

TAXONOMIC SYNOPSIS OF *PITYOPSIS* (ASTERACEAE)

GUY L. NESOM

2925 Hartwood Drive
Fort Worth, Texas 76109
guynesom@sbcglobal.net

ABSTRACT

A taxonomic synopsis of the genus *Pityopsis* recognizes 12 species, none with infraspecific taxa. Most USA populations west of the Mississippi River are treated as ***Pityopsis tenuifolia*** (Torrey) Nesom, **comb. et stat. nov.**, although typical *P. graminifolia* reaches eastern Arkansas, Louisiana, and eastern Texas. Plants in Mexico and Central America are identified as a disjunct segment of *P. graminifolia* sensu stricto. *Pityopsis adenolepis* is regarded as a synonym of *P. aspera*. *Pityopsis microcephala* is a distinct species of the Gulf and South Atlantic coastal plains. Comments on diagnostic features, a formal nomenclatural summary, and a county-level distribution map are provided for each species.

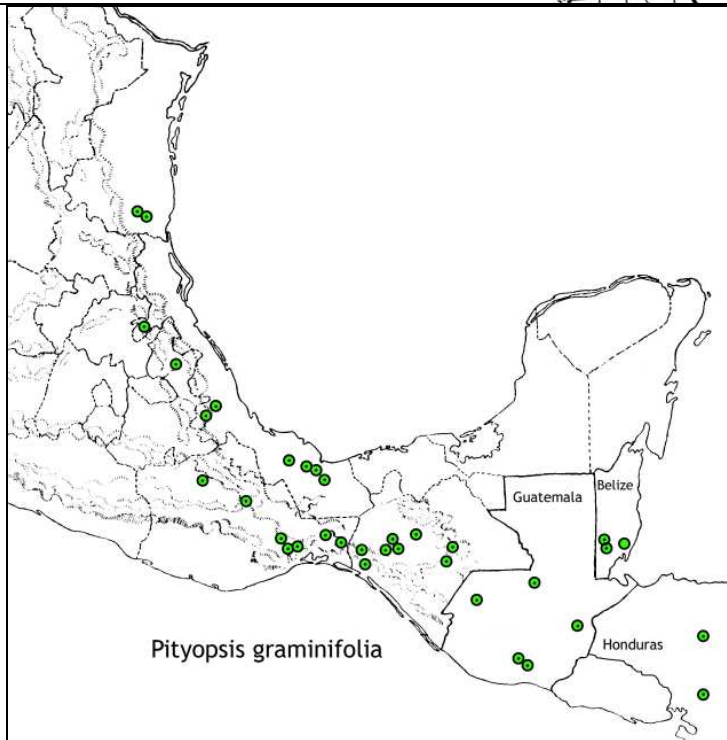
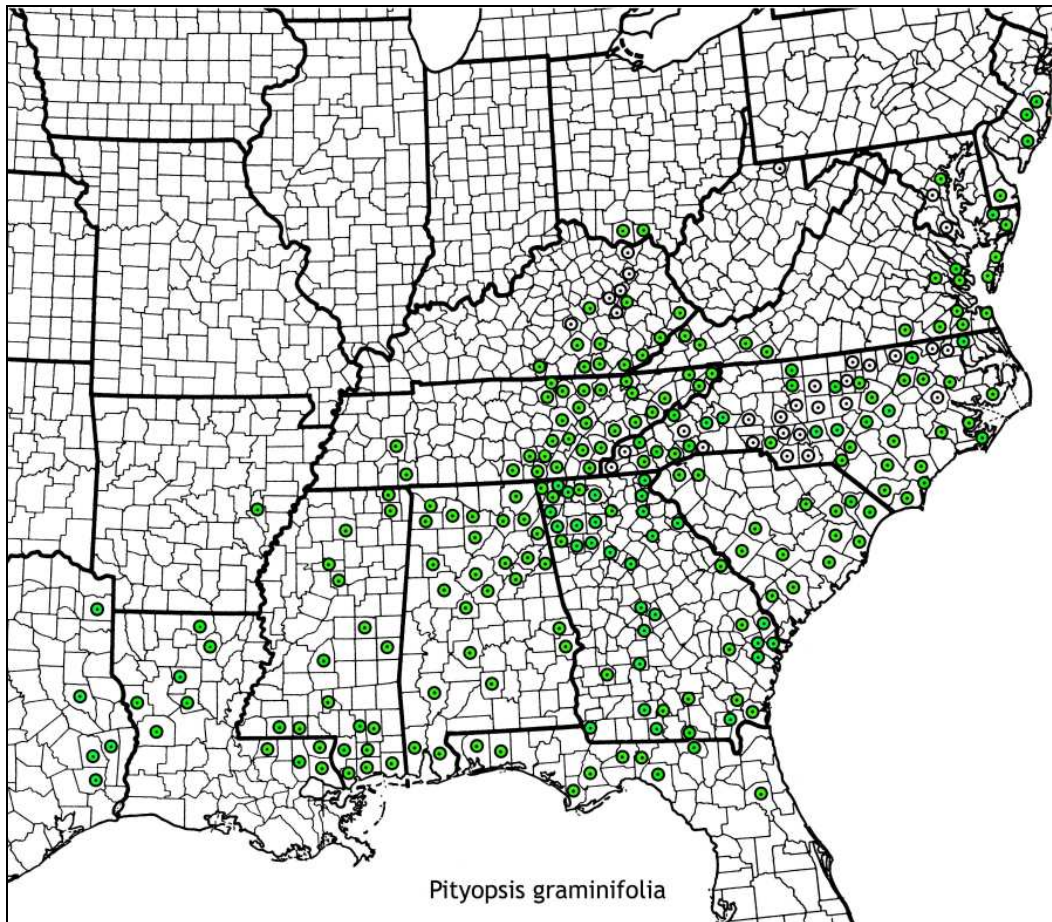
Interpretations of variation and associated nomenclature in *Pityopsis* Nutt. have varied (e.g., Small 1933; Fernald 1947, 1950; Dress 1953; Harms 1969; Bowers 1972; Cronquist 1980; Semple & Bowers 1985; Semple 2006; Weakley & Sorrie 2015). Recent taxonomic assessments of *Pityopsis* in the Florida peninsula (Bridges & Orzell 2018) have advanced an understanding of variation patterns within the genus — from the variable matrix of *P. graminifolia* sensu lato, Bridges and Orzell recognized *P. aequilifolia*, *P. latifolia*, and *P. tracyi* as distinct species. With this potential resolution, remaining taxonomic problems and disagreements in the genus mainly involve variation in plants identified broadly as *P. graminifolia*, as *P. adenolepis* and *P. aspera*, and as *P. oligantha*. The present report provides a taxonomic summary of the genus as a whole, with hypotheses toward resolving these problems.

Classifications and phylogenetic analyses of *Pityopsis* (e.g., Semple & Bowers 1985; Gowe & Brewer 2005; Teoh 2008; Hatmaker 2016) are difficult to interpret because of inconsistencies in identification and apparent inconsistencies in sampling of taxa. About the most that can be concluded with some confidence is that *P. falcata*, *P. ruthii*, and probably *P. pinifolia*, perhaps *P. flexuosa*, are components of one clade — these are taxa that do not exhibit fire-dependent flowering (Gowe & Brewer 2005) and essentially comprise sect. *Pityopsis* of Semple and Bowers (1985), which they characterized by the absence of large basal rosette leaves at the time of flowering. Sect. *Graminifoliae* (Small) Semple of Semple and Bowers (1985) is typified by *P. graminifolia*.

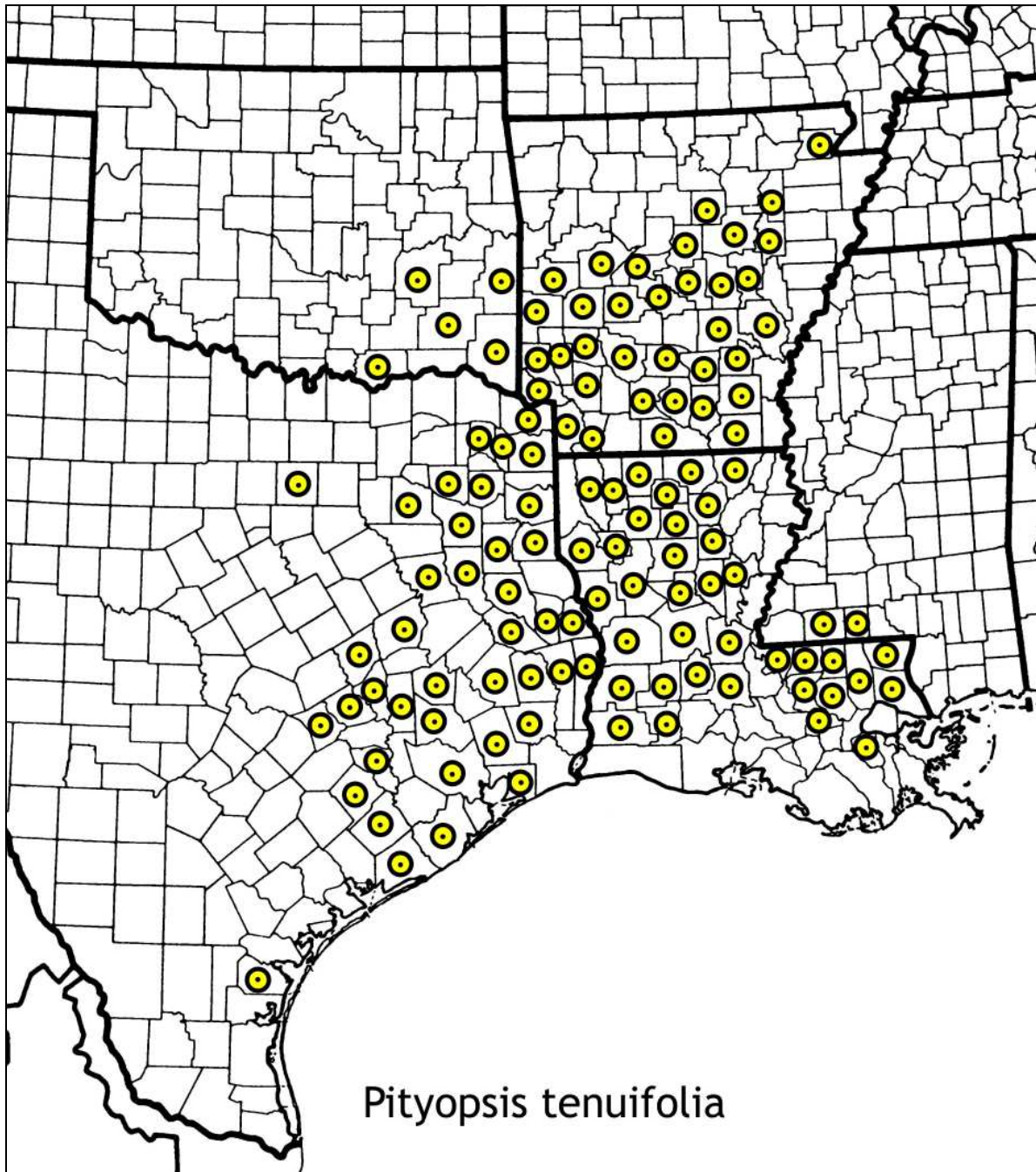
PITYOPSIS Nutt., Trans. Amer. Philos. Soc. ser. 2, 7: 317. 1840. *Chrysopsis* [unranked] *Pityopsis* (Nutt.) Torr. & Gray, Fl. N. Amer. 2(2): 252. 1842. *Heterotheca* sect. *Pityopsis* (Nutt.) Harms, Wrightia 4: 9. 1968. **LECTOTYPE** (Pfeiffer, Nom. 2: 735. 1873): *Pityopsis pinifolia* (Ell.) Nutt.

Heyfeldera Schultz-Bip., Flora 36: 35. 1853. **TYPE:** *Heyfeldera sericea* Schultz-Bip.

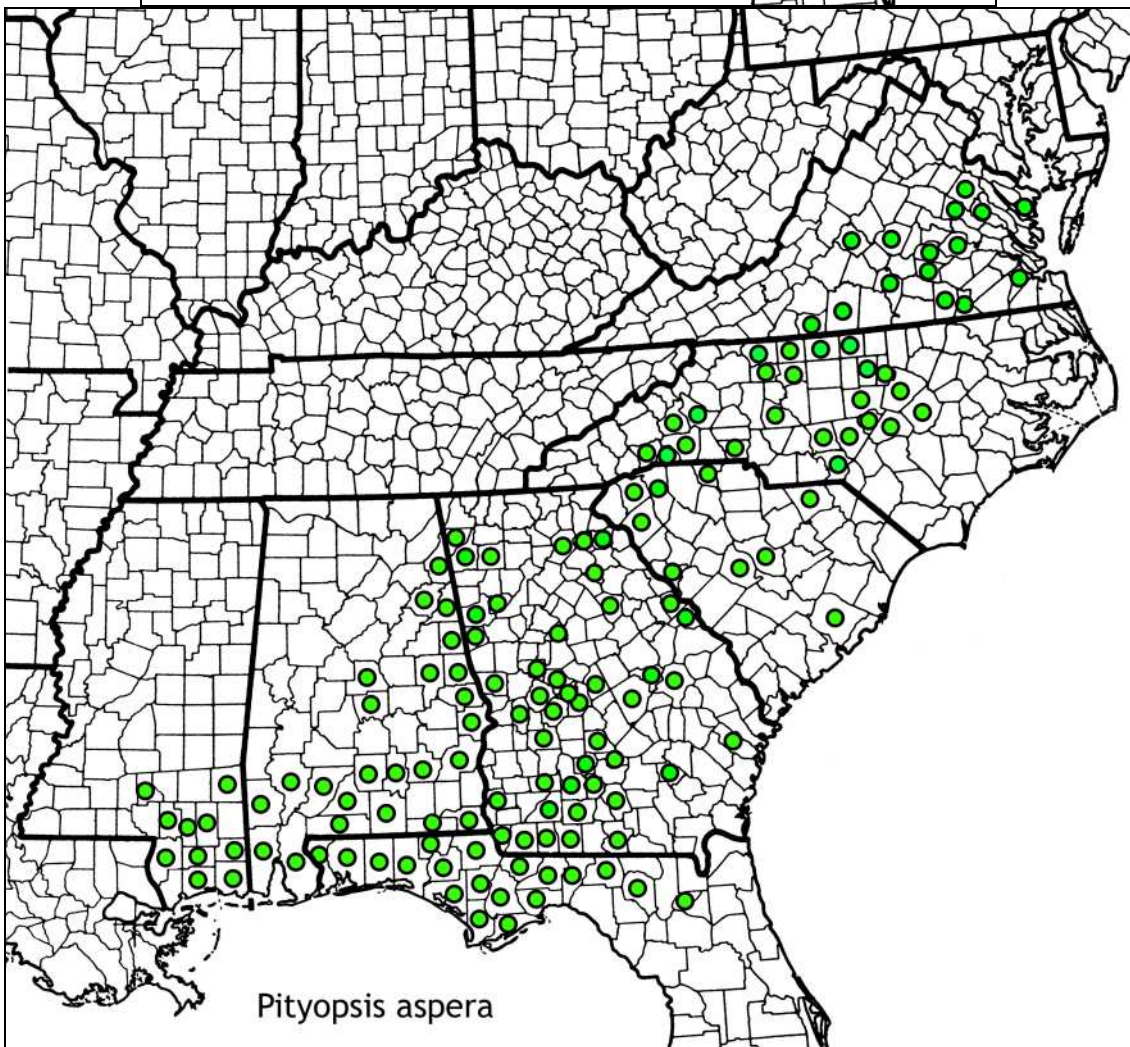
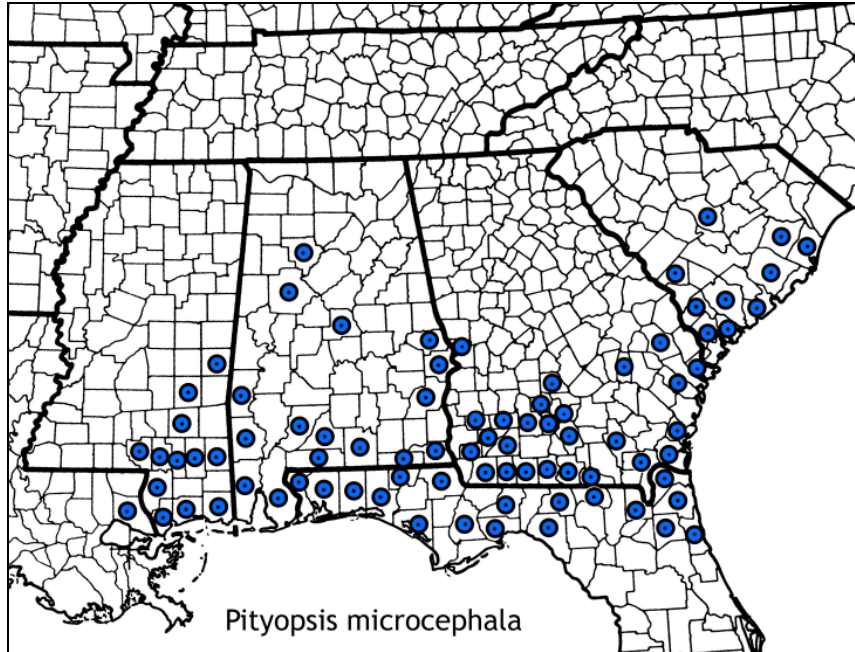
Herbaceous perennials, fibrous-rooted, usually with slender rhizomes or basal offsets. Indument silky-sericeous, of mostly appressed, anastomosing hairs, sometimes with stipitate glands. Leaves alternate, simple, entire, linear to linear-lanceolate or linear-oblongate, with parallel venation. Heads few to many in an open panicle; involucre turbinate; phyllaries in 4–8 graduated series. Ray corollas pistillate, fertile, yellow, coiling with maturity. Disc florets bisexual, fertile. Achenes of ray and disc similar, fusiform, loosely strigose; pappus of two series, the inner of barbellate bristles, the outer of much shorter setiform bristles or setae. Base chromosome number $x=9$.



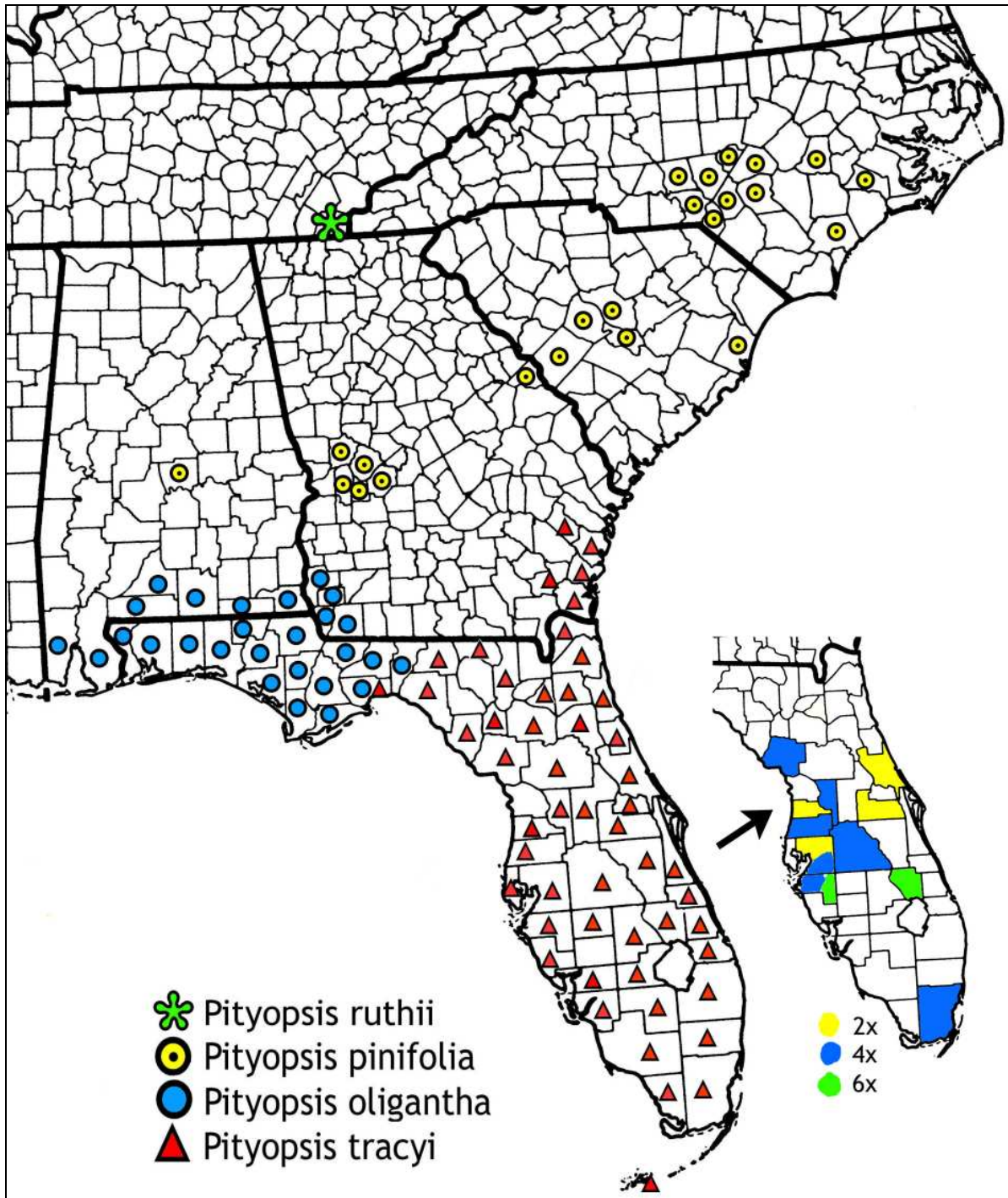
Maps 1 and 2. Distribution of *Pityopsis graminifolia*. Uncolored symbols are reliable records for which the author has not seen a voucher. The 'undotted' symbol in Belize perhaps is *P. tracyi* (text comments).



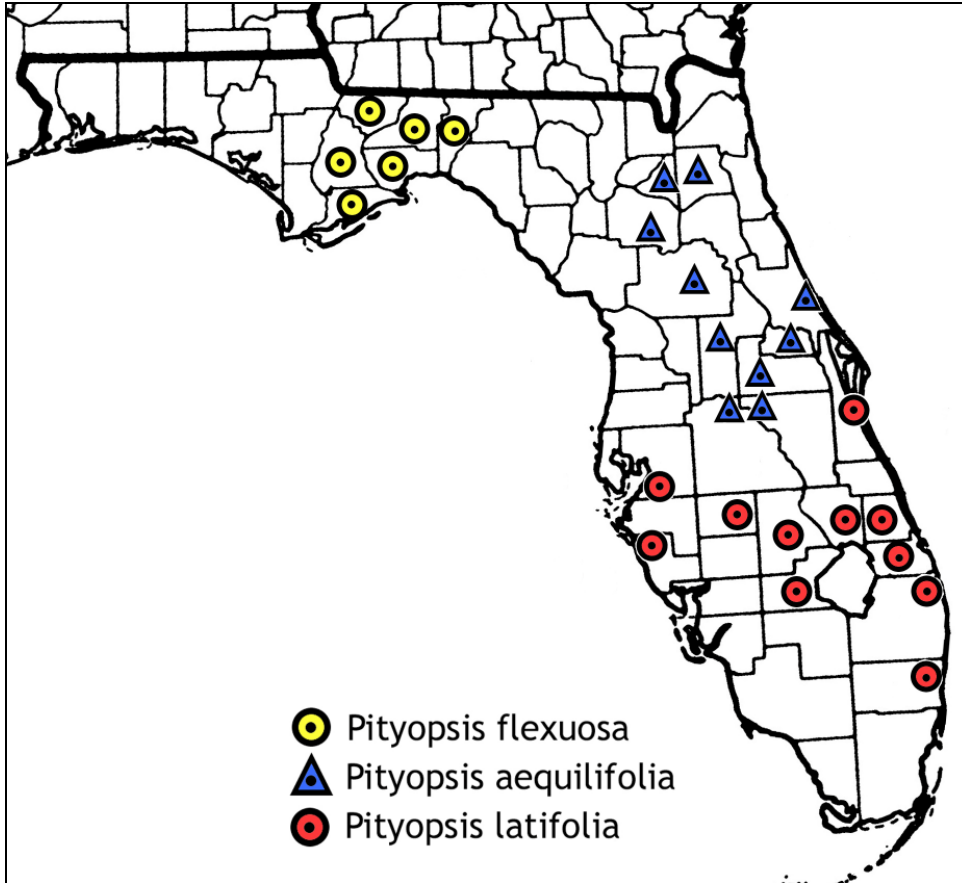
Map 3. Distribution of *Pityopsis tenuifolia*. Vouchers seen for most except a few in Arkansas.



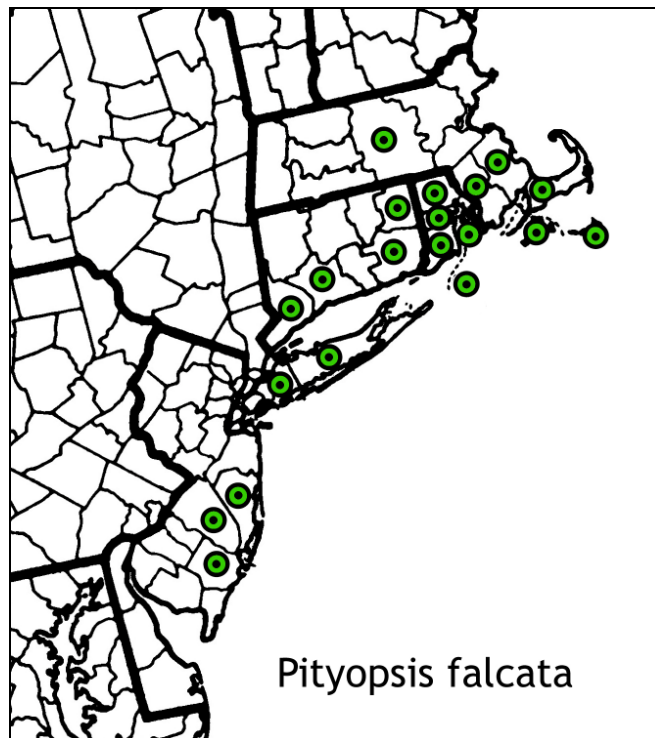
Maps 4 and 5. Distribution of *Pityopsis microcephala* and *P. aspera*. Vouchers seen.



Map 6. Distribution of *Pityopsis ruthii*, *P. pinifolia*, *P. oligantha*, and *P. tracyi*. Vouchers seen. Inset shows distribution of chromosome counts for *P. tracyi* (see text for data).



Map 7. Distribution of *Pityopsis flexuosa*, *P. aequilifolia*, and *P. latifolia*. Vouchers seen.



Map 8. Distribution of *Pityopsis falcata*. Mostly from literature.

1. ***Pityopsis aequilifolia*** (Bowers & Semple) Bridges & Orzell, J. Bot. Res. Inst. Texas 12: 31. 2018. *Pityopsis graminifolia* var. *aequilifolia* Bowers & Semple, Phytologia 58: 430. 1985. **TYPE: Florida.** Lake Co.: Tavares, sandy roadside on Fla Hwy 19, S of old US Hwy 441, 20 Sep 1971, *B.E. Wofford & F.D. Bowers 71-558* (holotype: TENN, image! in Bowers 1972). Map 7.

A distinctive species known from eight counties of north-central Florida. It is characterized by densely arranged, relatively broad and spreading (vs. narrow and closely appressed, as in *Pityopsis tracyi*), equal-sized cauline leaves, without enlarged, persistent basal leaves. Chromosome number diploid (citations below). Perhaps not distinct from *P. latifolia* (see comments following the latter).

Representative collections. Florida. Alachua Co.: Ashton Biological Research Station, 15 mi WSW of Gainesville, near Watermelon Pond, longleaf pine with *Quercus geminata* and *Q. incana*, 19 Oct 2001, *Carr 3964* (FLAS). Bradford Co.: 1.5 mi NW of Clay Co. line on Fla Hwy 100, 27 Oct 1978, Semple 4001, **2n=18** (USF). Clay Co.: ca. 8.1 air mi NW of Middleburg, ca. 1 air mi S of Duval Co. line, dry longleaf pine sandhills, 16 Oct 1992, *Orzell & Bridges 21159* (BRIT). Lake Co.: Fla Rte 19 ca. 7 mi S of jct with Fla Rte 20, sand pine scrub, 1 Nov 1978, *Godfrey 76863* (TTRS); ca. 5 air mi SE of Clermont, SW of powerline at dead end of unimproved road, 0.5 air mi S Hartwood Marsh Rd at a point 4.2 mi E of int US Hwy 27, overgrown longleaf pine-wiregrass sandhill and scrub, 8 Nov 1990, *Orzell & Bridges 15759* (FTG, TEX); 1 mi N of Altoona, deep sandy soil along RR, 27 Jul 1960, *Turner 4672* (SMU). Marion Co.: Rte 40 between Silver Springs and Rte 19, Ocala Natl Forest, dry sandy, sand pine scrub, 22 Nov 1980, *Gholson 8618* (FLAS); S of Juniper Spring Run, by Fla Rte 19, N of Fla Rte 40, S of Salt Spring, Ocala Natl Forest, sand pine-scrub oak sand ridge, 22 Nov 1980, *Godfrey 78274* (TTRS); 2.8 mi S of Salt Spring by Fla Rte 19, abundant in sandhill clearing (formerly sand pine scrub), 14 Oct 1987, *Godfrey 82582* (FTG); ca. 2 mi S of Salt Springs, Ocala Natl Forest, W side of FS Rd 65, 0.5 mi S of intersect. Fla Hwy 19, burned upland sandy longleaf pine savanna, 28 Apr 1990, *Orzell & Bridges 13272* (FTG); 9.6 km W of Juniper Springs on Hwy 40, Ocala Natl Forest, 1.0 km E of Forest Rd 579, edge of pine woods in road ROW, 23 Oct 1999, *Semple 10908*, **n=9II** (BRIT). Osceola Co.: 1 mi E of Loughman on Fla Hwy 54, dry open roadside, 7 Oct 1973, *Baltzell 5390* (FLAS). Polk Co.: Ca. 2.6 air mi E of the center of Davenport, W edge of Reedy Creek Swamp near mouth of Horse Creek, longleaf pine-turkey oak-wiregrass sandhill woodland, 12 Nov 1990, *Orzell & Bridges 15862* (FTG); ca. 1.3 air mi SE of the center of Davenport, W of Powerline Rd, just N of intersect. Snell Creek Rd, open, fire-maintained, disturbed sandhill, longleaf pine-turkey oak, 12 Nov 1990, *Orzell & Bridges 15885* (FTG, TEX); Davenport, sandy place, 20 Oct 1946, *Schallert 19882* (SMU); N of Withla on Co. Rd 33, 1.0 km S of Lake Co. line, disturbed sand, road ROW, 23 Oct 1999, *Semple 10905*, **n=9II** (BRIT, USF). Seminole Co.: 7.5 mi W of Sanford on Fla Hwy 46, sandy clearings in scrub, 2 Oct 1976, *Kral 59232* (VDB, VSC); ca. 4 mi SE of Sanford on US Hwy 17/92, weedy, moist, sandy margin of small pond in white sand *Pinus clausa* scrub, 28 Apr 1961, *Ray 10886* (USF); 5 mi S of Sanford, Hwy 17-92 at 5-Points, dry sandy field, 8 Jul 1966, *Scudder 7* (FLAS). Volusia Co.: [Daytona Beach], 1.4 mi S on Peninsula Drive from intersect. with Broadway St, sand pine grove, 30 Dec 1980, *Robinson 68* (USF).

2. ***Pityopsis aspera*** (Shuttlew. ex Small) Small, Man. S.E. Fl. 1341. 1933. *Chrysopsis aspera* Shuttlew. ex Small, Fl. S.E. US, 1182. 1903. *Heterotheca aspera* (Shuttlew. ex Small) Shinnars, Sida 3: 348. 1969. **TYPE: Florida.** Leon or Wakulla Co.: Inter Tallahassee et St. Marks, in pinetis, Aug 1843, *F. Rugel 484* (holotype: NY; isotypes: HAL image!, K image!, US image!). Rugel's apparent collection number, "484," is on the US label but not the others. Map 5.

Chrysopsis graminifolia var. *aspera* A. Gray, Syn. Fl. N. Amer. 1(2): 121. 1884. **TYPE: Florida.** Leon or Wakulla Co.: Inter Tallahassee et St. Marks, in pinetis, Aug 1843, *F. Rugel 484* (holotype: NY image!; isotypes: HAL image!, K image!, US image!). In synonymy, Gray cited "(*C. aspera*, Shuttlew. in distrib. coll. Rugel)." In an account of Rugel collections from western Florida and Alabama, "Ch.[rysopsis] *aspera* Shuttl. n. sp." was listed in Bot. Zeit. 3:

221. 1845 — as a nomen nudum, probably taken from the printed label of Rugel's distribution.

Chrysopsis adenolepis Fernald, *Rhodora* 44: 471. 1942. *Heterotheca adenolepis* (Fernald) Ahles, J. Elisha Mitchell Sci. Soc. 80: 172. 1964. *Pityopsis adenolepis* (Fernald) Semple, *Canad. J. Bot.* 58: 148. 1980. *Pityopsis aspera* var. *adenolepis* (Fernald) Semple & Bowers, *Univ. Waterloo Biol. Ser.* 29: 18. 1985. **TYPE: North Carolina.** Moore Co.: Pinehurst, old barren fields, 19 Aug 1897, *O. Katzenstein s.n.* (holotype: GH image!).

Harms (1969), Semple and Bowers (1985), and Semple (2006) treated *Pityopsis aspera* as including the typical form and *P. aspera* var. *adenolepis*. In the view of Semple and Bowers (following Bowers 1972 and Semple 1980, both of whom treated [*Chrysopsis*] *adenolepis* at specific rank), typical *P. aspera* is restricted to a small area of north-central Florida and adjacent Georgia and is diagnostically identified by stipitate-glandular peduncles, distal (and sometimes mid) stem portions, and margins of distal leaves. Plants identified as *P. adenolepis* or *P. aspera* var. *adenolepis* have involucre and a variable portion of the peduncles stipitate-glandular, but in contrast to *P. aspera*, faces of least distal leaves and most of the stem length are silky-sericeous; leaves rarely are glandular-margined.

In the view here, *Pityopsis aspera* is a distinctive species from Virginia southwest to Mississippi — characterized by involucre, peduncles, and a variable portion of the stem length stipitate-glandular and without sericeous vestiture. Outer to inner phyllaries are triangular and usually coarsely stipitate-glandular along the whole length. Glands along margins of distal leaves are more common in Florida and southern Georgia than elsewhere in the range but a geographic boundary does not appear to be sharply defined and there is considerable variation in the number and density of marginal glands. The portion of stem/peduncle that is stipitate-glandular is variable, but nowhere in the range are the stems glandular completely to the base. *Pityopsis aspera* spreads colonially through short basal offsets as well as longer, slender rhizomes.

Diploid and tetraploid chromosome numbers have been recorded for *Pityopsis aspera* sensu lato (Semple & Bowers 1987). Following the maps in Semple and Bowers (1987, Figs. 2 and 3), diploids (including *P. aspera* sensu stricto of Bowers and Semple) are restricted to the coastal plain from North Carolina to Florida and apparently do not overlap in range with the tetraploids. A morphological difference that would consistently distinguish putative diploids from tetraploids is not evident.

3. *Pityopsis falcata* (Pursh) Nutt., *Trans. Amer. Philos. Soc.*, n.s. 7: 318. 1840. *Inula falcata* Pursh, *Fl. Amer. Sept.* 2: 532. 1814 [1813]. *Inula mariana* var. *falcata* (Pursh) Nutt., *Gen. N. Amer. Pl.* 2: 151. 1818. *Chrysopsis falcata* (Pursh) Ell., *Sketch Bot. S. Carolina* 2(4): 336. 1824 [1823]. *Heterotheca falcata* (Pursh) Harms, *Castanea* 34: 408. 1969 [1970]. **TYPE: Protologue:** "Herb. Banks. mss. In sandy pine-woods: New Jersey." **NEOTYPE** (Semple & Bowers 1985): **New Jersey.** No other locality data, 1836, *J. Torrey s.n.* (US, not seen). Map 8.

A distinctive species, especially in its glabrate, falcate leaves, eglandular involucre and peduncles, peduncular bracts few or none, and distinctly corymboid capitulescence above the level of the leaves. Plants are characteristically caespitose with a dense mass of fibrous roots, sometimes with basal offsets or short rhizomes. Chromosome number diploid (Semple & Bowers 1987). *Pityopsis falcata* is the northernmost species of the genus, ranging from Massachusetts to New Jersey.

A collection of *Pityopsis falcata* was reported from southeastern Canada by Cody (1952): **Ontario.** Along Canadian Natl Railway tracks W of Toronto, 25 Aug 1949, *Sharp s.n.* (DAO, not seen). It apparently was a waif at this locality.

A collection from Pinellas Co., Florida, cited by Semple and Bowers (1985) and Semple (2006) as *Pityopsis falcata* (St. Petersburg, along a beach, 1955, *O. Gunnison* 2593, herbarium not cited) probably is an unusual plant of *P. tracyi*, which is common in the area.

4. *Pityopsis flexuosa* (Nash) Small, Man. S.E. Fl., 1341. 1933. *Chrysopsis flexuosa* Nash, Bull. Torrey Bot. Club 23: 107. 1896. *Heterotheca flexuosa* (Nash) Harms, Castanea 34: 408. 1969[1970]. **TYPE: Florida.** Leon Co.: Bellair, 3 Sep 1895, *G.V. Nash* 2545 (holotype: NY image!; isotypes: AC, E, F, FLAS, GH, K, MICH, MO, NDG, NEB, OS, P, US — images of all!). Map 7.

A distinctive species endemic to six counties of northern Florida, characterized by eglandular involucre and peduncles, relatively large heads (involucre (7–)8–11 mm high), zigzag nodes, and crowded cauline leaves. Chromosome number diploid (Semple & Bowers 1987).

5. *Pityopsis graminifolia* (Michx.) Nutt., Trans. Amer. Philos. Soc. 2, 317. 1841. *Inula graminifolia* Michx., Fl. Bor.-Amer. 2: 122. 1803 (before 19 March, fide Schubert 1942). *Chrysopsis graminifolia* (Michx.) Ell., Sketch Bot. S. Carolina 2(4): 334. 1824 [1823], not *C. graminifolia* (Michx.) Nutt. ex Torr. & Gray 1842. *Diplopappus graminifolius* (Michx.) Less., Linnaea 5(1): 144. 1830. *Diplogon graminifolium* (Michx.) Kuntze, Revis. Gen. Pl. 1: 334. 1891. *Heterotheca graminifolia* (Michx.) Shinnery, Field & Lab. 19: 71. 1951. **TYPE: USA.** No other collection data (probable holotype: P 00742815 image!; possible isotype: middle plant of P 00742818 image!, the 2 outer plants are *Pityopsis microcephala*). Maps 1 and 2.

Erigeron nervosus Willd., Sp. Pl., ed. 4, 3(3): 1953. 1803 (noted as 'in press' on 14 March, fide Schubert 1942). *Chrysopsis nervosa* (Willd.) Fern., Rhodora 44: 471. 1942. *Heterotheca nervosa* (Willd.) Shinnery, Field & Lab. 19: 68. 1951. *Pityopsis nervosa* (Willd.) Dress, Bailey 19: 166. 1975. **TYPE: USA.** No locality data (B — Bowers 1972 noted that he saw a photo). Protologue: "Habitat in America boreali.n 4 (v.s.) Caulis erectus pedalis simplex albotomentosus. Folia alterna inferiora quadri-pollicaria, summa semi-pollicaria et breviora, stricta rigida, lineari-lanceolata acuta integerrima nervosa viridia, subtus pilis sericeis adpressis albidis obsita. Panicula terminalis simplex, pedunculis tomentosus. Calyx imbricatus, squamis oblongis. Corollis non vidi. Pappus rufescens pilosus. W."

A plant in herbarium B-W (15682-010 image!) has an original label with "Am Sept, Desfontaines. W." — it has small heads with eglandular peduncles and densely glandular involucre and unambiguously is *Pityopsis microcephala* (Small) Small.

Inula argentea Pers., Syn. Pl. 2(2): 452. 1807. *Chrysopsis argentea* (Pers.) Ell., Sketch Bot. S. Carolina 2(4): 334. 1824 [1823]. *Pityopsis argentea* (Pers.) Nutt., Trans. Amer. Philos. Soc., n.s. 7: 318. 1840. **TYPE: USA.** No collection data (P? not seen; Bowers (1972) indicated that he saw an "isotype" at L). Protologue: "Hab. in Pennsylvania."

Haplopappus gramineus Benth., Pl. Hartw., 65. 1840. **TYPE: MEXICO. Oaxaca.** San Juan Reagi, July [1839], *K.T. Hartweg s.n.* (probable holotype: LD 1213502 image!).

Heyfeldera sericea Schultz-Bip., Flora 36(3): 36. 1853. **LECTOTYPE** (Semple & Bowers 1985): **MEXICO. Veracruz.** Mirador, Oct 1838, *J. Linden* 1144 (K image!).

Chrysopsis correllii Fern., Rhodora 44: 470, t. 741, f. 1–2. 1942. *Heterotheca correllii* (Fern.) Ahles, J. Elisha Mitchell Sci. Soc. 80: 173. 1964. **TYPE: USA. North Carolina.** Bladen Co.: Sandy region at White Lake, 15 Jul 1935, *D.S. Correll* 2577 (holotype: GH image!).

Chrysopsis nervosa var. *virgata* Fern., Rhodora 44: 474, t. 744, f. 1–2. 1942. **TYPE: USA. Virginia.** Nansemond Co.: NW of Magnolia, dry open sandy soil, 17 Oct 1941, *M.L. Fernald & B. Long* 14036 (holotype: GH image!; isotypes: GH, NY, PH, US – images! of all).

Chrysopsis nervosa var. *stenolepis* Fern., Rhodora 44: 474, t. 743, f. 1–2. 1942. **TYPE: USA. North Carolina.** Pamlico Co.: Olympia, open woodland, moist soil, 12 Jul 1922, L.F. & F.R. Randolph 910 (holotype: GH image!).

Pityopsis graminifolia is variable in habit (height, leaf size and shape) but consistent in its long, slender rhizomes, eglandular stems and peduncles, and relatively large heads with phyllaries glandular at least distally. The innermost series of phyllaries is unevenly longer than the next outer series and those phyllaries usually are thinner than the others (Fig. 1).

In North Carolina and Virginia, two widespread entities are present and distinct — *Pityopsis graminifolia* and *P. aspera*. From South Carolina to Mississippi, with the relatively simple recognition of *P. aspera*, *P. oligantha*, and *P. pinifolia*, it is clear that two further entities remain — one with small involucre and triangular, densely glandular phyllaries (*P. microcephala*) and one with larger involucre, the phyllaries narrowly oblong-lanceolate, slightly glandular, often mostly at the apices (*P. graminifolia*); Fig. 1 and key couplet below.



Figure 1. Representative involucre of *Pityopsis graminifolia* (left) and *P. microcephala* (right), at the same scale.

- 1. Involucre 8–10(–13) mm high, phyllaries linear-triangular (outer) to narrowly oblong-lanceolate (innermost), innermost series unevenly longer than the next outer series, inner to middle often glandular distally or only at the very apex, inner usually distinctly thinner; ray flowers 13–18
 ***Pityopsis graminifolia***
- 1. Involucre 6–7 mm high; phyllaries all narrowly triangular, evenly imbricate in length, inner to outer all densely glandular the whole length (at least along the midregion), all similar similar in thickness; ray flowers 5–11
 ***Pityopsis microcephala***

After study of a large set of collections from Mexico and Central America (at TEX-LL and UC-JEPS), no morphological features appear to unambiguously differentiate them from typical *Pityopsis graminifolia* of the eastern USA. Similarly, relatively uncommonly encountered populations in Louisiana, eastern Arkansas, and eastern Texas, within the range of *P. tenuifolia*, are identified here as *P. graminifolia*. Some of these plants have peduncles glandular a short distance beneath the involucre; the involucre is glandular only toward the apices of inner phyllaries, or all phyllaries may be sparsely glandular. The collection from Jasper Co., Texas (with glandular phyllaries and sparsely glandular distal peduncles), was originally identified as *P. oligantha* (Holmes & Singhurst 2012), and Semple and Bowers (1985) noted that a collection of *P. adenolepis* was made in Nacogdoches Co., Texas. Plants of *P. graminifolia* with similar vestiture occur in southwestern Mississippi, where the possibility exists that this might reflect introgression from *P. aspera*, but as noted by Bowers (1972, p. 105), similar plants also occur in Tennessee and Kentucky, where only *P. graminifolia* occurs. "These plants sometimes have glands on the peduncle which normally are hidden by pubescence but late in the year would be exposed giving a *H. adenolepis*-like peduncle."

Bowers observed that gene flow between *Pityopsis graminifolia* and *P. aspera* occurs in Virginia and in North and South Carolina, but "little of this introgression is seen in other areas even where the species may grow together." Observations in the present study suggest that gene flow between them also may occur across the Gulf Coastal Plain. In any case, however, most collections of *P. graminifolia* and *P. aspera* across their whole range are unambiguously identified as one or the other species.

Chromosome numbers tetraploid (inferred from mapped counts in North Carolina, Tennessee, and Virginia — Semple & Bowers 1987, Fig. 5; other tetraploid counts are from Alabama and northern Florida, probably for *P. graminifolia*) and diploid (from East Feliciana Par., Louisiana, cited below). Hybridization between *Pityopsis graminifolia* and *P. aspera*, the latter apparently tetraploid over most of its range, would be expected to occur more commonly than between *P. graminifolia* and diploid species, except, perhaps, where *P. graminifolia* and *P. tenuifolia* are sympatric. A single hexaploid count (Etowah Co., Alabama, Semple 6303) has been made for *P. graminifolia* (Semple & Bowers 1987).

In Arkansas, Louisiana, and Texas, obvious intermediates between *Pityopsis graminifolia* and *P. tenuifolia* are uncommon or non-existent, although each apparently is diploid in that region. The two have different ecological preferences, with *P. graminifolia* characteristically in more moist or boggy habitats.

Collections of *Pityopsis graminifolia* where sympatric with *P. tenuifolia*. **Arkansas.** Prairie Co.: P.O. Hazen, rice prairie, never plowed, terrace deposits, 215 ft, 2 Oct 1966 *Demaree 54723* (NLU), *Demaree 54752* (SMU) at the same locality is typical *P. tenuifolia*. **Louisiana.** East Feliciana Par.: 5.6 km SE of Clinton, Idlewild Research Station, 15 Oct 1991, *Lievens 5095* (TEX); E of Woodland, La Hwy 432, 1.5 km E of La Hwy 67, road R-O-W in oak-pine, 13 Oct 1991, *Semple & Suropto 10113*, **n=9II** (NLU). Grant Par.: Ca. 5 mi W of Georgetown, old tower on Johns Hill Rd, pine uplands, 25 Oct 1966, *Thomas et al. 1069* (NLU); SW of Georgetown, seepage area in pine woods off Tabor Road, 31 Aug 1968, *Thomas et al. 12246* (NLU); SW of Georgetown, seepage area in longleaf pine woods near Tabor Road, 4 Oct 1970, *Thomas 21571* (NLU). Ouachita Par.: E of Luna at Claire Branch, S of Red Cut Loop Rd, baygall area under power line beside dirt road, 18 Sep 1991, *Thomas et al. 125,241* (NLU). Sabine Par.: 0.5 mi S of Many, clear-cut woods beside US Hwy 171, 4 Oct 1980, *Thomas 73,805* (NLU). St. Tammany Par.: Many collections. Tangipahoa Par.: Hammond, SLU campus, infrequent at North Campus Rec Complex, 25 Oct 1996, *Montz 8413* (NLU); 1/2 mi W of I-59, W of Fluker and just S of La Hwy 10, longleaf pine woods, 25 Oct 1974, *Thomas et al. 42155* (NLU); beside La Hwy 10 at I-55 W of Fluker, cleared pine woods, 28 Oct 1978, *Thomas et al. 62067* (NLU). Union Par.: Ca. 5.0 mi ENE of Conway, Union Wildlife Mgmt Area, clearcut along Old Tennessee Rd, 25 Sep 1983, *Moore 2697* (NLU). Vernon Par.: 1.5 mi ESE of Leesville, 1 mi E of Ft. Polk, Multi Purpose Range Complex, longleaf pine upland, 28 Oct

1997, *Keith s.n.* (NLU). Washington Par.: Many collections. Winn Par.: Ca. 1/2 mi E of Natchitoches Parish line, along KCS RR tracks and adjacent woods beside La Hwy 156, 20 Oct 1979, *Hutchinson & Carroll 294* (NLU); W of Winnfield on Hwy 84, 1.5 mi E of Gum Springs near Forest Service Rd 529, woods beside hwy at a creek, 25 Oct 1980, *Thomas 74419* (NLU). **Texas.** Cass Co.: Ca. 6.5 mi S of Bivins, sandy woods and seepage area, 18 Oct 1962, *Correll 26415* (LL). Hardin Co.: Village Creek State Park, E edge of Lumberton, 23 Oct 2003, *Sanders 6298* (BRIT, TEX). Jasper Co.: Kirbyville, Kirbyville Airport, periodically mowed area, 24 Sep 2000, *Holmes 11100* (BAYLU). Nacogdoches Co.: 1 mi S of Lone Pine Baptist Church, occasional in sandy soil next to road, 13 Oct 1976, *Cox 299* (BRIT); 6 mi E of jct Hwy 59 and FM 2664, creek area in pine-hardwood forest, 20 Oct 1976, *Nixon 7462* (BRIT); clear-cut logging site, *Schuster 221* (USFS, fide Semple & Bowers 1985, p. 20, identified by them as *P. aspera* var. *adenolepis* "out of the normal range ... and probably [representing] a chance introduction into the clear-cut logging tract site."). Tyler Co.: 2.5 mi N of Warren, infrequent in sandy soil above pitcher plant bog, 28 Sep 1948, *Cory 54904* (LL); Big Thicket Natl Preserve, E side of Turkey Creek Unit, Turkey Creek Pitcher Plant Bog/Savanna, on Pitcher Plant Trail, ca. 3.5 km S of FM 1943, 16 Oct 1997, *McRoberts 3715* (TEX); 6 mi N from Colmesneil on Hwy 69, pine-oak forest, 25 Sep 1988, *Suh 123* (TEX).

6. *Pityopsis latifolia* (Fern.) Bridges & Orzell, J. Bot. Res. Inst. Texas 12: 31. 2018. *Chrysopsis graminifolia* var. *latifolia* Fern., Bot. Gaz. 24: 434. 1897. *Chrysopsis latifolia* (Fern.) Small, Fl. S.E. US, 1182, 1339. 1903. *Pityopsis graminifolia* var. *latifolia* (Fern.) Semple & Bowers, Univ. Waterloo Biol. Ser. 29 (Rev. *Pityopsis*): 28. 1985. **LECTOTYPE** (Semple & Bowers 1985): **Florida.** [Martin Co.]: Jensen, sparse pine land, 25 Mar 1897, *A.H. Curtiss 5819* (GH image!; isolectotypes: GH image!, NY image!). Map 7.

As noted by Bridges and Orzell (2018, p. 28), *Pityopsis latifolia* is characterized by its "well-developed rosette of spreading to somewhat ascending, broadly strap-like basal leaves, typically over 2 cm wide, and its reduced, clasping cauline leaves. The inflorescence stalks are relatively short and stout, usually under 40 cm tall, and bear few heads. ... [It] flowers most profusely in the mid to late dry season (winter into early spring) and is therefore phenologically segregated from other members of *Graminifoliae* in the region [Atlantic Coastal Ridge], which flower in the late wet season into the early part of the dry season." Chromosome number diploid (citations below).

Pityopsis aequilifolia and *P. latifolia* are similar in their relatively large, densely arranged and even-sized cauline leaves, dense inflorescence of heads on short peduncles, and eglandular involucre, and both produce a woody, corm-like base and dense mass of fibrous roots, apparently without rhizomes. Diploid chromosome counts have been made for both. *Pityopsis latifolia* is distinct in its larger and persistent basal leaves, larger involucre, and phenology, and as considered here, the two species are allopatric (Map 7). They are so similar, however, and perhaps overlapping in morphology, that they should be investigated toward the possibility that only a single entity is represented. For specimens without basal parts, my identifications essentially have been based on geography, sorting them arbitrarily into northern and southern segments. Bowers (1972) and Semple and Bowers (1985) identified *P. graminifolia* var. *aequilifolia* as having a broader range on the Florida peninsula than mapped here, in part, apparently, because they included collections of *P. latifolia* sensu stricto. The two entities contrasted below, mostly following Bridges and Orzell (2018).

- | | |
|---|--------------------------------------|
| 1. Involucres 5–9 mm high; disc florets 15–29; stem leaves dense, stiff and sharply pointed at apex; basal leaves narrow, similar to the cauline, usually not persistent | <i>Pityopsis aequilifolia</i> |
| 1. Involucres 8–13 mm high; disc florets >30; stem leaves few, soft and obtuse or slightly acute at apex; basal leaves broadly oblanceolate, often persistent, narrowing to the cauline | <i>Pityopsis latifolia</i> |

Broad-leaved plants of *Pityopsis tracyi* that might be confused with *P. aequilifolia* or *P. latifolia* produce slender, scale-leaved rhizomes and have a relatively slender caudex without densely

massed fibrous roots. Hybrids and introgressants, however, apparently are formed and identifications of such may be arbitrary (see comments following *P. tracyi*).

***Pityopsis latifolia*, representative collections.** **Florida.** **Brevard Co.:** N. Merritt's Island, 1.5 mi S of intersect. of Rte 3 and Happy Creek Rd, dry sandy soil near borrow pit on W side of Rte 3, 5 Feb 1973, *Shuey s.n.* (USF). **Broward Co.:** W of Ft. Lauderdale, 14 Feb 1931, *Bailey s.n.* (FLAS); 4 mi W of Deerfield, cut over pineland, 23 Feb 1941, *C. Deam 60848* (IND); S of Deerfield along ACL rights of way, *Pinus-Sabal* scrub in deep white sand, 21 Mar 1965, *Lakela 28333* (USF); 3 mi N of Pompano Beach, W of US Hwy 1, sand pine scrub, 20 Oct 1962, *Will s.n.* (FLAS). **Glades Co.:** Palmdale, plentiful on prairies, 7 Nov 1945, *Brass 15662* (Archbold); 3 mi W of Ortona on Hwy 78, scrub pine, 1 Nov 1969, *McCart 11,1196* (SMU). **Hardee Co.:** Highlands Hammock State Park, 13.5 mi E of Zolfo Springs, 8 mi W of Sebring, pine-oak scrub on white sand, 10 Nov 1978, *Hansen 4916* (USF). **Highlands Co.:** Lake June-in-Winter Scrub [Preserve State Park], Bobcat Trail, edge of flatwoods at edge of fire land, disturbed, 22 Oct 2002, *Bishop LJ0179* (USF); N side of Lake Annie, off of Rte 70 just W of Old State Rd 8, open sandy soil, 3 Sep 1981, *Correll 52397* (FTG); near Lake Josephine, Sebring, Sentinel Point Rd-Lake Josephine Dr, open pine sandhill, 29 Nov 1980, *Herndon 438* (FTG); ca. 3.5 air mi NE of Sebring, ca. 0.9 air mi S of Grassy Pond, ca. 0.75 air mi N of Carter Creek, ca. 2.3 air mi NE of jct Co Rds 17A and 700A (Arbuckle Creek Rd), white sand rosemary-scrub oak bald, 9 Nov 1990, *Orzell & Bridges 15796* (FTG, TEX); ca. 30 mi E of Arcadia along Rte 70, oak-pine scrub, sandy soil, 25 Apr 1951, *Webster 4213* (SMU). **Hillsborough Co.:** Rest area on Hwy 41, 0.7 mi S of [Little] Manatee River, sand pine-oak sandhill association, disturbed white sandy soil, 30 Sep 1976, *Semple 2501, n=9II* (USF). **Martin Co.:** N end of Jonathan Dickinson State Park, common in recently burned sand pine dunes, 28 Jul 1971, *Avery 995* (FTG); 5 mi W of Indiantown on State Rd 710, along RR tracks, 11 Nov 1968, *Keith & McCart 10265* (SMU); 9 mi NW of Umatilla by Fla Hwy 42, pineland sandhills, 10 Aug 1972, *Kral 48007* (VDB); just W of Jensen Beach, coastal dune scrub, 15 Aug 1972, *Kral 48079* (VDB); just W of Hobe Sound by US Hwy 1, sand pine scrub, 18 Sep 1973, *Kral 51772* (VDB); Stuart, dry sandy scrubland, 28 Dec 1954, *Moldenke 21480* (SMU); ca. 0.9 air mi NW of Gomez, E of US Hwy 1, ca. 0.5 mi SE of jct Hobe Street, Atlantic Coastal Ridge scrub, 8 Mar 1993, *Orzell & Bridges 21259* (USF); Jonathan Dickinson State Park, pine woods near Casuarina campground, 10 Nov 1974, *Popenoe 295* (FTG); Jonathan Dickinson State Park, along edge of upper Kitchings Creek trail in moist prairie, 28 Jan 1979, *Popenoe 1584* (FTG); 2 mi W of Hobe Sound along US Hwy 2, sandy hills, 30 Nov 1974, *Turner & Plettman F45, n=9II* (FTG, LL). **Okeechobee Co.:** Okeechobee, pineland, 12 Oct 1941, *Davis s.n.* (FLAS); 1 mi E of Okeechobee City, low pineland, 7 Nov 1945, *West s.n.* (FLAS). **Palm Beach Co.:** Near West Palm Beach, sandy woods, 22 Feb 1904, *S. Deam 1710* (IND); northern city limits of Lake Park near US Hwy 1, around margins of saw palmetto and live oak scrubland, 8 Oct 1953, *Dress 2761* (FLAS); 1 mi N of Juno-Jupiter border off US Hwy 1, sand pine scrub, 3 Feb 1972, *Durako 48* (USF); Loxahatchee Wildlife Refuge off US Hwy 441 and due W of Lantana, slash pine-saw palmetto flats, 15 Nov 1984, *Kral 71686* (TENN); 1 mi S of Boynton Beach, pine-oak, white sand, 26 Dec 1967, *McCart et al. 35* (SMU); Boynton Beach at SW corner of I-95 and Hypoluxo Road, behind Grace Presbyterian Church, sand pine scrub, 30 Dec 1986, *Zona 150* (FLAS). **Sarasota Co.:** Sarasota, 23 Jan 1943, *Perkins s.n.* (USF). **St. Lucie Co.:** Inglehart Ranch, ca. 4 mi N of Martin Co. line, ca. 4.6 mi E of Okeechobee Co. line, edge of *Pinus clausa-Ceratiola ericoides* scrub in open sand, 12 Feb 1998, *Bradley & Woodmansee 890* (FTG); Rte 70, common in sandscrub, 26 Oct 1957, *Brass 29049* (Archbold Biol. Station); Savannas State Reserve, just N of Walton Rd, just W of FEC RR, disturbed scrub, 8 Nov 1995, *Gann & Bradley 211* (FTG); ca. 2-3 mi E of White City, sand dunes, 17 Sep 1964, *Kral 22862* (SMU); northern part of the county, E side of US Hwy 1, coastal sand scrub with *Pinus clausa*, 28 Jul 1962, *Lakela 25218* (FLAS); sand pine scrub, ca. 1 air mi NW of Walton, on ridge between FEC RR and "The Savannahs": Savannas State Reserve, sand pine scrub, 7 May 1990, *Orzell & Bridges 13375* (FTG, TEX); near Rio, scrub, 7 Jan 1923, *Small et al. 10776* (FLAS); Savannas State Reserve, S of Midway Rd (Co. Rd 712) N of Walton Rd, just W of RR tracks, disturbed open scrub, 5 Mar 1998, *Woodmansee 18* (FTG).

7. ***Pityopsis microcephala*** (Small) Small, Man. S.E. Fl., 1341. 1933. *Chrysopsis microcephala* Small, Fl. S.E. US, 1182, 1339. 1903. *Heterotheca microcephala* (Small) Shinnery, Field & Lab. 19: 68. 1951. *Chrysopsis graminifolia* var. *microcephala* (Small) Cronq., Brittonia 29: 219. 1977. *Pityopsis graminifolia* var. *microcephala* (Small) Semple, Canad. J. Bot. 58: 148. 1980. **TYPE: Florida.** Duval Co.: Dry pine barrens near Jacksonville, 13 Oct 1894, A.H. Curtiss 5319 (holotype: NY image!; isotypes: GH image!, K image!, US image!). Map 4.

Pityopsis microcephala is distinctive in its small heads (6-7 mm high, with 5-11 ray flowers), densely stipitate-glandular involucre, and eglandular peduncles. The phyllaries (outermost to inner) are consistently triangular-lanceolate and evenly imbricate — the outermost (those at the involucre base) are densely congested and tiny, grading quickly in size into the primary 3-4 series. As noted by Semple and Bowers (1985), plants of the type collection are variable in the density of involucre glandularity, but even if this might reflect introgression from *P. graminifolia*, all of the type plants have the head size and involucre morphology of *P. microcephala*. Chromosome number diploid (inferred from mapped counts; Semple & Bowers 1987).

***Pityopsis microcephala*, collections seen, Louisiana.** St. Tammany Par.: Ca. 3.5 mi ENE of Abita Springs along La Hwy 435, undeveloped areas behind Hillcrest subdivision, weedy, roadside ditch bordering pine woods, 17 Sep 1981, Pruski 2142 (TEX); La Hwy 434, ca. 1.5-2 mi S of jct with US Hwy 190 in Lacombe, weedy roadside along pine woods, 13 Oct 1981, Pruski 2206 (TEX); pine forest next to West Gate Rd, N of Transportation Rd, 30 Sep 1994, Slaughter 5629 (TEX).

8. ***Pityopsis oligantha*** (Chapm. ex Torrey & Gray) Small, Man. S.E. Fl., 1341. 1933. *Chrysopsis oligantha* Chapm. ex Torrey & Gray, Fl. N. Amer. 2(2): 253. 1842. *Heterotheca oligantha* (Chapm. ex Torrey & Gray) Harms, Wrightia 4: 11. 1968. **LECTOTYPE** (Semple & Bowers 1985): **Florida.** Damp barrens, April and May, *Dr. Chapman s.n.* (NY 163244 image!; isolectotypes: NY 163244 and 163245 images!; probable isolectotypes: GH 55871, 55872, and 55873 images!, K image!, NY 163238 and 163246 images!, PH image!, US 652187, bearing 2 collections, image!, YU image!). Protologue: "Damp pine barrens of Middle Florida." Map 6.

A distinctive species endemic to panhandle Florida and adjacent counties of Georgia and Alabama, characterized by few heads on sparsely leafy stems (the basal leaves persistent) and glandular involucre and peduncles. Plants often develop a lignescent, fibrous-rooted caudex but characteristically produce long rhizomes. Habitats of *Pityopsis oligantha* are distinctly wetland and it is characteristically spring-flowering. Chromosome number tetraploid (Semple & Bowers 1987). A report of the occurrence of *P. oligantha* in Texas (Holmes & Singhurst 2012) was based on a collection of plants recognized here as *P. graminifolia*. Collections from Mississippi identified as *P. oligantha* (Rogers 45468 image! – Pearl River Co. and Gordon 1548 image! – George Co., both at MMNS) instead have proved to be *P. aspera*.

9. ***Pityopsis pinifolia*** (Ell.) Nutt., Trans. Amer. Philos. Soc., ser. 2, 7: 318. 1840. *Chrysopsis pinifolia* Ell., Sketch Bot. S. Carolina 2(4): 335. 1824 [1823]. *Diplogon pinifolium* (Ell.) Kuntze, Revis. Gen. Pl. 1: 334. 1891. *Heterotheca pinifolia* (Ell.) Ahles, J. Elisha Mitchell Sci. Soc. 80: 173. 1964. **NEOTYPE** (Semple & Bowers 1985): **Alabama.** No other data, *S. Elliot s.n.* (NY 00163185 image!). Map 6.

A distinctive and morphologically unmistakable species, especially in its glabrate, linear-filiform leaves, with scattered populations and population clusters from central Alabama (Autauga Co.: 6 Jun 1995, Oberholtzer *s.n.*, AUA-image!) to southeastern North Carolina. Chromosome number diploid (Semple & Bowers 1987). Spreading colonially by long, slender rhizomes.

10. *Pityopsis ruthii* (Small) Small, Man. S.E. Fl. 1341. 1933. *Chrysopsis ruthii* Small, Bull. Torrey Bot. Club 24: 493. 1897. *Heterotheca ruthii* (Small) Harms, Castanea 34: 408. 1969 [1970]. **TYPE: Tennessee.** Polk Co.: Hiawasee Valley, rocks, Oct 1896, A. Ruth 7 (holotype: NY image!; isotypes: NCU image!, OS image!). Ruth's label on the OS sheet specifies "rocks at McFarland." Map 6.

A distinctive species endemic to rocky habitats along the Hiawasee and Ocoee rivers in Polk Co., Tennessee. Involucres and peduncles stipitate-glandular, otherwise glabrous. Chromosome number diploid (Semple & Bowers 1987). Because of its restricted geography and rarity, it has been the subject of autecological, ecological, and genetic studies (e.g., Farmer 1977; Thomson & Schwartz 2006; Moore et al. 2016; Hatmaker et al. 2018; Wadl et al. 2018).

11. *Pityopsis tenuifolia* (Torrey) Nesom, **comb. et stat. nov.** *Inula graminifolia* var. *tenuifolia* Torrey, Ann. Lyceum Nat. Hist. New York 2: 212. 1827. *Pityopsis graminifolia* var. *tenuifolia* (Torrey) Semple & Bowers, Univ. Waterloo Biol. Ser. 29 (Rev. *Pityopsis*): 24. 1985. **TYPE:** No collection data cited in the protologue but probably this: **Oklahoma** (one of the southeastern counties). Long Expedition, early Sep 1820, E.P. James s.n. (holotype: NY image!). The Long Expedition (1819-1820, with James as botanist, see Torrey 1827) reached Fort Smith, Arkansas (the expedition's endpoint), on 13 September 1820, after traveling through the Texas panhandle region and across southern Oklahoma. Map 2.

Pityopsis tenuifolia is distinctive in its slender rhizomes, eglandular vestiture (peduncles, involucres), closely ascending cauline leaves, minute, densely arranged peduncular bracts grading into the outer (basal) phyllaries, involucres 8–11 mm high with linear-triangular, evenly imbricate phyllaries, and ray florets 7–9 mm long. Chromosome number diploid (inferred from mapped counts in Arkansas, Louisiana, and Texas; Semple & Bowers 1987, Fig. 5). It is similar to *P. tracyi* in most features but is consistent in chromosome number and is less variable in morphology. Their disjunct geography and a consistent difference in achene morphology support recognition of *P. tenuifolia* at specific rank.

1. Achenes 2.5–3 mm long, with 7–8 prominently raised, resinous veins ***Pityopsis tenuifolia***
 1. Achenes 2.5–4 mm long, without raised veins, or if veins slightly raised then not resinous
 ***Pityopsis tracyi***

***Pityopsis tenuifolia*, collections seen, Mississippi.** Amite Co.: South Greensburg Road at Mary Wall Bridge Road S of Liberty, school lands, 28 Sep 1998, Alford 94 (MISS); 15 mi N of Liberty, pinelands, 16 Oct 1973, Westbrook s.n. (LSU). Pike Co.: Hwy 570 NE of McComb, near jct with River Rd, 13 Oct 2012, Sullivan 12.4752 (MMNS); along W bank of Bogue Chitto River at the US Hwy 98 bridge SE of McComb, 12 Oct 1996, Thomas 152,957 (TENN).

12. *Pityopsis tracyi* (Small) Small, Man. S.E. Fl., 1341. 1933. *Chrysopsis tracyi* Small, Fl. S.E. US, 1182. 1903. *Heterotheca graminifolia* var. *tracyi* (Small) Long, Rhodora 72: 43. 1970. *Pityopsis graminifolia* var. *tracyi* (Small) Semple, Phytologia 58: 430. 1985. *Pityopsis nervosa* var. *tracyi* (Small) Ward, Novon 14: 368. 2004. **TYPE: Florida.** Manatee Co.: Palma Sola, 3 Dec 1901, S.M. Tracy 7713 (holotype: NY image!; isotypes: F image!, GH image!, US image!). Map 6.

Pityopsis tracyi is "a very distinct species and the most common member of section *Graminifoliae* in central and south-central Florida" (Orzell & Bridges 2018, p. 31). It occurs into counties of southeastern Georgia as well as in the Bahamas and perhaps in Belize in Central America (see citations below).

"*Pityopsis tracyi* is a robust, large-flowered species that is locally abundant in somewhat poorly to poorly drained pine savannas and seasonally wet grasslands with a historical high fire return interval (annual or biennial) from lightning season fires. Within the C4 grass-dominated groundcover matrix of these savanna-grasslands, *P. tracyi* often forms clonal patches from its elongated and branched underground rhizomes, which enable it to rapidly resprout after fires. A single genet is capable of occupying an area several meters in diameter" (Bridges & Orzell 2018, p. 31).

Cauline leaves of *Pityopsis tracyi* are usually linear to linear-triangular, usually ascending close to the stem; involucre and peduncles eglandular; involucre 7–14 mm high; phyllaries evenly imbricate in length, linear-triangular with a linear apex, usually loosely strigose-hirsute from base to tip. A relatively unelaborated caudex and long, slender rhizomes distinguish *P. tracyi* from *P. aequilifolia* and *P. latifolia*, which occur in sympatry.

Plants of the type collection of *Pityopsis tracyi* (Fig. 2) produce long, persistent basal leaves and both the basal leaves and the cauline leaves are nearly filiform. Plants of similar morphology are relatively common in southern counties of the peninsula (especially Dade, Collier, Hendry, Lee, and Monroe counties, where *P. tracyi* is the only species present), but Figures 2-14 show a range of variation in the habit of the species. Stem height, the number and density of cauline leaves, and the number and size of heads are variable.

Diploid, tetraploid, and hexaploid chromosome numbers have been recorded for *Pityopsis tracyi* (all within Florida), but a clear geographic pattern (see Map 6, inset) is not evident in the collections I have studied. **Diploid (2n=18):** Hernando Co., *Semple 2559* (USF); Hillsborough Co., *Semple 2529* (USF); Orange Co., *Semple 2556* (USF); Volusia Co., *Semple 2540* (USF). **Tetraploid (2n=36):** Dade Co., *Turner F-33* (LL); Hillsborough Co., *Semple 5406* (USF); Levy Co., *Semple 3953* (cited by Semple & Bowers 1987 as *P. graminifolia*); Manatee Co., *Semple 5411* (cited by S&B 1987 as *P. graminifolia*); Pasco Co., *Semple 5416* (cited by S&B 1987 as *P. graminifolia* var. *latifolia*); Polk Co., *Semple 7484* (cited by S&B 1987 as *P. graminifolia* var. *latifolia*); *Semple 10904* (USF); Sumter Co., *Semple 3977* (USF). **Hexaploid (2n=54):** Manatee Co., *Semple 5410* (cited by S&B 1987 as *P. graminifolia* var. *tracyi*); Okeechobee Co., *Semple 7514* (cited by S&B 1987 as *P. graminifolia* var. *tracyi*).

Bridges and Orzell (2018, p. 31) observed that a fourth species of *Pityopsis* (apart from *P. aequilifolia*, *P. latifolia*, and *P. tracyi*) occurs in central and southern Florida — "a short, small-headed species with very narrow leaves ... restricted to well-drained sandhills with an open canopy of *Pinus palustris* or *Pinus densa*" — identified by them as *P. microcephala*. As identified here, these plants (fide a photo by Edwin Bridges from a Highlands County population) are a very small-headed form of *P. tracyi* — similarly small-headed plants (involucre 7–8 mm high and with relatively few phyllaries) occur at least in Okeechobee and Seminole counties (pers. observ.). Edwin Bridges (pers. comm.) notes that the small-headed Highlands County plants were discontinuous in morphology from others (larger-headed) at the same locality. It seems plausible that differences in chromosome number may underlie the apparent reproductive isolation.

Some of the chromosome number variants may be hybrids and introgressants among *Pityopsis tracyi*, *P. aequilifolia*, and *P. latifolia* and identifications (to species) of the polyploids may sometimes be arbitrary. For example, in Levy County, typical *P. tracyi* is known to occur (Fig. 11), but morphological variants also have been collected — Figs. 12 and 13 show rhizomatous plants with densely arranged, relatively broad cauline leaves suggestive of *P. aequilifolia*; Fig. 14 shows a densely fibrous-rooted plant with narrow leaves characteristic of *P. tracyi*.

***Pityopsis tracyi*, representative collections.** **Georgia.** Brantley Co.: Hwy 82, 6.0 mi W of jct US Hwy 301 in Nahunta, open sandy area along and N of hwy, 21 Sep 1991, *Carter 9222* (VSC). Camden Co.: Ca. 11.75 air mi NNE of St. Mary's waterfront Cabin Bluff preserve, 0.76 mi W of Shellbine, cutover



Figure 2. *Pityopsis tracyi*, US isotype. Manatee Co., Florida.

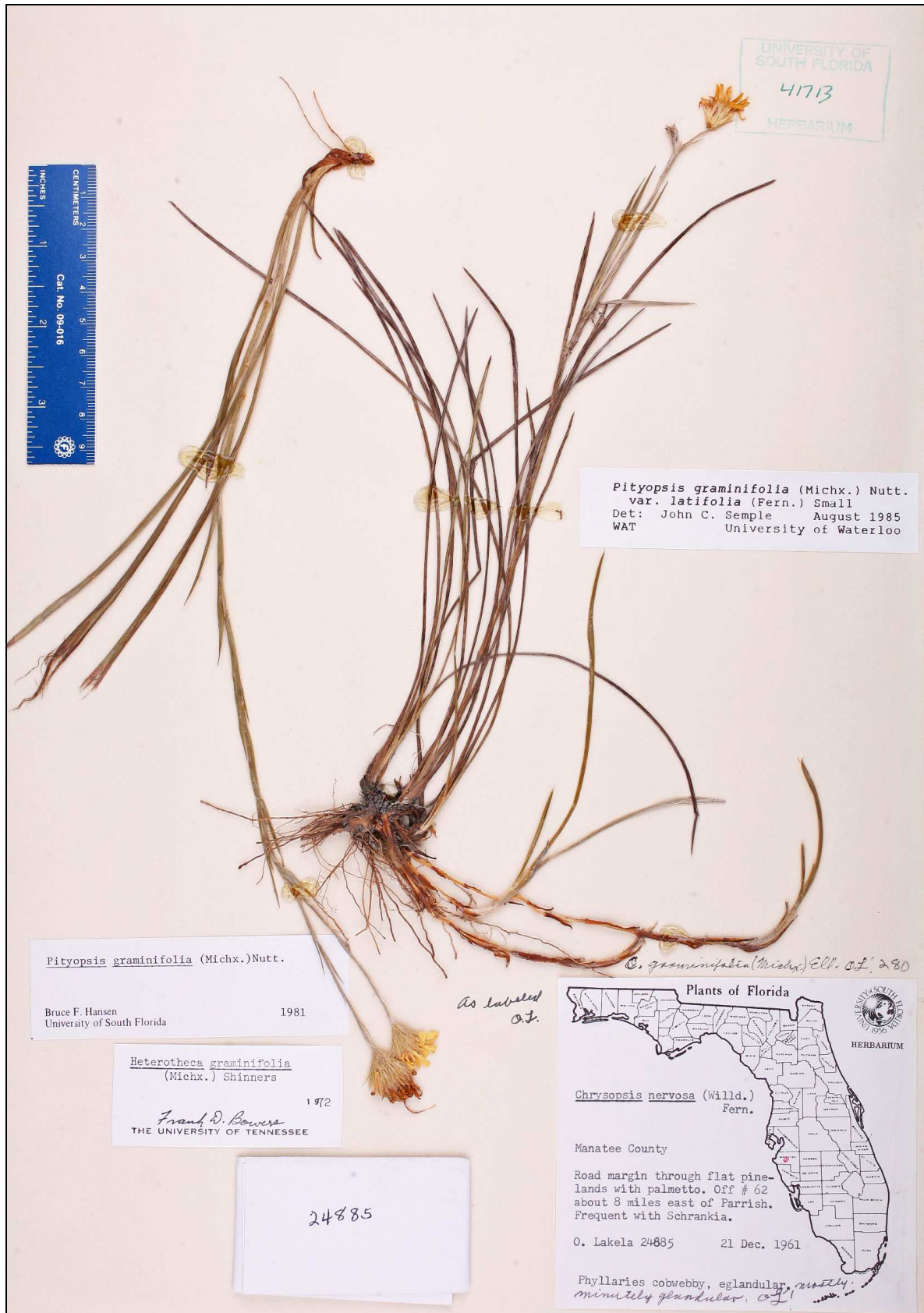


Figure 3. *Pityopsis tracyi*. Manatee Co., Florida



Figure 4. *Pityopsis tracyi*. Hillsborough Co., Florida. *Semple* 5406, voucher for tetraploid chromosome count.



Figure 5. *Pityopsis tracyi*. Hillsborough Co., Florida.



Figure 6. *Pityopsis tracyi*. Hillsborough River State Park in Hillsborough Co., Florida. *vanHoek & Petty HR0407* (USF). The left plant is typical in morphology; the right plant perhaps is *P. latifolia* (basal portions critical for ID). Alternatively, the two might simply be populational variants, or the right plant might be introgressed with genes of *P. latifolia*, perhaps a ploidal variant (see text).



Figure 7. *Pityopsis tracyi*. Polk Co., Florida. *Semple 10904* (USF), voucher for tetraploid count.



Figure 8. *Pityopsis tracyi*. Polk Co., Florida.



Figure 9. *Pityopsis tracyi*. Polk Co., Florida.



Figure 10. *Pityopsis tracyi*. Polk Co., Florida.



Figure 11. *Pityopsis tracyi*. Levy Co., Florida. Typical morphology.



Figure 12. *Pityopsis tracyi*. Levy Co., Florida. Rhizomatous, perhaps introgressed from *P. aequilifolia*.



Figure 13. *Pityopsis tracyi*. Levy Co., Florida. Rhizomatous, introgressed from *P. aequilifolia*.



Figure 14. *Pityopsis tracyi*. Levy Co., Florida. Apparently without rhizomes, perhaps introgressed from *P. aequilifolia*. Note viviparous head (arrow); viviparous heads on *P. tracyi* also have been observed in Pinellas Co. (Wunderlin *et al.* 10357, USF).

flatwoods, 16 Sep 1995, *Carter 12789* (VDB). Glynn Co.: S tip of Jekyll Island, ca. 0.1 mi W of beach and 3 mi NNE of Jekyll Point, abundant on open, mostly stabilized dunes, 11 Sep 1974, *Duncan 29116* (TEX, VDB); S tip of Jekyll Island, ca. 1 mi NE of Jekyll Point, stabilized dunes, 13 Oct 1975, *Duncan 29648* (GA); Jekyll Island, sand dunes near picnic area, 9 Aug 1977, *Jones & Coile INPR38* (GA); Jekyll Island, edge of sand dunes, 23 Oct 2001, *McNeilus 01-365* (LSU); Sea Island, E of Cloisters Hotel, sandy soil, 28 Nov 1935, *Pyron & McVaugh 195* (GA); Jekyll Island, along E side of South Beach Drive opposite 4-H soccer fields, 3.3 km S of intersection with causeway (Jekyll Island Rd/Ga Hwy 520), 21 Sep 2003, *Thom & Weng 219* (GA). Long Co.: 5.8 mi W of Hwy 301 on Ga Hwy 261, turkey oak, sandy slope, 6 Oct 1962, *Bozeman 1903* (NCU); Griffin Ridge WMA, 1st entrance off Hwy 301S, sandhills, 12 Sep 1999, *Holland 218* (GA). McIntosh Co.: Sapelo Island, 3 mi due N of S end and on inland side, open pine-live oak woods, 15 Oct 1956, *Duncan 20655* (BRIT, GA, SMU, TEX, VSC); 3.0 mi W of Darien, dry sandy bluff, 17 Sep 1961, *Harmer 1356* (GA). **Bahamas**. Grand Bahama: Bootle Bay Village area, old field, large colonies to 1 m high, 8 Nov 1973, *Correll 40678* (LL, TEX); Freeport, intersect. of Settlers Way and East Mall, burnt-over pineland, 14 Aug 1974, *Correll & Kral 42822* (VDB). **Belize**. Toledo District: Near Jenkins Creek, open pine ridge, 26 Aug 1942, *Gentle 4091* (LL).

The collection cited here for *Pityopsis tracyi* in Belize is in a distantly disjunct locality for the species and perhaps could be an aberrant plant of *P. graminifolia* (see Map 1), but it appears to differ morphologically from other *P. graminifolia* in Mexico and Central America. Typical *P. graminifolia* has been collected in the El Cayo District of Belize (e.g., *Hunt 7*, LL; *Lundell 6630*, LL, TEX).

ACKNOWLEDGEMENTS

Thanks to Curtis Hansen (AUA) for providing an image of the Alabama collection of *Pityopsis pinifolia* and to Heather Sullivan (MMNS) for images of Mississippi collections identified as *P. oligantha*, Alan Franck and Richard Wunderlin at USF for comments on Florida collections, Edwin Bridges for comments on the central Florida endemics, and TEX-LL and the collected BRIT herbaria (BRIT, NLU, SMU, VDB) for hospitality while studying there. Collections cited from FLAS, FTG, GA, IND, MISS, MMNS, TENN, TTRS, USF, and VSC have been seen via online images.

LITERATURE CITED

- Bowers, F.D. 1972. A biosystematic study of *Heterotheca* section *Pityopsis*. Ph.D. dissertation, Univ. of Tennessee, Knoxville.
- Bridges, E.L. and S.L. Orzell. 2018. Reassessment of *Pityopsis* section *Graminifoliae* (Small) Semple in peninsular Florida. Pp. 29–32, in Weakley et al. Combinations, rank changes, and nomenclatural and taxonomic comments in the vascular flora of the southeastern United States. III. J. Bot. Res. Inst. Texas 12: 27–67.
- Cody, W.A. 1952. *Chrysopsis falcata*, adventive in Canada. Rhodora 54: 308.
- Cronquist, A. 1980. Vascular Flora of the Southeastern United States. Volume 1, Asteraceae. Univ. of North Carolina Press, Chapel Hill.
- Dress, W.J. 1953. A revision of the genus *Chrysopsis* in eastern North America. Ph.D. dissertation, Cornell University, Ithaca, New York.
- Farmer, R.E. 1977. Seed propagation of *Heterotheca ruthii*. Castanea 34: 402–409.
- Fernald, M.L. 1942. The seventh century of additions to the flora of Virginia (continued). Rhodora 44: 457–478. [*Chrysopsis graminifolia* and allies in Virginia and the Carolinas, pp. 464–475]
- Fernald, M.L. 1950. Gray's Manual of Botany (ed. 8). American Book Co., New York.
- Gowe, A.K. and J.S. Brewer. 2005. The evolution of fire-dependent flowering in goldenasters (*Pityopsis* spp.). J. Torrey Bot. Soc. 132: 384–400.
- Harms, V.H. 1969. A preliminary conspectus of *Heterotheca* section *Pityopsis* (Compositae). Castanea 34: 402–409.
- Hatmaker, E.A. 2016. Population genetics and genomics within the genus *Pityopsis*. MS thesis, Univ. of Tennessee, Knoxville.

- Hatmaker, E.A., M.E. Staton, A.J. Datillo, D. Hadziabdic, T.A. Rinehart, E.E. Schilling, R.N. Trigiana, and P.A. Wadl. 2018. Population structure and genetic diversity within the endangered species *Pityopsis ruthii* (Asteraceae). *Front. Pl. Sci.* 9: 943. <doi: 10.3389/fpls.2018.00943>
- Holmes, W.C. and J.R. Singhurst. 2012. *Pityopsis oligantha* (Asteraceae) new to Texas. *Phytoneuron* 2012-110: 1–4.
- Moore, P.A., P.A. Wadl, J.A. Skinner, R.N. Trigiano, E.C. Bernard, W.E. Klingeman, and A.J. Datillo. 2016. Current knowledge, threats, and future efforts to sustain populations of *Pityopsis ruthii* (Asteraceae), an endangered southern Appalachian species. *J. Torrey Bot. Soc.* 143: 117–134.
- Semple, J.C. and F.D. Bowers. 1985. A revision of the goldenaster genus *Pityopsis* Nutt. (Compositae: Astereae). *Univ. Waterloo Biol. Ser.* 29: 1–34.
- Semple, J.C. and F.D. Bowers. 1987. Cytogeography of *Pityopsis* Nutt., the grass-leaved goldenasters (Compositae: Astereae). *Rhodora* 89: 381–389.
- Semple, J.C. 2006. *Pityopsis* (Asteraceae). Pp. 222–228, in *Flora of North America North of Mexico*, Vol. 20. Oxford Univ. Press, New York and Oxford.
- Schubert, B.G. 1942. Willdenow's *Species Plantarum* and Michaux's *Flora Boreali-Americana*: Dates of publication. *Rhodora* 44: 147–151.
- Small, J.K. 1933. *Manual of the Southeastern Flora*. Univ. of North Carolina Press, Chapel Hill.
- Thomas, R.D. and C.M. Allen. 1997. *Atlas of the Vascular Flora of Louisiana*, Vols. 1-3 (plus updates). Louisiana Dept. of Wildlife and Fisheries, Natural Heritage Program, Baton Rouge.
- Thomson, D.M. and M.W. Schwartz. 2006. Using population count data to assess the effects of changing river flow on an endangered riparian plant. *Conserv. Biol.* 20: 1132–1142.
- Torrey, J. 1827. Some account of a collection of plants made during a journey to the Rocky Mountain in the summer of 1820, by Edwin P. James, M.D. Assistant Surgeon U.S. Army. *Ann. Lyceum Nat. Hist. New York* 2: 161–254.
- Wadl, P.A., A.M. Saxton, G. Call, and A.J. Datillo. 2018. Restoration of the endangered Ruth's Golden Aster (*Pityopsis ruthii*). *Southeast. Naturalist* 17: 19–31.
- Weakley, A.S. and B.A. Sorrie. 2015. *Pityopsis*. Pp. 1162–1164, in A.S. Weakley. *Flora of the Southern and Mid-Atlantic States* (working draft, 21 May 2015). Univ. of North Carolina Herbarium (NCU), North Carolina Botanical Garden, Univ. of North Carolina at Chapel Hill.