Graptopetalo Rose proximum, a quo calycis segmentis reflexis, corollae ore clauso sementisque concoloribus basi angustatis enatioaibus ornatis, fiilamentis aetate non reflexis, stylis elongatis differt. Pax vobiscum. Herba perennis succulenta glabra. . . ." (Page 76.) And so on for 13 more lines of impeccable Latin prose.

Well, I would cite many more examples of Dr. Moran's contributions and philanthropies, but perhaps it is time to let him tell us about the "PLANT LIFE OF BAJA CALIFORNIA".

NEW OR RENOVATED POLEMONIACEAE FROM BAJA CALIFORNIA, MEXICO (IPOMOPSIS, LINANTHUS, NAVARRETIA)

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In collecting in Baja California I have found three Polemoniaceae that seem to be unnamed, three whose generic position needs changing, and a few otherwise worth noting. The first set of my specimens is in the herbarium of the San Diego Society of Natural History (SD); duplicates will be distributed. In this account, my field numbers are prefixed with "M". I am grateful to Drs. Alva Day and Charles H. Uhl for chromosome counts and to Dr. Day also for the drawings and for reviewing this paper. Also, I thank the curators at POM, RSA, UC, and US for the loan of specimens, and at GH for photographs.

Ipomopsis

In his reclassification of the Polemoniaceae, Grant (1959) maintained *Ipomopsis* Michx. as a genus distinct from *Gilia* R. & P., with the expanded limits he had proposed before (Grant, 1956). Between these two rather large and variable groups he found general differences in duration, leaf distribution, leaf texture and dissection, flowering season, corolla form and venation, seed size and shape, etc.; and despite some specific exceptions, the two genera appear distinct. He also found a supporting cytological difference: *Ipomopsis* has a basic chromosome number of $x = 7$, as in *Eriastrum* and *Langloisia,* whereas *Gilia* has $x = 9$ as in *Navarretia, Leptodactylon,* and *Linanthus.* Thus *Ipomopsis* seems well maintained in this expanded sense.

Asa Gray named three species of *Loeselia* from the Sierra Juárez of northern Baja California: *L. effusa* (1876), *L. tenuifolia* (1876), and *L. guttata* (1885). He placed them in their own section, Giliopsis, "connecting with Gilia". Gray (1886) transferred all three to *Gilia* section Ipomopsis (Michx.) Benth.; but Brand (1907) and Standley (1924) kept them in *Loeselia,* and likewise Jepson (1943) and Mason (1951) kept in *Loeselia* the one species extending into Alta [upper] California. Grant (1959) defined *Loeselia* to exclude these species, placing *L. effusa* in *Gilia* section Giliastrum Brand, *L. tenuifolia* in *Ipomopsis* section

PHLOGANTHEA (A. Gray) V. Grant, and *L. guttata* in synonymy under *Ipomopsis tenuifolia*. Study of these plants suggests that Gray was right in recognizing three species and in placing them in one genus but that the genus now should be *Ipomopsis* rather than *Loeselia* or *Gilia*.

These three species appear to form a close natural group within *Ipomopsis,* distinct from other species of section PHLOGANTHEA but not different enough to be treated as a separate section. They might be called a subsection of PHLOGANTHEA, but without first–hand information about other members of the genus, I will not attempt a reorganization at this level. For convenience, therefore, I refer to them informally as the Giliopsis group, without proposing any change in nomenclatural status. The group may be described as follows.

IPOMOPSIS section PHLOGANTHEA, Giliopsis group
Loeselia section *Giliopsis* A. Gray, Proc. Amer. Acad. Arts 11:86. 1876.
Loeselia subgenus *Giliopsis* [attributed to Gray by] Peter, Nat. Pflanzenfam. 4(3a):54. 1891.

Annual with basal rosette and leafy stems or perennial with several leafy stems from woody base, glandular puberulent at least above, more or less pubescent with white multicellular hairs or glabrate in age, the herbage with odor recalling tomato plants. Leaves horny–mucronate, linear and entire or the lower pinnatifid with a few linear to ovate, mucronate lobes. Flowers cymose, erect to horizontal, borne spring to autumn. Calyx regular, with scarious intervals equalling or wider than herbaceous ribs, rupturing in fruit. Corolla either red and concolorous or white to pink and irregularly spotted, nearly regular to strongly irregular; when corolla irregular, the anterior (lower) one or two sinuses deeper than the others and the posterior or anterior segment respectively in plane of symmetry; throat (measured to base of deepest sinus) much shorter to slightly longer than tube, narrowly funnelform; segments variously spreading, oblong to linear, cuneate, truncate and irregularly tridentate, muricate–papillose ventrally especially near base of posterior segments. Stamens subequally inserted at base of throat, well exserted from throat, nearly equalling to well exceeding segments, declined with tips upcurved when corolla irregular; anthers versatile, lobed from base nearly to insertion; pollen blue. Seeds pale brown, mucilaginous when wet, oval, rounded on back and pitted, flattish on face; or when crowded, seeds irregularly angulate. Chromosome number: $x = 7$.

The type species of *Loeselia* section GILIOPSIS is *L. tenuifolia,* designated by Grant (1956).

In all three species of the Giliopsis group, the flowers range from nearly regular to strongly irregular; and when irregular, they follow either of two variable patterns. To some extent the variation is between individual plants, the flowers of one being generally more regular than those of another; but also, the flowers of one individual may vary markedly. The attitude of the flowers varies from erect to horizontal, and the erect flowers tend to be more regular. In nearly regular flowers, the lower (anterior) sinuses of the corolla are scarcely deeper than the upper (posterior); the corolla segments are about equal and diverge about equally; and the stamens are not declined but equally spaced about the mouth of the corolla. In irregular flowers, either two lower sinuses of the corolla are conspicuously (to 6 mm) deeper than an uppermost one, or one lower sinus is conspicuously deeper than the upper two; the segments may be unequal, and they spread variously in bilateral symmetry; and the stamens are declined. Also, the two lateral sinuses vary in position and depth. When two lowest sinuses are deepest, the lowermost segment lies in the midplane of the flower, and the other four segments diverge from it to varying degrees, depending on the position and depth of the lateral sinuses: in extreme flowers the other four segments are within an upper arc of about 180°, thus forming an upper lip. When one lower sinus is deepest and marks the midplane, the two lowest segments diverge from it to varying degrees, again depending on the position and depth of the lateral sinuses: in extreme flowers all five segments are within an upper arc of 180°, thus forming an upper lip with no lower lip. Although the symmetry varies in all three species, the modes are different, the flowers of *I. tenuifolia* being more often nearly regular, those of *I. effusa* and *I. guttata* more often one– or two–lipped and seldom nearly regular.

The herbage of all three species has a characteristic odor, which on an early label I compared with that *Lantana camara* L. but which I settled on comparing with that of *Lycopersicon esculentum* Mill.

The three species of the Giliopsis group differ from other members of *Ipomopsis* in their cuneate–truncate and irregularly tridentate corolla segments. No other thoroughgoing distinction from PHLOGANTHEA is evident. Whether the odor of the herbage is distinctive is not known since no comparable information is available for the other species. Like Giliopsis, the other five species of PHLOGANTHEA also have more or less irregular flowers; and floral symmetry is similarly variable at least in *I. havardii* (A. Gray) V. Grant, with the midplane of the flower passing through either a lower segment or a lower sinus. That species, of western Texas, is perhaps especially close to the Giliopsis group, as suggested by the treatment of Brand (1907).

Ipomopsis effusa (A. Gray) Moran, comb. nov.
Loeselia effusa A. Gray, Proc. Amer. Acad. Arts 11:86. 1876.
Gilia dunnii Kellogg, Pacific Rural Press 17:354. 1879. (Based on specimen sent by G. W. Dunn "from the southern part of [California]".)
Gilia effusa Macbride, Contr. Gray Herb. 56:57. 1918.

Annual with basal leaf rosette and 1–several slender leafy stems, 0.5–3 dm high, moderately pubescent. Cotyledons basally connate, oblong to linear–oblanceolate, acute, entire, 3–8 mm long. Rosette leaves 0.5–3 cm long, simple or mostly pinnatifid, with 2–10 oblong to ovate lobes mostly in upper half and sometimes crowded near apex, the rachis 0.5–1 mm wide, the lobes ca as wide and 0.5–2 mm long; cauline leaves similar, fewer–lobed and smaller upward, the upper entire, linear. Flowers May to October. Calyx 3–4 mm long, the lobes 0.5–1 mm long, the scarious intervals often marked with purplish red. Corolla commonly one–lipped, sometimes two–lipped, rarely nearly regular, pink and white, 9–14 mm long, the tube and throat white to pinkish with small darker pink spots, the tube 1.5–2 mm long, ca 1 mm wide (unflattened), the throat 1–1.5 (–3) mm long, ca 1.5 mm wide, the lower sinus(es) 0.5–3.5 mm deeper than upper, the segments deep pink, darker below, at base white with pink spots, 4–7 mm long, 2–4.5 mm wide above, 0.7–1.5 mm wide at base. Filaments white, 6–9 mm long, exserted 5–8 mm from throat and about equalling corolla segments. Style 5–10 mm long. Capsules 3–5 mm long, 1.5–2.5 mm thick. Seeds ca 1 mm long. Chromosome number $n = 7$.

Type: Tantillas Mountains, Lower California, [ca 10 September] 1875, *Edward Palmer 767* (GH, photo SD). This would be the Sierra Juárez, probably somewhere near El Progreso. On the same sheet is a later collection by C. R. Orcutt from nearby El Topo.

Distribution: On gravelly flats often with *Pinus quadrifolia* Parl. and in mountain meadows with *Pinus jeffreyi* Grev. & Balf., or occasionally in upper chaparral, at 1000–2600 m and straggling to lower elevations along streams, northern Baja California Norte: Sierra Juárez, 1000–1600 m; Sierra San Pedro Mártir, 875–2600 m.

Dr. Uhl reports a gametic chromosome number of $n = 7$ probable for a collection of *I. effusa* (*M17887*) from Yerba Buena, in the Sierra San Pedro Mártir; and Dr. Day, from many clear cells, reports $n = 7$ for a later collection (*M18467*) from the same place.

Grant (1959) placed this species in *Gilia* section GILIASTRUM Brand, but his criteria (1956: 351–352:1959:79) point to *Ipomopsis*. In *I. effusa* the stem is leafy, the leaves are simple or once–pinnate, and the segments are horny–mucronate. Flowering is in summer, from May to September. The flower is strongly irregular, the corolla is irregularly spotted, and its veins do not anastomose. The seeds are oblong, not small and spheroidal, and the chromosome number is $n = 7$. In all these respects, *I. effusa* is like *Ipomopsis*, not like *Gilia*. Although it is annual, like most species of *Gilia* and like no others of PHLOGANTHEA, both other section of *Ipomopsis* do include annuals. Thus there seems no reason to put it in *Gilia*. And finally, *I. effusa* agrees with the other two species of Giliopsis in types of pubescence, odor of herbage, and patterns of floral irregularity, and, most notably, in the cuneate–truncate and irregularly tridentate corolla segments.

From the other two members of the Giliopsis group, *I. effusa* differs in its annual habit and basal leaf rosettes, its more consistently pinnatifid leaves, with more lobes, and its smaller flowers, with much shorter corolla tube. The corolla is often one-lipped and seldom nearly regular; hence it is generally more strongly irregular than that of *I. tenuifolia* and perhaps also than that of *I. guttata.*

Ipomopsis guttata (A. Gray) Moran, comb. nov.
Loeselia guttata A. Gray, Proc. Amer. Acad. Arts 20:302. 1885.
Gilia guttata A. Gray, Syn. Fl. N .Amer. Ed. 2. 2(1):411. 1886.

Perennial with several slender leafy stems from woody base, 1–4 dm high, sparsely pubescent. Leaves mostly entire but the lower occasionally 1–3 lobed, 0.5–2.5 cm long, ca 0.5 mm wide or a little more, the lobes ca as wide, to 3 mm long. Flowers May to October. Calyx 3–5 mm long, the lobes 1–2 mm long, the scarious intervals purplish. Corolla commonly two-lipped or one-lipped but sometimes nearly regular, deep pink to white, lighter with age, irregularly spotted deep pink to purplish red, withering bluish to purplish, 12–25 mm long, the tube 5–11 mm long, ca 1 mm wide (unflattened), slightly wider at base, the throat 1–2 mm long, 1.5–2 mm wide, the lower sinus(es) 0.5–6 mm deeper than the upper, the segments 5–9 mm long, 2–3.5 mm wide above, 1–1.5 mm wide at base. Filaments white, 6–10 mm long, exserted 5–9 mm from throat and so about equalling corolla segments. Style 8–18 mm long. Capsules 3–5 mm long, 1.5–2.5 mm thick. Seeds ca 1.5 mm long. Chromosome number: $n = 7$.

Type: from "near Hanson's Ranch", 18 September 1884, *C. R. Orcutt 1225* (GH, photo SD). Since Orcutt (1893) reported returning from Hanson's by San Rafael, and since another herbarium label puts him in San Rafael on 19 September, he could well have collected the type about 12–15 km southwest of Laguna Hanson, where the plant is known to occur.

Distribution: Openings in chaparral, with *Adenostoma fasciculatum* H. & A., and often also *A. sparsifolium* Torr., on the west slope of the Sierra Juárez and the Sierra San Pedro Mártir, Baja California Norte, at 800–1650 m. Apparently local, known only from two areas: 3–6 km W to SW of El Rayo, Sierra Juárez, 1450–1650 m, *M13536, 13552, 16636, 18483, 22738;* foothills of Sierra San Pedro Mártir from 1 mi S of Rancho Santa Cruz, 1050 m (*Wiggins 10031*), southward at intervals for 15–20 mi (Wiggins 1944); divide between Arroyos Santa Cruz and San Antonio, 1000 m, *M16417, 23474;* 5.5 km W of Santa Cruz, 800 m, *M16280.*

Dr. Day reports a gametic chromosome number of $n = 7$ for a collection (*M18483*) of *I. guttata* from west of El Rayo, in the Sierra Juárez. In some cells she found a ring or chain of four chromosomes, and in some the pairing appeared to be poor.

Grant (1959:137, 145) referred this species to snyonymy under *I.*

tenuifolia, but it is clearly distinct. It is similar in size and habit, but with leaves a little narrower and more commonly entire. The flowers are strikingly different in color—white or pink and irregularly spotted rather than bright red; they are somewhat smaller, with narrower corolla tube and segments, much shorter throat, and much shorter stamens; and generally they are more markedly irregular. So far as known, the areas of the two species are distinct, but they are close enough that some overlap may occur.

Wiggins (1944) reported this species from the foothills of the Sierra San Pedro Mártir and gave notes about the flowers.

Ipomopsis tenuifolia (A. Gray) V. Grant, Aliso 3:357. 1956.
Loeselia tenuifolia A. Gray, Proc. Amer. Acad. Arts 11:86. 1876.
Gilia tenuifolia A. Gray, Syn. Fl. N. Amer. Ed. 2. 2(1):411. 1886.
Gilia truncata A. Davidson, Bull. S. Calif. Acad. Sci. 22:72, pl. 19. 1923. (Based on *Payne & Kessler 3572,* from near Jacumba, San Diego Co., Calif.)

Perennial with several slender leafy stems from woody base, 1–4 dm high, sparsely to moderately pubescent. Cotyledons basally connate, linear–oblanceolate, acute, horny–apiculate, ca 10–12 mm long and 1–2 mm wide. Leaves entire or lower often 1–4 lobed, 5–35 mm long, mostly 0.5–1 mm wide, the lobes ca as wide, to 7 mm long. Flowers March to December. Calyx 5–9 mm long, the lobes (1–)2–3 mm long, the scarious intervals reddish. Corolla nearly regular to two–lipped or sometimes more or less one–lipped, bright red except for irregular white guide–marks at very base of segment and continuous with white or light pink color within tube, (12–)16–28 mm long, the tube 5–10 mm long, 1.5–2 mm wide (unflattened), slightly wider at base, the throat 6–11 mm long, 2.5–3 mm wide, the lower sinus(es) 0.5–4 mm deeper than upper, the segments 4–9 mm long, 2–5 mm wide above, 1–2.3 mm wide at base. Filaments red above, white below, 14–22 mm long, exserted 8–14 mm from throat and so exceeding corolla segments. Style 20–30 mm long. Capsules 5–7 mm long, 2–3.5 mm wide. Seeds ca 2 mm long. Chromosome number: $n = 7$.

Type: from "northern borders of Lower California, Tantillas Mountains, especially at the entrance of the Great Canyon, W. Dunn, E. Palmer", [ca 10 September] 1875 (GH, photo SD). Presumably this is near El Progreso, in the Sierra Juárez. Though not mentioned on the label, G. W. Dunn was on this trip (McVaugh, 1956).

Distribution: On open gravelly slopes and in arroyos, associated with pinyon–juniper woodland, chaparral, or desert scrub, from southern California to north–central Baja California (Baja California Norte) at 100–2300 m elevation: Mammoth Wash, Chocolate Mts., Imperial Co., [ca 100 m] *E. Gray* (SD); SW Imperial Co. and SE San Diego Co., Calif., ca 450–1200 m; Sierra Juárez at 1100–1600 m on the west slope, with stragglers down to 700 m in eastside canyons; west slope of Sierra San Pedro Mártir, 800–2300 m; Cerro Matomí, 1375 m, *M20806*; Cerro San Miguel, 1125 m, *M19519*; Cerro San Luis, 1300 m, *Moran & Henrickson 10300;* Ubi [= Yubay, near 29°11′N, ca 650 m], *Brandegee in 1889* (SD, UC).

Grant (1959) cited a chromosome number of $2n = 14$ for *I. tenuifolia,* based on a collection from Jacumba, California.

Grant and Grant (1965) reported that plants from Jacumba grown at Claremont, California, were commonly visited by hummingbirds: "Their bills slip easily into the tube as they hover and probe for nectar, and their heads become dusted with pollen at the same time." They concluded that hummingbirds are the animals best fitted to feed on and pollinate these flowers. This is the only species of section Phloganthea with flowers red like the hummingbird–pollinated flowers of section Ipomopsis. Grant and Grant (1965) found the Jacumba plants self–incompatible.

The corolla of *I. tenuifolia* is often nearly regular, as shown by Mason (1951: Fig. 4007), by Grant (1959: Fig. 45, from Brand), and by Grant and Grant (1965: pl. 2F); but it may also be markedly irregular. In the other two species of the Giliopsis group, presumably pollinated by insects, most flowers are markedly irregular. The red hummingbird–pollinated flowers of *Ipomopsis* section Ipomopsis are quite regular.

Like some other hummingbird flowers, *I. tenuifolia* is sometimes called "chuparosa" in Mexico. Also as common names, Martínez (1937) cited "ubi" and "agua bonita": clearly both are from Brandegee (1889), who gave them not as plant names but as place names.

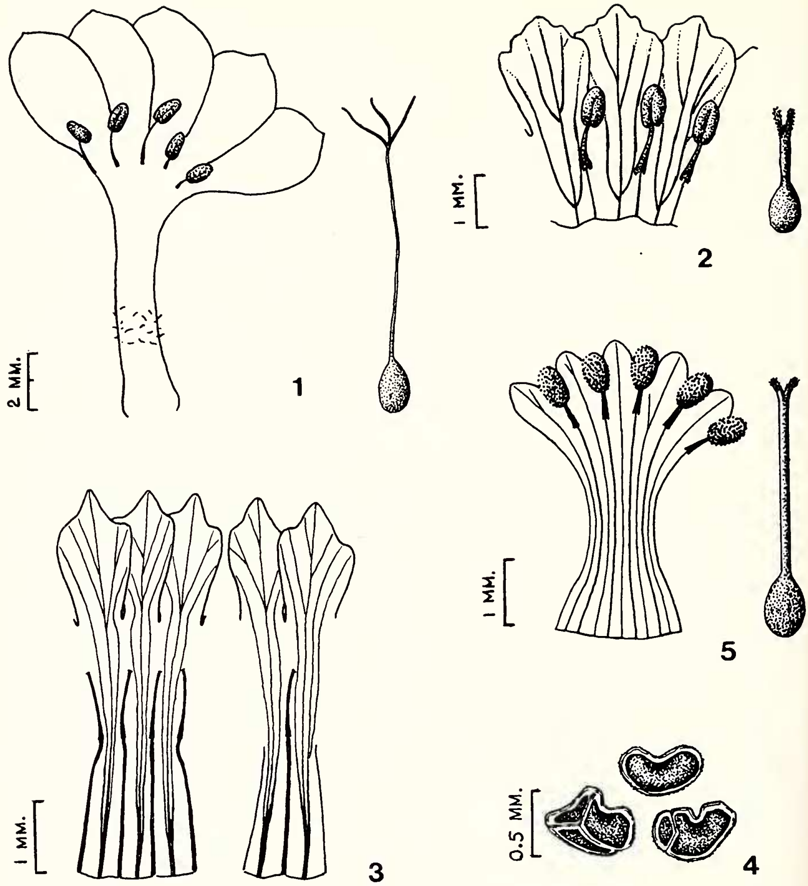
With *I. tenuifolia* in section Phloganthea, V. Grant (1956, 1959) placed the Baja California shrub commonly called *I. gloriosa* (Brandegee) A. Grant. However, Alva Day and I are studying this plant and consider that it probably does not belong to *Ipomopsis.*

Ipomopsis sonorae (Rose) A. Grant ex V. Grant, of section Microgilia (Benth.) V. Grant, also occurs in Baja California: vernally moist depressions, sandy brush–covered flats north of the bay, San Quintín, 30 m, *Raven, Mathias, & Turner 12378* (UC), det. by V. Grant; La Bocana, east base of Sierra San Borja, 250 m, *M12494* (SD), det. by Alva Day.

Linanthus and Navarretia Species

Linanthus jamauensis Moran, spec. nov. Fig. 1.

Planta annua hispidula supra glandulo–puberulenta 2–13 cm alta plerumque ramosa, internodiis infernis brevibus, supernis elongatis. Folia 1–9 mm longa 3–5 partita, segmentis linearibus spinuloso–apiculatis. Inflorescentia aperta, floribus terminalibus subsessilibusque vel axilliaribus longeque pseudopedicellatis. Calyx tubulo–campanulatus 3–4 mm



Figs. 1–5. Drawings by Dr. Alva Day. Fig. 1. *Linanthus jamauensis,* corolla, pistil; *Moran 20930* (type). Fig. 2. *Linanthus uncialis,* part of corolla, pistil; *Raven Mathias, & Turner 12528*. Figs. 3,4. *Linanthus viscainensis,* corolla, seeds; *Moran & Reveal 19868* (type). Fig. 5 *Navarretia fossalis,* corolla, pistil; *Moran 16014* (type).

longus ⅓ lobatus, tubo infra sinua scarioso. Corolla tubulo–infundibuliforma 10–17 mm longa, tubo gracillimo 6–10 mm longo intus supra basim puberulo–annulato, fauce 1–2 mm longa, lobis rubellis obovatis 3–6 mm longis. Filamenta sub sinubus inserta valde inaequilonga, brevissimis ca 0.3 mm longissimis 1.2–2.3 mm longis. Typus: *Moran 20930* (SD 83887). Species staminibus valde inaequalibus notabilis, corollae tubo gracillimo calyce 2–3–plo longiore in sectione Dactylophyllo praeterea distincta, *L. rattanii* et *L. ambiguo* fors proxima qui autem foliis 3–7–partitis, calycibus grandioribus, corollis dissimiliter coloratis, et staminibus aequalibus valde exsertis differunt.

Much branched or rarely simple annual herb, 2–13 cm high and to 17 cm wide, hispidulous with stiff, tapering, whitish non–glandular trichomes to 0.15 mm long on stems and to 0.3 mm long or more on leaves, and glandular–puberulent with colorless 2–3–celled trichomes ca 0.1 mm long, each tipped with a yellowish globule to 0.05 mm thick, which shrinks and dries reddish. Hypocotyl papillose. Cotyledons subsessile and connate, elliptic, rounded at apex, 1.5–3 mm long, ciliate at base, otherwise glabrous. Stem reddish, to ca 1 mm thick at base, the main axis ca 2–6 cm high, with 3–10 nodes, in favorable years overtopped by 1–5 orders of axillary branches, hispidulous and scarcely glandular below, often closely leafy below, the basal internodes often only 1–3 mm long; branches mostly rebranching at each node; upper internodes more slender and elongate, commonly 0.5–3(–4) cm long, subglabrous except often glandular just below nodes, the ultimate to 0.2 mm thick. Leaves opposite and connate, palmate; lower 1–9 mm long, 1–12 mm wide, moderately hispidulous ventrally and on margins of segments, less so towards apex, scarcely glandular, mostly 5–parted (or lowermost pairs 3–parted or rarely simple), the segments linear, spinulose–apiculate, to 0.75 mm wide, ca half as thick or more, the middle 1–7 mm long, the lateral slightly shorter; upper leaves smaller, less hispidulous and more glandular towards base, mostly 3–parted. Flowers pink, diurnal, terminal and sessile or subsessile in a leaf pair or axillary on slender pseudopedicels to 15 mm long. Calyx tubular–campanulate, (2–)3–4 mm long, ca 1 mm wide, lobed ca one–third, moderately glandular throughout or at least in basal half, the tube with herbaceous ribs and scarious intervals about equally wide, the lobes equal, triangular–lanceolate, spinulose–apiculate, herbaceous, with scarious margins only at base. Corolla tubular–funnelform, (7–)10–17 mm long; tube pinkish, slender, 0.3–0.5 mm wide (flattened), scarcely widened upward, 6–10 mm long, glabrous or commonly glandular–puberulent without, with puberulent ring ca 2 mm from base within; throat funnelform, 1–2 mm long, 1.5–2 mm wide above, glabrous; lobes pink, of various shades in different plants, drying blue–violet, narrowly obovate, rounded at apex, 3–6 mm long, 2–3 mm wide. Filaments subequally inserted in upper throat ca 0.3–0.6 mm below sinuses, markedly unequal, the shortest ca 0.3 mm long, the longest 1.2–2.3 mm long; anthers 0.8–1.0 mm long; pollen yellow. Ovary ca 1 mm long; style reaching corolla mouth, the stigma lobes exserted, 1–2.5 mm long. Capsules oblong, light tan, ca 2–3.5 mm long, 1–1.5 mm thick, with ca 2–3 seeds per cell. Seeds tan, irregular, verrucose, ca 1 mm long, mucilaginous when wet.

Type: Abundant on gentle north slope at 1250 m, with *Juniperus californica* Carr., *Pinus quadrifolia* Parl., and *Yucca schidigera* Roezl, ca 1 km W of Portezuelo de Jamau, Sierra Juárez, Baja California Norte, México (near 31°37′N, 115°39′W), 19 May 1973, *Moran 20930* (Holotype SD 83887).

Distribution: Known only from the southern Sierra Juárez. Other collections: gentle open north slope 3 mi NE of El Rincón, 1250 m, *M21257;* Portezuelo de Jamau, 1300 m, *M13886;* type locality, *M21221*; openings in chaparral, mesa 1 mi S of Portezuelo de Jamau, 1450 m, *M20937, 21224*; flat divide 4 km NW of Cerro el Saiz, 1300 m, *M23282*.

Whereas plants collected in the relatively rainy year of 1973 (*20930, 20937*) were bushy–branching, those collected at the same places (*21221, 21224*) in the drier year of 1974 were mostly simple, with only 3–5 nodes and a single flower each. In May 1976, another dry time, I found no plants at either place.

This plant, with its short few–lobed leaves and open inflorescences, falls in the section Dactylophyllum (Benth.) V. Grant (Grant 1959: 108, 109). It may have one to five generations of axillary branches, each of one elongate internode, or of very few, and ending with a leaf pair and a terminal sessile or subsessile flower. In the ultimate branchlets the upper leaf pair may be reduced or quite absent: with no leaves, the branchlet is like a pedicel and would commonly be called one. However, Grant used the term "peduncle" for the stalk of the flower in this section.

Within Dactylophyllum, the new species falls in the group of species (*L. ambiguus* [Rattan] Greene, *L. aureus* [Nutt.] Greene, *L. bakeri* Mason, *L. bolanderi* [A. Gray] Greene, *L. lemmonii* [A. Gray] Greene, and *L. rattanii* [A. Gray] Greene) with glabrous filaments but with a puberulent ring within the corolla below the insertion of the stamens. From all these species, and apparently from all other members of the genus, it differs in its markedly unequal filaments, the longest about 4–8 times the shortest. Within the section it is remarkable also for its long slender corolla tube, 2–3 times the calyx and about ⅓ mm wide: in most other species the corolla is shorter or at least has a much shorter tube. Within the section, only *L. rattanii,* of the North Coast Ranges of California, and *L. ambiguus,* of the South Coast Ranges, have corollas that may be as long, though commonly they also are shorter. Both species differ further in their 3–7–parted leaves, their flowers more commonly borne on long pseudopedicels, their generally longer calyx, their differently colored corollas, and their exserted and more nearly equal stamens.

Linanthus orcuttii (Parry & Gray) Jeps., Man. Fl. Pl. Calif. 804. 1925.
Gilia orcuttii Parry & Gray, Proc. Davenport Acad. Nat. Sci. 4:40. 1884.
Linanthus pacificus Milliken, Univ. Calif. Publ. Bot. 2:53. 1904.
Linanthus orcuttii ssp. *pacificus* (Milliken) Masin, in Abrams, Ill. Fl. Pac. States 3:426. 1951.

The type of *G. orcuttii* is from a "high mountain ridge in Lower California, collected by C. R. Orcutt, June 1883". From two accounts (Orcutt, 1883, 1893), it came from the north slope of the Guadalupe Mountains, "credited with an altitude of 4000 feet [ca 1200 m]" and with

Pinus coulteri near the summit, up valley from Rancho Guadalupe, 75 mi [120 km] from San Diego by road. This is the 1350-m peak now mostly called Cerro Blanco or Sierra Blanca, 8 km SE of Guadalupe (near 32°03′N, 116°30′W), with the only stand of *P. coulteri* within 50 km. *Linanthus orcuttii* is rather scarce in the open Coulter pine wood on the north slope, at ca 1000–1200 m (*M16160, 23240*). It also occurs, rarely, in the Sierra San Pedro Mártir (damp soil along streamlet, La Concepción, 1500 m, *M15019;* canyon of Río Santo Domingo, 950 m, *I. L. Wiggins 10023A* [DS]; Jeffrey pine forest, Santa Eulalia, 1850 m, *M11137*) and near the mouth of Río Santo Domingo (near Hamilton Ranch, *J. H. Thomas 104* [DS]). (Dr. Day tells me of the two DS specimens, which I have not seen.)

Milliken (1904) described *L. pacificus* from Palomar Mountain, San Diego Co., without reference to *L. orcuttii*. It occurs also on Monument Peak, Laguna Mountains, 1800 m (*Beauchamp & Williams 2754,* SD). Jepson (1925, 1943) and Munz (1935) listed it in synonymy under *L. orcuttii*. Mason (1951) made it a subspecies of *L. orcuttii,* but with no comparison; and he was followed by Munz (1959, 1974). Grant (1959) referred *L. pacificus* to *L. orcuttii* with no comment as to subspecific status; but while he placed *L. orcuttii* in section DIANTHOIDES (Endl.) V. Grant, he named *L. pacificus* type of section PACIFICUS (Jeps.) V. Grant.

The specimens at hand show no basis for separating *L. pacificus* even subspecifically.

Linanthus uncialis (Brandegee) Moran, comb. nov. Fig. 2.
Gilia uncialis Brandegee, Zoe 5:107. 1897.

Delicate annual 2–7 cm high, commonly simple, ± lightly puberulent with slender several-celled trichomes 0.1–0.3 mm long, those of upper parts gland-tipped. Lower leaves opposite for 3–6 pairs, connate at base, simple, narrowly linear, horny-tipped, obtuse and apiculate, 3–18 mm long, ca 0.3–0.6 mm wide, channelled ventrally especially towards base, puberulent ventrally in lower half; upper few alternate, similar. Flowers February to April, terminal and solitary or also with 1–2 from upper axils on pedicels 5–10 mm long. Calyx 3–7 mm long, the tube 1–3 mm long, with scarious intervals slightly wider than herbaceous ribs, the sinuses V-shaped, the lobes linear, obtuse and apiculate, membranous-margined in lower ca 1 mm, channelled and puberulent ventrally, 2–5 mm long, in larger calyces often markedly unequal. Corolla white, 3–6 mm long, funnelform, glabrous within, the tube and throat each ca 1 mm long, the lobes obovate or narrowly so, ± erose to irregularly rounded-toothed, ca 2–3 mm long. Filaments inserted at base of throat, equal, glabrous, ca 0.8 mm long; anthers oval, ca 0.3 mm long after dehiscence; pollen yellow. Style ca 0.5–1.0 mm long; stigmas ca 0.5–0.8 mm long. Capsules 3–4 mm long.

Type: Abundant on sides of gulches and in shade of bushes near summit of highest mountain [ca 1200 m], Cedros Island, Baja California Norte, México [near 28°08′N, 115°13′W], 7 Apr 1897, *T. S. Brandegee s.n.* (Holotype UC 125003).

Distribution: Near west coast of central and north–central Baja California at 500–1200 m. Other collections: Baja California Norte: Aguajito grade 2 km E of Aguajito, 540 m, *Raven, Mathias, & Turner 12528* (LA?, RSA, SD); 0.5 mi SW of southernmost pine grove, 1600 ft, Cedros Island(*Haines & Hale s.n.* (LA?, UC). Baja California Sur: upper N slope of Cerro Azul [ca 100 km SE of type locality], 700 m, *Moran & Reveal 19991.*

Brandegee wrote that this plant was closely allied to *Gilia dianthoides* Endl. [*Linanthus dianthiflorus* (Benth.) Greene], differing most obviously in its small corolla but not resembling the depauperate form of that species seen about San Diego in dry seasons. Grant (1959) kept it in *Gilia,* in section Giliastrum Brand, whose type is *G. rigidula* Benth. However, it does seem closer to *L. dianthiflorus* than to any species of *Gilia,* especially in view of the opposite leaves; and I place it in *Linanthus* section Dianthoides (Endl.) V. Grant.

Linanthus uncialis resembles *L. dianthiflorus* in its leaves and calyx and its often pedicellate flowers. It differs in its glabrous filaments and its smaller and apparently unmarked corolla, glabrous within, with less prominent veins and no regular denticulations. Other species placed by Grant in this section have mostly palmately parted leaves (except *L. maculatus* [Parish] Milliken), subsessile flowers, and calyx segments hyaline–margined over most of their length; and in some the calyx is more deeply divided. In most species the corolla is larger than in *L. uncialis*. The only other species with simple leaves and small flowers is *L. maculatus,* a rare endemic of the northwestern Colorado Desert, California. That is also a small plant but otherwise quite different: with compact branching habit; coarser pubescence; shorter, broader, thicker leaves; more flowers, on short pedicels; calyx divided to the base; corolla lobes spreading, subtruncate, maculate.

Linanthus viscainensis Moran, spec. nov. Figs. 3, 4.

Planta annua 3–15 cm alta irregulariter multiramosa plus minusve villosa et glanduloso–puberulenta. Folia 5–18 mm longa, inferioribus oppositis linearibus, superioribus saepe alternis plerumque tripartitis, segmentis linearibus. Flores vespertini in cymulis vulgo trifloris conferti. Calyx tubularis 4–7 mm longus plus minusve ad medium lobatus, sinubus acutis, tubo infra sinus et segmentorum marginibus inferioribus scariosis. Corolla calycem subaequans tubulo-infundibularis, segmentis albis 1–2 mm longis. Stamina inclusa brevia faucis basi inserta. Semina rubiginosa subreniformia irregulariter alboangulata foveolataque hilo constricta.

Typus: *Moran & Reveal 19868* (SD 92324). Species *L. arenicolae* affinis, sed ille parvior densiorque fere e basi dichotome ramosus, villosus sed non glandulo–puberulentus, foliorum segmentis altior insertis, seminibus sub aqua non mucilaginosis.

Erect bushy annual 3–15 cm tall and to 15 cm wide, glandular–puberulent with 2–3–celled trichomes mostly 0.05–0.1 mm long and each tipped with a yellowish globule, also more or less pubescent with multicellular white trichomes mostly 0.3–0.6 mm long. Stems slender, reddish, glandular, pubescent especially above, the main axis with ca 5–8 nodes, the lower internodes 1–3 mm long, the upper to 2 cm; lower branches also commonly with several nodes. Leaves opposite and basally subconnate below, often alternate above or at least with some pair–members well separated, 5–18 mm long, strongly nerved, pubescent ventrally at least near base, the lower simple, the upper simple or mostly 3–parted with lateral segments commonly ca half the mid–segment, the leaf or segments narrowly linear, 0.25–1 mm wide, horny–apiculate. Inflorescence cymose, the main axis and each branch ending in a flower, the main branches overtopped by 2–4 generations of axillary branchlets, each commonly of one internode, the lower elongate, to 4 cm, the ultimate very short, thus forming cymules of mostly 3 crowded subsessile or short–pedicellate flowers. Calyx tubular–campanulate, 4–7 mm long, 1–1.5 mm wide, sparsely glandular, pubescent at base and on pedicels, also in mouth and ventrally on lower half of lobes, the tube 2–4 mm long, with hyaline intervals equalling or slightly exceeding herbaceous ribs in width, the lobes erect or slightly outcurved, often unequal, subulate, hyaline–margined below, apiculate, 1–4 mm long, the sinuses sharply V–shaped. Corolla vespertine, tubular–funnelform, 4–6.5 mm long, the tube white, ca 2–3 mm long, ca 0.5 mm wide, the throat poorly delimited and scarcely wider, yellow, 1–1.5 mm long, the segments white (or light yellow?), narrowly obovate, subacute, 1–2 mm long, 0.5–1 mm wide. Stamens included, the filaments glabrous, 0.3–0.5 mm long, inserted somewhat unequally at base of throat, the anthers ca 0.25 mm long. Style 0.5–1 mm long; stigma lobes 0.5–1 mm long. Capsules oblong, light tan, 2–4 mm long, 1.5–2 mm thick, with ca 15–20 seeds per cell. Seeds red–brown, 0.4–0.6 mm long, subreniform, irregularly angled and pitted, notched and white at the hilum, the testa closely adherent but projecting as narrow whitish wings on some angles, mucilaginous when wet.

Type: Few and scattered in sandy bed of Arroyo Malarrimo 18 km S of mouth, at 75 m, Baja California Sur, México (near 27°39′N, 114°29′W), 6 Feb 1973, *Moran and James L. Reveal 19868* (Holotype SD 92324).

Distribution: Known only from sandy arroyo beds east and southeast of Bahía Tortuga, on the Viscaino Peninsula, northwest part of Baja California Sur. Other collections: scarce in bed of Arroyo Largo 6.5 km

E of mouth, 110 m, *Moran & Reveal 19931;* scarce in arroyo bed 13 km by road NW of Asunción, 70 m, *Moran & Reveal 19786.*

At all three localities *L. viscainensis* was scarce, widely scattered along the sandy arroyo beds. Plants collected in mid–morning and early afternoon had no open flowers; only the late afternoon collection had any flowers open. These flowers had a white tube and segments and yellow throat; but closed ones at another locality looked as if the segments might have been light yellow.

The new species appears most closely related to *L. arenicola* (M. E. Jones) Jepson & Bailey, reported as a rare gypsophile occurring from the eastern Mojave Desert of California to southern Utah. That plant also has simple or 3–parted leaves, and it is similar in the size and form of the calyx and of the corolla, which again is vespertine. However, it is a smaller and more compact plant, branching dichotomously from near the base. the main axis having only one or two nodes, and flowering from even the lowest dichotomies. In *L. viscainensis* the main axis and its lower branches each have several nodes; and the upper branching is not regularly dichotomous because the leaves are not regularly opposite. *Linanthus arenicola* is similarly pubescent or more so, but it is not also glandular–puberulent; the lateral lobes of the leaves are inserted higher above the base; and the seeds are slightly larger and not mucilaginous when wet.

Mason (1938) considered *L. arenicola* (as *L. mohavensis* Mason) most closely related to *L. jonesii* (A. Gray) Greene, which it resembles in its vespertine flowers and its subreniform seeds, notched at the hilum. Likewise, Jepson (1943) placed *L. arenicola* in his subgenus EULINANTHUS, with *L. dichotomus* Benth. (generitype), *L. bigelovii* (A. Gray) Greene, and *L. jonesii*—all with vespertine flowers. Grant (1959) kept only *L. dichotomus, L. bigelovii, L. jonesii,* and *L. concinnus* Milliken in section LINANTHUS, characterized in part by flowers vespertine, calyx sinuses broad and more or less truncate, and filaments inserted on the corolla tube, i.e., below the throat. *Linanthus arenicola*, with sinuses V–shaped and filaments inserted low in the throat, he placed in section DIANTHOIDES (Endl.) V. Grant.

The vespertine flowers of *L. arenicola* and *L. viscainensis* do not alone necessarily show close relationship with the section LINANTHUS. However, the notched seeds are remarkably similar to those of *L. jonesii* and are different from those of section DIANTHOIDES. Furthermore, the calyx sinuses, though V–shaped, are not so deep as in most members of DIANTHOIDES. And other members of that section have broader corollas, mostly campanulate to funnelform (with a comparatively long tube and throat only in *L. killipii* Mason and *L. orcuttii* [Parry & Gray] Jepson) and mostly spotted at the throat. Thus there is reason to think that *L. arenicola* and *L. viscainensis* may belong in the section LINANTHUS.

Navarretia fossalis Moran, spec. nov. Fig 5.

Herba annua erecta prostratave 1–15 cm alta et lata plus minusve villosa et glanduloso–puberulenta, capitulo florali primario sessili caulescentive, vulgo ramos patulos in capitula similaria desinentes infra emittenti. Folia 1–5 cm longa remote pinnatifida infimisve integris. Bracteae 5–15 mm longae pinnatifidae, lobis acerosis. Calyx 4–8 mm longus, lobis inaequalibus integris, tubi ore arte ciliato. Corolla alba 4.5–6.5 mm longa, lobis uninervatis. Filamenta proxime infra sinua corollae inserta, 0.3–1.0 mm longa. Stigmata duo 0.2–0.3 mm longa. Capsula bilocularis diaphana indehiscens. Semina 5–25 rubiginosa 0.7–1.1 mm longa foveolata sub aqua mucilaginosa. Typus: *Moran 16014* (SD 70313). Ab aliis speciebus quarum stamina in sinibus corollae pariter inserta sunt calyce longiore (in illis plerumque 4–5 mm) fiilamentisque brevioribus (in illis plerumque 1.5–3 mm) differt. A *N. bakeri, N. pauciflora,* et *N. pleiantha* capsulis bilocularibus pluriseminalibus, a *N. prostrata* foliis basalibus parvioribus, calycis lobis simplicibus, corollaque parviore alba praeterea differt.

Annual 1–15 cm high and wide, the primary head sessile or caulescent, solitary or with 1–several spreading branches below, each bare below and ending in a similar head or also with several lateral heads; some parts pubescent with somewhat crinkly white pluricellular trichomes ca 0.5–1.0 mm long and glandular–puberulent with 2–3–celled trichomes ca 0.05 mm long, each tipped with a yellowish globule to ca 0.05 mm thick. Cotyledons connate at base, filiform, ca 5–13 mm long, bluntly horny–tipped. Stems whitish, retrorse puberulent or glabrous below. Leaves and foliaceous bracts soft–herbaceous when fresh, the bracts and upper leaves drying stiff and spinose. Lower leaves opposite, glabrous, 1–5 cm long, less than 0.5 mm wide, filiform and entire or remotely pinnatifid with linear or bifurcate lobes, the apices spinulose–apiculate. Middle leaves alternate, similar, remotely pinnatifid. Foliaceous bracts 5–15 or more mm long, ± pubescent in lower half, the rachis oblong, 0.5–2 mm wide, several nerved, scarious margined and ciliate, with 1–7 pairs of simple or basally branching acerose lobes mostly below middle, the terminal lobe linear, acerose. Heads 1–2 cm wide, each a compact compound cyme of 15–50 subsessile flowers, flowering in May and June. Calyx 4–8 mm long, the tube 2–3 mm long, scarious between ribs, ± pubescent and glandular, closely ciliate at mouth, the sinuses truncate, the lobes glabrous, linear, acerose, unequal by ± 2 mm, commonly 2 exceeding and 3 shorter than corolla, drying purplish. Corolla white, 4.5–6.5 mm long, in age circumscissile at base and pushed up by developing ovary, the tube 3–4 mm long, 0.2–0.4 mm wide, widened at base, the throat ca 0.5–1.0 mm long, the limb 3–4 mm wide, the lobes oblong, rounded at apex, 1–2 mm long, 0.4–0.7 mm wide, the single nerve sometimes with 1–2 ascending weak branches. Filaments inserted just below sinuses, 0.3–1.0 mm long; anthers oblong, sagittate, 0.5–0.9 mm long before dehiscence and 0.3–0.6 after. Ovary ovoid, green, ca 1 mm long, 2-celled; style slender, 2.5–4 mm long; stigma lobes 2, 0.2–0.3 mm long. Capsules 2–3 mm long, very narrowly attached, 2-celled, with diaphanous walls, indehiscent. Seeds 5–25, oval to irregular, 0.7–1.1 mm long, red-brown, finely pitted, mucilaginous when wet. Chromosomes: $n = 9$.

Type: Common in dry adobe soil, bank of ranch pond, Rancho Mesa el Tigre, 14.5 km SE of La Misión, Baja California Norte, Mexico, 375 m (near 32°00′N, 116°44′30″W), 31 May 1969, *Moran 16014* (Holotype SD 70313).

Distribution: Locally common in a few vernal pools and roadside depressions below 450 m, western Riverside and southwest San Diego Counties, California, and northwest Baja California. Other collection: Riverside Co.: 1 mi E of Perris, *R. Hoover 11152* (UC). San Diego Co.: 1 mi N of San Marcos, *F. Gander 3809* (SD); National Ranch, *D. Cleveland in 1882* (SD, UC), *Orcutt s.n.* (UC); Loma Alta, Otay Mesa, *F. Gander 217* (SD); Siempre Viva Rd., Otay Mesa, *R. M. Beauchamp 405* (SD); La Media Rd., Otay Mesa, 150 m, *Moran & Witham 16041, M23576.* Baja California Norte: Tijuana Airport, 150 m, *M16054, 16105;* mesa 5 km WNW of Ejido Matamoros, 150 m, *M17535;* 2.2 km SW of Redondo Sta., 220 m, *M17835;* mesa near canyon rim SE of La Misión, 250 m, *M15808a, 16004;* 18 km SE of La Misión, 325 m, *M14993, 14999;* 2 km NW of Ejido Ruben Jaramillo, 30 m, *M23503;* 2 km N of Rancho Ibarra, 50 m, *M22088;* 3.5 km E of old San Quintín, 10 m, *M23515.*

Dr. Day reports a gametic chromosome number of $n = 9$ for a collection (*M23503*) of *N. fossalis* from near Ruben Jaramillo. This count agrees with earlier ones for *Navarretia* (e.g. Grant, 1959).

In view of the truncate and closely ciliate calyx sinuses, the one-veined corolla lobes, the indehiscent capsules, the minutely two-lobed stigma, and the vernal pool habitat, *N. fossalis* clearly belongs in section NAVARRETIA (= section FRAGILES Crampton) (cf. Crampton, 1954; Grant, 1959). Here it falls in the group of species (*N. bakeri* Mason, *N. pauciflora* Mason, *N. pleiantha* Mason, *N. prostrata* [A. Gray] Greene) whose filaments are inserted in or just below the sinuses of the corolla. *Navarretia bakeri, N. pauciflora,* and *N. pleiantha* all occur in northern California, in Lake County and *N. bakeri* also more widely. Like these three, *N. fossalis* has entire calyx segments; from them it differs in its two-celled capsules with more numerous seeds (5–25 vs. 1–5), its longer calyx (mostly 5–7 vs. 4–5 mm), and its shorter filaments (0.3–1.0 vs. 1–3 mm).

Navarretia fossalis has been confused with *N. prostrata,* which extends from Merced and Monterey to Los Angeles and Riverside Counties, California. Thus Jepson (1943) referred a San Diego County collection to *N. prostrata,* though he called it "a partial departure from the usual form" in its elongate main axis; and Mason (1957) also gave the range of *N.*

prostrata as south to San Diego County. *Navarretia prostrata* agrees with *N. fossalis* and differs from the three northern species in having two-celled capsules with more numerous seeds. Typically, *N. prostrata* has a distinctive aspect, with its main floral head sessile in a broad basal rosette, the leaves 3–8 or even 13 cm long, with a rachis often 1 mm and sometimes 3 mm wide, the long-stemmed lateral heads, when present, also subtended by conspicuous leaves; and few collections include caulescent plants. In *N. fossalis* the main floral head is more commonly caulescent, though in some populations often shortly so and in a few commonly sessile; and the leaves are mostly less than 3 cm long and 0.5 mm wide. In *N. prostrata* the calyx tends to be a little smaller (mostly 4–6 vs. 5–7 mm); and its larger segments often are tridentate, whereas in *N. fossalis* all are entire. Also, in *N. prostrata* the corolla is longer (6 or mostly 7–9 vs. 4.5–6.5 mm) and commonly blue or lavender rather than always white; the filaments are longer (1 or mostly 1.5–3 vs. 0.3–1.0 mm); and the anthers are longer (to 1.2 mm before dehiscence and 0.5–0.8 mm after vs. to 0.9 mm before and 0.3–0.6 mm after). Because of the longer corolla and shorter calyx, the corolla of *N. prostrata* typically is well exserted, whereas that of *N. fossalis* is included.

Jepson (1943) commented on the variation in vegetative characters in *Navarretia* and also on the variation in the calyx in some species and the similarity of calyx lobes to bractlets and leaves. In *N. fossalis,* so far as seen, the calyx segments are always entire. In *N. prostrata* the one to four largest segments often each have one or mostly two lateral teeth near the apex. Sometimes most flowers of one plant have tridentate calyx segments, sometimes relatively few, and sometimes none. Apparently, however, most if not all populations include plants with tridentate segments: for every herbarium sheet examined had such plants.

So far as noted on labels, the corolla color of *N. prostrata* is blue or violet, or blue or violet to white; but there is not enough information to surmise that all populations include blue or violet flowers.

So far as known from collections, *N. fossalis* occurred in relatively few of the many vernal pools formerly in San Diego County, and in just three areas. From two of these areas the vernal pools and the plant probably are gone, and on Otay Mesa it is now known only in a few of the few remaining pools; nor has it been found in artificial depressions. Possibly it survives also near Perris, Riverside County, but in any case it must be counted in Alta California a rare and endangered species. In Baja California, however, its future seems more hopeful. Although I found it there in only three areas of natural vernal pools, and some of these pools are since destroyed, it is well established in several rather widely scattered artificial depressions. Thus as the natural vernal pools disappear, it is becoming more a plant of roadside ditches; and I name is accordingly.

My three recent southern collections (*22088, 23503, 23515*), from 120 km or more below any of the northern, are all from ditches made during construction of the highway completed about 1972—though the roadbed was started and these ditches perhaps dug several years before. The distribution of vernal–pool plants in these relatively new roadside ditches is still irregular and presumably unstabilized. An intriguing question is the source of these new colonists—whether from far to the north or from some unknown local population. With *N. fossalis* at one southern locality I was surprised to find *Orcuttia californica* Vasey, a very rare grass (cf. Moran, 1969) apparently known before in Baja Caifornia only from the type collection from San Quintín in 1886 and from my recent collections at Tijuana Airport. Having found neither the grass nor any natural vernal pools about San Quintín, I had wondered whether it persisted in that area. The recent collection suggests that it does and thus further suggests some refuge in the area where the Navarretia may also have persisted. Thus it seems reasonable to suppose that *N. fossalis* may be native as far south as San Quintín, even if it has perhaps not been found there by earlier collectors.

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THE FLORAL ECOLOGY OF ASCLEPIAS SOLANOANA WOODS.

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Asclepiads possess a mechanism for pollen transfer which requires insects to remove discrete packets of pollen (termed pollinia) and later to insert these into receptive stigmatic chambers on other flowers. Several workers (Robertson, 1929; Grant, 1949; Woodson, 1954; Macior, 1965; Stebbins, 1970) have speculated that mechanical and ethological exclusion devices may be significant in the present reproductive isolation of certain *Asclepias* species. Stebbins (1974) further suggests that these exclusion devices, coupled with oligotrophy, may have been instrumental in the diversification of taxa throughout the Asclepiadaceae.

This paper is part of a study in which the floral ecology of a number of Californian and Mexican *Asclepias* species is being examined to determine pollination mechanisms and to assess the roles of insect behavior, floral morphology, and habitat specificity in reproductive success. The emphasis of this paper is to elucidate the life history and floral ecology of *Asclepias solanoana* as it occurs in the North Coast Ranges of California. Particular attention is given to the efficiency of the reproductive process with regard to flower, fruit, and seed production. Behavioral patterns and morphological adaptations both of the plant host and its insect vectors are analyzed in detail and correlated to the efficiency of the actual pollination process.

Geography and Site Description: Asclepias solanoana is endemic to northern California, occurring within the North Coast Ranges from Trinity County near Peanut in the north to Napa County near the Lake County boundary in the south (Fig. 1). It is known only from a few small