrow basal leaf sheaths and leaf blades, with the faces of those basal leaf sheaths always smooth and glabrous (Figs. 17–19). This immediately caught the authors' attention, as typical *A. gyrans* of more well-drained uplands of the region always has appressed-pubescent basal leaf sheaths. Typical *A. gyrans* material from as far away as southwest Missouri maintains this basal leaf sheath pubescence character.

Within the genus *Anatherum* (= *Andropogon* sect. *Leptopogon*), basal leaf sheath pubescence is not always a conserved or reliable character and can be impossible to discern from digital specimen images, so an effort

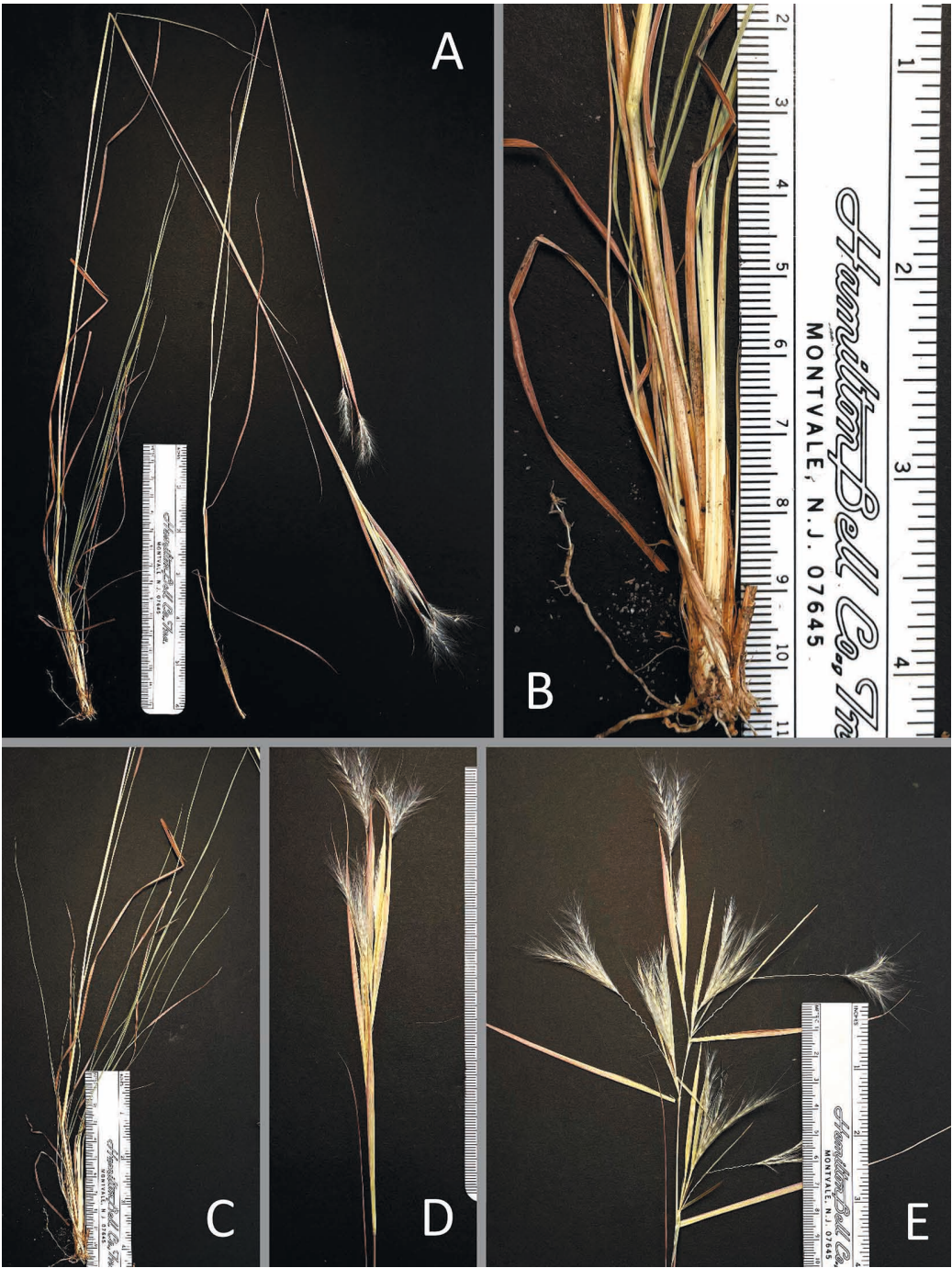


FIG. 17. Type specimen for *Anatherum subtile* Budach & E. Bridges Full sheet (A), basal leaf sheaths (B), basal leaves (C), original untampered inflorescence with closed sheaths and hidden rames (D), tampered inflorescence with stem and raceme sheaths pulled back to expose the rames (E). Source: Budach.

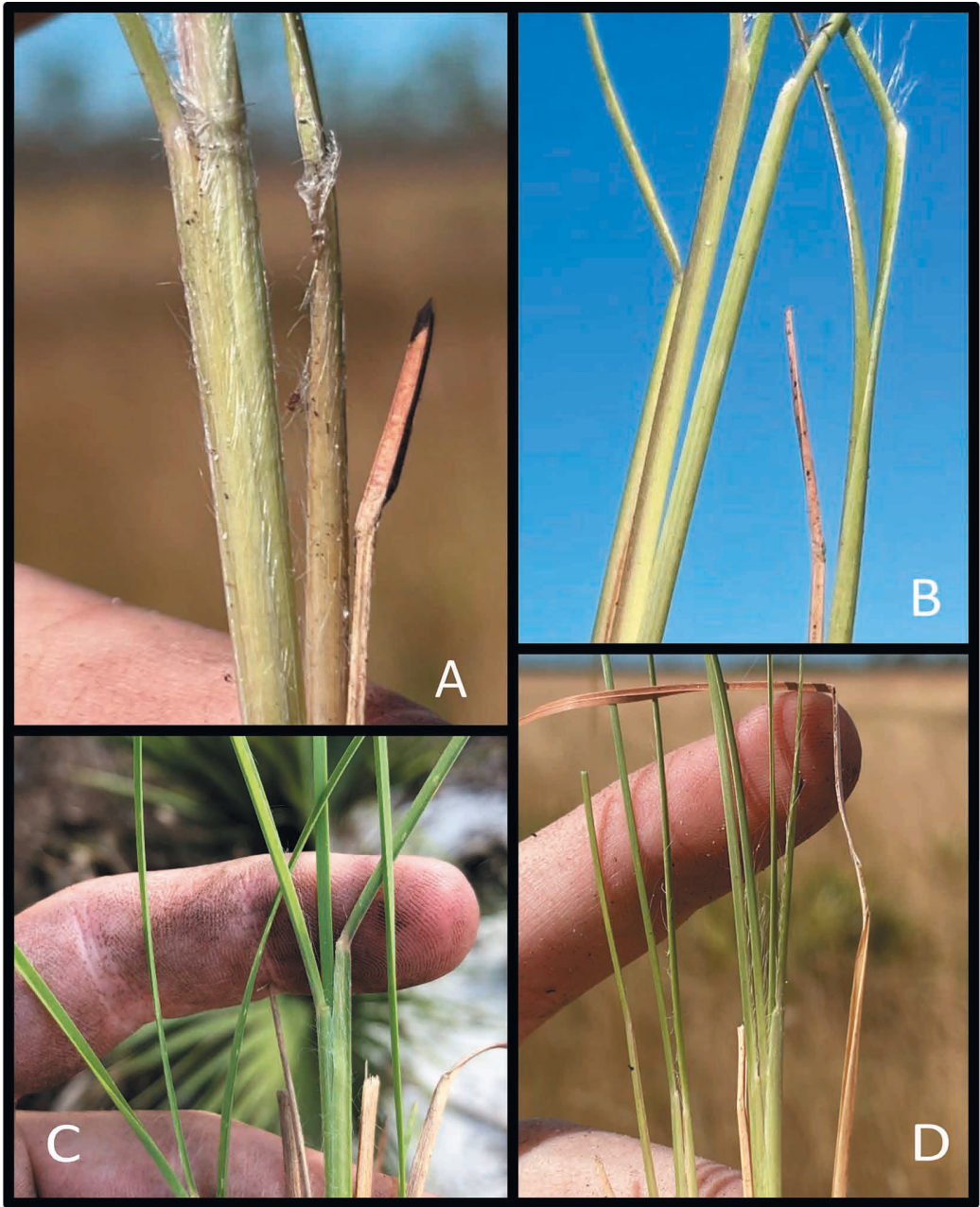


FIG. 18. Basal leaves and sheaths of *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg (A, C) and *Anatherum subtile* Budach & E. Bridges (B, D). Source: Budach.

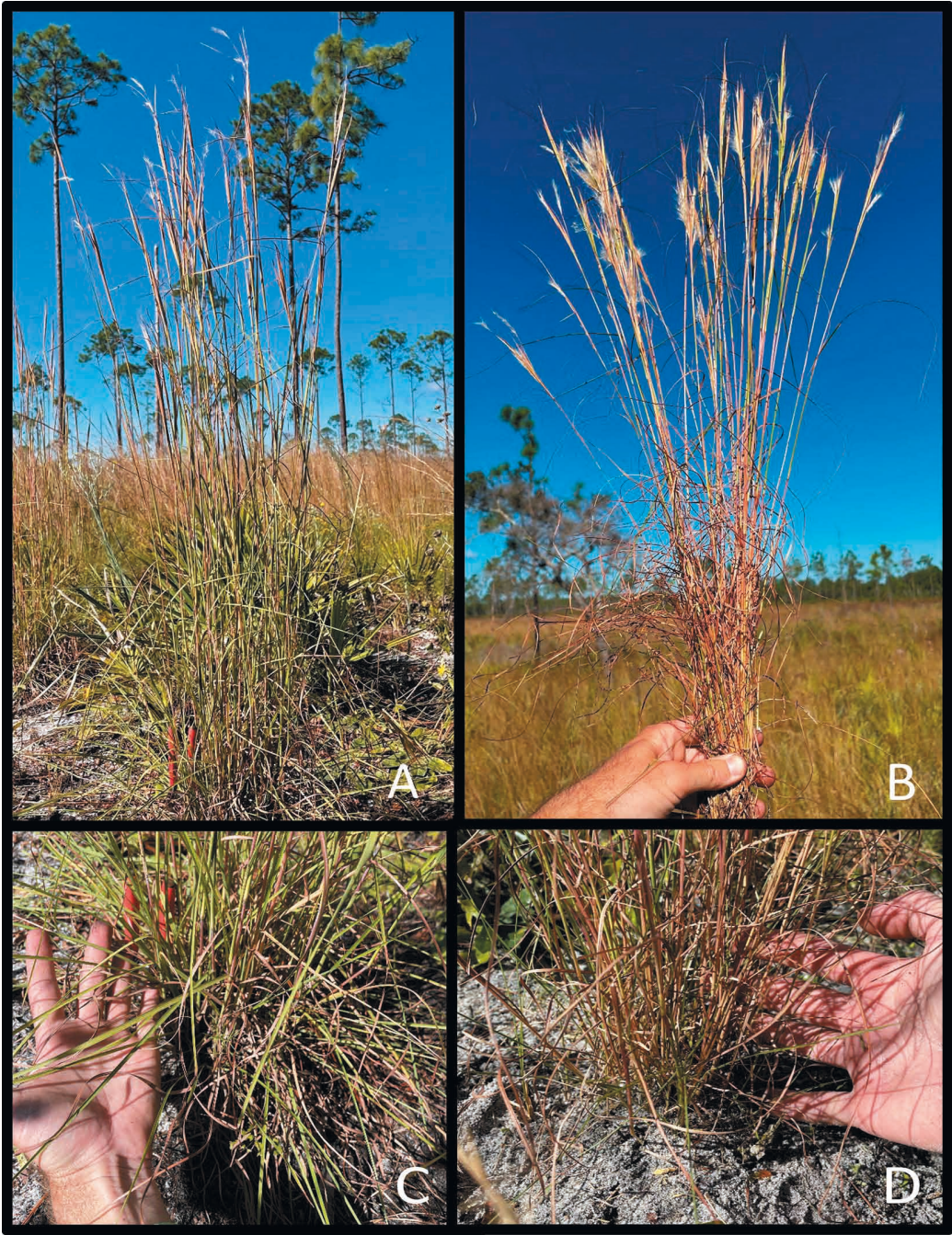


FIG. 19. Recently-burned examples of the aspect and basal leaves of both *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg (A, C) and *Anatherum subtile* Budach & E. Bridges (B, D). Source: Budach.

was made to observe and document this character *in situ* wherever and whenever possible. After over three years of field work throughout the state of Florida spanning the full range of potential habitat, we were able to consistently use this basal leaf sheath pubescence character in conjunction with a habitat separation to differentiate *Anatherum subtile* from typical *Anatherum gyrans*. Along with the basal leaf sheath pubescence character, a set of morphological measurements was made from Floridian specimens of both entities, and we found the following characters to be reliable in separating these species: fertile culm diameter at the midpoint, width of the basal leaf sheaths, width of longest basal leaf blade, width of the widest upper stem sheath, length of the shortest raceme sheath, length of the rachis internode, and length of the pedicel of pedicellate/vestigial spikelet. Given the restricted range and size of the sample, we suspect some of these characters to become more significant and others to become less significant as other researchers put them to the test over a wider geographical range (see below).

Characters that separate *A. subtile* from *A. gyrans* are based on 9 sheets of *A. subtile* and 8 sheets of *A. gyrans* from Florida. The ranges given represent the mean ± 1 standard deviation.

Culm Diameter: 1.3–1.7 mm (*A. subtile*) vs. 1.8–2.2 mm (*A. gyrans*)

As measured near the middle of a mature or nearly mature reproductive culm, typically below the widened summit of the internode and above the preceding leaf sheath summit. This character may become less informative if more material across the species' ranges is included.

Sterile Leaf Sheath Width: 1.4–2.6 mm vs. 2.4–3.8 mm

The combined width of the tightly overlapping basal leaf sheaths of a single sterile, non-reproductive ramet (or tiller); only including leaves from that growing season (dense layers of long-dead material from past growing seasons are excluded). This character was expected to be more informative, but *A. gyrans* in extremely dry or sterile situations will be stunted and approach the dimensions more typical of *A. subtile*.

Sterile Leaf Sheath Pubescence: glabrous vs. appressed-pubescent

This applies to the faces (lamina), not the margins of the sheaths of the basal leaves of a sterile, non-reproductive ramet; pubescence can be severely worn on very old material of *A. gyrans* (Fig. 19). This is the easiest and most consistent field character that seems to hold across the ranges of both entities.

Width of Longest Sterile Leaf: 1.0–2.2 mm vs. 2.0–3.0 mm

It can be difficult to get a leaf width measurement from pressed/dried *A. subtile* due to the extremely tightly folded nature of the lamina, whereas *A. gyrans* leaf blades are much more easily flattened for measurement (Fig. 19). A larger sample size from across the range of *A. gyrans* may pull the mean and standard deviation even further away from that of *A. subtile*.

Widest Upper Stem Sheath: 4.7–6.3 mm vs. 6.6–8.6 mm

The upper stem sheaths are the diagnostic, wider, bract-like structures that often obscure all the inflorescences within, and are the structures that make both entities so immediately recognizable in the field. The widest stem sheath can be chosen subjectively, with the width then carefully measured by rolling out the relatively fragile sheath blade. A much larger sample size from across the range of *A. gyrans* may pull the mean and standard deviation even further away from *A. subtile*.

Shortest Raceme Sheath: 3.3–4.5 mm vs 4.9–5.7 mm

The shortest raceme sheath is often, but not always, associated with the most strongly exerted inflorescences. It is sometimes associated with the greatly reduced inflorescence units hidden within the congested and obscured layer of stem and raceme sheaths. This character is not likely to become more informative with larger sampling across the range of these two entities but is included here due to the wide separation in our regionally specific measurements.

Rachis Internode Length: 3.0–3.8 mm vs 3.8–5.0 mm

This was an unexpected character difference between the two species. A greater sample of this character across the species' ranges would be very interesting. This character includes the full length of the rachis internode, from the base where it joins the base of the adjacent sessile (fertile) spikelet to the tip where it disarticulates from the next dispersal unit.

Pedicel of Pedicellate Spikelet Length: 4.6–5.6 mm vs 5.6–8.0 mm

This was an unexpected character difference between the two entities. A greater sample of this character across the species' ranges would be very interesting. This character is measured from the base where it joins the base of the adjacent sessile spikelet to the tip of the pedicel but NOT including the vestigial pedicellate spikelet if present.

It is possible to find nearly unrecognizable or unkeyable examples of both *Anatherum gyrans* and *Anatherum subtile*, made so by extreme forms of disturbance (intense or late-season fires, roller chopping, extreme soil disturbance, nutrient flushes, etc.). These anomalous examples will often have extremely exerted inflorescence units and reduced stem and raceme sheaths, while retaining the long inflorescence pubescence, twisted

awns, at least some very reduced and fully cleistogamous racemes, and diagnostic sheath pubescence (or lack thereof). In the past, these troubling individuals were often, in part, assigned to *Andropogon subtenuis* Nash, but the application of that name has been inconsistent across its range. A closer study of the type specimen for *A. subtenuis* Nash reveals it to be a burned or mowed example of what would otherwise be considered typical *Anatherum gyrans*, confirmed by its inflorescence structure and basal leaf sheath pubescence, along with awareness of this novel, disturbance-induced growth form. This behavior of a typically cleistogamous grass with hidden inflorescence units reverting to chasmogamy and strongly exerted inflorescence units in response to extreme disturbances is known from other grass species but not well documented in the literature.

Anatherum subtile is restricted to highly acidic and often hyperseasonal spodosols of the extreme southeastern coastal plain, with most records from Florida and only a few confirmed records from Alabama, Georgia, and Louisiana. The pubescence of the basal leaf sheaths, or lack thereof, is often not interpretable from specimen images, so it is difficult to confirm its identification without close examination of the physical specimens. Closer study at herbaria and in the field across the Coastal Plain is likely to expand the range of this new, cryptic species. It is most frequent in high quality mesic to dry pine flatwoods, savannas, and subtropical grasslands. It is rarely found as a waif on drier hummocks within seepage slopes and wetter grasslands and savannas and in slightly lower, wetter zones within xeric or scrubby flatwoods and savannas. In comparison, *Anatherum gyrans* is a common and occasionally weedy denizen of well-drained upland habitats throughout the southeast and is characteristic of *Pinus palustris* sandhill-savannas on deep sands. Both species are far easier to detect in areas that have been recently burned or otherwise disturbed, as both appear to produce much larger and more numerous fertile culms in those situations. Ongoing research suggests that *A. subtile* is far more dependent on fire than *A. gyrans*, producing far fewer and, in some cases, no fertile culms without recent fire, making it even more difficult to detect in unburned habitats. *A. gyrans*, while certainly stimulated by burning, does not require it and as a result can still be easily found in unburned habitats (Budach, Bridges, and Orzell, unpublished data).

In peninsular Florida specifically, *A. gyrans* is restricted to the deeper, well-drained yellow sand entisols of the uplands and ridgetops. On the Lake Wales Ridge, where narrow sandhill ridges are often separated from adjacent flatwoods and depressions by extremely sharp and narrow ecotones, it is possible to find typical *A. gyrans* at the top of the ridge in the well-drained yellow sands with *A. subtile* just a stone's throw away downslope where the sands are white or gray and occasionally to rarely saturated. Even in these narrow zones of close contact, the authors have not seen signs of hybridization or clinal patterns of intermediacy between the two entities. Indeed, a quick glance at the basal leaf sheath pubescence of material from central Florida is enough to estimate the landscape position and habitat of the specimen.

CHANGES TO KEY IN WEAKLEY AND SOUTHEASTERN FLORA TEAM (2023)

6. Upper culm sheaths distinctly broadened and strongly overlapping, often largely hiding the raceme sheaths before senescence (but in some forms with the raceme sheaths strongly exerted); culms mostly < 1 m tall (to 1.4 m tall)

Andropogon gyrans

Change above to:

6. Upper culm sheaths distinctly broadened and strongly overlapping, obscuring at least some of the raceme sheaths before senescence, occasionally with few to many raceme sheaths strongly exerted; culms mostly < 1 m tall (to 1.4 m tall)

NEW LEAD

- NL1. Faces of basal leaf sheaths appressed-pubescent, ≥ 2.4 mm wide from keel to keel; basal leaf blades ≥ 2.0 mm wide unfolded, not difficult to unfold; widest upper culm sheaths ≥ 6.6 mm wide when unrolled; rachis internode ≥ 3.8 mm long; pedicel ≥ 5.6 mm long; plants of well-drained uplands throughout the southeastern U.S. *Anatherum gyrans*
 NL2. Faces of basal leaf sheaths glabrous, ≤ 2.6 mm wide from keel to keel; basal leaf blades ≤ 2.2 mm wide unfolded, very difficult to unfold; widest upper culm sheaths ≤ 6.3 mm wide when unrolled; rachis internode ≤ 3.8 mm long; pedicel ≤ 5.6 mm long; plants of hyperseasonal, occasionally to rarely saturated soils of dry to mesic flatwoods, savannas, and subtropical grasslands of the extreme southeastern Coastal Plain *Anatherum subtile*

There is also a need to strip *Andropogon subtenuis* Nash out of the key, as this concept is now included in *Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg. *Andropogon subtenuis* occurs multiple times in the key, in

part because of the inconsistent use and application of the name after its resurrection. We can find fully enclosed rames hidden within the stem sheaths on even the most diminutive and reduced examples of *Anatherum gyrans*, including those similar to the very anomalous form of the type specimen of *Andropogon subtenius*. We believe the change in wording in the couplet will help to include specimens with much-reduced upper stem sheaths that still overlap and obscure at least some of the much-reduced racemes.

The following paragraph gives the synonymy of the application of names to our current concept of *Anatherum subtile* in recent floras and monographs in the style of the synonymy statements in Weakley and Southeastern Flora Team (2023). These do not represent nomenclatural synonymy but rather the equivalence (or concepts greater than (“>”) or less than (“<”) our current understanding of the application of this name).

Synonymy: <*Anatherum gyrans* (Ashe) Voronts. & E.A. Kellogg (2023); > *Andropogon subtenius* Nash – (Weakley & Southeastern Flora Team 2023); < *Andropogon elliottii* Chapm. – W V; > *Andropogon gyrans* Ashe var. *gyrans* “common variant” – Campbell (1983); > *Andropogon gyrans* Ashe var. *gyrans* “tenuous variant” – Campbell (1983); < *Andropogon campyloracheus* Nash – RAB, S; < *Andropogon elliottii* Chapm. – HC, Tx; < *Andropogon elliottii* Chapm. – RAB, S; > *Andropogon elliottii* Chapm. var. *elliottii* – F, G; > *Andropogon elliottii* Chapm. var. *gracilior* Hack. – F, G; > *Andropogon elliottii* Chapm. var. *projectus* Fernald & Griscom – G; < *Andropogon gyrans* Ashe – C; < *Andropogon gyrans* Ashe var. *gyrans* – ETx1, FlGr, FNA25, K1, K3, K4, Mo1, WH3.

POACEAE

Proposal of three new species of ***Dichantherium*** from fire-maintained pinelands of northeastern Florida, eastern North Carolina, and North Andros Island (The Bahamas)

Primary authors: Richard J. LeBlond, Bruce A. Sorrie, and Susan C. Carr

We describe three new species of *Dichantherium* from fire-maintained pineland communities of eastern North Carolina, northeastern Florida, and North Andros Island in the Bahamas. The taxonomy of *Dichantherium* has long been one of turmoil and differences in concepts, from the issue of its recognition (or not) as separate from *Panicum* (now clearly resolved) to the taxonomic concepts to be applied in the recognition of species and infraspecies (still highly uncertain). Majure et al. (2023) have initiated the effort to apply phylogenetic analyses to further assess the evolutionary mechanisms within the genus and to reassess taxonomic concepts and ranks based on the integration of new and old tools. Here, we propose three additional, morphologically distinctive species of *Dichantherium* in the hopes that they will be included in future synthetic approaches to species delimitation in the genus.

***Dichantherium androsense* (Poaceae), a new species from Andros Island in the Bahamas.**

Six collections from four populations of an unusual *Dichantherium* taxon not matching any species or section recognized by Freckmann and Lelong (2003) were made from North Andros Island in the Bahamas in 1992 and 1993 (Sorrie & LeBlond, 1997).

***Dichantherium androsense* LeBlond & Sorrie, sp. nov. (Fig. 20).** TYPE: THE BAHAMAS: North Andros District: wet Pineland off NE side of a connector road heading NW towards Main Lumber Road from Queen’s Highway at a point 8.7 mi S of the North Andros airport, lat. 24.9353, long. –78.0409; 6 May 1993, LeBlond 3266, Sorrie, & Weakley (HOLOTYPE: NCU), Sorrie 7220, LeBlond, & Weakley (ISOTYPE: US).

Diagnosis.—*Dichantherium androsense* superficially resembles *D. acuminatum* var. *acuminatum* with its small spikelets, ciliate blades and overall pubescence, but differs from it and all other known *Dichantherium* taxa by a combination of its short, bushy ligule and the absence of a pseudoligule; glabrous to glabrate spikelets; shiny and often glandular to stipitate-glandular glumes and lower lemma; and sheath papillae that are distinctly red-orange and swollen *in situ* (this character lost in drying).

Description.—1–several culms together, caespitose, nonrhizomatous. Culms to 40 cm, slender, 0.4–1.1 mm in diameter at lowest elongate internode; internodes moderately pilose or papillose-pilose with hairs 0.5–2 mm long; nodes, especially lower, bearded with retrorse hairs (hairs of the nodes and internodes often lost as specimens age). Rosette leaves 1.5–3 cm long × 3–5 mm wide, moderately-densely pubescent abaxially, sparsely pubescent adaxially, margins ciliate. Culm leaf sheaths half or less as long as internodes, moderately pilose to papillose-pilose with variably spreading hairs (0.5–)1–2 mm long (*in situ*, sheath papillae are



FIG. 20. Holotype of *Dichantherium androsense*. Image by Shanna Oberreiter (NCU).

distinctively red-orange and swollen, but this character is lost in drying). Ligule cilia bushy, 0.5–0.8(–1.3) mm long, membranous portion minute or absent, without a distinct pseudoligule. Blades 2–5.5 cm long × 2–5 mm wide, usually ciliate distally as well as proximally, moderately to sparsely pilose adaxially with appressed hairs, moderately densely papillose-pilose abaxially with non-appressed hairs. Vernal panicles ±3 cm long × 1.5 cm wide (few seen, these senescent), rachis sparsely pilose with spreading hairs to 0.3 mm long; rachis, branches, and pedicels minutely scabrous. Spikelets elliptical, obtuse, (1.4–)1.5–1.6(–1.7) mm long, the glumes and lower lemmas shiny, sometimes glandular to stipitate-glandular, glabrous to sparsely puberulent; lower glumes 0.5–0.6(–0.7) mm long, obtuse to broadly acute; upper glumes and lower lemmas equaling upper lemmas. Autumnal sheaths and blade abaxial surfaces densely (–sparsely) pubescent with spreading hairs 0.2–0.5 mm long; autumnal panicle indumentum similar to vernal. None of the vegetative features can be described as velvety-pilose.

Etymology.—The taxon was determined to be distinct by examining plants collected on North Andros Island in The Bahamas, and only known from that island as of this accounting.

Additional collections (paratypes). **THE BAHAMAS. North Andros District:** wet Pineland off west side of Main Lumber Road N of junction with SE-NW connector road from Queen's Highway, 15 Mar 1992, *LeBlond* 2666 & *Sorrie* (FTG); same location, 4 May 1993, *LeBlond* 3250, *Sorrie*, & *Weakley* (MO); N side of Cross Creek and W side of Main Lumber Road 2.4 mi N of junction with SE-NW connector road from Queen's Highway, 4 May 1993, *Sorrie* 7202, *LeBlond*, & *Weakley* (FLAS); marsh/pineland ecotone near wellfield SW of Nichols Town, off road to Red Bays, 7 May 1993, *LeBlond* 3272, *Sorrie*, & *Weakley* (FSU).

Distribution and ecology.—Currently, *Dichantherium androsense* is only known from North Andros Island. The island's climate is maritime subtropical, with tropical summers and warm temperate winters (Sealey 1994). The geological substrate is oolitic and bioclastic limestone (Frazer & Eshbaugh 1996). Plants were primarily found beneath an open canopy of *Pinus caribaea* Morelet var. *bahamensis* (Griseb.) Barrett & Golfari. The primary habitat is the Pineland wet variant of Correll (1979) and Nickrent et al. (1988). This habitat is ecotonal in character between the denser and more inland canopies of the Pineland dry variant and the terrestrial reaches of the Saltwater Marsh community (Nickrent et al. 1988) (also known as swash), which become brackish to fresh inland.

The Pineland wet variant community is characterized by having water within a few inches of the surface, with an open canopy of *Pinus caribaea* var. *bahamensis*. According to Correll (1979) and Nickrent et al. (1988), woody plants include *Metopium toxiferum* (L.) Krug & Urban, *Byrsonima lucida* (Mill) DC., *Exostema caribaeum* (Jacq.) Roem. & Schult., *Coccoloba* spp., *Guapira discolor* (Spreng.) Little, *Pithecellobium guadalupense* Chapm., *Corchorus hirsutus* L., *Bourreria ovata* Miers, and *Lantana involucrata* L. Vines include *Smilax laurifolia* L., *Ipomoea microdactyla* Griseb., *Rhabdadenia biflora* (Jacq.) Muell., and *Centrosema virginiana* (L.) Benth. Herbs include *Rajania hastata* L., *Rhynchospora colorata* (L.) H. Pfeiff., *Chloris petraea* Sw., and *Andropogon* spp. Structurally and compositionally, this habitat is clearly a “tropical relative” of Wet Pine Savanna habitats found in the southeastern United States.

Plant associates at the Pineland wet variant sites of *Dichantherium androsense* include *Pinus caribaea* var. *bahamensis*, *Metopium toxiferum*, *Thrinax morrisii* H. Wendl., *Cordia bahamensis* Urban, *Stigmaphyllon sagraeanum* Juss., *Ernodea littoralis* Sw., *Rhynchospora colorata*, *Tetrazygia bicolor* (Mill.) Cogn. var. *bicolor*, *Linum bahamensis* Northrop var. *corallicola* (Small) Rogers, *Waltheria bahamensis* Britton, *Psidium longipes* (Berg) McVaugh, *Anemia adiantifolia* (L.) Sw., *Schizachyrium gracile* (Spreng.) Nash, *Smilax havanensis* Jacq., *Andropogon virginicus* L. (s.l.), *Jacquemontia verticillata* (L.) Urban, *Aletris bracteata* Northrop, *Setaria chapmanii* (Vasey) Pilg., *Zamia pumila* L., and *Dichantherium caeruleum*. Habitat at the site located off the road to Red Bays is ecotonal between the Pineland wet variant community and the Tussock Marsh community described by *Sorrie* & *LeBlond* (1997).

Discussion.—The small spikelets, ciliate blades, and overall pubescence suggest a relationship with *Dichantherium acuminatum* (Swartz) Gould & C.A. Clark in sect. *Lanuginosa*, but the Andros plants differ by lacking a pseudo-ligule behind the short ligule and by the absence of velvety pubescence. They also differ by characters of the spikelet and leaf sheaths. Both glumes and the lower lemma are shiny and often glandular to

stipitate-glandular, and glabrous to sometimes sparsely pubescent. *In situ*, sheath papillae are distinctly red-orange and swollen, but this character is lost in drying. Plants were primarily found beneath an open canopy of *Pinus caribaea* Morelet var. *bahamensis* (Griseb.) Barrett et Golfari. Four additional species of *Dichantherium* are known from the Bahamas: *D. caerulescens* (Hackel ex Hitchc.) Correll, *D. commutatum* (Schult.) Gould, *D. dichotomum* (L.) Gould var. *nitidum* (Lamarck) LeBlond, and *D. neuranthum* (Griseb.) LeBlond. All but *D. commutatum* are known from North Andros Island (Correll & Correll 1982; Sorrie & LeBlond 1997). *Dichantherium caerulescens* has been found in the same habitat as *D. androsense*.

***Dichantherium arenicollinum* (Poaceae), a new species from peninsular Florida**

A new species of *Dichantherium* is described from dry pine/oak sandhills in Clay and Volusia counties in northern peninsular Florida. It was discovered by Carr at two locations in northern peninsular Florida and has strong credentials as a new species in sect. *Pedicellata*. This section previously included two species, *D. pedicellatum* (Vasey) Gould and *D. nodatum* (Hitchc. & Chase) Gould, both restricted to Texas and Mexico (and Guatemala for *D. nodatum*) (Freckmann & Lelong 2003). Distinguishing characteristics of the section include hard, cormlike bases, absence of a basal rosette, large basal leaves, and basally attenuate spikelets. The novel species differs from the other members of the section by several characters of the spikelets. Both Florida locations are on ridgetops in pine/oak sandhill habitat, inspiring the Latin epithet for “sandhill,” *arenicollinum*.

***Dichantherium arenicollinum* LeBlond & S.C. Carr, sp. nov. (Fig. 21).** TYPE: U.S.A. FLORIDA: Clay Co.: Jennings State Forest, ridgetop sandhill with mature open pine/oak canopy, lat. 30.180028N, long. -81.935917W, 23 Apr 2023, Carr s.n. (HOLOTYPE: NCU; ISOTYPES: FLAS, US).

Diagnosis.—*Dichantherium arenicollinum* shares the basal features and attenuated spikelets of *D. pedicellatum* and *D. nodatum*, but differs from both by having shorter and narrower spikelets, shorter lower glumes, and shorter and relatively wider upper florets.

Description.—Vernal culms 1-few, 30–80 cm long, caespitose to short-rhizomatous, bases hardened, thickened, 3–4 mm wide at emergence from root crown. Internodes 1.3–1.5 mm wide to 20 cm long, proximal internodes moderately densely ascending-appressed (-retorse) pilose with hairs about 2 mm long, distal internodes becoming less densely and appressed pilose. Nodes densely bearded with spreading to spreading-retorse hairs 1.5–2.5 mm long, becoming glabrate in age. Basal rosettes absent. Leaf sheaths shorter to much shorter than internodes, the ascending pubescence increasing distally on individual sheaths. Ligule a minute membrane with cilia < 1 mm long but vernal blades with a pseudoligule up to 8 mm long behind it. Culm blades 4–5, 5–13 cm long × 4–11 mm wide, averaging 15 × or more as long as wide, margins scabrous and often ciliate for most of their lengths with hairs to 6 mm long; basal blades largest, blades quickly becoming smaller and less ciliate upwardly on culm, the hairs emanating from the blade surface closely adjacent to the margin; blade surfaces densely appressed-pubescent abaxially, becoming less so upward on the culm, adaxial surface glabrous to glabrate, bases narrowly rounded to clasping; uppermost blade (flag) 2.8–5.2 cm long × 3–5 mm wide. Peduncles 10–20 cm long × 0.5–0.7 mm wide, moderately ascending pilose with hairs to 1 mm long, these continuing into the panicle rachis, the branches and pedicels glabrous. Panicles 5–9 cm long × 5–8 cm wide, the branches widely spreading, pedicels 2–23 mm long. Spikelets mostly purplish, 2.3–2.7 mm long × 1.2–1.5 mm wide, elliptic to obovoid, basally attenuate, moderately to densely pubescent with spreading hairs 0.2–0.4 mm long. Lower glumes 0.9–1.3 mm long, ovate-acute to deltoid-triangular, attached about 0.2–0.4 mm below expansion of upper glume and lower lemma, their bases nearly or completely encircling the pedicel. Upper glume and lower lemma equaling upper lemma (or the upper glume sub-equaling). Upper lemma 2.0–2.1 mm long × 1.2–1.4 mm wide, apex glabrous. Autumnal blades 1.8–6.0 cm long × 1.5–4 mm wide, glabrous adaxially, glabrous to sparsely pilose abaxially. Autumnal spikelets stramineous, 2.6–2.9 mm long × 1.0–1.1 mm wide before divergence of glumes away from central axis.

Additional collections. **FLORIDA. Clay Co.:** Jennings State Forest, ridgetop sandhill with mature open pine/oak canopy, lat. 30.180028N, long. -81.935917W, 6 Nov 2001, Carr s.n. (PARATYPE: MO). **Volusia Co.:** sandhill south of state route 40, Heart Island Conservation Area, lat. 29.184117, long. -81.34615, 17 Dec 2002, Carr s.n. (PARATYPE: FSU).



FIG. 21. Holotype of *Dichantherium arenicollinum*. Image by Shanna Oberreiter (NCU).

Distribution and ecology.—*Dichanthelium arenicollinum* is currently known only from the two localities on peninsular Florida. Habitat at the Clay Co. site in Jennings State Forest is a ridgetop sandhill with evidence of recent fire and likely with a history of frequent fire. The open mature canopy is dominated by *Pinus palustris* Mill., with an oak understory of *Quercus laevis* Walter, *Q. incana* W. Bartram, and *Q. margaretiae* (Ashe) Small. Prominent ground layer plants include *Aristida beyrichiana* Trin. & Rupr., *Castanea pumila* (L.) Mill. and *Serenoa repens* (W. Bartram) Small. The Volusia Co. site in Heart Island Conservation Area is a ridgetop sandhill where most of the pine canopy has been removed, with exotic pasture grasses present in patches. *Quercus laevis*, *Q. incana* and *Q. geminata* Small form an understory over *Aristida beyrichiana*, *Eremochloa ophiuroides* (Munro) Hack., *Sorghastrum secundum* (Elliott) Nash, *Schizachyrium scoparium* (Michx.) Nash var. *stoloniferum* (Nash) J. Wipff, and *Tephrosia chrysophylla* Pursh. *Dichanthelium malacon* also occurs at this site.

Discussion.—Regarding the absence of a basal rosette, in *Dichanthelium* that is a common occurrence in collected specimens and does not necessarily mean that the plant will not produce one later. Also, some species produce basal rosettes in temperate regions but not in tropical regions. The plants in sect. *Pedicellata* have never been observed to produce a basal rosette and instead produce basal offshoots with leaves that are among the largest on the plant, though these are frequently not collected, especially in *D. nodatum* specimens. Silveus (1942) describes basal offshoots in both Texas taxa: “Late in the fall shoots appear at the base of plants with blades 2–4” [5–10 cm] long, 7–10 mm wide, prominently papillose-ciliate with sheaths more densely hirsute than those of the mature culms. These shoots somewhat resemble a winter rosette, but they later develop into flowering culms.” The largest leaf blades in *Dichanthelium arenicollinum* are 13 cm long × 11 mm wide and are basal.

Autumnal spikelets of *Dichanthelium arenicollinum* are 2.6–2.9 mm long × 1.0–1.1 mm wide, while those of vernal spikelets are 2.3–2.7 mm long × 1.2–1.5 mm wide; the autumnal spikelets are also more strongly attenuate basally. The glumes and lower lemma of autumnal spikelets diverge from the central axis by as much as 45 degrees or more, similar to the habit of *D. malacon* (Nash) LeBlond. It is most readily distinguished from the other members of sect. *Pedicellata* by the following floral characters:

KEY

1. Spikelets 2.3–2.9 mm long × 1.0–1.4 mm wide; lower glumes 0.9–1.3 mm long; upper florets 2.0–2.1 mm long × 1.2–1.4 mm wide ***Dichanthelium arenicollinum***
1. Spikelets 3.2–4.4 mm long × 1.3–1.6 mm wide; lower glumes 1.5–2.2 mm long; upper florets ±3 mm long × 1.3–1.5 mm wide.
2. Cauline leaves 4–7, texture thin, glabrous to minutely hispid; ligule a ciliate membrane; vernal panicles 3–6 cm long 2–4 cm wide; lower glume narrowly triangular ***Dichanthelium pedicellatum***
2. Cauline leaves 8–14, texture thick, firm, puberulent; ligule of cilia only; vernal panicles 3–13 cm long, 2–8 mm wide; lower glume deltoid ***Dichanthelium nodatum***

***Dichanthelium freckmannii* (Poaceae), a new species from the Coastal Plain of North Carolina**

A distinctive but geographically restricted new species of *Dichanthelium* has been found on the outer Coastal Plain of North Carolina, in wet savanna habitat underlain by shallow coquina limestone. Associates include the very rare *Scleria bellii* LeBlond, *Rhynchospora thornei* Kral, *Carex lutea* LeBlond, *Coreopsis aristulata* LeBlond, Sorrie, & Weakley, *Thalictrum cooleyi* H.E. Ahles, and an undescribed species of *Allium* per Weakley and Southeastern Flora Team (2023), as *Allium* species 1. The specific epithet honors Robert W. Freckmann, co-author with Michael G. Lelong of the *Dichanthelium* treatment in *Flora of North America* Volume 25 (Freckmann & Lelong 2003). His extensive research while at the University of Wisconsin has greatly clarified and expanded our knowledge of this large and complex genus.

***Dichanthelium freckmannii* LeBlond, sp. nov. (Fig. 22).** TYPE: U.S.A. NORTH CAROLINA: Onslow and Pender counties: Sandy Run Savannas State Natural Area, in wet pine savanna habitat recovering from clear-cut, about 800 m N of Shelter Swamp Creek on the border of Onslow and Pender counties, lat. 34.61409, long. –77.63201, 6 Jun 2013, LeBlond 6960, Weakley, & Sorrie (HOLOTYPE: NCU; ISOTYPE: US).

Diagnosis.—*Dichanthelium freckmannii* may be a hybrid of *D. scabriusculum* (Elliott) Gould & C.A. Clark and *D. scoparium* (Lam.) Gould, but the vernal spikelets are shorter than those of either of the putative parents,



Fig. 22. Holotype of *Dichantherium freckmannii*. Image by Shanna Oberreiter (NCU).

and the cauline leaves are fewer. Autumnal spikelets are longer and narrower than the vernal, a condition that has not been reported for the other two species.

Description.—Vernal culms 1-few, cespitose to short-rhizomatous, stout, 70–140 cm long, 1.5–2.5 mm wide at lowest elongate internode. Lower internodes moderately densely ascending papillose-pilose, medial and distal internodes becoming less densely pubescent with mixed orientation hairs 1–2 mm long. Nodes bearded with densely retrorse hairs 1–2.5 mm long at proximal nodes, hairs becoming 0.5–1 mm long on distal nodes. Winter rosette not seen. Basal leaf sheaths erect, their blades erect to retrorse, from 3.8–12.8 cm long $\times$ 4–12 mm wide. Cauline leaves 4–7. Sheaths shorter than internodes, moderately densely papillose-pilose with hairs 1–2 mm long of mixed orientation, becoming less dense on distal sheaths; collars densely pubescent; lower and mid-culm sheaths 3.5–9.5 cm long, distal-most sheath (of flag) 4.5–13 cm long. Ligules 1.2–3 cm long, densely ciliate, membranous portion 0.1–0.4 mm long. Blades linear-lanceolate, gradually tapered distally to acuminate-aristate apex, bases narrowly rounded to subcordate to truncate, 7–20 cm long $\times$ 5–10 mm wide, averaging more than 15 $\times$ as long as wide; adaxial surface sparsely pubescent proximally, glabrate distally, the surface smooth to sparsely scabrous; abaxial surface moderately pubescent to moderately densely velvety-pubescent; margins scabrous, eciliate to ciliate basally; uppermost blade (flag) 3.5–6 cm long $\times$ 4–6 mm wide. Peduncles 5.5–13.5 (–23.5) cm long when mature, moderately short pubescent. Panicles 7.5–14 cm long $\times$ 4.5–7 cm wide, averaging less than half as wide as long; rachis short-pubescent proximally, glabrate distally; branches glabrate and spreading-ascending to ascending; pedicels glabrous. Vernal spikelets 1.9–2.3 mm long, 0.9–1.0 mm wide, elliptic, acute, moderately densely puberulent with hairs 0.1–0.2 mm long; lower glumes 0.5–0.7 mm long, 1/2–1/3 as long as spikelet, ovate with rounded (–acute) apex; upper glumes and lower lemmas subequal, exceeding fertile lemma by about 0.2 mm; upper lemma 1.7–1.8 mm long $\times$ 0.7–0.8 mm wide. Autumnal culms branching from mid and especially upper nodes, the top-heavy culms sprawling over other vegetation. Primary (aestival) branching begins 35–75 cm above culm base. Fascicled leaves of secondary (autumnal) branches 1–3 cm long $\times$ 1.5–5 mm wide. Autumnal panicles hidden in the fascicles. Spikelets 2.2–2.5 mm long, 0.8–1.1 mm wide, longer and proportionately narrower than vernal spikelets.

Etymology.—The specific epithet honors Robert W. Freckmann, co-author with Michel G. Lelong of the *Dichantherium* treatment in *Flora of North America* Volume 25 (Freckmann & Lelong 2003). His extensive research while at the University of Wisconsin has greatly clarified and expanded our knowledge of this large and complex genus.

Additional collections: **U.S.A. North Carolina. Onslow/Pender cos.:** Sandy Run Savannas State Natural Area, in wet pine savanna habitat recovering from clear-cut, about 800 m N of Shelter Swamp Creek on the border of Onslow and Pender counties, lat. 34.61409, long. –77.63201, 29 Oct 2014, *LeBlond* 7159 (PARATYPE: NCSC, NCU); 76 Jun 2022, *LeBlond* 7189 (PARATYPES: FLAS, MO, USCH).

Distribution and ecology.—The type locality on the border of Onslow and Pender counties in North Carolina is currently the only known population of *Dichantherium freckmannii*. Habitat is a fire-adapted wet pine savanna recovering from a circa-1980 clear-cut and surface disturbance, with the soil having a calcareous influence from a subterranean coquina limestone layer. The natural community has been classified as a Very Wet Loamy Pine Savanna by the North Carolina Natural Heritage Program. “These communities are very rare, with a limited and patchy geographic range. They often, maybe always, have inclusions where soils are high in calcium and have a higher pH (5.5 to 7.2), but the majority of their soil is similar to other pine savannas (pH 3.8–4.1)” (Schafale 2023). The site is also the type locality for *Scleria bellii*, and associates include *Rhynchospora thornei*, *Carex lutea*, *Coreopsis aristulata*, *Thalictrum cooleyi*, *Allium* species 1 (sensu Weakley & Southeastern Flora Team 2023), *Dichantherium scoparium*, *D. scabriusculum* and *Scleria pauciflora* Muhl. ex Willd. var. *caroliniana* Alph. Wood.

Discussion.—The stout, long sulcate culms, leaf blade length and subcordate bases, and top-heavy autumnal branching align this entity with *Dichantherium scoparium* and *D. scabriusculum*, both of which occur at the site. It differs from both primarily by vernal spikelet length, in number of nodes per culm, and in having longer and relatively narrower autumnal spikelets. Several other characters can be used to separate *D. freckmannii* from the other two species individually, as in the following key.

KEY

1. Culm nodes glabrous to puberulent; ligule an eciliate membrane 0.5–1.3 mm long; blade abaxial surface glabrous (–sparsely pubescent basally); peduncle scabrous to smooth (rarely pubescent); panicle rachis glabrous, usually pellucid-punctate _____ **Dichanthelium scabriusculum**
1. Culm nodes retrorsely bearded; ligule densely ciliate, 0.5–3 mm long; blade abaxial surface moderately to densely pubescent; peduncle moderately to densely short-pubescent; panicle rachis pubescent proximally, glabrate distally, not pellucid-punctate.
 2. Lowest elongate internode 2.1–3.5 mm wide; cauline leaves 7–11; ligule 0.5–2 mm long; vernal culm blades 9–20 mm wide, averaging 10× or less as long as wide, adaxial surface densely soft-pubescent; vernal panicles 5–12 cm wide, more than half as wide as long when mature; vernal and autumnal spikelets 2.2–2.8 mm long × 1.3–1.5 mm wide, ovoid-ellipsoid to obovate, abruptly pointed; upper glume shorter than fertile lemma _____ **Dichanthelium scoparium**
 2. Lowest elongate internode 1.6–2.5 mm wide; cauline leaves 4–7; ligule 1.2–3 mm long; vernal culm blades 5–10 mm wide, averaging 15× or more as long as wide, adaxial surface sparsely pubescent proximally, glabrate distally; vernal panicles 4.5–7 cm wide, less than half as wide as long when mature; vernal spikelets 1.9–2.3 mm long × 0.9–1.0 mm wide, ellipsoid, acute; autumnal spikelets 2.2–2.5 mm long × 0.8–1.1 mm wide, narrowly elliptic, acute to long-acute; upper glume exceeding fertile lemma _____ **Dichanthelium freckmannii**

New and Noteworthy Vascular Plant Records for Alabama

Primary authors: T. Wayne Barger, Alan M. Cressler, Noah D. Yawn, and Chris Oberholster

During routine plant surveys extending to all portions of Alabama, eight noteworthy native species, *Arnica acaulis*, *Asarum acuminatum*, *Asclepias connivens*, *Berberis canadensis*, *Bulbostylis warei*, *Ctenodon viscidulus*, *Parnassia grandifolia*, and *Pinguicula pumila*, were collected and are reported herein as one state record, six historical records, and one notable range extension for the state. Determination of noteworthy status was ascertained by using the *Alabama Plant Atlas* (Keener et al. 2023), *BONAP-Synthesis* (Kartesz/BONAP 2024), *NatureServe* (NatureServe Explorer 2024), *SERNEC Data Portal* (SERNEC 2024), the *Flora of the Southeastern United States* (Weakley & Southeastern Flora Team 2023) and other literature searches. Vouchered specimens were deposited in the Alabama Natural Heritage Section Heritage Herbarium (ALNHS). Precise plant locations are withheld due to the sensitive nature of the plant populations described and/or special permissions required for access to each site.

***Arnica acaulis* (Walt.) Britton, Sterns, & Poggenb. [Asteraceae] Leopardbane**

Listed as an SH-S1/G4 taxon (ALNHP 2023; Keener et al. 2023), Leopardbane had previously been collected only once [Houston Co., 7 May 2005, Kral 96213 (GA, TROY, USCH)] from Alabama, 18 years before the current collection. Due to the non-specific label data, the site of the original collection was unknown. *Arnica acaulis* has been considered historic in Alabama (Keener et al. 2023) and an S1 (ALNHP 2023), this collection removes doubt that the species should be considered extant for Alabama. More common in North Carolina, South Carolina, and Virginia, *A. acaulis* is thinly distributed from Alabama to Pennsylvania (Kartesz/BONAP 2024; Weakley & Southeastern Flora Team 2023).

Arnica acaulis is known to occur in a variety of open grassland habitats, including pine sandhills, sandy oak-pine woodlands, savannas, and, in the northern portions of its range, serpentine barrens. Associated species for this report include *Chaptalia tomentosa* Vent., *Drosera brevifolia* Pursh, and *Marshallia graminifolia* (Walter) Small.

Voucher Specimen: ALABAMA. Houston Co.: Rare in dark, open, mucky soils of former wet pine-savanna, 22 Mar 2023, T. Wayne Barger 5944 (ALNHS8050).

***Asarum acuminatum* (Ashe) E.P. Bicknell [Aristolochiaceae] Hydra-Flower Wild-Ginger**

This collection marks the first report for Alabama of this taxon, formerly often only recognized at the varietal level of or under synonymy with *A. canadense* L. (Ashe 1897; Whittemore et al. 1997; Weakley & Southeastern Flora Team 2023). The next closest observation known for Hydra-Flower Wild-Ginger is from approximately 70 miles (113km) to the north, near Smithville, Tennessee [DeKalb Co., 28 Apr 1992, Kral 80256 (APSC)]. Hydra-Flower Wild-Ginger's distribution is unclear at present due to only recent widespread recognition, though it appears it is predominantly west of the Blue Ridge Mountains (Estes 2015; Weakley & Southeastern Flora Team 2023). This station in the southern Cumberland Plateau may represent a southerly distribution limit for the species.

Asarum acuminatum is distinct from *A. canadense* by its spreading, long-caudate erect calyx lobes and overall larger calyx tube (see Fig. 23); additionally, its calyx lobes are ascending to antrorse at floral maturity compared to Canadian Wild-Ginger's retrorse calyx lobes at floral maturity (Estes 2015). Ashe (1897) originally described the taxon as a variety of *A. canadense* based on these floral characters, as well as its seemingly more membranous, densely pubescent leaves (Kelly 2001). The leaf shape is diagnostic for this taxon later in the growing season; *A. acuminatum* possesses leaves that are approximately as wide as long, whereas *A. canadense* has leaves that are wider than their length at maturity (D. Estes, pers. comm.). Additionally, distributions of *A. acuminatum* and *A. canadense* are unclear because they were previously considered conspecific with the similar but distinct and southerly *Asarum reflexum* E.P. Bicknell. The Spaulding et al. (2019) treatment of the genus for Alabama concluded that *A. canadense* s.s. is currently restricted to Jackson County, which is similar to the range of *A. acuminatum* in the state. While *A. acuminatum* and *A. canadense* both possess larger, spreading calyx lobes that taper to acuminate or revolute tips, respectively (Estes 2015; Weakley & Southeastern Flora Team 2023), *A. reflexum*, the most common species of deciduous ginger in the state, possesses calyx lobes that are shorter than those of the former two species, gradually taper to an acute and flattened tip, and are sharply reflexed and remain spread at anthesis (Keener et al. 2023).

Voucher Specimen: **ALABAMA. Jackson Co.:** uncommon on NE-facing limestone talus slopes on The Nature Conservancy of Alabama (TNC)/Paint Rock Forest Research Center property in well-drained soils within seasonal limestone talus wash channels; calyx lobes long tapered and spreading, 18 Apr 2021, Noah D. Yawn 151, & Alan Cressler, Bill Finch, and Beth Maynor Finch (ALNHS 7860). **STATE RECORD.**

***Asclepias connivens* Baldw. ex Ell. [Apocynaceae] Large-Flower Milkweed**

With only one previously known Alabama collection from June 1974 [Covington Co., 25 Jun 1974, Kral 53454 (BRIT)], the second collection of this uncommon S1 species (ALNHP 2023) comes 46 years after its initial discovery in the state (SERNEC 2024). Large-flower milkweed inhabits wet pine flatwoods and seepage bogs in the lower coastal plain of South Carolina, Georgia, and into the panhandle of Florida (Kartesz/BONAP 2024; Weakley & Southeastern Flora Team 2023), where it is most commonly encountered in savannas with *Sarracenia* spp. This Alabama collection represents an extension of the western distribution limit for the species.

Voucher Specimen: **ALABAMA. Covington Co.:** Open remnant of wet pine savanna on S side of roadway; much woody encroachment, fire needed, 4 Jun 2020, T. Wayne Barger 5206 (ALNHS 6790).

***Berberis canadensis* Mill. [Berberidaceae] American Barberry**

This species was previously known from four counties in Alabama through historical collections (Jefferson County in 1944, Lee County in 1968, Shelby County in 1944, and Tuscaloosa County in 1933), so the present Bibb County collection marks the first collections of this rare S1 (ALNHP 2023; Keener et al. 2023) taxon for Alabama in 55 years [Lee Co., 20 Apr 1968, Carr 75 (AUA)]. Many directed searches at each previously known collection site were unproductive in relocating the taxon.

The rarity of *B. canadensis* is often attributed to a widespread eradication program in the early 20th century due to its ability to vector the black stem rust, *Puccinia graminis* Pers., a fungus that disastrously affects cereal crops (Strausbaugh & Core 1978). These efforts resulted in the destruction of an estimated 150 million American barberry shrubs between the years 1935–1950 across its range (Strausbaugh & Core 1978). However, southeastern United States populations of the species likely did not experience as severe eradication pressure due to the low survivability of black stem rust in the climate of the deeper South. Perhaps loss of primary fire-maintained woodlands has instead or also played a significant role in the decline of *B. canadensis* (Hill 2003).

Voucher Specimens: **ALABAMA. Bibb Co.:** Thin soils overlain on west facing Ketona Dolomite outcrop; small population of (possibly clonal) shrubs totaling ca. 300 stems; dried pedicels observed, 3 Jul 2020; with *Echinacea purpurea* (L.) Moench, *Thalictrum amphibolum* Greene, *Myriopteris lanosa* (Michx.) Grusz. & Windham, *Clematis glaucophylla* Small, under *Juniperus virginiana* L., 3 Jul 2020, Noah D. Yawn 53 & Alan Cressler (ALNHS 6942); 23 Jul 2020, T. Wayne Barger 5301 & Noah D. Yawn (ALNHS 6942).

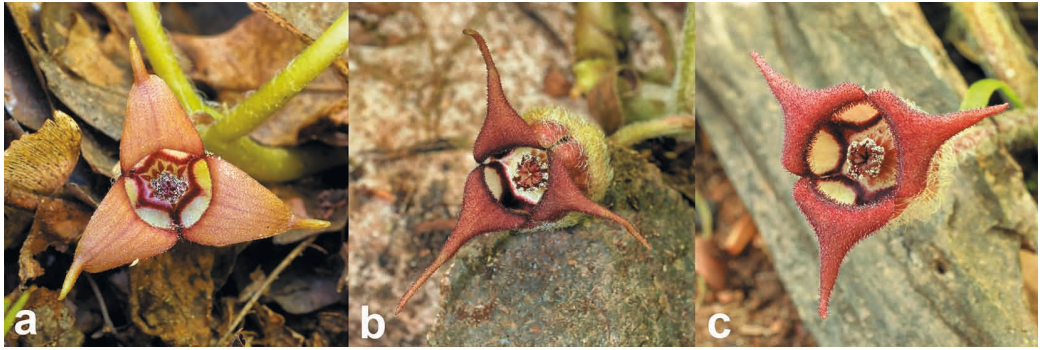


FIG. 23. Flower comparison of all three southeastern *Asarum* taxa: **a.** *Asarum reflexum*, Montgomery County, AL; **b.** *Asarum acuminatum*, Jackson County, AL; **c.** *Asarum canadense*, Jackson County, AL. Flowers not to scale. Photographs: Alan M. Cressler.

***Bulbostylis warei* (Torr.) C.B. Clarke [Cyperaceae] Ware's Hair Sedge**

Bulbostylis warei (Torr.) C.B. Clarke is reported herein for only the third time since its discovery in Alabama by Roland Harper in 1949 [Baldwin Co., 10 Aug 1949, Harper 4123 (UNA)]. Though present throughout much of Florida, the S1 species (ALNHP 2023; Keener et al. 2023) is uncommon in Georgia and South Carolina (Kartesz/BONAP 2024) and is considered extirpated in North Carolina (Kartesz/BONAP 2024). Each of the previous Alabama collections was from coastal Baldwin County islands/dune swales near the Florida state line. Searches along roadways and undisturbed lots of deep, sandy areas revealed two isolated populations in high-risk areas that are subject to residential development and habitat destruction.

Bulbostylis warei is encountered in longleaf pine sandhills, as well as dry pine flatwoods, aeolian dunes, and Florida scrub oak pine forest (Weakley & Southeastern Flora Team 2023), rendering it a rare species in Alabama as a function of limited habitat.

Voucher Specimens: **ALABAMA. Baldwin Co.:** Rare in deep, white sands of coastal area; NE quadrant of undeveloped lot with minimal/sparse groundcover, 6 Nov 2019, T. Wayne Barger 5017 (ALNHS 6651); numerous individuals in upland sands of residential lot to be cleared for development, 21 Sep 2021, Gena Todia 5917 (ALNHS7862).

***Ctenodon viscidulus* (Michx.) D.B.O.S. Cardoso & A. Delgado. [Fabaceae] Sticky Jointvetch**

This report represents the second known collection of this historic taxon (SH/G5) from Alabama, the first since Dr. Charles Mohr collected it from Dauphin Island (Mobile County) in July 1878. Uncommon in a bare sandy opening of a grassy lawn-like expanse of an old Spanish cemetery, plants were localized to a small area. This native taxon is more commonly found in neighboring Escambia County, Florida and much of central Florida. However, outside of this area, *C. viscidulus* is only sporadic from coastal Georgia counties westward to Texas. The rarity of this somewhat hard-to-detect species may be due to it being an ephemeral, short-lived perennial in disturbed or borderline suitable habitat.

Voucher Specimen: **ALABAMA. Baldwin Co.:** Open sandy soils of old Spanish cemetery; former sandy pine flatwoods, approximately 230 m from bay shoreline, 2 Aug 2023, T. Wayne Barger 6135 (ALNHS 8329).

***Elionurus tripsacoides* Humb. & Bonpl. ex Willd. [Poaceae] Pan-American Balsamscale:**

Collected in 1992 from what would later become the state-owned Grand Bay Savanna Forever Wild Complex, this voucher was the first and remains the only collection of Pan-American Balsamscale known from Alabama. Not widely collected outside of Texas and the Florida Panhandle, this 6–8 foot tall, caespitose, perennial grass species is considered historic in Mississippi and has only one recent collection identified from Georgia (Oct 2002, R. Kral 93525, Early Co., GA; NYBG 1597309). Found in low sandy pinewoods and savannas, this taxon's distribution stretches southward through Mexico and Central America to South America.

Voucher Specimen: **Mobile Co.:** 5.2 mi SW of jct w/AL Hwy 188, on University Rd, from Bayou La Batre; Pt. aux Pines, in estuarine slash pine flatwoods; 6' tall, 12 Aug 1992, Chris Oberholster, CO#499, (ALNHS8885). **STATE RECORD.**

Parnassia grandifolia DC. [Parnassiaceae] Large-Leaf Grass-of-Parnassus

Large-Leaf Grass-of-Parnassus was known from a single, isolated locality in Bibb County where a small population (ca. 200 individuals) grows in close association with Ketona Dolomite along a small tributary. This rare S1 (ALNHP 2023; Keener et al. 2023) taxon has been collected from this site in Bibb County (by many botanists) since its discovery there in the late 1970s [Bibb Co., 30 Oct 1977, *Sessler 1938* (AUA)]. The only additional known collection for Alabama was in Choctaw County [Choctaw Co., 12 Oct 1951, Harper 4191 (UNA)] which, despite repeated searches, has not been relocated. The newly reported Conecuh County population, with thousands of individuals, represents the first new county discovery and the largest known population for the species in Alabama in almost 50 years. Compared to the Bibb County population, the plants at this Conecuh County site bear a close resemblance to those of the disjunct Apalachicola Florida region, possibly representing a genetic bridge between Apalachicola and the Appalachian Foothills populations (A. Floden pers. comm. 2020).

Parnassia grandifolia (G3) is uncommon across its southeastern range, primarily growing in the Appalachian and Ozark Highlands, most often in either calcareous or ultramafic settings, and rarely in Coastal Plain fens and seeps (Kartesz/BONAP 2024; Weakley & Southeastern Flora Team 2023). The global rarity of this species, as well as its peculiar distribution, makes this Conecuh County location remarkable in the Alabama flora.

Voucher Specimen: **ALABAMA. Conecuh Co.:** Large population (ca. 10,000 stems) growing on nearly vertical calcareous clay north bank of the Sepulga River with moderate seepage; plants almost rhizomatous in habit, with dark green ovary, emarginate petal margins, and bright, orange pollen; growing with *Pelazconeuron ovatum* (R.P. St. John) A.R. Sm. & S.E. Fawc. and *Adiantum capillus-veneris* L., 17 Nov 2020, Noah D. Yawn 101 (ALNHS 6984).

Pinguicula pumila Michx. [Lentibulariaceae] Small Butterwort

Two previous collections of Small Butterwort are known from Alabama [Baldwin Co., 03 Apr 1966, *Kral 21686* (BRIT); Mobile Co., 15 Apr 1967, *Kral 28309* (BRIT)]. Given the allure and charismatic nature of carnivorous plants, the 54-year gap in collections likely indicates a high degree of rarity of the S1 species (ALNHP 2023; Keener et al. 2023) within the state. *Pinguicula pumila* favors moist to wet, sandy localities, primarily in open pine flatwoods and savannas (Wood & Godfrey 1957). Strangely, *Pinguicula pumila* appears to be the rarest of the *Pinguicula* species in Alabama (Kartesz/BONAP 2024; Keener 2023); this is more puzzling considering its comparatively widespread distribution across the southeastern United States, ranging from North Carolina south into the Florida Keys and the Bahamas and west into eastern Texas (Weakley & Southeastern Flora Team 2023).

Voucher Specimen: **ALABAMA. Mobile Co.:** Mucky soils at edge of drainage through Nyssa woods; *Sarracenia* and *Drosera* spp. present, 7 Apr 2021, William V. Underwood and T. Wayne Barger, SP#5458, (ALNHS7124).

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