

# CHROMOSOME NUMBERS OF *GLANDULARIA* (VERBENACEAE) FROM CENTRAL AND TRANS-PECOS, TEXAS

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## ABSTRACT

Meiotic chromosome counts for 66 populations of the genus *Glandularia* (sensu Umber 1979) are reported, all from the state of Texas. These include counts for the following taxa: *G. bipinnatifida* var. *bipinnatifida* ( $n = 15$  pairs); *G. bipinnatifida* var. *brevispicata* ( $n = 15$  pairs); *G. pumila* ( $n = 10$  pairs); *G. quadrangulata* ( $n = 10$  pairs); *G. racemosa* ( $n = 10$  pairs); *G. verecunda* ( $n = 10$  pairs); and *G. wrightii* ( $n = 10$  pairs). The taxonomic import of these data is discussed.

## RESUMEN

Se publican los recuentos cromosómicos en meiosis de 66 poblaciones del género *Glandularia* (sensu Umber 1979), todos del estado de Texas. Se incluyen recuentos de los siguientes taxa: *G. bipinnatifida* var. *bipinnatifida* ( $n = 15$ ); *G. bipinnatifida* var. *brevispicata* ( $n = 15$ ); *G. pumila* ( $n = 10$ ); *G. quadrangulata* ( $n = 10$ ); *G. racemosa* ( $n = 10$ ); *G. verecunda* ( $n = 10$ ); y *G. wrightii* ( $n = 10$ ). Se discute la importancia taxonómica de estos datos.

*Glandularia* is a difficult genus, as well noted by Umber (1979) in his systematic treatment of the group, and by both Henrickson (2003) and Turner (2003) in their running accounts of several taxa. In his efforts to utilize cytological data in evaluating taxonomic groupings, Umber summarized previous counts for the genus, this amounting to 47 reports for 20 species, including 10 of his own. Subsequently, few additional counts have been forthcoming, although Poggio et al. (1993), without reference to Umber's work, noted that the genus is amphotropical in distribution, those of South America possessing mostly diploid taxa ( $2n = 10$  or  $2x = 5$ ), those of North America mostly hexaploid ( $2n = 30$  or  $6x = 30$ ). Actually, of the North American taxa of *Glandularia* counted to date (ca. 20 species), half are tetraploids ( $4x = 20$ ), and half are hexaploids ( $6x = 30$ ); no diploids have been reported, suggesting a South American origin for the group, as first noted by Schnack (1964).

In the present account we provide chromosome counts for an additional 66 populations from six species, all of these from Texas, as summarized in Table 1. We subsequently discuss the import of these data according to the treatment of Umber.

TABLE 1. Chromosome counts of *Glandularia* (sensu Umber 1979).

<b>Glandularia bipinnatifida</b> (Nutt.) Nutt. var. <b>bipinnatifida</b> : all counts <i>n</i> = 15 pairs. Brewster Co.: 0.5 mi S of Alpine, <i>Powell 6415</i> (SRSC). Brewster Co.: 1 mi S of Alpine, <i>Powell 6416</i> (SRSC). Brewster Co.: 1.4 mi S of Alpine, <i>Powell 6417</i> (SRSC). Brewster Co.: 9 mi SE of Alpine, <i>Powell &amp; Powell 6429</i> (SRSC). Brewster Co.: 6 mi N of Alpine, <i>Powell &amp; Powell 6431</i> (SRSC). Brewster Co.: 3 mi W of Alpine, <i>Turner 24-157</i> (SRSC, TEX). Brewster Co.: 14 mi NE of Marathon, <i>Turner 24-168</i> (SRSC, TEX). Crockett Co.: ca. 15 mi W of Ozona, <i>Turner 24-532</i> (SRSC, TEX). Culberson Co.: ca. 18 mi W of Orla, <i>Turner 24-370</i> (SRSC, TEX). Hudspeth Co.: 6.1 mi W of Sierra Blanca, <i>Turner 24-184</i> (SRSC, TEX). Hudspeth Co.: Allamoore exit, IH 10, ca. 20 mi E of Sierra Blanca, <i>Turner 24-318</i> (SRSC). Jeff Davis Co.: 0.1 mi along Farm Rd 2017 from Hwy. 90, <i>Turner 24-554</i> (SRSC, TEX). Kimble Co.: ca. 3.6 mi along old Segovia Road from IH-10, <i>Turner 24-221</i> (SRSC, TEX). Pecos Co.: ca. 3 mi W of Longfellow, <i>Rodriguez &amp; Turner 24-201</i> (SRSC, TEX). Pecos Co.: ca. 4 mi NW of Longfellow, <i>Rodriguez &amp; Turner 24-202B</i> (SRSC, TEX). Pecos Co.: ca. 27 mi S of Fort Stockton, <i>Turner 24-169</i> (SRSC, TEX). Pecos Co.: 23 mi S of Fort Stockton, <i>Turner 24-179</i> (SRSC, TEX). Pecos Co.: 2.1 mi N of Fort Stockton, <i>Powell &amp; Powell 6436</i> (SRSC). Pecos Co.: 2 mi SE of Fort Stockton, <i>Powell &amp; Powell 6438</i> (SRSC). Pecos Co.: 1.5 mi S of Fort Stockton, <i>Powell &amp; Powell 6440</i> (SRSC). Pecos Co.: N part of Fort Stockton, <i>Powell &amp; Powell 6443</i> (SRSC). Pecos Co.: ca. 15 mi E of Bakersfield, <i>Turner 24-444</i> (SRSC, TEX). Presidio Co.: ca. 22 mi W of Marfa, <i>Turner 24-183</i> (SRSC, TEX). Presidio Co.: ca. 20 mi S of Marfa, <i>Turner 24-277</i> (SRSC, TEX). Reeves Co.: 2 mi E of Balmorhea, <i>Turner 24-226</i> (SRSC, TEX). Sutton Co.: 6 mi W of Sonora, <i>Turner 24-223</i> (SRSC, TEX).
<b>Glandularia bipinnatifida</b> var. <b>brevispicata</b> Umber: all counts <i>n</i> = 15 pairs. Culberson Co.: ca. 2 mi W of Guadalupe Mts. Natl. Park, <i>Turner 24-228</i> (SRSC, TEX). Culberson Co.: 3 mi along Hwy. 652 from its juncture with US 180, <i>Turner 24-242</i> (SRSC, TEX). Culberson Co.: roadside park just W of Guadalupe Mts. Natl. Park, <i>Turner 24-254</i> (SRSC, TEX).
<b>Glandularia pumila</b> (Rydb.) Umber: all counts <i>n</i> = 10 pairs. Brewster Co.: ca. 5 mi W of Alpine, <i>Turner 24-141</i> (SRSC). Crockett Co.: above Fort Lancaster, <i>Turner 24-32</i> (TEX).
<b>Glandularia quadrangulata</b> (Heller) Umber: all counts <i>n</i> = 10 pairs. Crockett Co.: ca. 5 mi due N of Sheffield, <i>Turner 24-72</i> (SRSC, TEX). Crockett Co.: where Hwy. 1973 crosses into Val Verde Co, <i>Turner 24-145</i> (SRSC, TEX).
<b>Glandularia racemosa</b> (Eggert) Umber: all counts <i>n</i> = 10 pairs. Brewster Co.: Dog Flats, Big Bend Natl. Park, <i>Powell et al. 6406</i> (SRSC). Brewster Co.: 5.6 mi S along Hwy. 385 from intersection with Hwy. 2627, <i>Turner 24-51</i> (SRSC, TEX). Brewster Co.: 6 mi E of Marathon, <i>Turner 24-142</i> (SRSC, TEX). Pecos Co.: 9 mi W of Fort Stockton, <i>Turner 24-29</i> (SRSC, TEX). Pecos Co.: 3.5 mi E of Fort Stockton, <i>Turner 24-30</i> (SRSC, TEX). Pecos Co.: 2.2 mi along Hwy. 67 from IH-10, <i>Turner 24-43</i> (SRSC, TEX). Pecos Co.: 11.5 mi SE of Imperial, <i>Turner 24-59</i> (SRSC, TEX). Pecos Co.: 6 mi S of Fort Stockton, <i>Turner 24-180</i> (SRSC, TEX).



TABLE 1. continued

**Glandularia verecunda** Umber: all counts  $n = 10$  pairs.

- Brewster Co.: Dog Flats, Big Bend Natl. Park, *Powell et al.* 6405 (SRSC).
- Brewster Co.: 10 mi N of Panther Junction, Big Bend Natl. Park, *Powell et al.* 6412 (SRSC).
- Brewster Co.: 5.6 mi S along Hwy. 385 from intersection with Hwy. 2627, *Turner 24-50* (SRSC, TEX).
- Pecos Co.: 9 mi W of Fort Stockton along IH-10, *Turner 24-28* (SRSC, TEX).
- Pecos Co.: 3.5 mi E of Fort Stockton, *Turner 24-30* (SRSC, TEX).
- Pecos Co.: 2.2 mi along Hwy. 67 from IH-10, *Turner 24-44* (SRSC, TEX).
- Pecos Co.: 0.3 mi from Pecos River along Hwy. 67, *Turner 24-66A* (SRSC, TEX).
- Pecos Co.: 2 mi S along Hovey road from IH-10, *Turner 24-121* (SRSC, TEX).

**Glandularia wrightii** (A. Gray) Umber: all counts  $n = 10$  pairs.

- El Paso Co.: Franklin Mts., ca. 8 mi N of El Paso, Loop Road, Fusselman Mt. Canyon trailhead, *M. Turner 107* (SRSC).
- Brewster Co.: Panther Junction, Big Bend Natl. Park, *Fenstermacher s.n.* (SRSC).
- Brewster Co.: Panther Pass, Big Bend Natl. Park, *Fenstermacher s.n.* (SRSC).
- Brewster Co.: 9 mi SE of Alpine, *Powell 6414* (SRSC).
- Brewster Co.: ca. 5 mi S of Alpine, *Powell 6418* (SRSC, TEX).
- Brewster Co.: 9 mi SE Alpine, *Powell & Powell 6430* (SRSC).
- Brewster Co.: 6 mi N of Alpine, *Powell & Powell 5432* (SRSC).
- Brewster Co.: ca. 5 mi W of Alpine, *Turner 24-156* (SRSC, TEX).
- Brewster Co.: Turner Canyon, 5 mi W Alpine, *Turner 24-429* (SRSC).
- Brewster Co.: 32 mi S of Alpine, *Turner 24-159* (SRSC, TEX).
- Jeff Davis Co.: ca. 8 mi NW of Fort Davis, *Hedges 75* (SRSC).
- Jeff Davis Co.: 4 mi S of Fort Davis, *Powell et al.* 6433 (SRSC).
- Jeff Davis Co.: Davis Mts. State Park, *Turner 24-200* (SRSC, TEX).
- Jeff Davis Co.: ca. 20 mi E of Fort Davis, *Turner 24-227* (SRSC, TEX).
- Presidio Co.: ca. 20 mi S of Marfa, *S. Powell 22* (SRSC).
- Presidio Co.: ca. 14 mi S of Marfa, *Turner 24-288* (SRSC, TEX).
- Presidio Co.: ca. 23 mi S of Marfa, *Turner 24-289* (SRSC, TEX).

**Glandularia bipinnatifida** var. **bipinnatifida**

Umber reported chromosome counts for 18 collections of this taxon from over a broad range. Fifteen of these were listed as  $n = 15$  pairs; three with  $n = 10$  pairs. The latter counts, as noted below, perhaps relate to *G. wrightii*. We report herein counts for an additional 26 collections of *G. b.* var. *bipinnatifida*, all with  $n = 15$  pairs.

**Glandularia bipinnatifida** var. **breviscapa**

Umber reported a single collection (the Type) of this taxon as  $n = 15$  pairs. We have added three additional counts from the Guadalupe Mts. of Culberson Co., Texas, all with  $n = 15$  pairs.

**Glandularia pumila**

Umber reported only two counts for this taxon, both by Lewis and Oliver (1961) from Central Texas, and both with  $n = 10$  pairs. We report here two additional counts from western Texas, both having the same number.

***Glandularia quadrangulata***

Umber listed a single count of  $n = 10$  pairs for this taxon, as first reported by Lewis and Oliver (1961) from a population in southern Texas. We report two additional collections, both with  $n = 10$  pairs.

***Glandularia racemosa***

Umber reported counts of only two collections of this taxon, an unvouchered count of  $n = 15$  pairs by Derman (1936), and a count of  $n = 15$  pairs by Umber himself, the latter from Pecos Co., Texas. On the basis of these two reports Umber reckoned the taxon to be a hexaploid ( $6x = 30$ ). We present here counts from eight Texas populations, including the populational site from which Umber obtained his count of  $n = 15$  pairs. All proved to be tetraploids ( $4x = 40$ ).

It would appear that *G. racemosa* is not a hexaploid as previously reported; both Umber (1979) and Henrickson (2003) used such data to bolster their acceptance of *G. racemosa* as a valid species, as opposed to its submergence under *G. quadrangulata* as originally proposed by Turner (1998). Actually, morphological characters alone will serve to distinguish *G. racemosa* from *G. quadrangulata* (Turner, in prep.).

***Glandularia wrightii***

Umber reported counts of three collections of this taxon, all with  $n = 10$  pairs. He acknowledged its close relationship to *G. bipinnatifida* (so far as known a hexaploid) but noted its consistently tetraploid chromosome number, and seeming restriction to the higher portions of the Chisos, Davis, and Franklin mountains of Trans-Pecos, Texas. The only exceptional counts for *G. bipinnatifida* (i.e.,  $n = 10$  pairs) reported by Umber are three: two from Texas (El Paso and Pecos counties) and one from Arizona (Apache Co.). Interestingly, two of the latter were identified by their collectors as *G. wrightii*. Regardless, we present here counts for 17 collections of *G. wrightii*, all tetraploid with  $n = 10$  pairs. The species often grows in close proximity to *G. bipinnatifida* without showing signs of hybridization, although putative first generation hybrids would be exceedingly difficult to detect without cytological data. Nevertheless, field observations and chromosomal data assembled by the present authors strongly suggest that *G. wrightii* is a good biological species, contrary to the views of Turner (1998) who treated it as synonymous with his concept of *G. bipinnatifida* var. *ciliata* (Benth.) B.L. Turner.

**MATERIALS AND METHODS**

All counts were obtained from meiotic material collected in the field; preservation and staining procedures follow the methods outlined by Powell and Weedon (2001).



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