

Resolution of the *Galphimia langlassei* Complex (Malpighiaceae) from the Pacific Slope of Mexico

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ABSTRACT. Four species were discerned in a complex of *Galphimia* Cav. (Malpighiaceae) from the Pacific slope of Mexico. Three are newly described (*G. arenicola*, *G. mexiae*, and *G. radialis*). One is transferred from *Thryallis* L. (nom. rejic.) to *Galphimia*, and the new combination *G. langlassei* is proposed.

The Neotropical genus *Galphimia* Cav. comprises ca. 20 species of large herbs or shrubs, mostly occurring in Mexico; one species, *G. gracilis* Bartl., is widely cultivated as an ornamental in warm regions. W. R. Anderson (1978) assigned *Galphimia* to tribe Galphimieae along with *Verrucularia* Adr. Juss., *Lophanthera* Adr. Juss., and *Spachea* Adr. Juss., a placement confirmed by Cameron et al. (2001) and Davis et al. (2001). *Galphimia* has yellow petals, often suffused with red. It is unusual among New World Malpighiaceae in that the sepals do not bear one or two large oil glands on the abaxial surface. In most species the calyx is eglandular, but in some a small gland, which resembles the leaf glands, is borne at the base of the sinus of some or all adjacent sepals (Castro et al. 2001). As in other genera, the loss of oil glands is accompanied by the presence of large anthers, which suggests a shift in pollinator reward to pollen. The tricarpellate ovary bears three free, subulate, and unornamented styles, each with a terminal stigma. The fruit is a schizocarp breaking into three one-seeded cocci.

The confusion surrounding the disposition of the generic names *Thryallis* and *Galphimia* was reviewed by Morton and Cuatrecasas (1967) and summarized by C. Anderson (1995). Morton and Cuatrecasas proposed conservation of *Thryallis* Mart. over *Thryallis* L., and *Thryallis* Mart. is now the correct name for a genus of five species of Brazil and adjacent Paraguay and Bolivia (C. Anderson 1995). Species described in *Thryallis* L. belong to *Galphimia* Cav. Regrettably, sometimes species of *Galphimia* are still cited as "*Thryallis*" and specimens are filed under "*Thryallis*" in herbaria in the mistaken assumption that the name conserved is *Thryallis* L., displacing *Galphimia*.

Blake (1917) published *Thryallis langlassei* based on *Langlasse 955* from Guerrero. This name, as well as the previously unpublished combination *Galphimia langlassei*, have been widely applied to collections from the Pacific slope of Mexico with deciduous petals and lanceolate to elliptical laminas, which were considered to represent a widespread and variable species. Study of this diverse assemblage of specimens revealed it in-

cludes four taxa, three of them previously unrecognized and one corresponding to *T. langlassei*. Niedenzu (1914, 1928) saw little material from this region of Mexico and interpreted *G. gracilis* very broadly. In his revision of *Galphimia* (1914) he cited *Langlasse 955* under *G. gracilis*; in his treatment of the Malpighiaceae for *Das Pflanzenreich* (1928) he considered *T. langlassei* a synonym of *G. gracilis* and therefore did not transfer the epithet to *Galphimia*. The combination *Galphimia langlassei* is formally proposed below.

Of the three novelties, only *G. mexiae* shares many characters with *G. langlassei*, differing most notably in its smaller flowers in which the stamens bear anthers that are short (2.3–2.5 mm) and oblong to elliptical in outline (Fig. 3f) instead of long (3–4 mm) and narrowly triangular in outline, i.e., tapered toward the apex (Fig. 1f). *Galphimia radialis* has similar, short anthers but much larger flowers with subequal petals (Fig. 4e, f); in most species of *Galphimia* the posterior petal (the "flag") is notably larger and differs in shape (e.g., Figs. 1d, e, 3d,e). Also, the stipules of *G. radialis* are 4–6 mm long (Fig. 4c); in the other species treated here they are only 1.2–3 mm long. *Galphimia langlassei*, *G. mexiae*, and *G. radialis* are all found in oak and pine-oak forests.

The third species here newly described, *G. arenicola*, bears less resemblance to *G. langlassei* than the other two and also differs in its habitat preference. The hairs on the vegetative parts are all borne on small tubercles, which persist after the hair is sloughed off, so that the stems, axes, petioles, peduncles and pedicels, and even the abaxial costa of leaves are tuberculate. Such tubercles are also found in *G. tuberculata* (Rose) Nied. (including *Thryallis humilis* Rose) and *G. hirsuta* Cav. In *G. arenicola* the leaf margin bears irregularly spaced, multicellular processes, which resemble the tubercles but are 3–4 times as long (Fig. 5c) and lack a terminal hair. The margin is entire in *G. tuberculata*. In the well-named *G. hirsuta* the leaf margin, like the surfaces, are covered with hairs borne on tubercles; the tubercle remains if the hair is broken off. *Galphimia arenicola* also differs in its much smaller flowers and its habitat. It is reported from dunes and sandy soils of the coastal

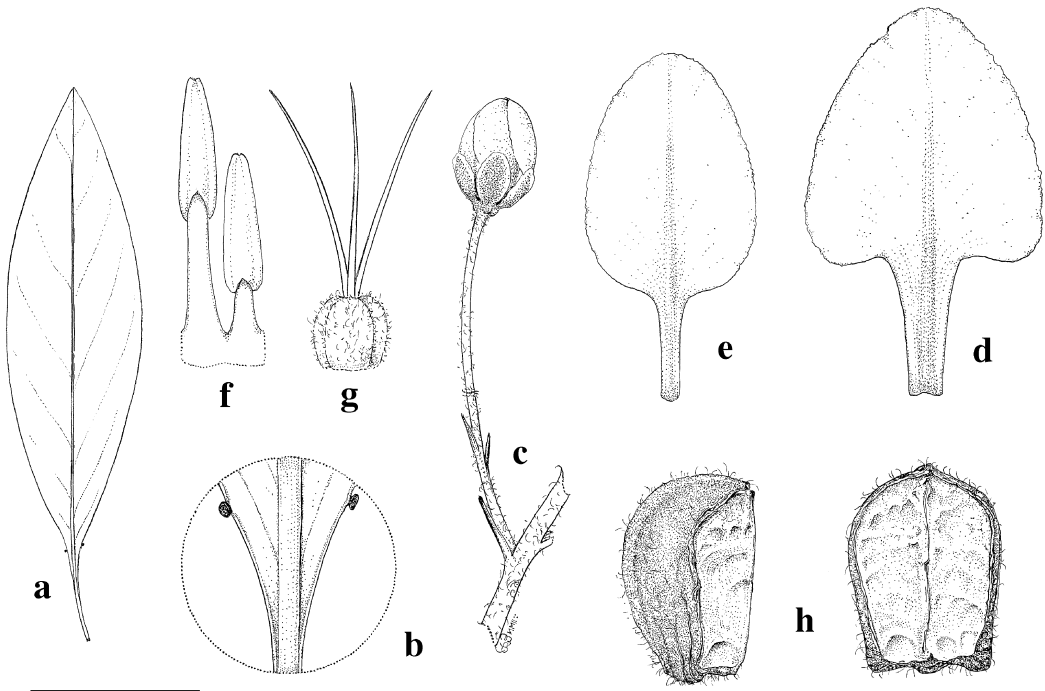


FIG. 1. *Galphimia langlassei*. a. Leaf. b. Detail of base of lamina, showing a pair of leaf glands. c. Flower bud borne on pedicel and peduncle, with portion of inflorescence axis. d. Posterior petal. e. Lateral petal. f. Abaxial view of stamens opposing posterior petal (at right) and posterior-lateral sepal (at left). g. Gynoecium. h. Two cocci, shown in lateral and adaxial view. Scale: a, bar = 4 cm; b, f, g, h, bar = 4 mm; c, bar = 1 cm; d, e, bar = 5 mm. (Based on: a, b, Cuevas & Rosales 1828; c, Daniel & Bartholomew 4849; d, e, Cochrane et al. 11687; f, g, Santana M. et al. 4807; h, Pepita 86.)

forest, unusual sites for a species of Malpighiaceae. *Galphimia hirsuta* grows in pine-oak forests and *G. tuberculata* in lowland deciduous forest though not on dunes.

The relationships of *Galphimia langlassei*, *G. mexiae*, *G. radialis*, and *G. arenicola* cannot be determined until a revision of the entire genus is completed. A prelim-

inary review predicts that *G. langlassei*, *G. mexiae*, and *G. radialis* will prove closely allied, whereas the discordant *G. arenicola* may belong with *G. tuberculata* and *G. hirsuta*. The following key separates the four species treated here, which were formerly included in *Thryallis langlassei*.

1. Stipules (3.5-) 4-6 mm long; leaf glands embedded in the margin of the lamina (Fig. 4b); peduncles and pedicels tomentulose and with a dense band of hairs hiding the articulation (Fig. 4d); posterior and lateral petals subequal; highlands of central Guerrero. *G. radialis*.
1. Stipules 1.2-3 (-3.5) mm long; leaf glands raised above the epidermis or with a stalk to 1.2 mm long; peduncles and pedicels tomentulose to sparsely so, the articulation readily visible; posterior and lateral petals unequal.
2. Hairs of vegetative parts borne on persistent tubercles; ovary glabrous; coastal Oaxaca. *G. arenicola*.
2. Hairs of vegetative parts sessile, tubercles absent; ovary pubescent.
3. Anthers (2.8-) 3-3.6 (-4) mm long, narrowly triangular in outline (the base ca. twice as wide as the apex); filament of stamen opposing the posterior petal shorter than that of stamens opposing the posterior-lateral sepals (1.6-2.6 mm vs. 3.5-4.6 mm); limb of lateral petals 6-7 mm long, 4.5-5.5 mm wide, limb of posterior petal 6.5-7.7 (-8) mm long, 6-7.7 mm wide; peduncles 0.6-1.2 (-1.6) times as long as pedicels; Jalisco, Colima, Michoacán, Guerrero. *G. langlassei*.
3. Anthers 2.3-2.5 (-2.8) mm long, oblong or elliptical in outline (equally wide at base and apex); filament of stamen opposing the posterior petal and those of stamens opposing the posterior-lateral sepals subequal [1.5-1.7 (-2) mm vs. 1.5-1.8 (-2.2) mm]; limb of lateral petals 4.5-6 mm long, 3.7-4.7 mm wide, limb of posterior petal 5-6.5 mm long, 5-6.5 mm wide; peduncles 0.3-0.5 (-0.7) times as long as pedicels; southern Nayarit and adjacent Jalisco. *G. mexiae*.

TAXONOMIC TREATMENT

Galphimia langlassei (Blake) C. Anderson, comb. nov.
Thryallis langlassei Blake, Contr. Gray Herb. 52: 71.
 1917.—TYPE: MEXICO. GUERRERO (fide Mc-

Vaugh, 1951): San Andrés, *Langlassé* 955 (holotype: GH!; isotypes: G!, K!, P!, US!). Fig. 1.

Shrubs or subshrubs to 3 m; stems sparsely tomentulose when young, soon glabrous. *Vesture* of all veg-

etative parts composed of sessile, straight or wavy to crisped, reddish brown hairs 0.2–0.8 mm long. *Laminas* of the larger leaves 5–14 cm long, 1.5–4.8 cm wide, elliptical or narrowly so to lanceolate, apex acute or apiculate, base attenuate and somewhat decurrent, glabrous or sometimes with a few scattered hairs abaxially on the midrib, costa and secondary veins prominent abaxially, margin entire; petioles 1–2.5 cm long, glabrous or with a few scattered hairs; leaf glands usually a pair (rarely only 1 gland) borne on the margin of the lamina 0.1–1 cm above the base, each gland 0.5–1.1 mm in diameter, disklike and raised above the epidermis, or nail-like and with a stalk to 1.2 mm long; stipules 1.2–2.8 (–3.5) mm long, 0.4–1 mm wide, linear or narrowly triangular. *Inflorescence* a terminal raceme, solitary or arranged dichasially or in a thyrses, the axes tomentulose or sparsely so; peduncles 4.5–12.5 mm long, pedicels 4.5–13 mm long, both tomentulose, peduncles 0.6–1.2 (–1.6) times as long as pedicels; bracts 1.3–2.2 (–3.4) mm long, 0.5–0.8 mm wide, linear; bracteoles 1–2 (–2.5) mm long, 0.3–0.5 (–0.7) mm wide, linear, subopposite or up to 2 mm apart, borne in the distal 1/4–1/2 of the peduncle. *Sepals* 2.7–3.5 mm long, 1.2–2 mm wide, oblong to elliptical, glabrous or with a few scattered hairs along the margin distally, glands absent or occasionally with 1 or 2 circular glands, each 0.3–0.5 mm in diameter and borne at the base of the sinus of two adjacent sepals. *Petals* deciduous, unequal, yellow, often suffused with red, especially along the claw and midrib of the limb; lateral petals: claw 2.3–2.8 (–3) mm long, 0.5–0.6 mm wide, limb 6–7 mm long, 4.5–5.5 mm wide, narrowly triangular-ovate; posterior petal: claw 3.5–4 mm long, 1.3–1.5 mm wide, limb 6.5–7.7 (–8) mm long, 6–7.7 mm wide, broadly triangular or ovate-triangular. *Stamens* with heteromorphic filaments but subequal anthers; filament opposite anterior sepal 3.5–4.5 mm long, filaments opposite anterior-lateral petals 2.8–3.5 (–3.7) mm long, filaments opposite anterior-lateral sepals 3–4 (–4.5) mm long, filaments opposite posterior-lateral petals 1.6–2.5 (–2.8) mm long, filaments opposite posterior-lateral sepals 3.5–4.6 mm long, filament opposite posterior petal 1.6–2.6 mm long; anthers (2.8–) 3–3.6 (–4) mm long, tapered toward the apex. *Ovary* pubescent; styles 5–6.5 (–6.8) mm long. *Coccus* 4–4.5 mm long, pubescent to glabrescent when mature but some hairs always present, especially on the sutures; mature seed not seen.

Phenology. Collected in flower November through June, in fruit from February through June.

Distribution (Fig. 2). Mexico (Jalisco, Colima, Michoacán, Guerrero); oak forests and pine-oak forests, also at forest margins; 100–1710 m.

Additional Specimens Examined. MEXICO. COLIMA: steep mountainsides 9–10 km E or SE by winding rd from Minatitlán, *McVaugh* 26226 (MICH). GUERRERO: Mpio. Montes de Oca, San Antonio, *Hinton et al.*

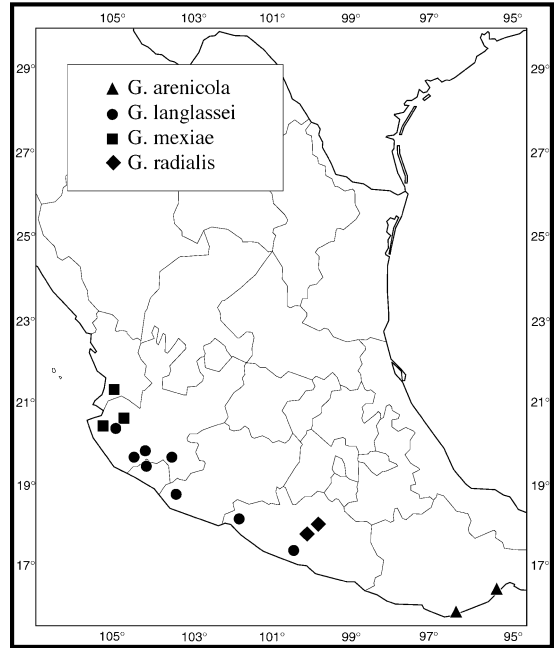


FIG. 2. Distribution of *Galphimia arenicola*, *G. langlassei*, *G. mexiae*, and *G. radialis*.

11683 (GH, US). JALISCO: cerro al N de Telacruz, *Alcoer* S. 135 (IBUG); ejido de Ayotitlán, al E de Telacruz, camino a Minatitlán, *Alcoer* S. et al. 211 (IBUG); Mpio. Minatitlán, lower slopes of Sierra de Manantlán, NNE of Telacruz, 19°29'13"N, 104°07'24"W, *Cochrane et al.* 12153 (MICH, WIS); Mpio. Casimiro Castillo, 3–4 km SE of Casimiro Castillo, Arroyo Tacubaya, at base of Cerro La Petaca, ca. 20 km SSW of Autlán, 19°34'50–54"N, 104°24'29–45"W, *Cochrane et al.* 11687 (WIS); Mpio. Casimiro Castillo, 1–2 km al E de Casimiro Castillo, *Cuevas & Rosales* 1828 (IEB, WIS, ZEA); Mpio. Cuautitlán, 14–15 km al NW de Minatitlán, 3–4 km al NNW de Telacruz, 19°29'46"N, 104°08'00"W, *Cuevas & Guzmán* 3783 (ZEA); Mpio. Cuautitlán, 50 km al NW de Colima, 2–3 km al NW de Telacruz, 19°29'40"N, 104°08'08"W, *Cuevas & Nieves* 2125 (WIS, ZEA); rd to Microondas Los Mazos near summit of pass (Puerto Los Mazos) between Autlán and La Huerta, *Daniel & Bartholomew* 4849 (CAS, MICH); Mpio. Tecalitlán, carr. Cd. Guzmán–Pihuamo, Km 46, terracería Llanitos–Mexiquillo a 16 km, *Fuentes* O. 47 (CHAPA, ENCB, IBUG, MICH); Mpio. Autlán, 13–14 km al SSW de Autlán, 3–4 km al S de Ahuacapán, camino Ahuacapán–Las Joyas, 19°39'07"N 104°19'42"W, *Guzmán H. et al.* 1217 (WIS, ZEA); Mpio. Autlán 12–13 km al SSE de Autlán; 500–1000 m al SSE de Ahuacapán 19°39'50"N, 104°19'07"W, *Guzmán & Cuevas* 879 (IBUG, MEXU, WIS, ZEA); 13–14 km al N de Cuautitlán, 9 km al SEE de Casimiro Castillo, *Gúzman & López* 697 (ZEA); Mpio. Talpa de Allende, brecha de Talpa a La Cuesta,

Machuca N. et al. 7063 (MICH); precipitous mountainsides 10–12 km above (N of) La Cuesta, below pass to Talpa de Allende, *McVaugh* 23357 (ENCB, MICH); along hwy SW of Autlán toward Manzanillo, on upper slopes of barranca above the pass, *McVaugh* 10234 (MEXU, MICH); Mpio. Tecalitlán, Palos Altos, entre el camino San Isidro y la carr. federal a Cd. Guzmán, *Mendoza* 3790 (MEXU); Mpio. Tecalitlán, 48 km al S de Cd. Guzmán por la carr. a Pihuamo, luego a 1 km al NE de Canutillo por brecha de Llanitos a Mexiquillo, *Morones G.* 257 (CHAPA); Mpio. Autlán, 3 km S por brecha a Las Joyas–Ahuacapán, *Pepita* 86 (ZEA); Mpio. Tecalitlán, Km 6, brecha a Jilotlán de Dolores, *Pérez de la Rosa* 7 (IBUG, MICH); Mpio. Talpa La América, 5 km al N de Cuale, por camino a Los Lobos, *Pérez de la Rosa* 1383 (IBUG); Mpio. Tecalitlán, 18 km por brecha Llanitos–Canutillo, 48 km de Cd. Guzmán por carr. a Pihuamo, *Pichardo A.* 24 (CHAPA, IBUG, MICH); Mpio. Cuautitlán, entre Ayotitlán y Chancol, 19°28'N, 104°10'W, *Robles et al.* 712 (IEB, WIS, ZEA); Mpio. Casimiro Castillo, 8–9 km al SSW de Autlán, 12–13 km al NNE de Casimiro Castillo, Puerto Los Mazos, 19°41'41"N 104°23'54"W, *Sánchez & Guzmán* 4 (WIS, ZEA); Mpio. Autlán, Arroyo de Ahuacapán, 800 m al SE de Ahuacapán, 19°39'33"N, 104°18'53"W, *Santana M. et al.* 4351 (ZEA); Mpio. Cuautitlán, 6 km al NW de Minatitlán, 3–4 km al NNW de Peña Colorada, La Astilla, 19°25'N, 104°06'W, *Santana M. et al.* 4788 (WIS, ZEA); Mpio. Cuautitlán, 4–5 km al NW de Minatitlán, 2–3 km al NNE de Peña Colorada, Las Pesadas, 19°24'N, 104°04'W, *Santana M. et al.* 4807 (WIS, ZEA); Reserva de la Biosfera, Barranca del Tecolote, Ejido La Naranjera, camino a Casimiro Castillo, *Vázquez* 3981 (ZEA); 2.5 km S of Puerto Los Mazos, 19°41'15"N, 104°23'36"W, *Wetter et al.* 1061 (MICH, WIS, ZEA). MICHOCÁN: Aquila, Distr. Coalcomán, *Hinton et al.* 15867 (NY, US).

Galphimia mexiae C. Anderson, sp. nov.—TYPE: MEXICO. JALISCO: San Sebastián [del Oeste] to Hacienda de Ottotal, Sierra Madre Occidental, *Mexia* 1778 (holotype: CAS!; isotypes: A!, GH!, MO!, US!). Fig. 3.

Herba vel suffrutex. Laminae 4–12 cm longae, 1.8–4 cm latae, lanceolatae vel ellipticae vel anguste rhombicae, glabrae, margine integrae, glandibus 0.4–0.8 mm diametro, sessilibus vel pedicellatis; petioli 1–2 (–3.5) cm longi; stipulae 2–3 mm longae. Inflorescentia racemosa vel dichasialis vel thyriformis. Petala decidua; petala lateralibus ungue 2–2.8 mm longo, 0.5–0.6 mm lato, limbo 4.5–6 mm longo, 3.7–4.7 mm lato, ovato-triangulari; petalungo posticum ungue 3.3–4 mm longo, 1.4–1.8 mm lato, limbo 5–6.5 mm longo, 5–6.5 mm lato, late triangulari vel ovato-triangulari. Antherae 2.3–2.5 (–2.8) mm longae, oblongae vel ellipticae. Ovarium pu-

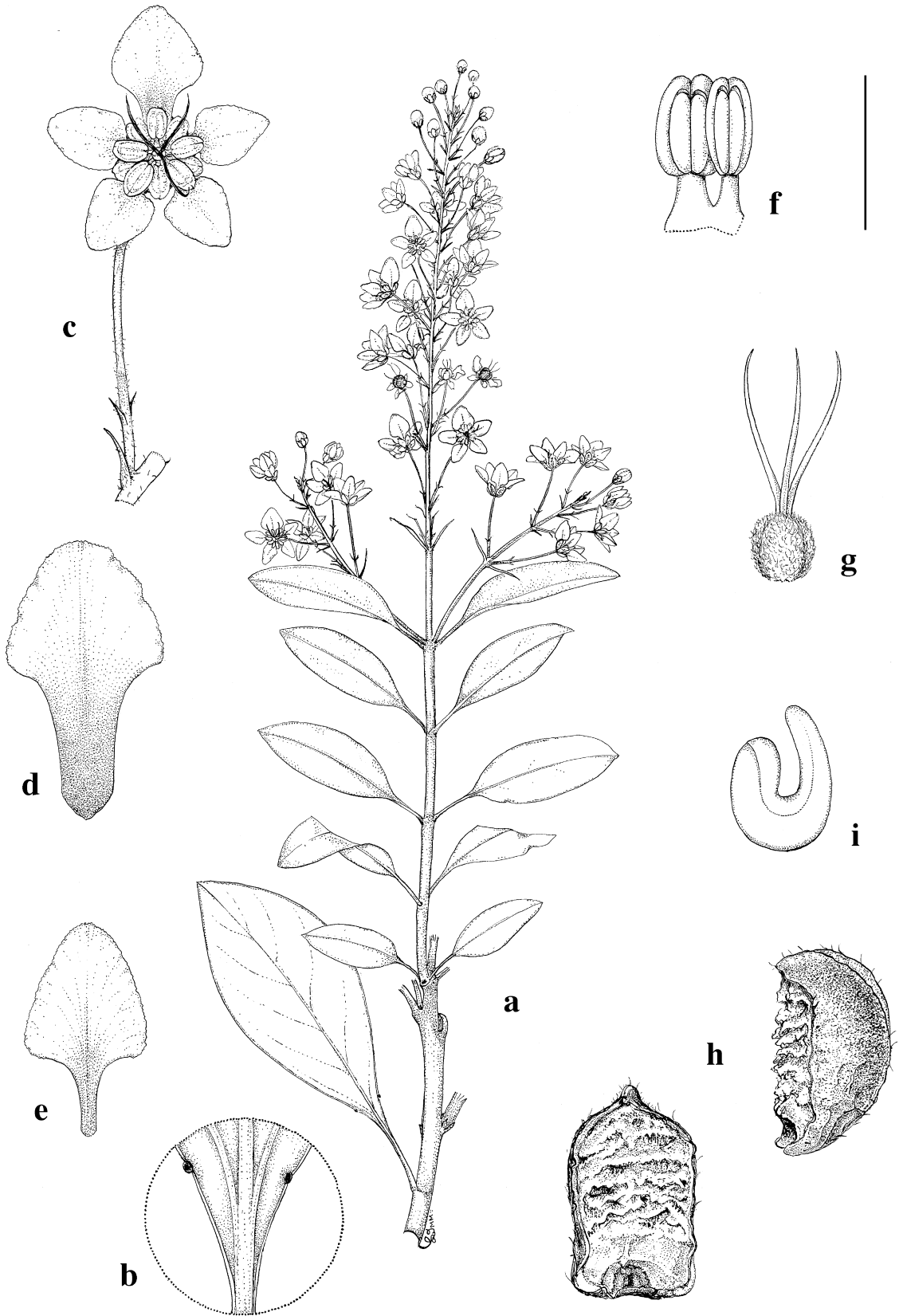
bescens; styli 4–5 mm longi. Coccus 4.5–5.5 mm longus, pubescens vel glabrescens.

Large herb or shrub to 3 m; stems sparsely tomentulose when young, soon glabrous. *Vesture* of all vegetative parts of sessile, wavy to crisped, reddish brown hairs 0.2–0.5 mm long. *Laminae* of the larger leaves 4–12 cm long, 1.8–4 cm wide, lanceolate to elliptical to narrowly rhombic, apex acute or apiculate, base cuneate and somewhat decurrent, glabrous, costa and secondary veins prominent abaxially or the secondaries only slightly so, margin entire; petioles 1–2 (–3.5) cm long, glabrous; leaf glands a pair borne on the margin of the lamina commonly ca. 1 cm above the base, each gland 0.4–0.8 mm in diameter, disklike, sessile and usually somewhat prominent, or sometimes nail-like and with a stalk up to 0.5 mm long; stipules 2–3 mm long, 0.5–1.8 mm wide, narrowly triangular to linear. *Inflorescence* a terminal raceme, solitary or commonly arranged dichasially or in a thyrse, the axes tomentulose; peduncles 3.5–7 mm long, pedicels 8.5–12 mm long, both sparsely tomentulose to glabrate, peduncles 0.3–0.5 (–0.7) times as long as pedicels; bracts 2–4 mm long, 0.6–1.2 mm wide, linear; bracteoles 1.2–2 mm long (2.5–3 mm in *Nelson* 4060), 0.4–0.6 mm wide, linear, subopposite or up to 2 mm apart, borne on the distal 1/4–1/2 of the peduncle or sometimes just below the apex. *Sepals* 2.5–3 mm long, 1.4–2.3 mm wide, oblong to narrowly elliptical, glabrous, glands absent. *Petals* deciduous, yellow and suffused with red along the claw and midrib of the limb; lateral petals: claw 2–2.8 mm long, 0.5–0.6 mm wide, limb 4.5–6 mm long, 3.7–4.7 mm wide, ovate-triangular; posterior petal: claw 3.3–4 mm long, 1.4–1.8 mm wide, limb 5–6.5 mm long, 5–6.5 mm wide, broadly triangular or ovate-triangular. *Stamens* with heteromorphic filaments but subequal anthers; filament opposite anterior sepal (2.2–) 2.6–3 mm long, filaments opposite anterior-lateral petals (2.2–) 2.4–3 mm long, filaments opposite anterior-lateral sepals 2–2.8 mm long, filaments opposite posterior-lateral petals 1.8–2.3 (–3) mm long, filaments opposite posterior-lateral sepals 1.5–1.8 (–2.2) mm long, filament opposite posterior petal: filament 1.5–1.7 (–2) mm long; anthers 2.3–2.5 (–2.8) mm long, oblong or elliptical in outline. *Ovary* pubescent; styles 4–5 mm long. *Coccus* 4.5–5.5 mm long, pubescent to glabrescent when mature; seed 2.6–2.7 mm long; embryo globose, ca. 2.5 mm long, radicle 1.4–1.5 mm long, outer cotyledon 2.5–2.8 mm long, folded at 1/3, inner cotyledon 1.8–2.1 mm long, 1.4–1.5 mm wide, folded at 1/3.

Phenology. Collected in flower and fruit from February through May.

Distribution (Fig. 2). Mexico (southern Nayarit and northwestern Jalisco); pine-oak forest; 630–1880 m.

Additional Specimens Examined. MEXICO. JALISCO: 27.8 mi SSE of Puerto Vallarta, *Almeda* 2543 (CAS,



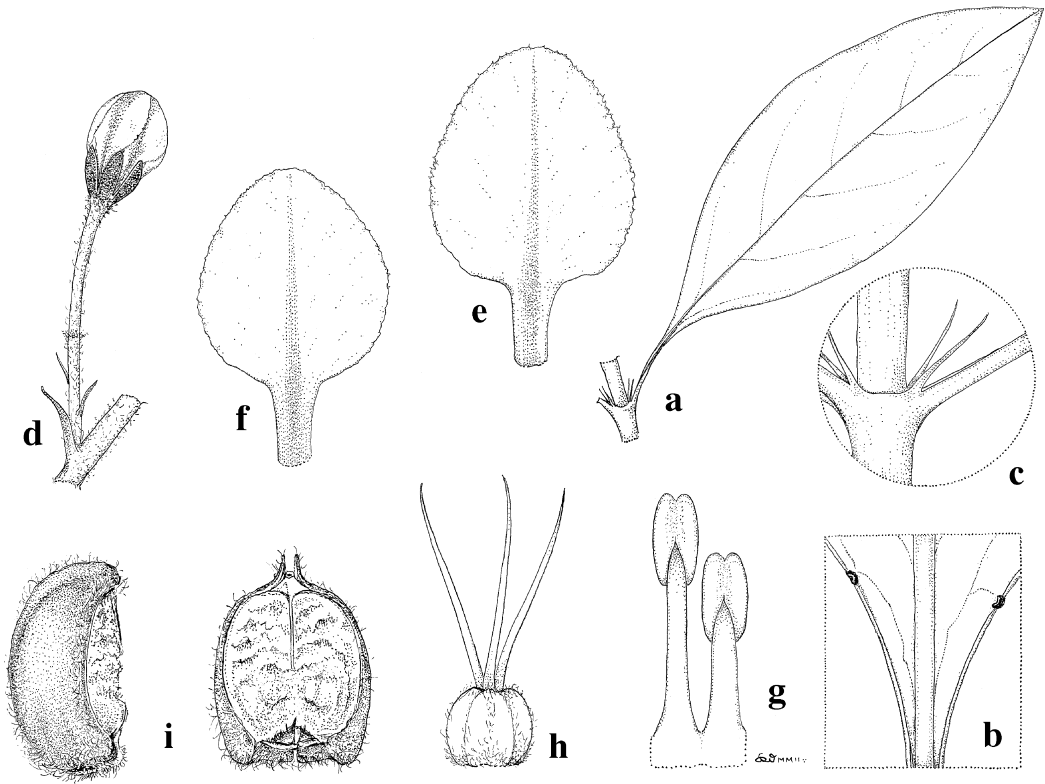


FIG. 4. *Galphimia radialis*. a. Leaf. b. Detail of base of lamina, showing a pair of leaf glands. c. Detail of a node, showing the long stipules. d. Flower bud borne on pedicel and peduncle, with portion of inflorescence axis. e. Posterior petal. f. Lateral petal. g. Abaxial view of stamens opposing posterior petal (at right) and posterior-lateral sepal (at left). h. Gynoecium. i. Two cocci, shown in adaxial and lateral view. Scale: a, bar = 4 cm; b, c, 1 cm; d, bar = 1.3 cm; e, f, bar = 5 mm; g–i, bar = 4 mm. (Based on: a, Estrada R. 119; b–d, Fonseca 1001; e–h, Tenorio L. 1471; i, Paray 2014.)

MICH); low hills ca 35 km (straight line) E of Cabo Corrientes, on rd from Puerto Vallarta to El Tuito, Anderson & Anderson 6122 (MICH); without locality, Beechey s.n. (K); Mpio. San Sebastián, 20 km al SW de San Sebastián, brecha Mascota–San Sebastián, Flores M. 199 (IBUG); Mpio. Talpa, entre Cumbre del Tejamanil y Cuale, González T. 102 (MICH); Mpio. Cabo Corrientes, steep mountainsides 3–10 km generally E on rd to Mina del Cuale, from junction 5 km NW of El Tuito, McVaugh 26411A (MICH); San Sebastián to Hacienda de Ototal, Sierra Madre Occidental, Mexia 1779-a (NY); Sierra Madre Occidental, trail San Sebastián to Las Mesitas, Mexia 1863-a (F, US); rd between Mascota and San Sebastián, Nelson 4060 (GH, US); Mpio. San Sebastián del Oeste, camino San Sebastián–Mascota, Ramírez

D. 305 (IBUG). NAYARIT: 17.7 km al W de Tepic, 7 km al W de Carranza, Cowan 4773 (MICH, TEX); Mpio. Tepic, 7 km al S de la entrada al camino del Cuarenteño, 21°28'N, 105°00'W, Flores F. 2531 (MEXU).

This attractive species is named for the intrepid botanist Ynes Mexia (1870–1938), whose fine collections from the area of San Sebastián del Oeste have yielded many novelties.

Galphimia radialis C. Anderson, sp. nov.—TYPE: MEXICO. GUERRERO: Mpio. Chichihualco, 29 km al W de Filo de Caballo, carr. a Pto. del Gallo, Tenorio L. 1471 (holotype: MICH!). Fig. 4.

Frutex. Laminae 7–12 cm longae, 2–5 cm latae, lan-

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FIG. 3. *Galphimia mexiae*. a. Flowering branch. b. Detail of base of lamina, showing a pair of leaf glands. c. Flower borne on pedicel and peduncle, with portion of inflorescence axis. d. Posterior petal. e. Lateral petal. f. Adaxial view of stamens opposing posterior petal (at left) and posterior-lateral sepal (at right). g. Gynoecium. h. Two cocci, shown in adaxial and lateral view. i. Embryo. Scale: a, bar = 4 cm; b, bar = 8 mm; c, bar = 1 cm; d, e, bar = 5 mm; f–h, bar = 4 mm; i, bar = 2.6 mm. (Based on: a–c, Anderson & Anderson 6122; d–g, Nelson 4060; h, i, Almeda 2543.)

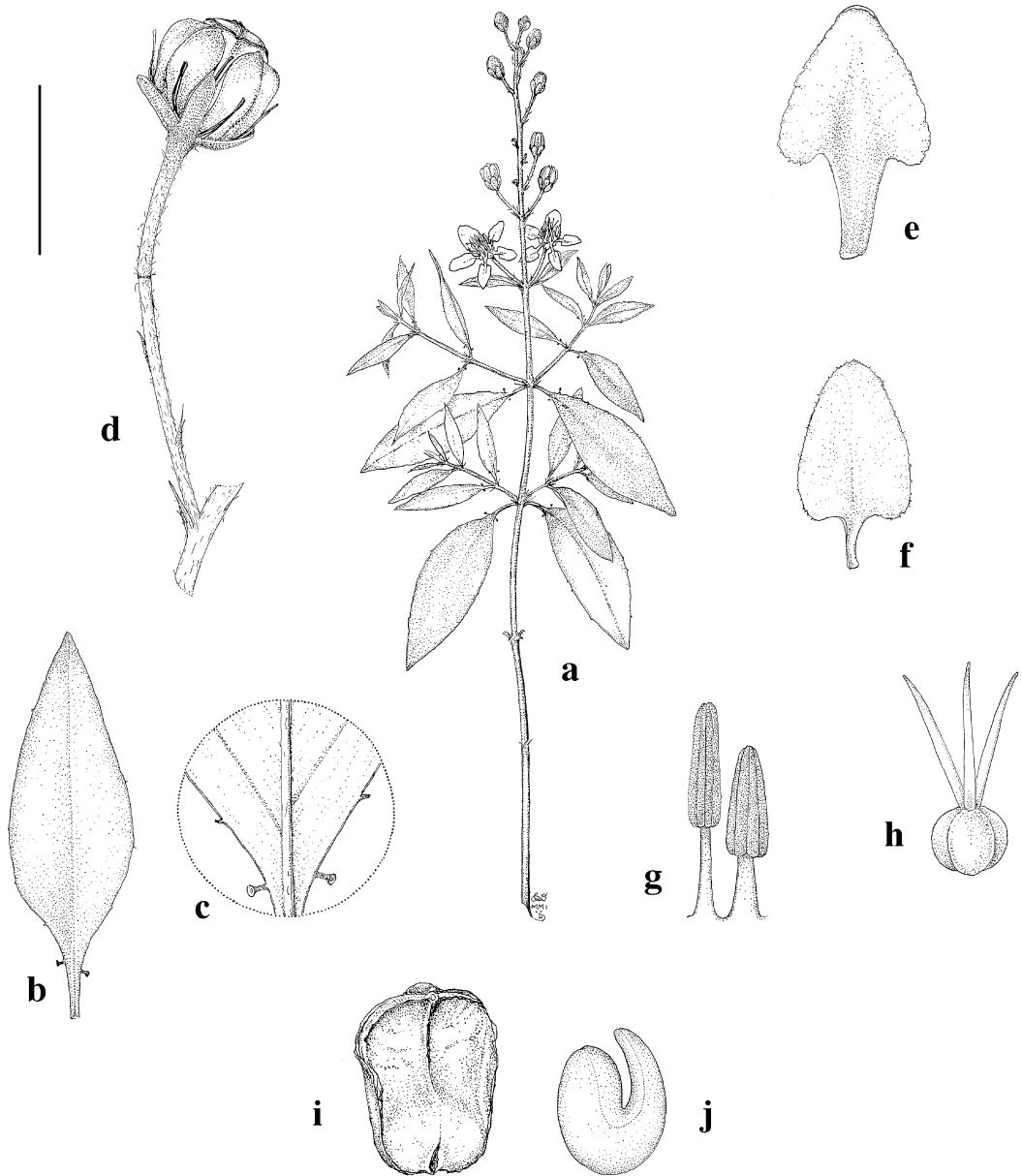


FIG. 5. *Galphimia arenicola*. a. Flowering branch. b. Leaf. c. Detail of base of lamina, showing a pair of leaf glands and marginal processes. d. Fruit borne on pedicel and peduncle, with portion of inflorescence axis. e. Posterior petal. f. Lateral petal. g. Adaxial view of stamens opposing posterior petal (at right) and posterior-lateral sepal (at left). h. Gynoecium. i. Cocculus, adaxial view. j. Embryo. Scale: a, bar = 4 cm; b, bar = 2 cm; c, d, bar = 8 mm; e, f, bar = 6 mm; g-i, bar = 4 mm; j, bar = 2.73 mm. (Based on: a, b, c, Martínez 1817; d-h, Castillo C. et al. 9642; i, j, Castillo C. et al. 9498.)

ceolatae vel ellipticae, glabrae, margine integrae, glandibus 0.4–0.5 mm diametro, sessilibus; petioli 1.5–2.3 cm longi; stipulae (3.5–) 4–6 mm longae. Inflorescentia racemosa. Petala decidua, subaequalia, ungue 2–2.8 mm longo, 0.6–0.7 mm lato, limbo 6.5–7.7 mm longo, 5.5–6.5 mm lato, late ovato. Antherae 2.2–2.5 mm longae, oblongae. Ovarium suturis et basi pubescens; styli 4.6–5.2 mm longi. Cocculus 4.7–5 mm longus, suturis et basi pubescens.

Shrub to 3 m; stems tomentulose when young, soon glabrous. Vesture of all vegetative parts of subsessile, wavy to crisped, reddish brown hairs 0.2–0.7 mm long. *Laminas* of the larger leaves 7–12 cm long, 2–5 cm wide, lanceolate to elliptical, apex apiculate, base cuneate-decurrent, glabrous adaxially and abaxially, costa prominent abaxially, secondary veins slightly prominent, margin entire; petioles 1.5–2.3 cm long, glabrous; leaf glands borne on the margin of the lamina well

above the base, commonly 2–2.5 cm above the base, each gland 0.4–0.5 mm in diameter, embedded in the margin; stipules (3.5–) 4–6 mm long, 0.5–1 mm wide, linear. *Inflorescence* a terminal raceme, the axes tomentulose; peduncles 4–9.5 mm long, pedicels 7–13.5 mm long, both tomentulose but densely so in a band at the articulation, peduncles 0.5–0.8 times as long as pedicels; bracts 3–6 mm long, 0.5–0.7 mm wide, linear, bracteoles 1.6–3 mm long, 0.4–0.6 mm wide, linear, subopposite or up to 2.2 mm apart, the proximal bracteole inserted below to about the middle of the peduncle, the distal one at about the middle to the distal 1/4 of the peduncle. *Sepals* 3.5–4.5 mm long, 1.6–2 mm wide, linear to oblong, glabrous or with a few scattered hairs abaxially, glands absent. *Petals* deciduous, yellow and suffused with red, especially along the claw and midrib of the limb, subequal, the posterior petal slightly larger than the lateral ones, claw 2–2.8 mm long, 0.6–0.7 mm wide, limb 6.5–7.7 mm long, 5.5–6.5 mm wide, broadly ovate. *Stamens* with heteromorphic filaments but subequal anthers; filament opposite anterior sepal 4.5–4.8 mm long, filaments opposite anterior-lateral petals 4.2–4.5 mm long, filaments opposite anterior-lateral sepals 4.4–4.5 mm long, filaments opposite posterior-lateral petals 3.2–4 mm long, filaments opposite posterior-lateral sepals 4–4.3 mm long, filament opposite posterior petal 3–3.5 mm long; anthers 2.2–2.5 mm long, oblong in outline. *Ovary* pubescent along the sutures and in the basal 1/3–1/2 on the surface, glabrous distally; styles 4.6–5.2 mm long. *Coccus* 4.7–5 mm long, pubescent along the sutures and basally; mature seed not seen.

Phenology. Collected in flower in January, May, August, and November, in fruit in March and August.

Distribution (Fig. 2). Mexico (Guerrero); oak forest and pine-oak forest; 2040–2100 m.

Additional Specimens Examined. MEXICO. GUERRERO: Mpio. Atoyac de Alvarez, trayecto entre Los Arayanes y El Descanso, *Estrada R. 119* (IEB); Mpio. Chichihualco, cerca de Hierba Buena, *Fonseca 1001* (MEXU); Mpio. Tlacotepec, faldas del Cerro Tlacotepec, *Paray 2014* (ENCB); Cerro Teotepec y alrededores, *Paray 4065* (MEXU).

Galphimia arenicola C. Anderson, sp. nov.—TYPE: MEXICO. OAXACA: Mpio. Tehuantepec, de Rincón Bamba a Garrapatero, Rincón Bamba se encuentra a 44 km al W de Salina Cruz, carr. a Pochutla, 15°59'N, 95°27'W, *Martínez 1817* (holotype: MO!; isotypes: IEB!, MEXU!). Fig. 5.

Frutex. Laminae 7–12 cm longae, 2–5 cm latae, lanceolatae vel ellipticae, glabrae, margine integrae, glandibus 0.4–0.5 mm diametro, sessilibus; petioli 1.5–2.3 cm longi; stipulae (3.5–) 4–6 mm longae. Inflorescentia racemosa. Petala decidua, subaequalia, ungue 2–2.8 mm longo, 0.6–0.7 mm lato, limbo 6.5–7.7 mm longo,

5.5–6.5 mm lato, late ovato. Antherae 2.2–2.5 mm longae, oblongae. Ovarium suturis et basi pubescens; styli 4.6–5.2 mm longi. Coccus 4.7–5 mm longus, suturis et basi pubescens.

Shrub to 4 m; stems pubescent when young, soon becoming glabrous but roughened by tubercles. *Vesture* of all vegetative parts of straight to wavy, reddish brown hairs, 0.5–1 mm long, each hair borne on a persistent tubercle up to 0.1 mm high. *Laminas* of the larger leaves 2.5–4.5 cm long, 1–1.5 cm wide, narrowly lanceolate to narrowly elliptical, apex acute, base cuneate-decurrent, adaxially glabrous, abaxially with scattered hairs (especially on the costa) when young but soon glabrous, costa prominent abaxially, secondary veins only faintly evident abaxially, margin with irregularly spaced, elongate, multicellular processes, like the tubercles but longer; petioles 0.4–0.8 cm long, very sparsely strigose to glabrous, roughened by persistent tubercles; glands borne on the laminar margin 2–5 mm above the base of the lamina, usually one pair or rarely 4 or 5 glands, each gland 0.4–0.5 mm in diameter, disk-like and raised above the epidermis, or nail-like and with a stalk up to 0.8 mm long; stipules 1.5–2.5 mm long, 0.5–0.7 mm wide, narrowly triangular to linear. *Inflorescence* a terminal raceme, the axes tuberculate and strigose, peduncles 4–7.8 mm long, pedicels 2–5 mm long, both tomentulose, peduncles 1.2–3 times as long as pedicels; bracts 2.3–3 mm long, 0.5–0.6 mm wide, linear, bracteoles 1.3–1.7 mm long, 0.4 mm wide, linear, borne in the proximal 1/4–1/2 of the peduncle, subopposite or up to 1 mm apart. *Sepals* 2.5–2.8 mm long, 1.4–1.6 mm wide, elliptical, glabrous or with scattered hairs near the base, glands absent. *Petals* deciduous, yellow and suffused with red; lateral petals: claw 2–2.3 mm long, 0.5–0.6 mm wide, limb 5–5.5 mm long, 3.3–4 mm wide, ovate to elliptical; posterior petal: claw ca. 3.5 mm long, 1.6 mm wide, limb ca. 4.5 mm long, ca. 4.5–5 mm wide, triangular. *Stamens* with heteromorphic filaments but subequal anthers; filament opposite anterior sepal 3–3.5 mm long, filaments opposite anterior-lateral petals 2.5–3 mm long, filaments opposite anterior-lateral sepals 3–3.1 mm long, filaments opposite posterior-lateral petals 1.5–1.8 mm long, filaments opposite posterior-lateral sepals 2.5–2.6 mm long, filament opposite posterior petal 1.6–2 mm long; anthers 2.4–2.8 mm long, tapered toward the apex. *Ovary* glabrous; styles ca. 3.6 mm long. *Coccus* ca. 5 mm long, glabrous; seed 2.8–3 mm long; embryo globose, ca. 3 mm long, radicle 1.2–1.3 mm long, outer cotyledon 2.7–2.8 mm long, folded at 1/2, inner cotyledon 2.3–2.5 mm long, folded at distal 1/3.

Phenology. Collected in flower and fruit in August.

Distribution (Fig. 2). Mexico (Oaxaca); on sandy soils, on dunes and in coastal deciduous forest; sea level to 10 m.

Additional Specimens Examined. MEXICO. OAXA-

CA: Mpio. Huatulco, 5 km de la carr. nac. por la brecha a las playas de Cacaluta, 15°45'10"N, 96°10'10"W, *Castillo C. et al.* 9498 (XAL); Mpio. Huatulco, Playa de San Agustín, 15°40'30"N, 96°14'20"W, *Castillo C. et al.* 9642 (MEXU, XAL); Playa Coyote, *Liebmann* 8675 (C); S. Agustín, *Liebmann* 8676, 8682 (C).

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