

YELLOW-FLOWERED LINUM (LINACEAE) IN TEXAS¹

C. MARVIN ROGERS

Department of Biology, Wayne State University, Detroit, Michigan

During the course of some studies of the genus *Linum*, I have had the opportunity to examine a large number of specimens from Texas. Since the state is of interest in having far more species than any other and since, henceforth, attention will not be given particularly to the Texas taxa, it seems profitable to bring together at this time some of the accumulated data. Some collections from the state have not yet been seen and these no doubt would reveal some more county records, but it seems unlikely that the distribution patterns which have emerged will be greatly changed.

The features used to distinguish the various taxa, especially in the *L. rigidum* group, will be discussed further at a later date. The characters used in the key are certainly not necessarily the most significant. Living material of most of the Texas species is now at hand and it may be that cytological and genetic studies of these plants will result in some modification of the species and varieties as treated here, but a sufficient amount of material has been examined that the present interpretation should provide a basic framework for the field identification and recognition of the Texas taxa.

For the ranges of some of the plants described here, collections from about 45 herbaria were examined, but for species of the *L. rigidum* group (*L. alatum*, *L. aristatum*, *L. australe*, *L. puberulum*, *L. rigidum* and *L. vernale*) distributional data comes principally from the collections of the United States Museum, the Gray Herbarium, the New York Botanical Garden, the Missouri Botanical Garden, the Chicago Museum of Natural History, Southern Methodist University, the University of Texas and the Lundell Herbarium, while for *L. rupestre* and *L. schiedeanum* the records come mainly from the last three. To the curators of all of these collections thanks are gratefully given.

The features of the genus as found in the state (excluding the two or three blue flowered species) may be summarized as follows:

Glabrous or occasionally pubescent annual or perennial herbs; leaves simple, sessile, entire or the upper glandular-toothed, alternate, opposite or rarely whorled on the lower part of the stem, alternate above; stipular glands present or none; inflorescence a terminal scorpioid cyme; flowers regular; sepals 5, imbricate, all or only the inner commonly with glandular-toothed margins; petals 5, convolute, separate, yellow, fugacious;

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stamens 5, united basally, with or without diminutive intervening staminodia; ovary superior, 5-carpelled, but becoming more or less completely 10-locular through the intrusion of false septa, dehiscent into 5 or 10 segments; seeds 10; styles 5, separate or united; stigmas capitate.

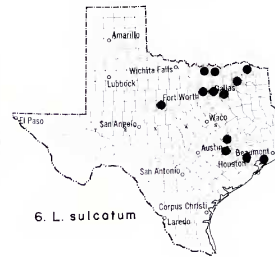
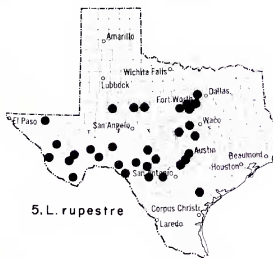
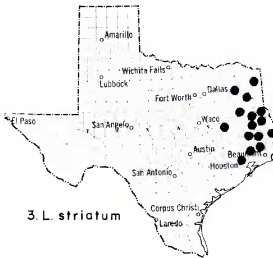
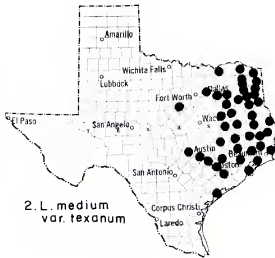
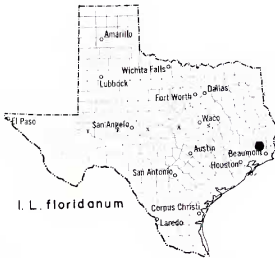
KEY TO THE SPECIES AND VARIETIES

- 1a. Styles separate or nearly so; fruit ultimately dehiscent into 10 one-seeded segments
 - 2a. Outer sepals entire
 - 3a. Fruit pyriform, longer than broad; pollen about 10-colpate 1. *L. floridanum*
 - 3b. Fruit spheroidal, as broad or broader than long; pollen 3-colpate.
 - 4a. Margins of inner sepals with conspicuous stalked glands; mature fruit in dried specimens usually adhering to the plant; leaves narrowly lanceolate or oblanceolate 2. *L. medium* var. *texanum*
 - 4b. Margins of inner sepals glandless or with very inconspicuous glands; mature fruit in dried specimens usually soon shattering; leaves elliptic to oblanceolate or obovate 3. *L. striatum*
 - 2b. Sepals all with glandular teeth
 - 5a. Perennial; styles completely separate; pollen 3-colpate
 - 6a. Leaves lanceolate or oblanceolate or broader, some of the lower ones in whorls of four 4. *L. schiedeanum*
 - 6a. Leaves linear, the lower ones alternate or opposite 5. *L. rupestre*
 - 5b. Annual; styles united at the base; pollen with about 20 germ pores 6. *L. sulcatum*
- 1b. Styles united to above the middle; fruit dehiscent along the false septa into 5 two-seeded segments
 - 7a. Sepals entire or fringed, not glandular-toothed
 - 8a. Upper leaves and bracts sparsely, but conspicuously ciliate-margined; cartilaginous portion of false septa conspicuously wider toward the base of carpel 7. *L. imbricatum*
 - 8b. Upper leaves and bracts not ciliate-margined; cartilaginous portion of false septa uniformly narrow or absent throughout 8. *L. hudsonioides*
 - 7b. Sepals glandular-toothed
 - 9a. Plants grayish puberulent throughout 9. *L. puberulum*
 - 9b. Plants glabrous or nearly so throughout
 - 10a. Outer sepals ovate, the broad, scarious margins irregularly crenate, each of the coarse teeth bearing a delicate gland 10. *L. alatum*
 - 10b. Outer sepals lanceolate or narrower, the margins not scarious or narrowly so, regularly, though sometimes sparsely, serrate with gland-tipped teeth
 - 11a. False septa incomplete, the inner margin terminating in a loose fringe; sepals persistent in fruit 11. *L. vernale*

- 11b. False septa complete; sepals usually deciduous in fruit
 12a. Leaves small, the lower tending to be hidden among the branches; plant broomlike, bushy with long, slender stiffly spreading-ascending, few-flowered branches 12. *L. aristatum*
 12b. Leaves quite evident; plants not broomlike, rather few-branched at the base or in the inflorescence
 13a. Stipular glands absent
 14a. Styles 6—10 mm. long
 15a. Stigmas pale; sepals green
 16a. Fruit thin-walled (dark seeds commonly evident through the wall), elliptic, the base rounded. 13a. *L. rigidum* var. *rigidum*
 16a. Fruit thick walled, opaque, broadly ovoid, tapering abruptly at the flattened base 13b. *L. rigidum* var. *berlandieri*
 15b. Stigmas black; sepals grayish or purplish. 13c. *L. rigidum* var. *filifolium*
 14b. Styles 3—4 mm. long 13d. *L. rigidum* var. *compactum*
 13b. Stipular glands present (sometimes on the lower part of plant only)
 17a. Styles more than 6 mm. long; petals more than 10 mm. long
 18a. Sepals green; stigmas pale 13b. *L. rigidum* var. *berlandieri*
 18b. Sepals grayish or purplish; stigmas black. 13c. *L. rigidum* var. *filifolium*
 17b. Styles less than 6 mm. long; petals less than 10 mm. long
 19a. Stipular glands present only near the base of the plant 14a. *L. australe* var. *australe*
 19b. Stipular glands present and prominent throughout 14b. *L. australe* var. *glandulosum*

1. LINUM FLORIDANUM (Planch.) Trel. var. FLORIDANUM. This, with the next two, is a part of a series of seven perennials, all confined to eastern North America. (See Brittonia 15: 47-122, 1963, for further discussion of these two species.) Though differing from the next in perhaps a dozen qualitative and quantitative characters, this variety is closely related to *L. medium* var. *texanum*, and is thought to hybridize with it. Several collections from eastern Texas appear to involve *L. floridanum* as a parent and it is possible that additional collecting in that part of the state will show it to be more widespread there. It is a fairly common plant in pine and pine-palmetto woodlands throughout much of the southern Atlantic and Gulf Coastal Plains, but is presently known in Texas from a single specimen from Hardin County.

2. LINUM MEDIUM (Planch.) Britton var. TEXANUM (Planch.) Fern. The typical variety of this species is confined to Ontario, but variety *texanum* ranges throughout most of eastern United States, westward to southeastern Iowa and eastern Texas, where it is a species of open woods, meadows and grassy roadsides.



3. *LINUM STRIATUM* Walt. This species is also widely distributed in eastern United States, mostly in the nonglaciated regions in moist situations along the borders of ponds, streams and roadside ditches. Perhaps two dozen collections from scattered localities in 15 counties in eastern Texas have been seen.

4. *LINUM SCHIEDEANUM* Schlecht. and Cham. This and the next are part of a complex of taxa, principally Mexican, of which the identity and relationships are far from completely clear. It seems fairly certain that the Texas plants included here belong to a very widely distributed species, correctly interpreted as *L. schiedeana*. As such, it is found mostly in calcareous soil from southern Mexico northward to the Chisos, Del Norte, Glass and Guadalupe Mountains of western Texas and southern New Mexico.

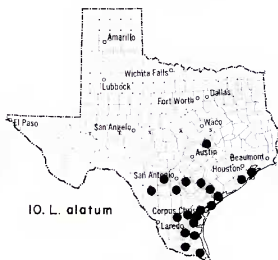
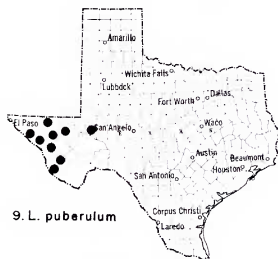
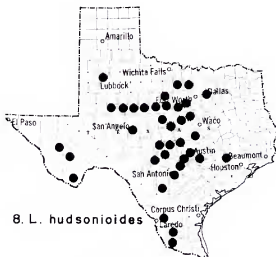
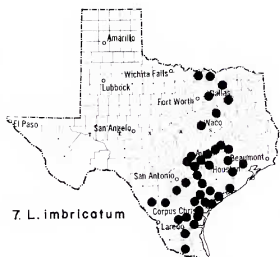
5. *LINUM RUPESTRE* (A. Gray) Engelm. This variable species occupies about the same range and habitat as the last and the two are found together over much of their ranges. *Linum rupestre* is found throughout most of Mexico, with central and western Texas constituting the northernmost limit of its range.

6. *LINUM SULCATUM* Riddell. This species is found in prairies and prairie like areas throughout central and northeastern United States and southern Canada, but is infrequently collected in the southern part of the range. It is of special interest in the genus, since it combines traits of the primitive *L. rupestre* and the highly specialized *L. rigidum* groups.

7. *LINUM IMBRICATUM* (Raf.) Shinnars. This and the next species resemble one another and have not generally been separated. (See Rhodons 65: 50-55, 1963, for further discussion of these three species.) They are small plants of distinctive habit with many, small imbricate leaves and few-flowered inflorescences. Though specimens have come from along both the Oklahoma and Mexico boundaries, the known range lies entirely within Texas, where it is a plant mostly of sandy soil throughout much of the east central part of the state.

8. *LINUM HUDSONIOIDES* Planch. Along with *L. imbricatum*, this is closely allied to the *L. rigidum* group which follows. It is found principally in sandy or gravelly, sometimes calcareous soil in the west central part of the state, with outlying stations in the trans-Pecos region of west Texas and southern New Mexico, the Wichita Mountains and perhaps in central Kansas.

9. *LINUM PUBERULUM* (Engelm.) Heller. This is easily recognized as the only densely pubescent species in the region. It is closely related to *L. australe* and occupies about the same range as that species at low and medium elevations in the mountains from southeastern Wyoming to Utah, south into northern Mexico and eastward through the trans-Pecos region of western Texas where it is found in rocky, sandy or occasionally calcareous situations.



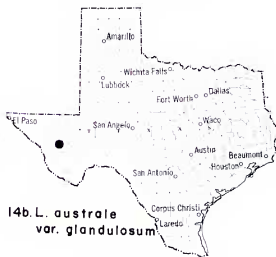
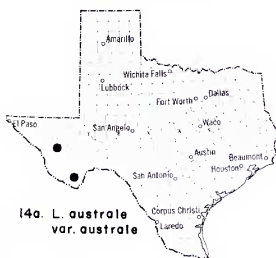
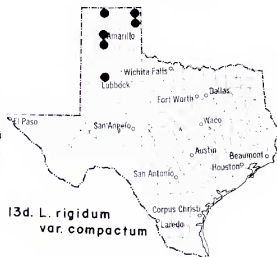
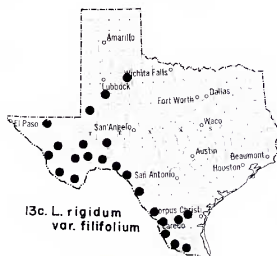
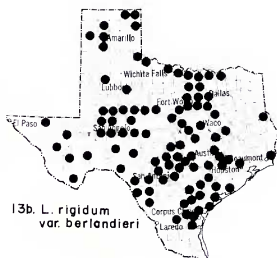
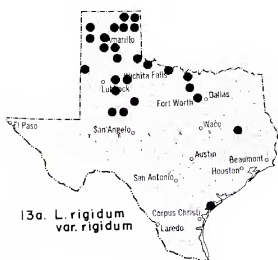
10. *LINUM ALATUM* (Small) Winkler. Like the previous species, this may be quite readily recognized, in this case by the unique sepals. Though it differs in other ways from *L. rigidum* var. *berlandieri*, it is surely closely related to that plant. The ranges of the two overlap, but there does not appear, in the specimens examined, evidence of hybridism. *Linum alatum* is found in sandy soil, sometimes along the beach, in south-eastern Texas, with a collection or two from Tamaulipas, Mexico, near the Rio Grande and from western Louisiana.

11. *LINUM VERNALE* Wooton. The poorly developed false septa and the tendency for the sepals to persist, together with several other features such as fruit shape and texture, indicate that this may be one of the more primitive species of the *L. rigidum* group. The species is found on stony, commonly limestone hills in the trans-Pecos region of Texas, adjacent New Mexico and northern Mexico.

12. *LINUM ARISTATUM* Engelm. This is a distinctive species, though certain of its features do not lend themselves to precise description. In addition to the characters indicated in the key, it has unique pale, narrowly elliptic, thin walled, easily crushed capsules. It is a species of sandy soil, ranging from eastern Utah and western Colorado south to northern Mexico and eastward into west Texas.

13a. *LINUM RIGIDUM* Pursh var. *RIGIDUM*. *Linum rigidum* ranges from southern Canada to central Mexico, with the Mexican populations, partly because of the scarcity of good collections, being poorly known. Long a source of confusion, the complex of which this is a part is the subject of some studies now in progress. In Texas the species appears to consist of four varieties which, though tending to intergrade somewhat in some areas, are sufficiently distinct that nearly every plant can be readily named. What is usually interpreted as the typical variety (the type has not been located) is a plant of the plains, ranging from north central Texas (one specimen from Aransas County) northward to Alberta and Manitoba. It is the tallest variety (average about 30 cm.) with an open, few flowered inflorescence, relatively large floral parts and no stipular glands.

13b. *L. RIGIDUM* var. *BERLANDIERI* (Hook.) T. & G. This is a showy plant, with some reason often considered a separate species. It is generally shorter (average 15-20 cm.) and more compact than var. *rigidum*, with leaves averaging twice as wide (2 mm.) and with sepals and floral bracts tending to be coarser and 3-nerved rather than 1-nerved. In the northern part of the range, where it overlaps that of var. *rigidum*, a number of collections appear to be intermediate. In southern Texas there is an interesting form with comparatively few, large marginal glands on the sepals, while in the northern part of the range is found a short, bushy branched, leafy variation which probably warrants further study. While the key is designed to include plants without stipular glands, they are present in nearly 90% of the specimens examined of this and



of variety *filifolium*. Variety *berlandieri* is found pretty much throughout the state and as far north as southeastern Colorado and central Kansas.

13c. *L. RIGIDUM* var. *FILIFOLIUM* Shinnars. As interpreted here, var. *filifolium* is a rather variable population. Most collections have come from sandy, rocky or sometimes calcareous soil in west Texas, but a few puzzling plants included here come from the southern plains country, while southeastward near the Mexico boundary, there is a gradual transition toward plants which are often perennial and possess long, slender sepals. These have been called *L. elongatum*. More study is necessary to determine the relationship of the west Texas plants to those found from Webb to Hidalgo Counties, as well as to some anomalous collections from northern Mexico.

13d. *L. RIGIDUM* var. *compactum* (Nelson) Rogers, comb. nov. (*L. compactum*, Nelson, Bull. Torr. Bot. Club 31: 241, 1904). This, as the name indicates, is a short, compact plant (average about 15 cm.) with small floral parts, no stipular glands and with rather coarse foliage and fruit somewhat as in var. *berlandieri*. Like var. *rigidum*, this is a plant of the plains, being found from northern Texas to southern Canada.

14a. *LINUM AUSTRALE* Heller var. *AUSTRALE*. *Linum australe* is a plant of low and medium elevations in the Rocky Mountains, most closely allied to *L. puberulum*, but also very likely related to *L. rigidum*. In Texas two varieties may be recognized. The typical variety, which has been collected in the Chisos and Davis Mountains, is found from northern Mexico to Alberta.

14b. *L. AUSTRALE* var. *glandulosum* Rogers, var. nov. Differt a var. *australe*, quod stipulas glandulosas atque clarissimas, flores paulo maiores, fructum paulo minorem hebet. HOLOTYPE: Palmer 465, Otinapa, Durango, Mexico (US; isotypes F, GH, MO, NY).

This differs from var. *australe* in the possession of very conspicuous stipular glands, these often being found at the base of the sepals as well as the bracts and leaves, and in the somewhat larger floral parts and smaller fruits. It is found from southern Arizona and the Davis Mountains in western Texas, south to Pueblo, Mexico.