

TAXONOMY OF SELINOCARPUS AND AMMOCODON (NYCTAGINACEAE)

Beverly Ann Fowler and B. L. Turner

The University of Texas, Austin, Texas 78712

Selinocarpus is primarily a North American desert genus belonging to the Nyctaginaceae. It is a relatively rare taxon, most of the species being confined to local outcrops of gypsum (CaSO_4). The species are perennial herbs or shrubs with unusually attractive yellow or white tubular flowers. The genus was proposed by Asa Gray, in 1853, in a paper dealing with the plants of the family Nyctaginaceae collected by Charles Wright during his explorations of western Texas, southern New Mexico and Arizona, and northeastern Mexico. The name Selinocarpus was chosen to emphasize the likeness between the fruits of the new genus and those of the genus Selinum (Umbelliferae). Two species were described, S. diffusus and S. chenopodioides. There is no indication that the genus was based primarily upon either species; consequently, the first S. diffusus, may be taken as the type. Since its original description, the genus has increased in size to include nine species. One of the original species, S. chenopodioides, has been segregated as the sole member of the genus Ammocodon, discussed in a separate section of this paper.

ECOLOGY

Selinocarpus is restricted primarily to the arid and semi-arid regions of the southwestern United States and northern Mexico, the one exception to this being S. somalensis which has been described from Somaliland in Africa.

As indicated, most of the species are gypsophiles. In fact, six of the eight North American species seem confined to gypseous soils: S. lanceolatus, S. purpusianus, S. palmeri, S. diffusus, S. parvifolius, and S. undulatus.

Selinocarpus angustifolius shows no marked soil preference. I. M. Johnston (1944) reported observing this species on basalt, volcanic tuff, igneous intrusives, limestone, caliche, and gypsum. The one common feature of these varied habitats is a preference for dry, well-drained sites. The species is tolerant to gypsum in at least limited quantities, however, and occasionally is found on predominantly gypsum soils. The closely related species, S. undulatus, is found more frequently on gypsum than S. angustifolius, though it presumably also grows on a variety of soils.

Selinocarpus nevadensis is known only from the basin region around Clark County, Nevada. Soil preference, if any, is not

known, although one collection is reportedly from calcareous soil.

No information is available as to the habitat or soil preferences of S. somalensis, which is known only from the type collection, but the area in which it occurs is described as desert with gypseous soils being plentiful (Horwood, 1976).

POLLINATION

The outcrossing flowers of all species of Selinocarpus, except perhaps those of S. angustifolius and S. undulatus, are probably pollinated by moths. Some of the characteristics of phalaenophilous species cited by Faegri and van der Pijl (1966) are (1) nocturnal anthesis, (2) strong perfume at night, (3) mostly white or faint colored, (4) deeply dissected lobes, (5) blossoms horizontal or pendant, rim absent or bent back, (6) anthers versatile, (7) nectar deeply hidden in a long tube, narrower than in bird blossoms, and (8) nectar guides generally absent, guidance by contour of blossom.

The flowers of all species of Selinocarpus open at dusk and close by mid-morning at the latest. (1) The nocturnal requirement of phalaenophilous species is thus fulfilled. (2) Personal observations as well as label data on specimens indicate that, when open, these flowers are fragrant. (3) All species, except S. angustifolius, are white, yellow, pale green, or pale pink. (4) The perianth is typically lobed, although not deeply so. (5) The flowers of all species are horizontal, vertical or rarely pendant, with very little rim, thus best adapted to a hovering pollinator such as a moth. (6) The anthers are versatile. (7) The nectar is located at the base of an elongate funnellform perianth which is from 10--15 mm. broad. The exception to this is the shorter perianth (10--15 mm. long, 6--8 mm. wide) of S. angustifolius and S. undulatus. (8) No nectar guides are present but the flowers are contoured so as to guide the proboscis to the nectaries.

The flowers, therefore, exhibit most of the generally accepted characteristics of phalaenophilous species. We have observed repeated hawkmoth visitations after sundown in at least one population of S. purpusianus at Cuatro Cienegas, Mexico. No other pollinator seems to fulfill the requirements of the genus.

The shorter flower of S. angustifolius and S. undulatus, though not well adapted to hawkmoths, may be pollinated by some other species of moths. These flowers, though shorter, are still nocturnal and appear to be adapted to hovering pollinators such as moths.

GENERIC RELATIONS

The most recent revision of the Nyctaginaceae was that of Heimerl (1934). In this classification, as well as that of Standley (1918), Selinocarpus was placed in the subtribe Boerhaaviinae (=subtribe Nyctaginae) of the tribe Mirabileae (=Nyctageae). Nowicke (1970) has recently reviewed the pollen morphology of this tribe, an approach which has been very helpful in delineation of the higher categories within the family. In general, her work corroborates that of Heimerl. In our work we have found nothing to doubt their placement of the genus.

Ammocodon is undoubtedly the genus most closely related to Selinocarpus. It is easily distinguished by its campanulate flowers clustered in umbelliform cymes.

ACKNOWLEDGEMENTS

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TAXONOMIC TREATMENT

Selinocarpus A. Gray

Selinocarpus A. Gray, Am. J. Sci. 15: 262. 1853.

Perennial herbs or low shrubs, erect or decumbent; stems relatively unbranched to much-branched. Leaves simple, opposite, pubescent or glabrate, those of a pair more or less unequal, sessile or petiolate, blades usually thick and succulent, entire or undulate. Flowers perfect, pseudo-axillary or solitary to geminate in the leaf axils, sessile or short pedicellate, often cleistogamous, each subtended by 1 to 4 narrow bracts. Perianth tubular-funnelform, the tube elongate or rarely short, not constricted above the ovary, rather abruptly expanded into a broad, shallowly 5-lobed limb, the lobes plicate. Stamens usually 5, or more rarely 4--8; filaments filiform, short connate at the base, adherent to the perianth tube basally; anthers didymous, exserted, opening longitudinally. Pollen

grains spheroidal (70-134^μ in diameter), pantoporate (18--45 pores), the pores 2.5--5.0 in diameter, the pore plate spinulose, sparsely tubiferous and spinulose, the spinules 2--4 long. Ovary oblong, style filiform, exserted; stigma peltate often with revolute margins, smooth. Anthocarp compressed, the body truncate to subtruncate, broadly 5-winged, the hyaline wings, not veined. Seed narrowly oblong to elliptical, light brown, the testa adherent to the pericarp; farinaceous endosperm; radicle elongate, descending.

Type species: Selinocarpus diffusus A. Gray.

KEY TO SPECIES

1. Perianth 10-15 mm. long; leaves distinctly petiolate, the petiole to 4 mm. long.
 2. Leaf blades linear to linear-lanceolate, margins entire and flat..... 4. S. angustifolius
 2. Leaf blades oblong to elliptical, margins undulate 5. S. undulatus
1. Perianth 17-45 mm. long.
 3. Leaves petiolate, the lower ones often long-petiolate; blades ovate or orbicular.
 4. Perianth 17-22 mm. long..... 9. S. somalensis
 4. Perianth 30-45 mm. long.
 5. Upper leaves much reduced, bract-like; fruit 9-10 mm. long 6. S. parvifolius
 5. Upper leaves not reduced; fruit 6-7 mm. long.
 6. Perianth limb ca. 15 mm. broad; leaves ovate to elliptical, often drying brownish-green 7. S. diffusus
 6. Perianth limb less than 10 mm. broad; leaves mostly rhomboid to broadly ovate, often drying yellowish-green 8. S. nevadensis
 3. Leaves sessile or subsessile, the petioles sometimes 1-3 mm. long; blades linear to broadly ovate or orbicular.
 7. Leaf blades more than 4 mm. wide 1. S. lanceolatus
 7. Leaf blades less than 4 mm. wide.
 8. Leaf blades linear, 10-40 mm. long; scarcely glandular-puberulent or glabrous; perianth pink 2. S. palmeri
 8. Leaf blades narrowly spatulate-oblong, 4-20 mm. long 3. S. purpusianus

1. Selinocarpus lanceolatus Wooton

Selinocarpus lanceolatus Wooton, Bull. Torr. Bot. Club 25: 304. 1898. HOLOTYPE (US!): U.S.A. New Mexico. Dona Ana Co. Co. Just S of the White Sands, 26 Aug 1897. Wooton 389 (Isotypes: GH! MO! NY! POM! UC! US!).

Perennial herb or half-shrub, to 3 dm. tall; stems erect or decumbent from a woody base, diffusely branched, densely leafy, covered throughout with minute, appressed, flattened, white hairs, or glabrate in age; leaves opposite, subsessile, with petioles to 3 mm. long; leaf blades thick, succulent, lanceolate to elliptical (rarely orbicular), 12--40 mm. long, 4--35 mm. wide, the apex acute or attenuate, the base obtuse, or, less often, cordate, the margins entire and flat; flowers solitary in leaf axils, subsessile, subtended by 2--3, subulate bracts, 1.5--4.0 mm. long; perianth elongate-funneliform, 30--45 mm. long, the tube slender, 10--20 mm. wide at the 5-lobed limb, calyx yellow; stamens 5--8, slightly exserted; anthocarp 6--9 mm. long, with 5 membranous wings, 2--4 mm. wide. Occasional cleistogamous flowers also occur.

DISTRIBUTION: North-central New Mexico southward into North-central Mexico. It is found almost exclusively on gypsum outcrops (Map. 1).

This species is easily distinguished from all other species of Selinocarpus by its dark bluish-green lanceolate leaves.

KEY TO VARIETIES

1. Leaves narrowly ovate-oblong (rarely broadly ovate in southern Hudspeth Co., Texas), 4--15(25) mm. wide; stems mostly wiry and reclined, rarely strictly erect; limb of corolla ca. 10 mm. wide; plants of the United States ...
..... 1.a. var. lanceolatus
1. Leaves ovate to orbicular to reniform, 15--35 mm. wide; stems stout and stiffly erect; limb of corolla 10--15 mm. wide; plants of Mexico 1.b. var. megaphyllus
- 1.a. Selinocarpus lanceolatus Wooton var. lanceolatus. Fig. 1
This is by far the more heavily collected variety of the species, being found, so far as is known, in the United States (Map 1), var. megaphyllus being confined to Mexico. However, plants from a single populational site in trans-Pecos Texas approach the var. megaphyllus and these are discussed in more detail below.
- 1.b. Selinocarpus lanceolatus var. megaphyllus Fowler & Turner, var. nov. Fig. 2
HOLOTYPE(LL): MEXICO. Chihuahua. Jurassic gypsum ca. 15 mi. SW of Estacion Moreon on Rio Conchos Lake Road, Sierra de la Monillas, 25 May 1971. Powell 2105. (Isotype: TEX!).

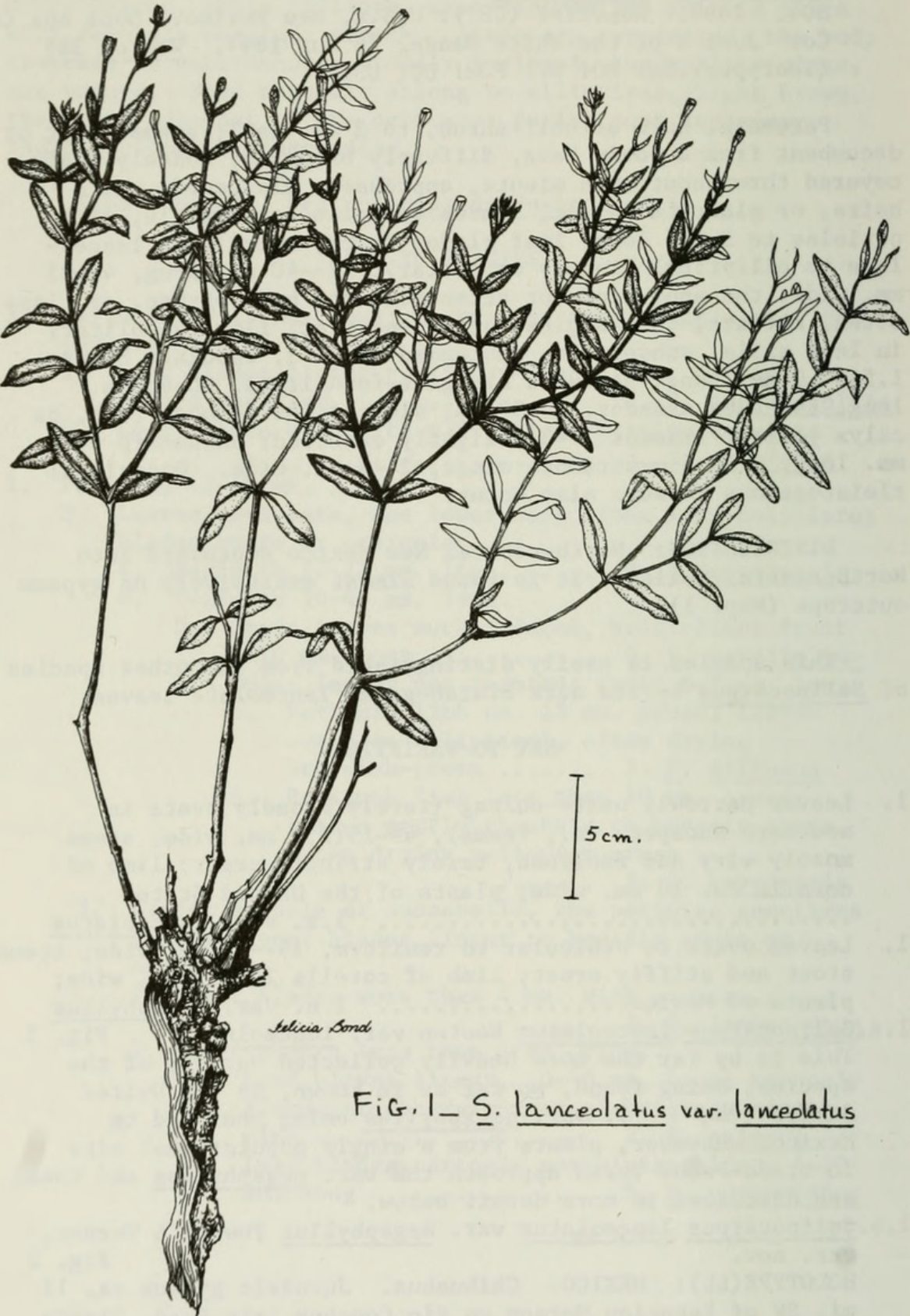


FIG. 1— S. lanceolata var. lanceolata

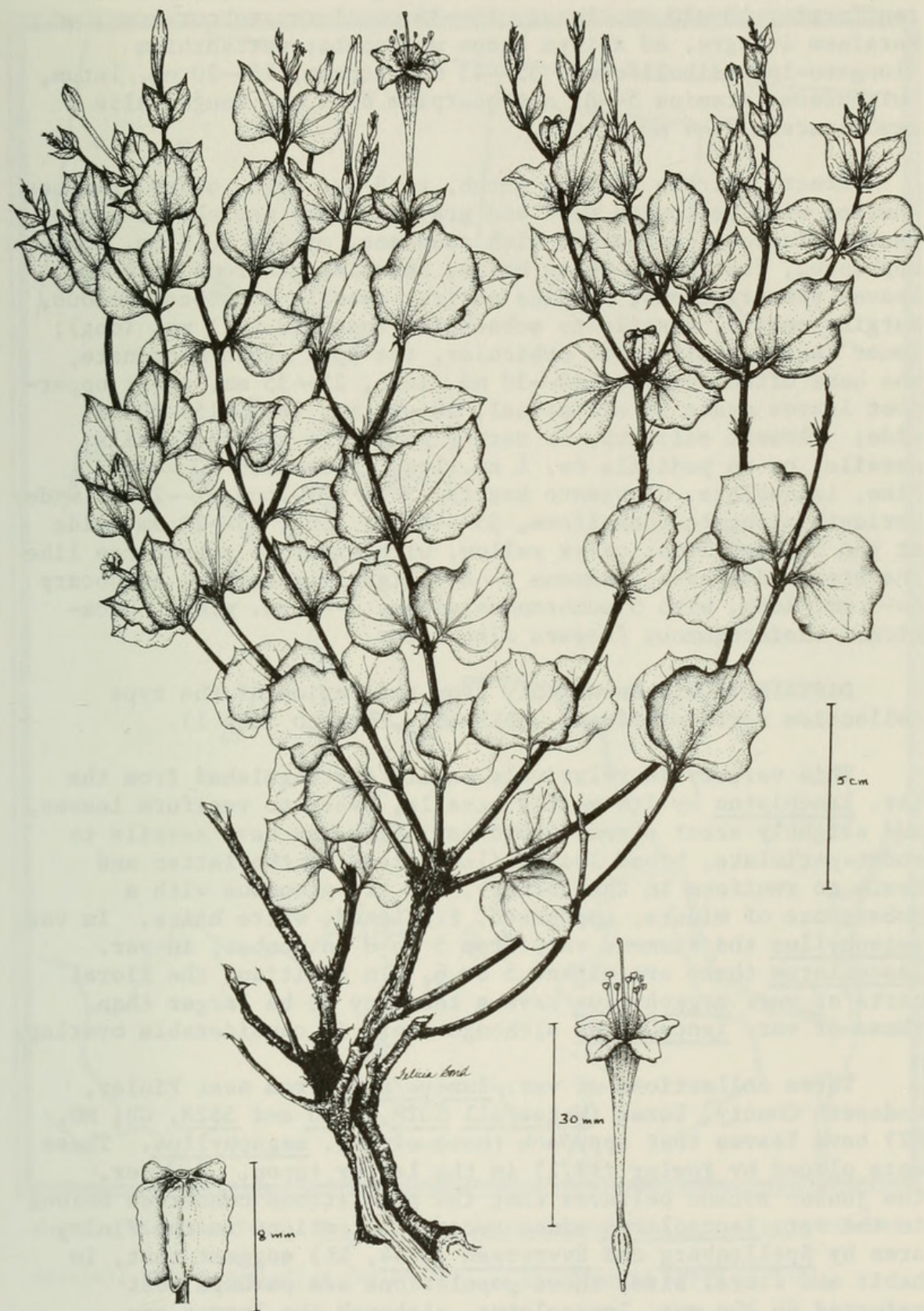


FIG. 2 - S. lanceolatus var. megaphyllus

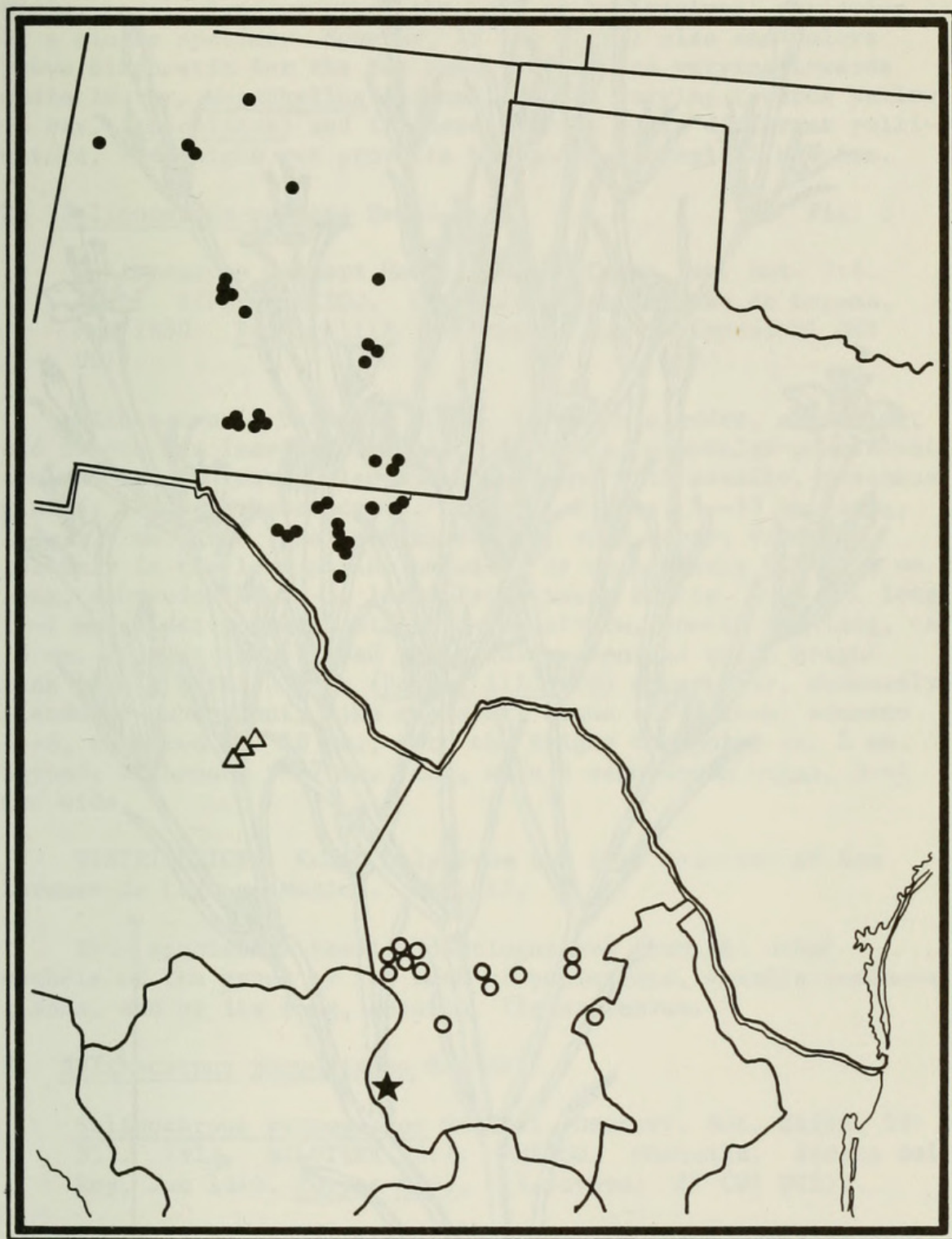
Frutex erectus, omnino ornatus pilis minutis adpressis complanatis albis; folia sessilia vel subsessilia, ovata vel reniformia, 10--30 mm. longa, 15--35 mm. lata, subcoriacea, ad marginem integra, ad apicem saepe mucronata; perianthium elongato-infundibuliforme, 35--45 mm. longum, 15--20 mm. latum, sulphureum; stamina 5--8; anthocarpium 6--9 mm. longa, alis 5 membranaceis 3--4 mm. latis.

Erect, brittle stemmed shrub, to 5 dm. high, older branches gnarled with yellowish wood and grayish bark, new shoots and leaves glaucous, pubescent with abundant, minute (0.2 mm. long), appressed, flattened, white hairs, becoming glabrous with age; leaves subcoriaceous, margins entire, sessile to subcoriaceous, margins entire, sessile to subsessile (petiole to 1 mm. long); lower leaves reniform to orbicular, the apex often mucronate, the base often cordate, 20--30 mm. long, 25--35 mm. wide; uppermost leaves ovate to elliptical, 10--20 mm. long, 15--20 mm. wide; flowers solitary, or rarely paired in the leaf axils, sessile, or on pedicels ca. 1 mm. long, subtended like, lanceolate, decussate bracts, 3--4 mm. long, 1--2 mm. wide; perianth elongate-funnelform, 35--45 mm. long, 15--20 mm. wide at the 5-lobed limb, calyx yellow, with external pubescence like the stem and leaves; stamens 5--8, slightly exserted; anthocarp 6--9 mm. long, with 5 membranous wings, 3--4 mm. wide. Occasional cleistogamous flowers also occur.

DISTRIBUTION: Known only from the region of the type collection north of Aldama, Chihuahua, Mexico (Map 1).

This variety is relatively easily distinguished from the var. lancolatus by its mostly sessile, ovate to reniform leaves, and slightly erect stems. Both varieties may have sessile to short-petiolate, broad leaves (lanceolate in the latter and ovate to reniform in the former), and are glaucous with a pubescence of minute, appressed, flattened, white hairs. In var. megaphyllus the stamens vary from 5 to 8 in number; in var. lanceolatus there are either 5 or 6. In addition, the floral parts of var. megaphyllus have a tendency to be larger than those of var. lanceolatus although there is considerable overlap.

Three collections of var. lanceolatus from near Finley, Hudspeth County, Texas (Waterfall 5028, 5790 and 5828, GH, MO, NY) have leaves that approach those of var. megaphyllus. These were placed by Fowler (1972) in the latter taxon. However, the junior author believes that the populations concerned belong to the var. lanceolatus since recent collections in the Finley area by Spellenberg and Syvertsen (3744, LL) suggest that, in habit and floral size, these populations are perhaps best referred to the var. lanceolatus, although the leaves are admittedly larger, approaching those of var. megaphyllus. Recent collections of the latter from Mexico also show considerable



Map 1. Distribution of Selinocarpus lanceolatus var. lanceolatus (closed circle); var. megaphyllus (triangle); S. purpusianus (open circle); S. palmeri (star).

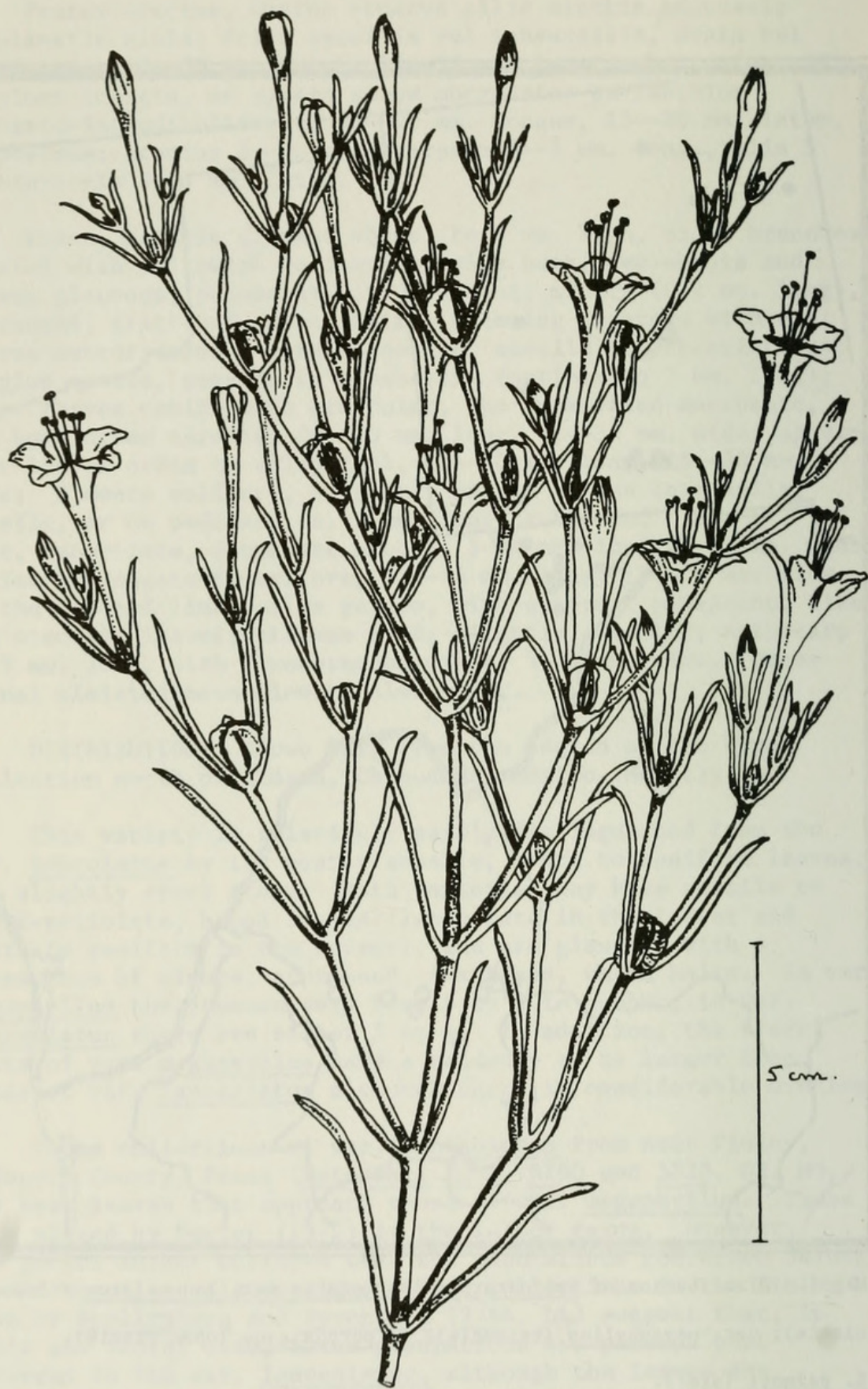


FIG. 3 — *S. palmeri* (after Hemsl., Pl. 70-1882)

variation in leaf size and shape, but general habital and floral features hold. Because of the "approach" noted in the Finlay populations we treat the taxa as but regional varieties of a single species. However, if the floral size and colors prove diagnostic for the two taxa (larger and varying towards white in var. megaphyllus and smaller and varying towards yellow in var. lanceolatus) and if these attract quite different pollinators, they might yet prove to be "good" biological species.

2. Selinocarpus palmeri Hemsl.

Fig. 3

Selinocarpus palmeri Hemsl., Biol. Centr. Am. Bot. 3:6. 1882. TYPE: MEXICO. Coahuila. San Lorenzo de Laguna, May 1880. Palmer 1118 (Holotype: K. Isotypes: F! GH! US!).

Dichotomously branched shrub, branches slender, ascending; old shoots and leaves glabrous to sparsely, glandular-puberulent, new shoots and leaves glaucous, pubescent with sessile, resinous glands; leaves subcoriaceous, sessile, linear, 9--33 mm. long, 1.0--1.5 mm. wide, the margins entire, apex acute; flowers solitary in the leaf axils, sessile, or on pedicels 0.2--1.0 mm. long, subtended by 2--3, lanceolate-linear bracts, 3--4 mm. long, 1--2 mm. wide; perianth elongate-funnelform, 36--49 mm. long, ca 15 mm. wide at the 5-lobed limb, calyx reported to be bright pink with a whitish base (Palmer 1118, GH) externally, obscurely glandular-puberulent, like the older stems and leaves; stamens 5--6, exserted ca. 10 mm., with the stigma extending ca. 2 mm. beyond; anthocarp 5--7 mm. long, with 5 membranous wings, 3--4 mm. wide.

DISTRIBUTION: Known only from the type locality of San Lorenzo de Laguna, Mexico. (Map 1).

This species is readily distinguished from all other members of the genus by its lack of pubescence, sessile resinous glands, and by its long, sessile, linear leaves.

3. Selinocarpus purpusianus Heimerl.

Selinocarpus purpusianus Heimerl, Oesterr. Bot. Zeits. 63: 353. 1913. HOLOTYPE(US!): MEXICO. Coahuila. Sierra del Rey, Jun 1910. Purpus 4505. (Isotypes: F! GH! UC!).

Intricately and dichotomously branched shrub, to 2 feet tall, leaves and stems densely pubescent with glandular, sessile or stalked, trichomes and often minute, appressed, flattened white hairs, becoming glabrate with age; leaves entire, thick, fleshy, sessile, linear-lanceolate to subspatulate, 6--20 mm. long, 1.5--4.0 mm. wide; flowers solitary in the leaf axils, sessile, or on pedicels 1--3mm. long, subtended by 2, lanceolate

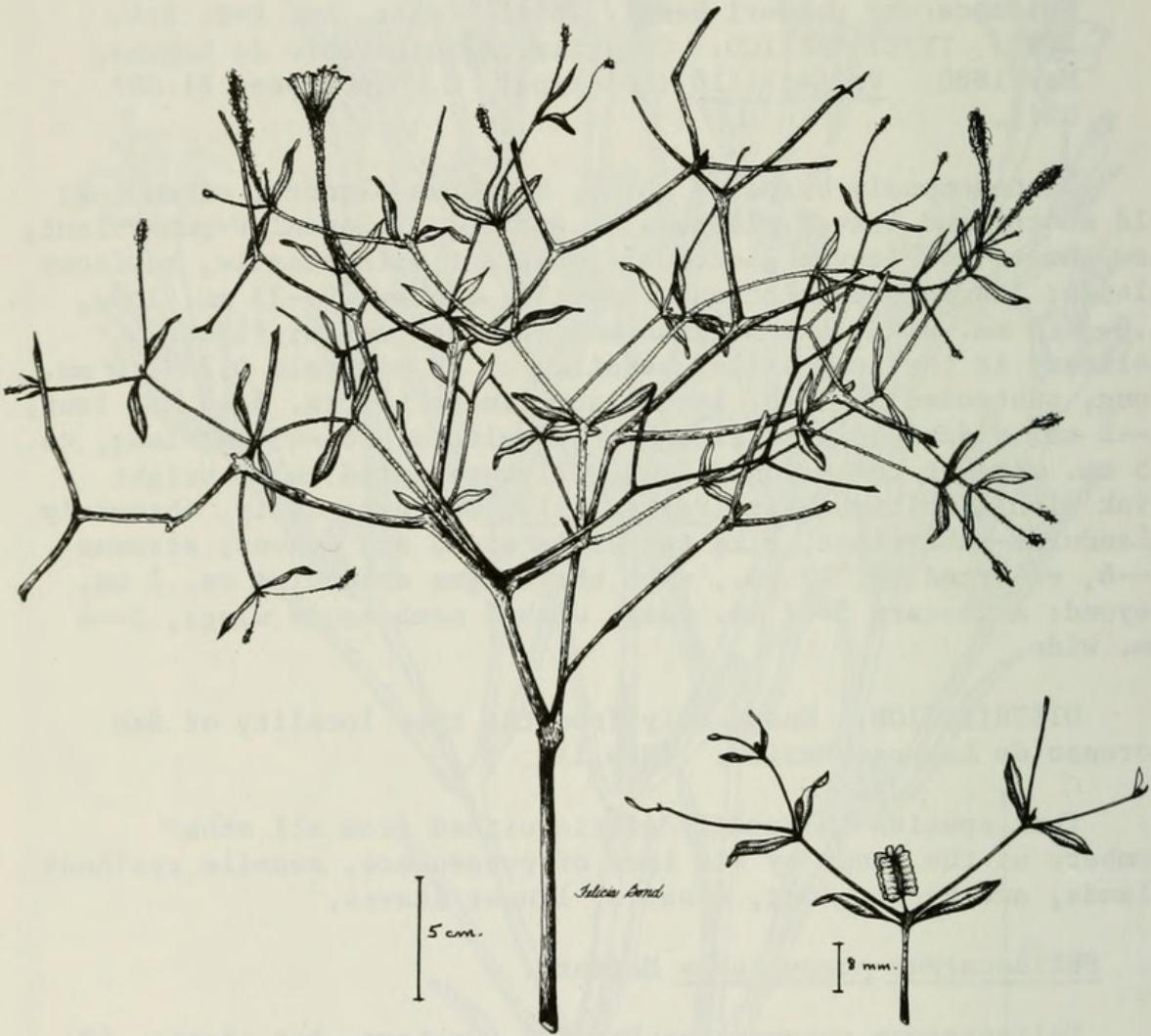


FIG. 4— *S. purpusianus* var. *purpusianus*

bracts, 2--5 mm. long; perianth elongate-funnelform, 30-40 mm. long, ca. 15 mm. wide at the 5-lobed limb; calyx cream-colored or yellow, with an external pubescence like that of leaves and stems; stamens 5 or 6 (rarely 4), slightly exserted; anthocarp 7.5--9.0 mm. long, with 5 membranous wings, 3--4 mm. wide. Occasional cleistogamous flowers also occur.

DISTRIBUTION: Region of Laguna del Rey in western Coahuila, Mexico, eastward to the Coahuila-Luevo Leon border area. (Map 1) It is apparently confined to well-drained gypsum ridges and dunes.

KEY TO VARIETIES

1. Plants glandular-hirtellous with a few appressed white trichomes often present; perianth bright yellow
..... 3a. var. purpusianus
1. Plants pubescent with appressed white trichomes and with a few glandular trichomes often present; perianth cream-colored to white 3b. var. marshii
- 3a. Selinocarpus purpusianus var. purpusianus. Fig. 4
Var. purpusianus is usually readily distinguished from var. marshii, as well as from all other species of Selinocarpus, by its sessile, linear to subspatulate, leaves and yellow flowers. Specimens, often in populational form, intermediate to the var. marshii occur, however, and the following may be cited:
COAHUILA. 40 km on Monclova-Piedras Negras Hwy 57, 24 Apr 1971, Richardson 1433 (TEX); 1 mi S of Estacion Hermanas, 4 Apr 1970, Turner 6012 (TEX). 100 km marker on Hwy 53 from Monterrey to Monclova, 1 May 1971, Fowler 4 (TEX); 101 km marker on Hwy 53 from Monterrey to Monclova, 1 May 1971, Fowler 5 (TEX).
- 3b. Selinocarpus purpusianus Heimerl var. marshii (I. M. Johnston) Fowler & Turner, comb. nov. Fig. 5
Selinocarpus marshii I. M. Johnston, Jour. Arn. Arb. 25: 162. 1944. HOLOTYPE (GH): MEXICO. Coahuila. Hermanas, about 40 km NE of Monclova, 20 Apr 1939. Marsh 1579. (Isotypes: F! TEX!).

Known only from several collections about the type locality (Fig. 2), where it occurs on dry gypsum ridges with a number of other gypsophilous endemics.

The variety differs from var. purpusianus in both perianth color and pubescence. The calyx of var. marshii is cream-colored or whitish as opposed to yellow. Pubescence differences are chiefly quantitative, var. marshii having fewer glandular-trichomes in proportion to the number of appressed, flattened, white hairs. In fact, some specimens of var. marshii do not possess glandular trichomes but may possess a few sessile, resinous glands.

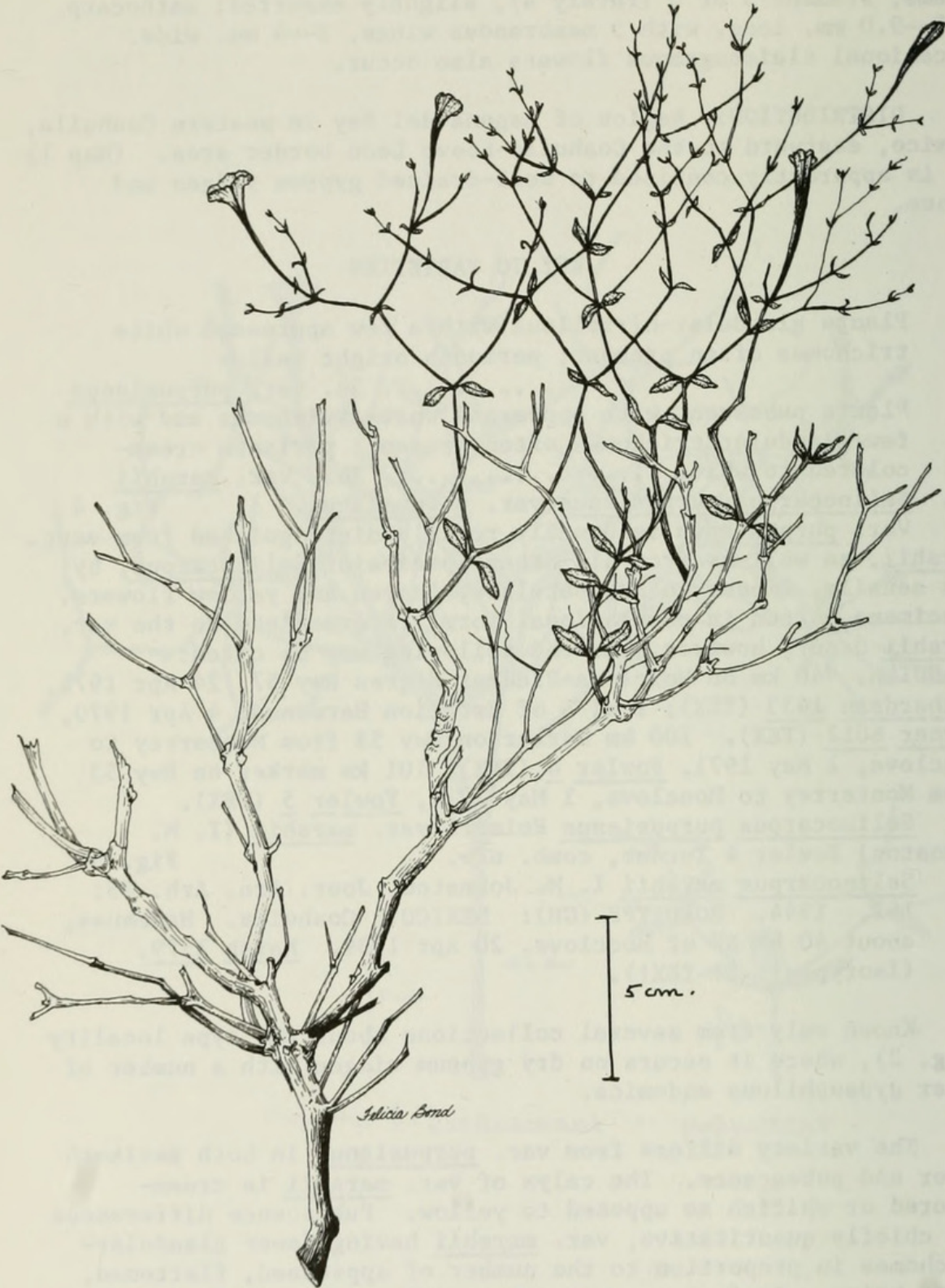


FIG. 5— *S. purpusianus* var. *marshii*

I. M. Johnston recognized this taxon as a species, emphasizing that it differed from S. purpusianus primarily by its pubescence: S. marshii having only appressed, flattened, white trichomes and S. purpusianus having mainly glandular trichomes. These differences are substantial when extreme individuals of the group are studied. However, several intermediate specimens (Fowler 4, 5; Richardson 1433; Turner 6012; all at TEX) have been observed. We have been unable to find additional characters which might be used to distinguish between the taxa, and since the characters concerned are trivial, and often vary in the same population (except for perianth color), we have treated them as varieties. Such treatment emphasizes the undoubtedly close relationship of the two taxa.

4. Selinocarpus angustifolius Torr.

Fig. 6

Selinocarpus angustifolius Torr., Bot. Mex. Bound. 170. 1859. LECTOTYPE (NY!): MEXICO. Chihuahua. Presidio del Norte (Ojinaga), July 1852. Parry s.n. (Possible isotypes: GH! NY! US!).

Perennial woody herb or low shrub, stems erect, 0.3--1.3 m. tall, much-branched from the base, glandular-puberulent, and with numerous curved, flattened, white trichomes with a conical base and T-shaped trichomes, glabrate in age; leaves with petioles to 3 mm. long, or occasionally sessile; leaf blades linear, oblong-linear to lanceolate-linear, 5--27 mm. long, 1--4 mm. wide, the margins entire and flat, often with some purple coloration, acute to rounded and apiculate at the apex, thick, fleshy, pubescent like the stem, the white trichomes often concentrated on adaxial surfaces, along the margins and veins; flowers solitary, or more rarely paired, in the leaf axils, on pedicels 1--3 mm. long, subtended by 1--3, minute, subulate bracts; perianth funnelform, 10--15 mm. long, 6--8 mm. wide at the 5-lobed limb; calyx brown, orange, or dark-greenish-yellow, with an external pubescence like the stem and leaves; stamens 5, slightly exserted; anthocarp 5--7 mm. long, the 5 membranous wings, 1.5--2.5 mm. wide, dull yellow to purple. Cleistogamous flowers often occur.

DISTRIBUTION: Trans-Pecos Texas in Presidio County and central Brewster County southward to the northern part of the state of Durango, Mexico (Map 2). It is usually found growing in dry, well-drained, rocky habitats. It apparently shows no strong preference for particular soil types, having been reported as growing on basalt, volcanic tuff, igneous intrusives, limestone, caliche, and gypsum.

This species is readily distinguished from all other species of Selinocarpus by its linear, petiolate leaves with entire margins and its short (ca. 15 mm. long) perianth.

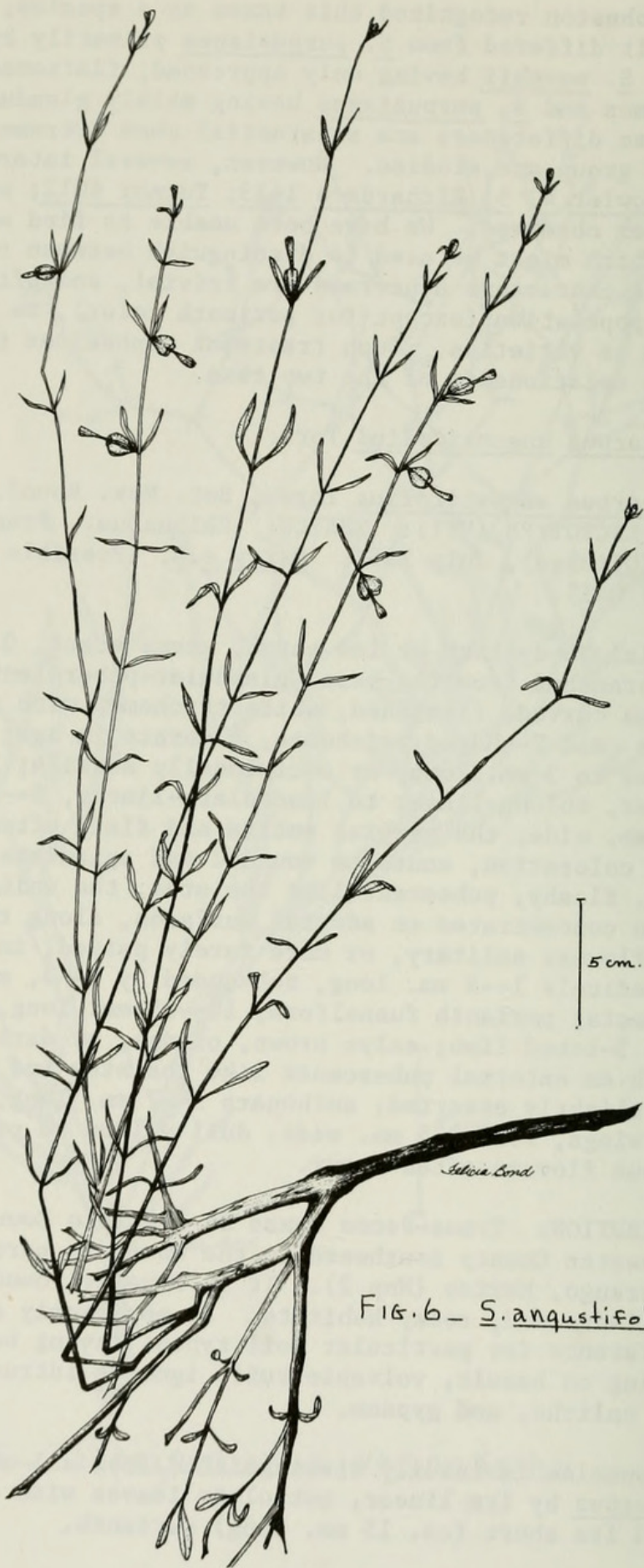


FIG. 6 - *S. angustifolius*

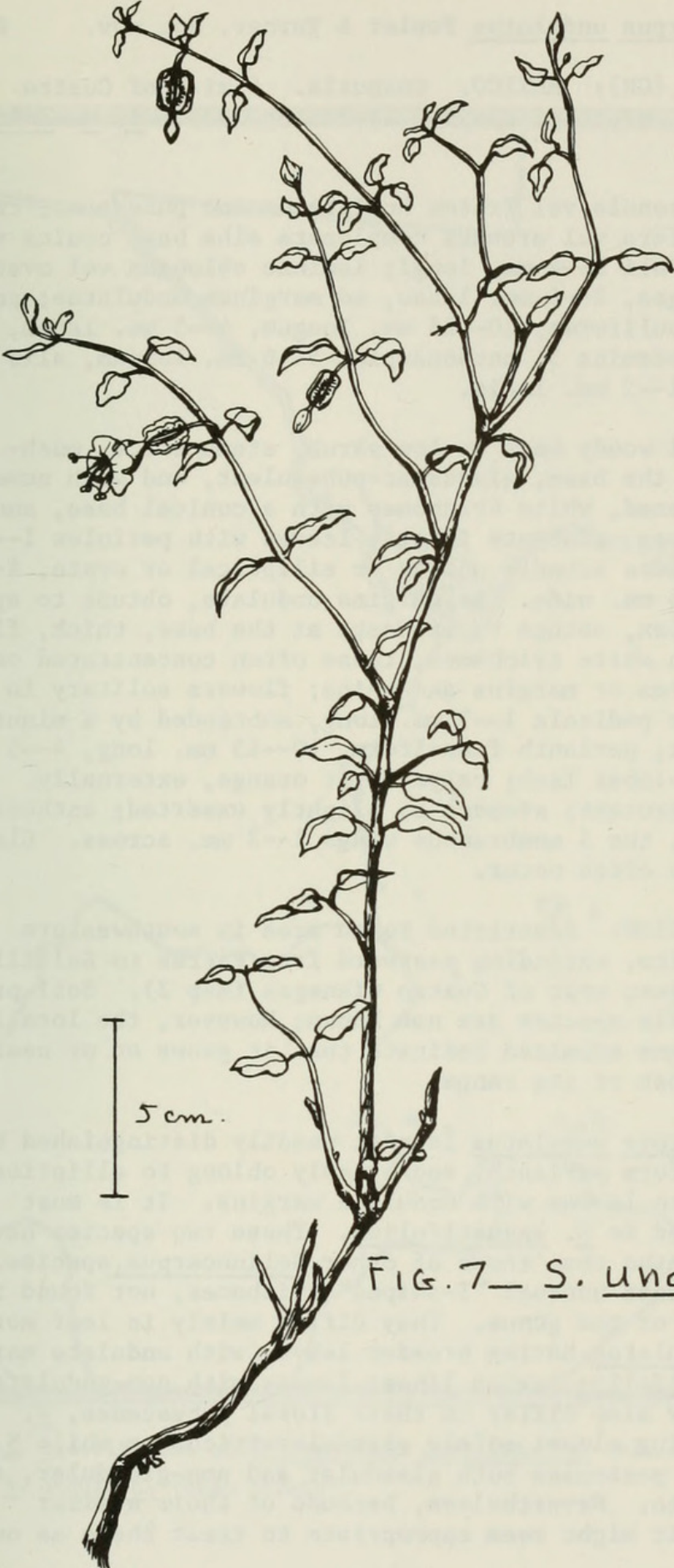


FIG. 7— S. undulatus

5. Selinocarpus undulatus Fowler & Turner, sp. nov. Fig. 7

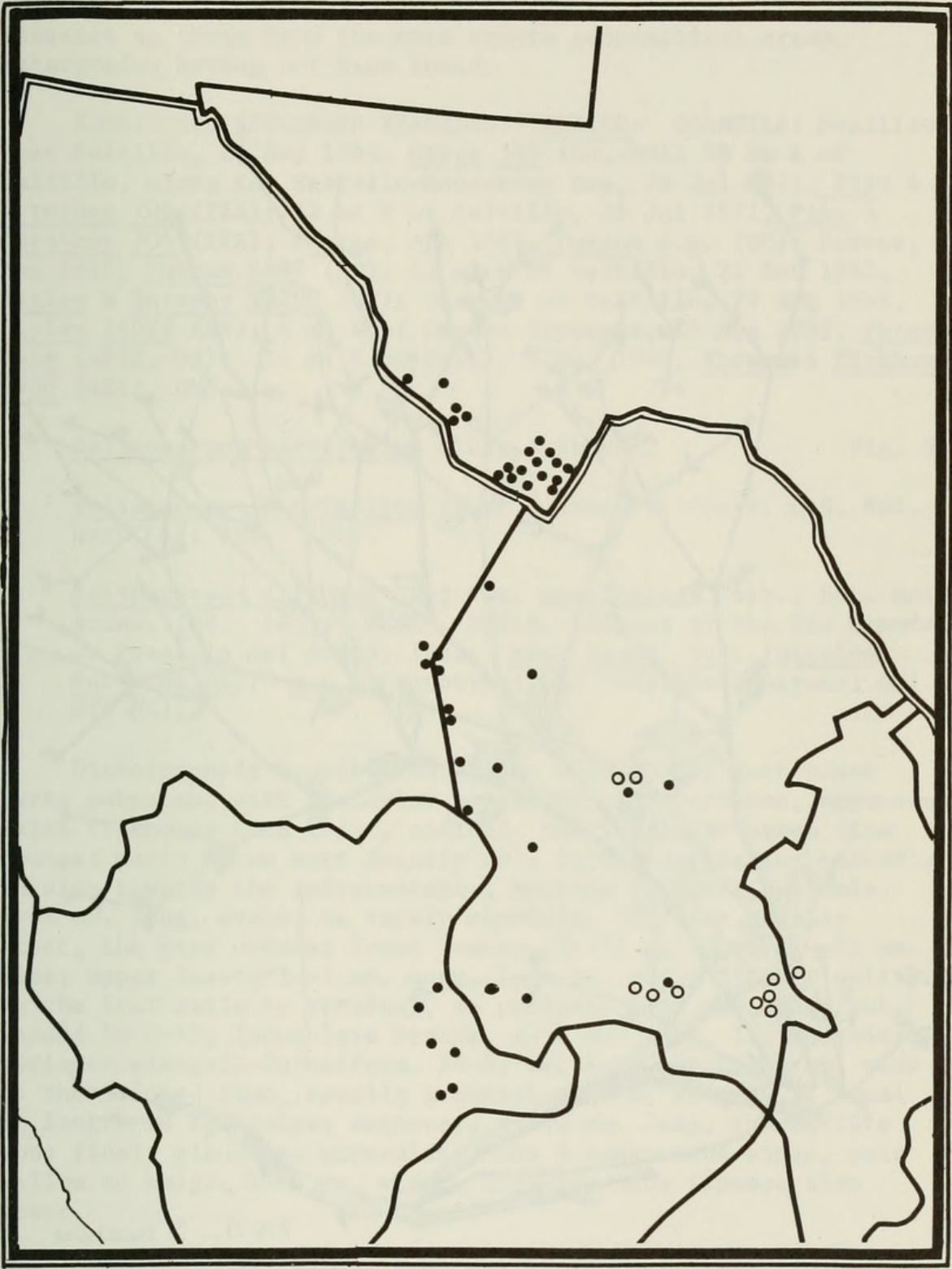
HOLOTYPE (GH): MEXICO. Coahuila. 4 mi W of Cuatro Cienegas, mouth of canyon, 24-26 Aug 1938. I. M. Johnston 7159.

Herba perennis vel frutex humilis omnino pubescens; trichomata glandulifera vel arcuata complanata alba base conica vel T-formia; petioli 1--4 mm. longi; laminae oblongae vel ovatae, 4--14 mm. longae, 2--6 mm. latae, ad marginem undulatae; perianthium infundibuliforme, 10--15 mm. longum, 4--5 mm. latum, cinnamomeum; stamina 5; anthocarpium 5--6 mm. longum, alis 5 membranaceis 1--2 mm. latis.

Perennial woody herb or low shrub, stems erect, much-branched from the base, glandular-puberulent, and with numerous curved, flattened, white trichomes with a conical base, and T-shaped trichomes, glabrate in age; leaves with petioles 1--4 mm. long; leaf blades broadly oblong or elliptical or ovate, 4--14 mm. long, 2--6 mm. wide, the margins undulate, obtuse to apiculate at the apex, obtuse to truncate at the base, thick, fleshy, pubescent with white trichomes, these often concentrated on adaxial surfaces or margins and veins; flowers solitary in the leaf axils, on pedicels 1--3 mm. long, subtended by a minute, subulate bract; perianth funnelform, 10--15 mm. long, 4--5 mm. wide at the 5-lobed limb; calyx burnt orange, externally glandular-puberulent; stamens 5, slightly exserted; anthocarp 5--6 mm. long, the 5 membranous wings 1--2 mm. across. Cleistogamous flowers often occur.

DISTRIBUTION: Restricted to an area in southwestern Coahuila, Mexico, extending eastward from Parras to Saltillo and northward to just west of Cuatro Cienegas (Map 2). Soil preferences of this species are not known; however, the localities of the specimens examined indicate that it grows on or near gypsum over most of its range.

Selinocarpus undulatus is most readily distinguished by its short, funnelform perianth, and broadly oblong to elliptical or ovate petiolate leaves with undulate margins. It is most closely related to S. angustifolius. These two species have shorter perianths than those of other Selinocarpus species. They also possess unusual "T-shaped" trichomes, not found in other species of the genus. They differ mainly in leaf morphology: S. undulatus having broader leaves with undulate margins, and S. angustifolius having linear leaves with non-undulate margins. They also differ in their floral pubescence, S. undulatus having almost solely glandular-trichomes while S. angustifolius possesses both glandular and non-glandular, small, white trichomes. Nevertheless, because of their similar morphologies it might seem appropriate to treat these as only



Map 2. Distribution of Selinocarpus angustifolius (closed circle) and S. undulatus (open circle).

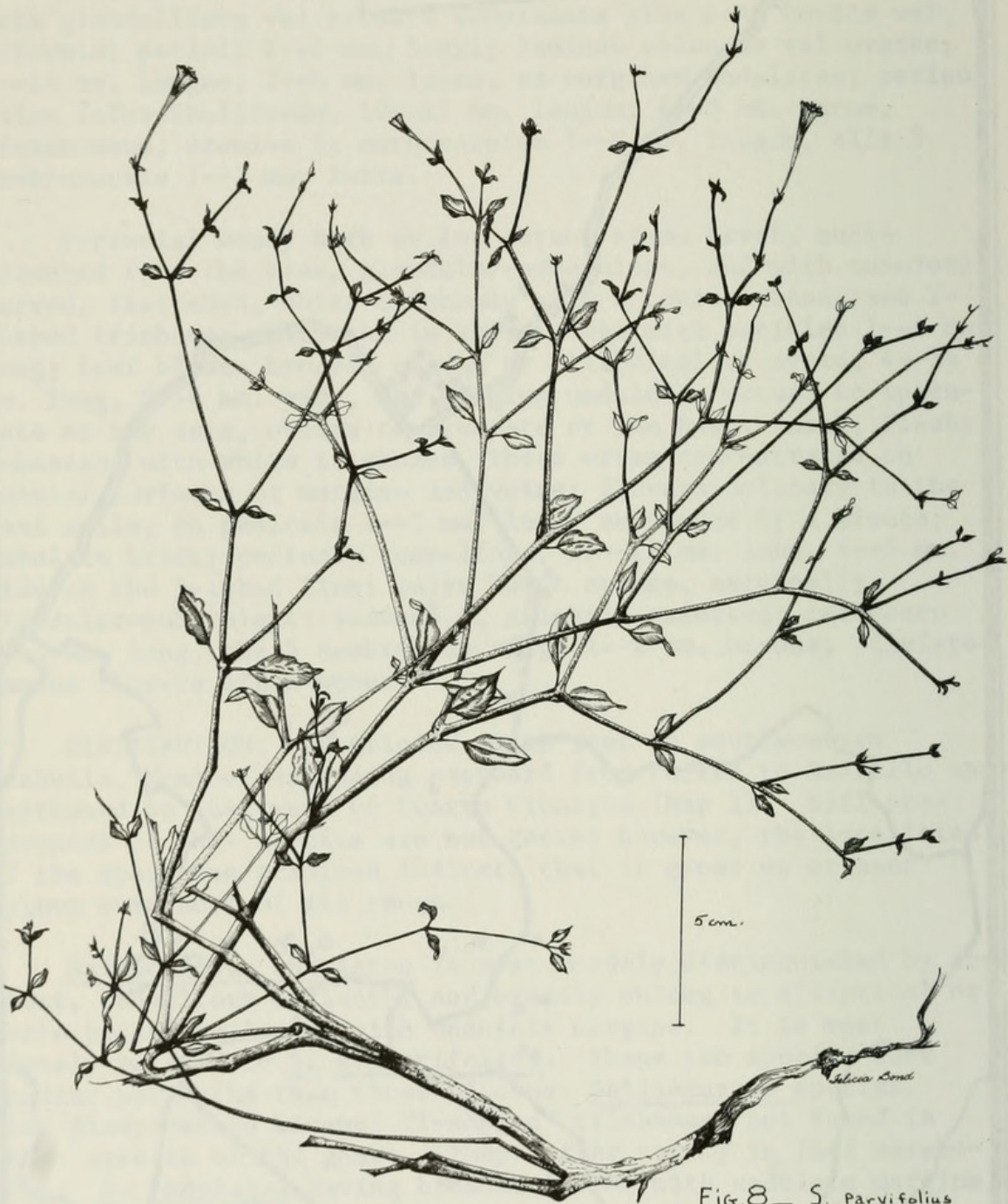


FIG. 8— *S. parvifolius*

varietally distinct. However, in regions where the two taxa occur together or overlap (e.g., in the Cuatro Ciénegas and Parras regions), they both appear quite distinct. In fact, collections of the two species from the area of sympatry are as distinct as those from the more remote geographical areas, intergrades having not been found.

ADDITIONAL SPECIMENS EXAMINED: MEXICO: COAHUILA: Mesillas, near Saltillo, 23 Sep 1848, Gregg 535 (GH, MO); 39 km E of Saltillo, along the Saltillo-Monterrey Hwy, 26 Jul 1971, Pilz & Strother 704 (TEX); 12 mi W of Saltillo, 26 Jul 1971, Pilz & Strother 705 (TEX); Parras, Apr 1905, Purpus s.n. (UC); Parras, Aug 1910, Purpus 4687 (UC); 13 mi W of Saltillo, 23 Oct 1963, Ripley & Barneby 13280 (NY); Cerro N of Saltillo, 27 Aug 1968, Ripley 14978 (NY); 4 mi W of Cuatro Ciénegas, 26 Aug 1938, Shreve 8458 (ARIZ, US); 14 mi E of Paila, 6 Sep 1940, Shreve & Tinkham 9900 (ARIZ, GH).

6. Selinocarpus parvifolius (Torr.) Standl.

Fig. 8

Selinocarpus parvifolius (Torr.) Standl., Contr. U.S. Nat. Herb. 12: 388. 1909.

Selinocarpus diffusus Gray var. parvifolius Torr., Bot. Mex. Bound. 168. 1859. TYPE: TEXAS. Canons of the Rio Grande or Presidio del Norte, 1852. Mex. Bound. Sur. (Bigelow, Parry et al.) s.n. (Lectotype: GH! possible isotypes: GH! NY! US!).

Dichotomously branched shrub, to 6 dm. high; most plant parts pubescent with glandular trichomes and flattened, appressed white trichomes with clear, conical, multicellular bases (the younger parts often more densely so); leaves decreasing markedly in size towards the inflorescence, margins undulate, petiole 1--8 mm. long, ovate, or rarely rhomboid, the apex usually acute, the base obtuse; lower leaves, 9--21 mm. long, 4--12 mm. wide; upper leaves 1--7 mm. long, 1--4 mm. wide; flowers solitary in the leaf axils or terminal, on pedicels 1--3 mm. long, subtended by 2--3, lanceolate bracts, 2--3 mm. long, 1.5 mm. wide; perianth elongate-funnelform, 34--52 mm. long, up to 15 mm. wide at the 5-lobed limb, usually greenish-yellow; stamens 5, equal in length to the calyx; anthocarp 8--10 mm. long, the striate body finely glandular puerulent, the 5 membranous wings, pale yellow to beige, 2--4 mm. wide. Cleistogamous flowers also occur.

DISTRIBUTION: Trans-Pecos region of Texas and adjacent Mexico (Map 3). It appears to be confined to the gypsaceous, Upper Cretaceous, shales and clays of this region.



FIG. 9 - S. diffusus

Selinocarpus parvifolius is easily distinguished by its ovate leaves which decrease markedly in size toward the inflorescence. It is probably most closely related to S. diffusus. This resemblance was first noticed by Torrey in his original description of the former as a variety of S. diffusus. The pubescence of these two species is very similar and both have broad, petiolate leaves. These characters serve to place S. diffusus, S. parvifolius, S. nevadensis, and possibly S. somalensis in a somewhat natural group. Of these, S. diffusus appears to be the most generalized form from which the others were presumably derived.

7. Selinocarpus diffusus A. Gray

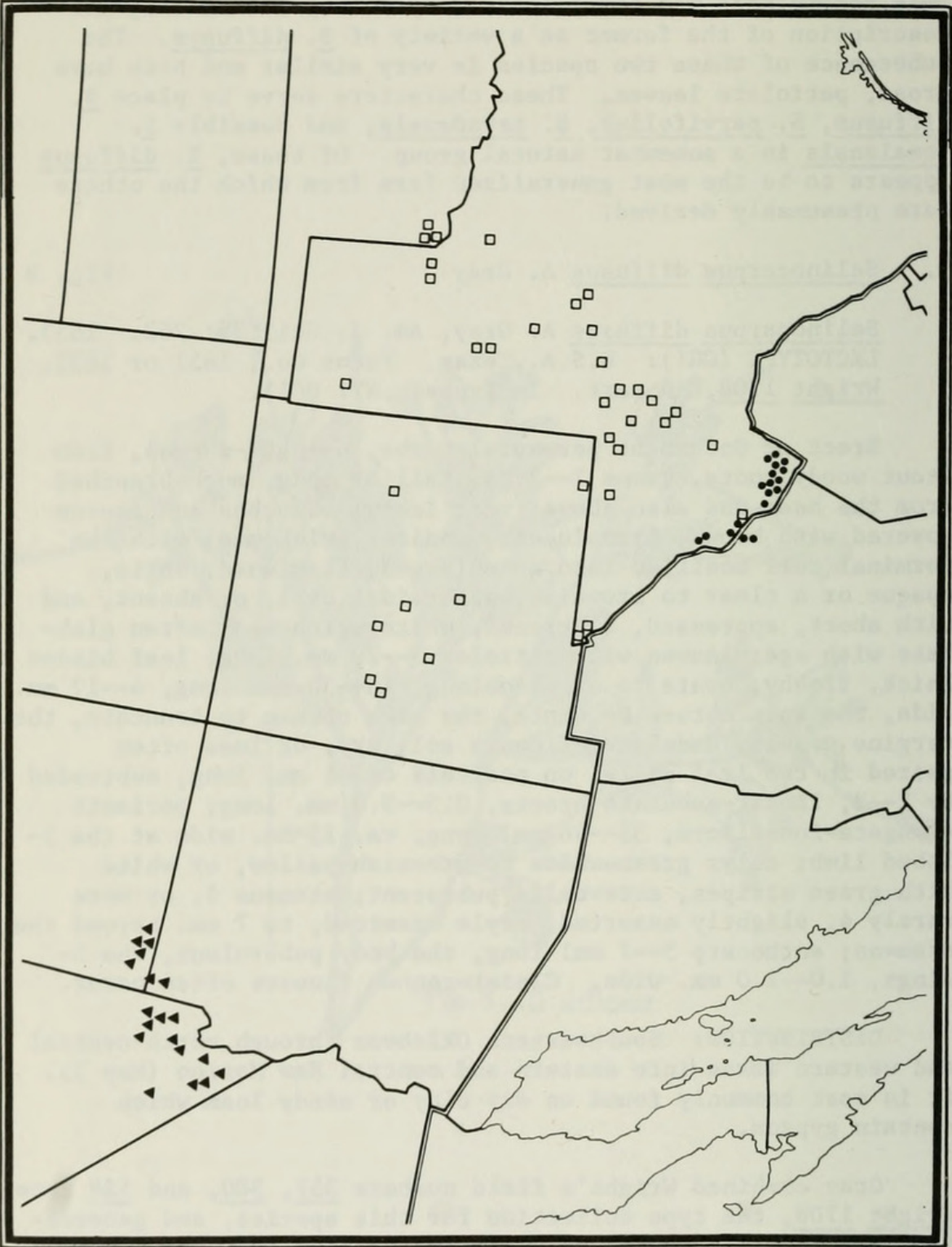
Fig. 9

Selinocarpus diffusus A. Gray, Am. J. Sci. 15: 262. 1853. LECTOTYPE (GH!): U.S.A. Texas. Pecos Co., 1851 or 1852. Wright 1708, in part. Isotypes: NY! UC!).

Erect or decumbent perennial herbs, or half-shrubs, from stout woody roots, stems 1--3 dm. tall or long, much-branched from the base and also above, very leafy; branches and leaves covered with brown, translucent, conical trichomes, with the terminal cell modified into an enlarged, flattened, white, opaque or a clear to brownish, spheroidal cell, or absent, and with short, appressed, flattened, white trichomes, often glabrate with age; leaves with petioles 3--20 mm. long; leaf blades thick, fleshy, ovate to ovate-oblong, 10--30 mm. long, 4--17 mm. wide, the apex obtuse to acute, the base obtuse to truncate, the margins usually undulate; flowers solitary, or less often paired in the leaf axils, on pedicels ca. 1 mm. long, subtended by 2--3, linear-subulate bracts, 0.5--5.0 mm. long; perianth elongate-funnelform, 35--48 mm. long, ca. 15 mm. wide at the 5-lobed limb; calyx green-white to greenish-yellow, or white with green stripes, externally pubescent; stamens 5, or more rarely 4, slightly exserted; style exserted, to 7 mm. beyond the stamens; anthocarp 5--7 mm. long, the body puberulent, the 5-wings, 1.0--2.0 mm. wide. Cleistogamous flowers often occur.

DISTRIBUTION: Southwestern Oklahoma through north-central and western Texas into eastern and central New Mexico (Map 3). It is most commonly found on dry clay or sandy loam which contain gypsum.

Gray combined Wright's field numbers 357, 380, and 528 into Wright 1708, the type collection for this species, and generalized the locality to "rocky hills and valleys from the Pecos to the Limpio". All three of the collections are from Pecos County, Texas. Number 357 is from the valley of the Pecos near the hills 5 Jun 1851; 380, from the stony hills at Comanche Springs, 7 Jun 1851; and 528, also from the stony hills at Comanche Springs 29 June 1852. One specimen from the Gray Herbarium has been



Map 3. Distribution of *Selinocarpus parvifolius* (circles), *diffusus* (squares), and *nevadensis* (triangles).

chosen to serve as a lectotype.

The species is readily distinguished from other members of the genus, except S. nevadensis, by its distinctly petiolate leaves and elongate perianth. Its more narrow, undulate leaves and broader, less delicate perianth serve to distinguish it from the closely related S. nevadensis.

8. Selinocarpus nevadensis (Standl.) Fowler & Turner, comb. nov.

Selinocarpus diffusus Gray subsp. nevadensis Standl., Contr. U.S. Nat. Herb. 12: 388. 1909. HOLOTYPE (US): U.S.A. Nevada. Lincoln Co.: Overton, May 1891. Bailey 1932.

Erect, decumbent, or prostrate, perennial herbs, or half-shrubs from stout woody roots, much-branched from the base and also above, the branches slender, very leafy; branches and leaves covered with short, appressed, flattened, white trichomes, sparsely glandular-puberulent, and with larger whitish, translucent trichomes with, or without, an enlarged, flattened, white, opaque terminal cell, often glabrate in age; leaves with petioles 3--20 mm. long, often exceeding that of the blades; leaf blades thick, fleshy, ovate, oval to orbicular, 10--26 mm. long, 6--19 mm. wide, the apex broadly obtuse to more rarely acute, often mucronate, the base rounded or truncate, the margins entire and smooth; flowers solitary, or less often paired in the leaf axils, on pedicels 1--3 mm. long, subtended by 2--3, linear-subulate bracts, 0.5--5.0 mm. long; perianth elongate-funneliform, 30--40 mm. long, the tube very slender, ca. 10 mm. wide at the 5-lobed limb; calyx greenish-white, externally glandular-hirtellous with short, appressed, flattened, white trichomes also present; stamens 5, or rarely 4, slightly exserted; style exserted ca. 4--6 mm. beyond the stamens; anthocarp 5--7 mm. long, with 5 wings, 1.5--2.0 mm. wide. Flowers often all cleistogamous.

DISTRIBUTION: Restricted to a small area encompassing Clark County, Nevada, Washington County, Utah, and the north-western tip of Mohave County, Arizona (Map 3). Herbarium label data indicate that populations are usually found in dry rocky areas with good drainage such as hills, washes, and disturbed roadsides. One collection (Preece & Turner 2562, SMU) was reportedly from calcareous soil.

The species is readily distinguished from its closest relative, S. diffusus, by its broader, more obtuse, leaves with flat margins. In addition, the leaves of S. nevadensis are often a brighter yellowish-green when dried, and the perianth is more slender and delicate.

Standley (1909) described this taxon as a subspecies of S. diffusus. At that time he noted the ease with which the two taxa could be distinguished and postulated that they were probably good species, but that the differences were difficult to define. After examining a more extensive collection of these plants, we find that the differences Standley noted, as outlined above, hold true and, in conjunction with their allopatry, constitute sufficient reasons for their recognition as species.

Selinocarpus nevadensis and S. diffusus possibly had a common origin from a widespread, ancestral species. Perhaps changing climatic conditions caused the extinction of the main mass of this ancestral population, leaving a relatively small isolated colony in the area currently occupied by S. nevadensis. The more southern element of this ancestral taxon presumably gave rise to S. diffusus.

Finally, it should be noted that A. Nelson apparently anticipated elevation of this taxon to specific rank, having annotated at least a few collections with the combination made here.

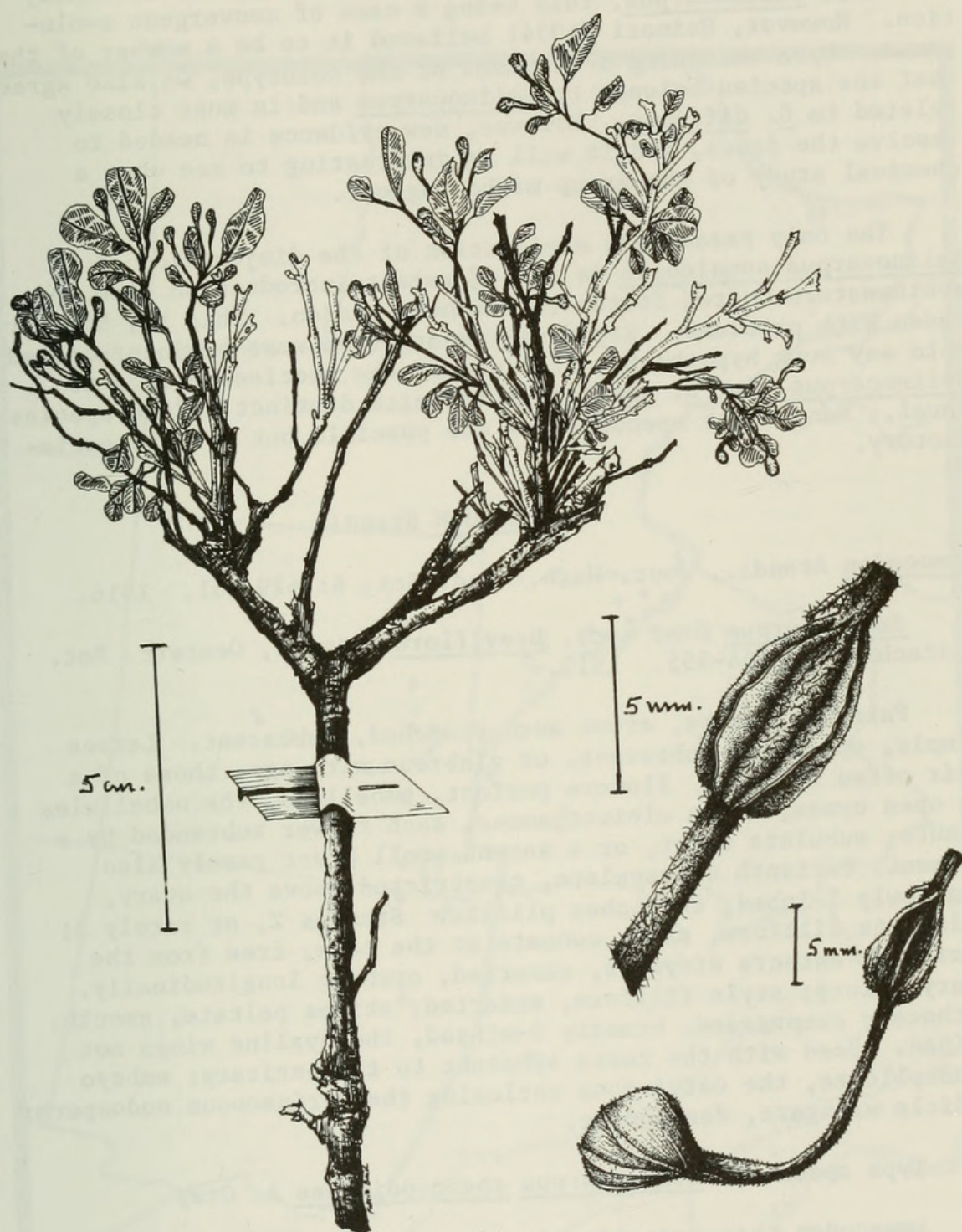
9. Selinocarpus somalensis Chiov.

Fig. 10

Selinocarpus somalensis Chiov., Flora Somala: 284. 1929.
HOLOTYPE (FI!): SOMALILAND. Costa dei Migiurtini, dintorni di Biaddo, June 1924. Puccioni & Stefanini 814 (901).

Low, hemispherical, much-branched, shrub, internodes, 6--12 mm. long, new shoots and leaves glaucous, pubescent with flattened, appressed, white trichomes with clear, conical bases, becoming glabrate with age; leaves with petioles 4--10 mm. long; leaf blades ovate to obcordate, 6.5--12.0 mm. long, 6--11 mm. wide, the apex obtuse to apiculate, the base oblique to attenuate, the margins entire; flowers solitary in the leaf axils, on pedicels ca. 2 mm. long, subtended by 2, opposite, linear bracts, ca. 3 mm. long, 0.5 mm. wide; perianth funnel-form, 20--22 mm. long, ca. 7 mm. wide at the 5-lobed limb; stamens 5, slightly exserted, filaments purplish; style purplish, exserted ca. 4 mm. beyond the stamens; anthocarp 7 mm. long, with 5 membranous wings, ca 1 mm. wide.

DISTRIBUTION: The species is known only from the type collection from Somaliland, Africa, the sole collection of any species of Selinocarpus outside of the southwestern United States or northern Mexico. No information is available from either the herbarium label or the original description with regard to habitat, but the area concerned is largely desert with extensive outcrops of gypsum (Horwood, 1976).

FIG. 10— S. somalensis (Holotype)

The disjunct distribution of S. somalensis is quite remarkable and we are unable to find a plausible explanation for its existence. It is possible that the species only superficially resembles Selinocarpus, this being a case of convergent evolution. However, Heimerl (1934) believed it to be a member of the genus. Upon examining a fragment of the holotype, we also agree that the species belongs to Selinocarpus and is most closely related to S. diffusus. However, new evidence is needed to resolve the issue, and it will be interesting to see what a chemical study of the group might suggest.

The only reasonable explanation of the disjunction of Selinocarpus somalensis is one of recent introduction from the southwestern United States or northern Mexico. This is, however, laden with problems. Rapid differentiation must be incorporated into any such hypothesis, if, indeed, the species belongs to Selinocarpus, for S. somalensis is quite distinct at the species level. Many other speculations are possible but none is satisfactory.

AMMOCODON Standl.

Ammocodon Standl., Jour. Wash. Acad. Sci. 6: 629-631. 1916.

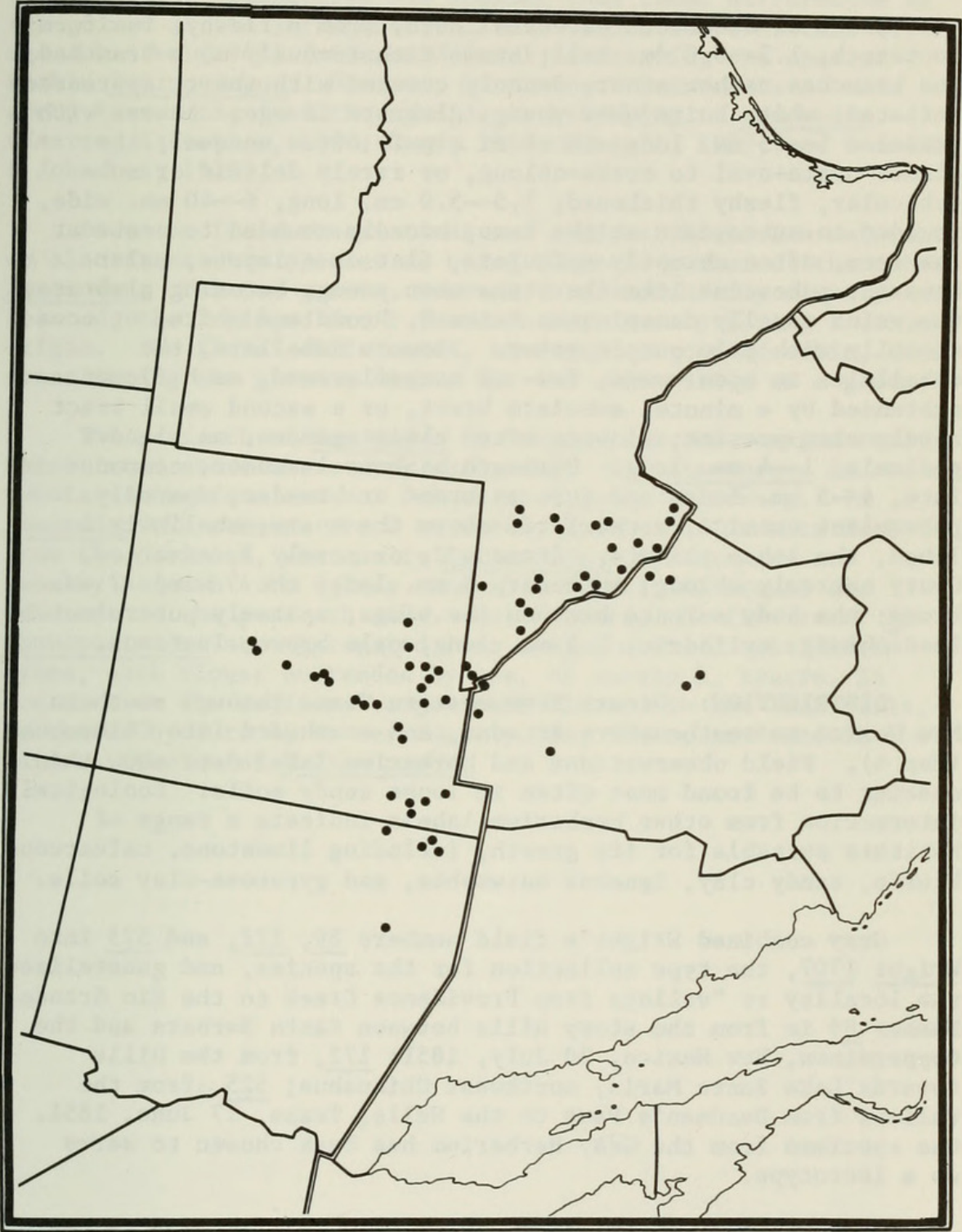
Selinocarpus Gray sect. Breviflora Heimerl, Oesterr. Bot. Zeitschr. 63: 354-355. 1913.

Perennial herbs, stems much-branched, pubescent. Leaves simple, opposite, pubescent, or glabrous with age, those of a pair often unequal. Flowers perfect, umbellate, the umbellules in open cymes, often cleistogamous, each flower subtended by a minute, subulate bract, or a second small bract rarely also present. Perianth campanulate, constricted above the ovary, shallowly 5-lobed, the lobes plicate. Stamens 2, or rarely 3; filaments filiform, short connate at the base, free from the perianth; anthers didymous, exserted, opening longitudinally. Ovary oblong; style filiform, exserted; stigma peltate, smooth. Anthocarp compressed, broadly 5-winged, the hyaline wings not veined. Seed with the testa adherent to the pericarp; embryo conduplicate, the cotyledons enclosing the farinaceous endosperm; radicle elongate, descending.

Type species: Selinocarpus chenopodioides A. Gray

1. Ammocodon chenopodioides (A. Gray) Standl.

Ammocodon chenopodioides (A. Gray) Standl., J. Wash. Acad. Sci. 6: 629-631.



Map 4. Distribution of Ammocodon chenopodioides.

Selinocarpus chenopodioides A. Gray, Am. J. Sci. 15: 262. 1853. TYPE: Left hand specimen on sheet labeled "Wright 1707" at GH, 1851 or 1852. Wright 1707 in part. (Lectotype: GH! Isotype: NY!).

Erect or decumbent perennial herb, from a fleshy, fusiform rootstock, 1.5--3.0 dm. tall; stems dichotomously much-branched, the branches rather stout, densely covered with short, appressed inflated, white hairs when young, glabrate in age. Leaves with petioles 5--45 mm. long, those of a pair often unequal; the blades ovate-oval to ovate-oblong, or rarely deltoid or sub-orbicular, fleshy thickened, 1.5--5.0 cm. long, 6--40 mm. wide, rounded to subcordate at the base, broadly rounded to acute at the apex, often abruptly apiculate, flat or crispate, paler beneath, pubescent like the stems when young, becoming glabrate, the veins usually conspicuous beneath, broad and white, or occasionally with pale purple color. Flowers umbellate, the umbellules in open cymes, few- or many-flowered, each flower subtended by a minute, subulate bract, or a second small bract rarely also present; flowers often cleistogamous, on slender pedicels, 1--4 mm. long. Perianth pink to lavender, campanulate, 4--5 mm. long, and just as broad or broader, sparsely puberulent outside, constricted above the ovary, shallowly 5-lobed, the lobes plicate. Stamens 2, or rarely 3, exserted. Ovary narrowly oblong; anthocarp 5 mm. long, the 5 wings 2 mm. broad; the body sulcate between the wings, sparsely puberulent. Seed oblong; cylindric, 2.5 mm. long, pale brown, lustrous.

DISTRIBUTION: Occurs from western Texas through southern New Mexico to southeastern Arizona, and southward into Chihuahua (Map 4). Field observations and herbarium label data show this species to be found most often in loose sandy soils. Ecological information from other herbarium labels indicate a range of habitats suitable for its growth, including limestone, calcareous bluffs, sandy clay, igneous outwashes, and gypseous-clay soils.

Gray combined Wright's field numbers 89, 172, and 525 into Wright 1707, the type collection for the species, and generalized the locality to "valleys from Providence Creek to the Rio Grande." Number 89 is from the stony hills between Santa Barbara and the Coppermines, New Mexico, 30 July, 1851; 172, from the hills towards Lake Santa Maria, northwest Chihuahua; 525, from the valleys from Deadman's Pass to the Wells, Texas, 17 June, 1851. One specimen from the Gray Herbarium has been chosen to serve as a lectotype.

This species was originally described as belonging to the genus Selinocarpus. Heimerl (1913) emphasized the differences between S. chenopodioides and the other members of the genus by dividing the genus into two sections: sect. Breviflora, containing only S. chenopodioides, and sect. Tubiflora, containing the

remainder of the species. Standley (1916) raised the sect. Breviflora to generic rank, naming the group Ammocodon, a position which he reaffirmed in his treatment of the Nyctaginaceae for the North American Flora (Standley, 1918). Heimerl (1934) reasserted his feeling that these differences be recognized at the infrageneric level. Tidestrom & Kittell (1941) and Johnston (1944) followed Heimerl in treating the species within Selinocarpus. However, more recent treatments of this group have recognized the species as belonging to Ammocodon (Kearney & Peebles, 1960; Reed, 1968; Lundell, 1969; and Correll & Johnston, 1970).

Based on field observations and study of herbarium material, we also treat this species as being the sole member of the genus Ammocodon. The two genera, however, are undoubtedly closely related, the 5-winged fruit found in both surely having a common origin. The floral differences, however, are considerable, this constituting the primary reason for its segregation as a genus.

The perianth of Ammocodon is campanulate and conspicuously constricted above the ovary, while that of Selinocarpus is tubular-funnelform and not constricted above the ovary. In Ammocodon the stamens are 2 or rarely 3, their filaments free from the perianth, whereas in Selinocarpus the stamens are usually 5 (with 4 to 8 less common) and their filaments are adherent to the perianth tube. Furthermore, the flowers of A. chenopodioides are aggregated into many-flowered, umbelliform cymes, each flower subtended by one, or rarely 2, bracts, in contrast to the solitary to geminate flowers in the leaf axils, subtended by 2 to 4, or very rarely one, bract, as found in the various species of Selinocarpus.

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