

TAXONOMY OF *GRINDELIA LANCEOLATA* SENSU LATO (ASTERACEAE)

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ABSTRACT

The concept of *Grindelia lanceolata* Nutt. has sometimes included up to four varietal taxa — three of them are recognized here at specific rank and one is treated as a synonym of *G. decumbens*. ***Grindelia lanceolata*** sensu stricto occurs most abundantly in Missouri, Oklahoma, Arkansas, with numerous scattered outliers east of the Mississippi River and in southeast Texas. ***Grindelia texana*** Scheele occurs mostly on the Edwards Plateau of Texas and in northeastern Coahuila, Mexico. ***Grindelia greenei*** Steyererm. is a rare species endemic to the area of Monterrey, Mexico, and its immediate environs. *Grindelia subincisa* Greene is treated without formal taxonomic status within ***G. decumbens*** Greene of Colorado and New Mexico. The four taxa are mapped.

In taxonomic studies of *Grindelia* from Mexico and New Mexico, plants that have been identified as *G. lanceolata* Nutt. need review because of contrasting taxonomic treatments. The species has sometimes included up to four varietal taxa — three of them are recognized here at specific rank and one is treated as a synonym of *G. decumbens* Greene.

1. **GRINDELIA LANCEOLATA** Nutt., J. Acad. Nat. Sci. Philadelphia 7: 73. 1834. **LECTOTYPE** (Steyermark 1934, p. 515; not Bartoli & Tortosa 2012): [**Oklahoma**. Probably Muskogee or Wagoner Co., July-Aug 1819], *Z. Pitcher s.n.* (PH!; probable islectotypes: BM image, NY image). See labels in Fig. 1. Protologue: "In Arkansas, T. Nuttall and Dr. Pitcher."

Steyermark cited the PH sheet as "type" in 1934 (ARKANSAS: "locality lacking, *Pitcher* [PA TYPE, NY]"), so the recent choice by Bartoli and Tortosa was superfluous.

Dr. Zina Pitcher was stationed as an army surgeon from November 1831 to July 1834 at Ft. Gibson, in what is now the northeast corner of Muskogee Co., Oklahoma (part of what was known as "Arkansas Territory" until 1836) and most of his collections probably were made in the vicinity of Ft. Gibson (McKelvey 1955). In 1833 he was part of a group building a portion of road from Fort Towson (in what is now Choctaw Co., Oklahoma) to Fort Smith, Arkansas (Fay 1975) and collected fossils of ammonites and oysters on the calcareous plains of the Kiamichi River (tributary of the Red River) in Choctaw County. He sent the fossils to the Academy of Natural Sciences of Philadelphia, where the ammonite was described in an 1834 publication — Pitcher also made collections of *Salvia* and *Corydalis* from "Red River, Arkansas" (see GH Herbarium 2019). He apparently sent his main set of vascular plant collections to PH, as they were significant in descriptions by Nuttall (1834) of new taxa.

Nuttall collected *Grindelia lanceolata* in eastern Oklahoma in 1819. In May and early June he was near the Red River in Choctaw County; from July into August he collected around Ft. Gibson, along the Verdigris River between Tulsa and Fort Gibson (in Muskogee, Wagoner, and Rogers counties), and up the Arkansas River to just west of Tulsa (Morrison 1926). His *G. lanceolata* collection almost certainly was made in the Ft. Gibson/Tulsa area, because the species flowers from late June through October. He later described (Nuttall 1834) a number of his own collections from eastern Oklahoma, citing his collections as types; he also based some of the new species on collections by Pitcher and some on collections by himself and later by Pitcher.

Grindelia lanceolata fma. *latifolia* Steyermark, Ann. Missouri Bot. Gard. 21: 516. 1934. **TYPE: USA. Missouri.** Stone Co.: Marble Cave, 11 Sep 1898, *W. Trelease s.n* (holotype: MO image).

Grindelia littoralis Steyermark, Ann. Missouri Bot. Gard. 21: 516. 1934. **TYPE: USA. Texas.** [Galveston Co.:] Evergreen [now known as Kemah], Galveston Bay, 20 Sep 1884, *J.F. Joor s.n.* (holotype: MO; isotypes: BRIT, ILL, MO).

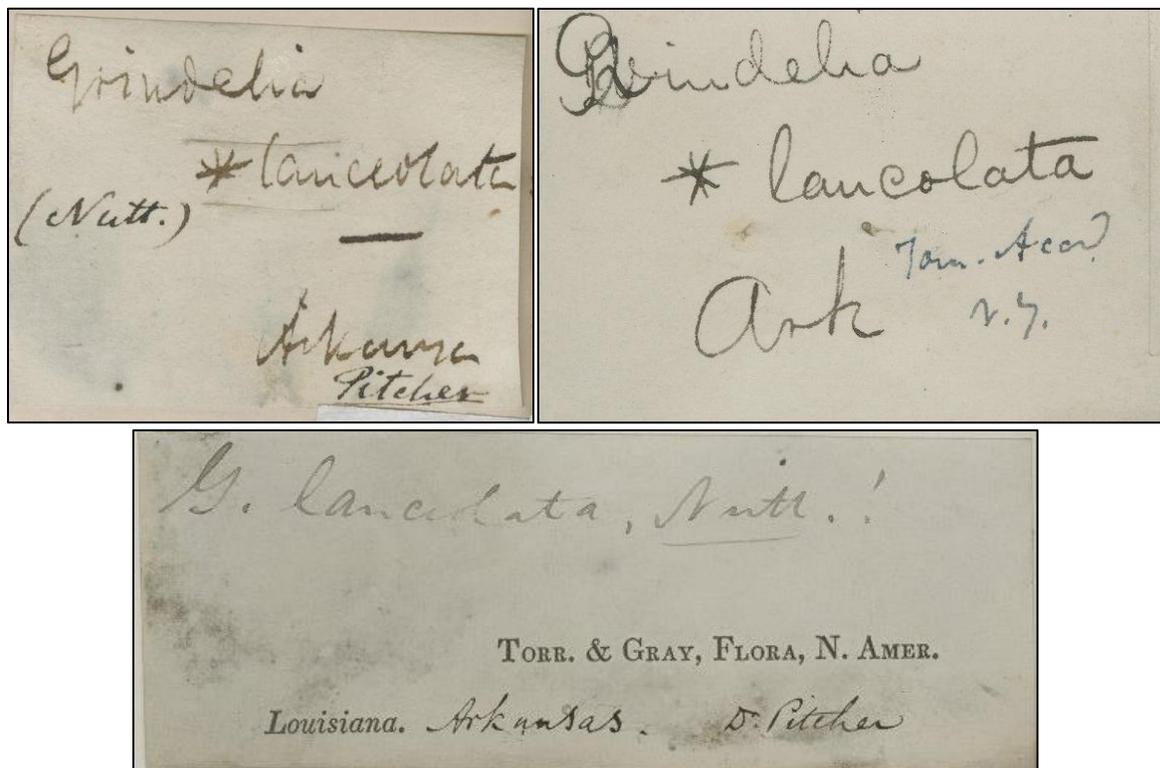


Figure 1. Labels for the type collection of *Grindelia lanceolata*. Top left: PH 00047860. Top right: BM 001050186 (perhaps not in Nuttall's hand?), mounted on same sheet as Drummond 137. Bottom: NY 00169613, mounted on same sheet as Drummond 137.

Steyermark (1934, p. 516) noted this for *Grindelia littoralis*: "This endemic of the Galveston Bay region is intermediate between *G. lanceolata* and *G. texana*. It possesses a larger amount of resin both on the leaves and involucre than either of the latter species; the leaf margins have teeth which are closely appressed and incurved, whereas in *G. texana* and *G. lanceolata* the teeth are directed outward and are more salient; the pappus awns in *G. littoralis* are mostly marked with several projections, whereas in the other two species they are entire or subentire." These features appear in various other localities and *G. littoralis* is interpreted.

The large leaves of *Grindelia lanceolata* fma. *latifolia* are distinctive but large-leaved variants appear sporadically elsewhere. Steyermark (1934, p. 516) noted that "This species is quite variable as to leaf shape, size, and margin, but the variations are not concomitant." Fma. *latifolia* also is regarded here as a populational variant.

Plants identified as *Grindelia lanceolata* from Chickasaw and Noxubee cos., Mississippi, and from Hale and Sumter cos., Alabama, are *Heterotheca camporum*. Collections identified as *G. lanceolata* from Potter Co., Texas, are *Rayjacksonia annua* (Higgins 12507, DES; Higgins 11466, UTC). Similarly, from Oklahoma, apparently the only collection from Harmon Co. is *Grindelia nuda* (IND, UTC); a collection from Canadian Co. is *Grindelia ciliata* (Kiddie 63, OCLA); a OKLA

collection from Woodward Co. proved to be a specimen of *Gaillardia*, mistakenly databased as *G. lanceolata*. A wool mill collection from South Carolina was from an introduced plant (Nesom 2004); disjunct occurrences in Virginia and North Carolina presumably are introduced (Weakley 2015). Plants from disjunct localities in Wisconsin (Dane Co., *Larsen s.n.*, WIS) and Ohio (Athens Co., *Porter & Wamsley 2116.1*, OS) were collected apparently in natural habitats and are considered here, tentatively, as native.

2. GRINDELIA TEXANA Scheele, *Linnaea* 21: 601. 1848. *Grindelia lanceolata* var. *texana* (Scheele) Shinnars, *Field & Lab.* 19: 78. 1951. **LECTOTYPE** (designated here, superceding the choice by Bartoli & Tortosa 2012): **USA. Texas.** [Comal Co.:] New Braunfels, "sparsely on stony prairies, 2-4 ft high, only branching above," Aug 1846, *F. Lindheimer* *Flora Texana exsiccata 418* (GH 283064 image; isolectotypes: G, GH-2 sheets, PH, US). Protologue: "Auf steiniger Prairie bei Neubraunfels: Lindheimer, August."

GH 283064 bears a handwritten label (by Lindheimer) identifying it as "*Grindelia lanceolata* var." and with collection data matching the protologue (Fig. 2): "Sparsely on stone prairies," "N Br" [New Braunfels], "Aug 46." The number "196," handwritten on the label, probably was Lindheimer's field number, different from his exsiccata numbering. The specimen also has an annotation by Asa Gray on one of his small "SYN. FL. N. AMER." labels as "forma spinulosa serrata," a phrase matching his description in *Flora of North America* (see next paragraph). The G, PH, and other two GH collections have only printed exsiccata labels, without Lindheimer's original notes that became part of the protologue. Bartoli and Tortosa chose the US collection as lectotype.

Torrey and Gray (1841, p. 248) recognized what would later be named as *Grindelia texana* as variety "y.?" within *G. lanceolata* — contrasted to typical form by 'leaves short, oblong-lanceolate, partly clasping, spinulose-serrulate; scales of the involucre with shorter appendages, more unequal and appressed, ... lower leaves incisely **spinulose-serrate**, or sometimes almost pinnatifid' and typified by "Texas, Drummond!" The Drummond collection almost certainly are the plants mounted with the BM and NY isolectotypes of *G. lanceolata*, as noted above.

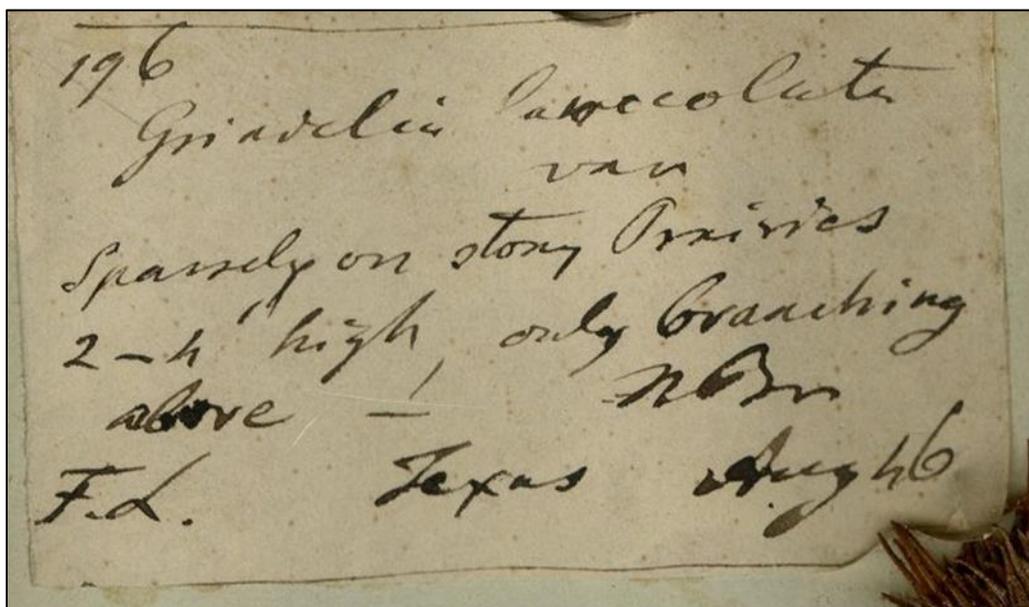


Figure 2. Handwritten label on the GH 283064 lectotype collection of *Grindelia texana*. This is the only one of the sheets of Lindheimer's collection with label data matching the protologue.

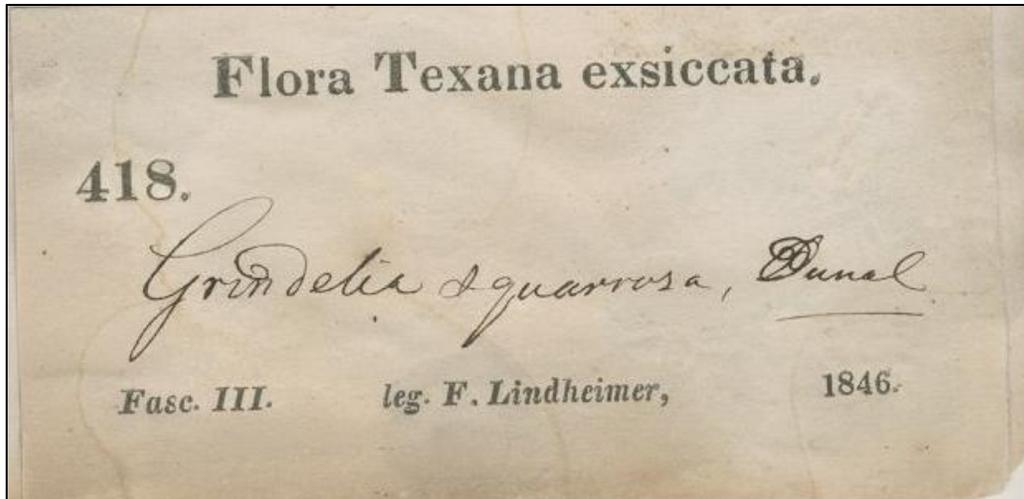


Figure 3. Label on the US type collection of *Grindelia texana*, selected by Bartoli and Tortosa as lectotype. The printed exsiccata label is the same as on the duplicates from G, GH, and PH.

Correll and Johnston (1970) included *Grindelia texana* as a synonym of *G. lanceolata*, but they noted that two morphological types exist in Texas (the *G. texana* type and "true *G. lanceolata*"; see comments below). Taylor and Taylor (1994) treated *G. texana* as a variety of *G. lanceolata*. Diggs et al. (1999) and Tyrl et al. (2009) included *G. lanceolata* but not *G. texana*, not even mentioning the latter as a synonym.

Shinners's reduction of *Grindelia texana* to varietal rank (1951) was accompanied by this comment: "Species and variety have the same habitat preferences and very small morphological differences (looking more distinct in print than in nature)." But while the differences may seem relatively small, they are consistent and mark distinct geographical entities. The sharply bounded eastern edge of the *G. texana* range coincides with the eastern boundary of the Edwards Plateau, and habitats are correspondingly distinct: rocky hills, bluffs, and ridges, limestone outcrops, prairies, and roadsides, upland clay and caliche — all characterized by a limestone substrate. Habitats of *G. lanceolata* also tend to be over calcareous substrate but are more diverse: limestone outcrops and glades, shell mounds, marsh, river, and stream banks, blackland, clay, and sandy prairies, forest openings, and rocky and gravelly roadbanks. Both taxa have chromosome counts of $2n = 12$.

Steyermark noted (1934, p. 516) that "In the vicinity of Dallas, Texas, a region of range overlap of *Grindelia texana* and *G. lanceolata* ... collections have been taken which are intermediate between, and may be hybrids of *G. texana* and *G. lanceolata*." Correll and Johnston (1970, p. 1572) made a similar observation, noting that "The plants from most of Texas have rather large achenes and mostly deltoid leaves (*G. texana*), but in north-central Texas this type grades northward into a type (true *G. lanceolata*) with shorter achenes, shorter duration (biennial?) and more elongate leaves." Strother and Wetter (2006) also treated *G. texana* as a synonym but recognized the occurrence of the morphogeographic variant. The present study confirms apparent gene flow in the area of sympatry of *G. lanceolata* and *G. texana* around Dallas (Fig. 4) — Figure 8 show a collection where both species apparently were present, Figure 9 where plants apparently were intermediate.

Gene flow apparently occurs between *Grindelia lanceolata* and *G. texana* in their small area of sympatry, and some disjunct prairie plants of southeastern Texas seem to show 'texana' features (see Fig. 7) and a collection of typical *G. texana* was made in Hopkins Co., Texas (Fig. 15), about 80 miles east of the closest populations in the main range. The decision here to recognize *G. texana* at specific rank emphasizes its essential fidelity to the Edwards Plateau region and its consistent morphological difference from *G. lanceolata*.

The couplet below essentially follows Steyermark's concepts:

- a. Annual or short-lived perennial; phyllaries subequal in length, outer about equalling the height of the disk; leaves mostly oblong to lanceolate-oblong or lanceolate, margins shallowly serrulate to serrate or crenulate, with (6–)10–20 pairs of teeth, distal narrowly lanceolate to lanceolate-linear; inner achene faces smooth or weakly longitudinally nerved **Grindelia lanceolata**
- a. Perennial; phyllaries graduated in length, outer less than 1/2 the height of the disk; leaves oblong or nearly elliptic to oblong-lanceolate, ovate-triangular or triangular, margins coarsely serrate with 3–8 pairs of aristate-spinulose teeth, distal usually ovate-triangular to ovate; inner achene faces with numerous, longitudinal, thin and superficial nerves **Grindelia texana**

Collections of plants disjunct in northern Mexico are these. **Coahuila**. 21 km S by winding road from Rancho Chupadero del Caballo toward Las Norias, 12 Sep 1972, *Chiang, Wendt, & Johnston 9170* (NY); W slopes of Sierra del Carmen, 8 km E of Hacienda Encantada, 15 Sep 1941, *Stewart 1702* (GH).

3. GRINDELIA GREENEI Steyermark, Ann. Missouri Bot. Gard. 21: 517. 1934. *Grindelia lanceolata* var. *greenii* (Steyermark) Nesom, Phytologia 68: 324. 1990. **TYPE: MEXICO. Nuevo León.** "Vicinity of Monterrey," 1924, *C.R. Orcutt 1204* (holotype: US image). Figure 16.

Additional collections examined. MEXICO. Nuevo León. Monterrey, "foot Chipinque," 9 Oct 1937, *Kenoyer 300* (F, MO); Monterrey, 1924, *Orcutt 1249* (US).

Grindelia greenii has been known by only three collections, as cited above, from Monterrey and close-by localities, but its continued existence is recently confirmed. Recent photos posted on Naturalista (2019) show it from two other sites, both also very near Monterrey (just west of García, southwest of Picachos el Fraile — photos by Carlos Velazco, see Fig. 17; Santa Catarina — photos by Tadeo Hernández). Nesom (1990) treated *G. greenii* at varietal rank within *G. lanceolata*, but the collections and photos show that its morphology is constant and distinct from *G. lanceolata*, and the disjunction of about 250 miles (Fig. 4) from both *G. lanceolata* and *G. texana* supports its recognition at specific rank.

Characteristic features: glabrous vestiture, leaves prominently punctate on both surfaces; leaves broadly oblong to broadly ovate-elliptic or lanceolate-oblong, 15–25 mm long, nearly even-sized up to the heads or slightly reduced, base truncate, apex rounded to rounded-obtuse, margins with 10–15 pairs of sharp-pointed but not spinulose teeth; involucre 10–12 mm wide; phyllaries distinctly graduate in length.

4. GRINDELIA DECUMBENS Greene, Pittonia 3: 102. 1896. *Grindelia hirsutula* var. *decumbens* (Greene) Ackerf., Fl. Colorado, ix. 2015. **TYPE: USA. Colorado.** [Montrose Co.]: Cimarron, 30 Aug 1896, *E.L. Greene s.n.* (holotype: NDG-53581; isotype: NDG-53582).

Grindelia subincisa Greene, Pittonia 4: 154. 1900. *Grindelia decumbens* var. *subincisa* (Greene) Steyermark, Ann. Missouri Bot. Gard. 21: 503. 1934. *Grindelia lanceolata* var. *subincisa* (Greene) Bartoli & Tortosa, Ann. Missouri Bot. Gard. 98: 480. 2011 [2012]. **LECTOTYPE** (Bartoli & Tortosa 2012): **USA. New Mexico.** [Rio Arriba Co.]: Chama, 5 Sep 1899, *C.F. Baker 683* (NDG-47371; isolectotypes: F, GH, NDG, NY, RM, RSA, US-2 sheets).

Bartoli and Tortosa (2012) transferred the mainly Colorado taxon *Grindelia subincisa* to *G. lanceolata* at varietal rank. Steyermark (1934), followed by Harrington (1954) and Martin and Hutchins (1980) placed *G. subincisa* as a variety within *G. decumbens*, while Allred and Ivey (2012) treated *G. subincisa* simply as a synonym within *G. decumbens*. Ackerfield (2015) treated *G. decumbens*, presumably including var. *subincisa*, at varietal rank within *G. hirsutula* Hook. & Arn., in its strict sense an endemic of California coastal ranges. Strother and Wetter (2006), however, enlarged

the concept of *G. hirsutula* by including within it about 30 taxa regarded as distinct by most other botanists. Strother and Wetter maintained *G. decumbens* as distinct; Ackerfield's taxonomic combination followed suit in *G. hirsutula* and further broadened its concept.

In allying *Grindelia subincisa* with *G. lanceolata*, Bartoli and Tortosa (2012) pointed out differences between *G. decumbens* and *G. lanceolata* (phyllary shape and degree of graduation and leaf tooth apex) but did not say on what basis they saw an intimate connection between *G. subincisa* and *G. lanceolata*. Within the larger population system of *G. decumbens*, even within single populations, morphology of leaf teeth and involucre varies and there appears to be no unarbitrary geographic or morphological way to recognize infraspecific entities (i.e., "subincisa") within what is identified here as *G. decumbens*. In addition to the wide geographic hiatus between *G. decumbens* and *G. lanceolata* (Fig. 4), diagnostic morphological differences are apparent — *G. decumbens* is shorter in stature, has smaller, hemispheric-campanulate involucre, and has graduated phyllaries with an abruptly narrowed-acuminate and reflexed apical region (Figs. 18, 19).

Plants IDed on SEINET and in databases as *Grindelia decumbens* from Fremont and Mesa counties, Colorado, and from Grant and Hidalgo counties, New Mexico, are not *G. decumbens*.

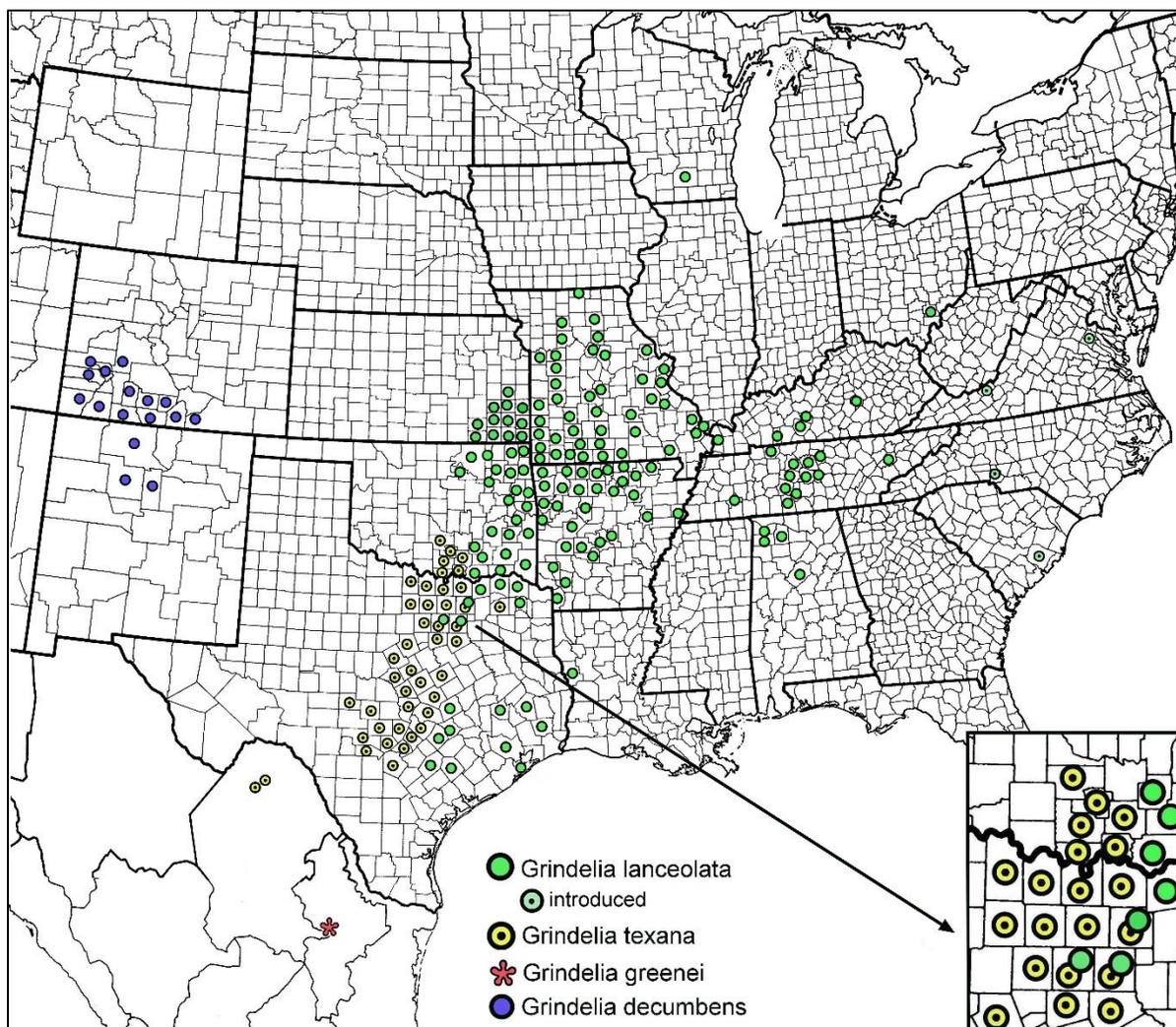


Figure 4. Distribution of *Grindelia lanceolata*, *G. texana*, *G. greenei*, and *G. decumbens*. Inset shows enlarged area of sympatry between *G. lanceolata* and *G. texana* — Collin, Dallas, and Tarrant counties. The eastward-disjunct collection of *G. texana* from Hopkins Co., Texas, is shown in Figure 15.



Figure 5. *Grindelia lanceolata*, representative morphology. Bastrop Co., Texas, Neff 02061103 (TEX).



Figure 6. *Grindelia lanceolata*, representative morphology. Polk Co., Texas, *Hillhouse s.n.* (TEX).



Figure 7. *Grindelia lanceolata*, representative morphology. Edmonson Co., Kentucky, *Medley & Cassel 14450-86* (ASPC).



Figure 8. *Grindelia lanceolata* (left) and *Grindelia texana* (right), apparently a mixed population. Dallas Co., Texas, *Biltmore 14926* (IND).



Figure 9. *Grindelia lanceolata* x? *G. texana*, both stems perhaps intermediate, or closest to *G. texana* (compare *G. texana* in Fig. 14 from Wise Co.). Dallas Co., Texas, *Lundell 11556* (LL).



Figure 10. *Grindelia lanceolata* with incised-spinulose leaf margins and graduated phyllaries more characteristic of *G. texana*, from a disjunct prairie habitat. Hardin Co., Texas, *Lundell 11556* (LL).



Figure 11. *Grindelia texana*, representative morphology. Tarrant Co., Texas, *Byerly 524* (BRIT).



Figure 12. *Grindelia texana*, representative morphology. Hamilton Co., Texas, Massey 341 (LL).



Figure 13. *Grindelia texana*, representative morphology. Brown Co., Texas, Hansen 7402 (TEX).



Figure 14. *Grindelia texana*, variability of leaf margin within a population. Wise Co., Texas, Orzell & Bridges 11285 (TEX).



Figure 15. *Grindelia texana*, typical morphology, eastward disjunct from the main range of the species (see Fig. 4). Texas, Hopkins Co.: 1 mi E of Mount Vernon, open roadside, 25 Jun 1949, Stiteler s.n. (PH).



Figure 16. *Grindelia greenei*, holotype.



Figure 17. *Grindelia greenei* from west of García, Nuevo León, just north of Monterrey. Photo by Carlos Velazco, 11 July 2007. From Naturalista 2019, used by permission.



Figure 18. *Grindelia decumbens*, representative morphology. Mesa Co., Colorado, Trappett 86-52 (MESA).



Figure 19. *Grindelia decumbens*, representative morphology. Mineral Co., Colorado, *Regensberg 1943* (DBG-KHD).

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