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CALCEOLARIA MEXICANA and *C. TRIPARTITA* IN MEXICO

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The large genus *Calceolaria* (Scrophulariaceae), variously estimated to comprise at least 200 and perhaps as many as 400 species, is mainly South American in distribution. It includes one well-marked group of about 20 species (Sect. *Aposecos* Benth., sensu Kränzlin, Fr., in *Pflanzenreich* IV. 257C [Heft 28]: 21–122. 1907; Subg. *Calceolaria*, sensu Edwin, G., in *Fl. Peru*, *Field Mus. Publ. Bot.* 13, pt. 5-B: 518, 552. 1971), in which the locules of the anther are not contiguous, but separated at the two ends of a long connective that may be longer than the locules themselves. All known material from Mexico and most of the specimens from Central America belong to this group, and have by most authors since 1839 been referred to *Calceolaria mexicana* Benth., the type of which came from the mountains of south-central Mexico.

One of us (Landrum) undertook to study what seemed to be unusually great variability in the leaf-form and plant-habit in the Mexican representatives of this group, anticipating the existence of regional populations within the species. He concluded after preliminary examination of a limited number of specimens that there were in fact two rather well-marked species involved, rather than the one traditionally recognized. We have subsequently examined a suite of more than 200 specimens from six herbaria (F, GH, MICH, MO, PH, US) and our studies indicate conclusively that the two species occur more or less co-extensively, both in Mexico and in Central America. In Mexico (excluding Chiapas) one is almost confined to the Sierra Volcánica Transversal; the other is found in the same region, but ranges farther northwest (into Durango and Sinaloa), and is known from a number of localities in the Sierra Madre del Sur in Guerrero and Oaxaca. Both are montane, but one is more restricted to the higher elevations at least in Mexico. Habitat-preferences of the two are similar. The two grow together or near together at some localities, e.g. near Comunidad, Edo. de México (*Hinton 4888, 4194*) near Antigua, Guatemala (*Molina 24809* includes both species, one at F, the other at MO); northwest of San Marcos, Guatemala (*Steyermark 35706, 35730*, with different habitat-data); along Río Chiriquí Viejo, above Guadalupe, Panama (*Croat & Porter 16024, 16038*). In Mexico we know of no localities where the two have been found intimately associated; in western Mexico (Durango, Jalisco, Michoacán), where rather numerous collections have been made from favorable localities, no more than one species has ever been collected in any one mountain range. In spite of the very considerable similarities between the two, they are readily separated by the characters used in the key below, and we do not hesitate to treat them as distinct. One of them is evidently *C. mexicana*; the other, after comparison with a number of South American specimens named by F. W. Pennell, and after study of the *Flora of Peru* (Edwin, 1971), we suppose to be *C. tripartita* Ruiz & Pavón. Others have suggested that *C. tripartita* may occur in Central America; Standley & Williams (*Fieldiana Bot.* 24, pt. 9: 341. 1973) considered the possibility that *C. mexicana* was a synonym of *C. tripartita*.

We are grateful to the curators of the herbaria listed above for loans of specimens and for other courtesies.

From the following description, which applies identically to the two taxa, it is not difficult to understand why they have been confused:

Annual herbs, the branches opposite, or dichotomous above; stems softly to firmly herbaceous, yellow-green to purplish; herbage bearing numerous multicellular, often glandular, hairs, the upper parts of the plant more densely pubescent; leaves opposite, green to yellow-green, petiolate, ovate to lanceolate in outline, membranaceous to slightly fleshy, the margins coarsely or finely serrate or doubly serrate; upper leaves passing gradually into the bracts of the inflorescence; inflorescence often much reduced, but when well-developed dichotomous, the two branches sometimes branching again dichotomously, often with 1 (–2) flowers in the crotch of each dichotomy, the individual branches terminating in small corymbs, racemes, or umbels; pedicels 0.5–3.5 cm long; pedicels and calyx glandular-pubescent; calyx 4-lobed, the lobes slightly unequal; corolla yellow, two-lipped, constricted between the lips, the lower lip saccate, inflated, the upper lip saccate, hoodlike; stamens 2, attached to the corolla at its base, one on each side of the ovary; filaments very short or almost wanting; anther-locules separated by an elongate connective; fertile locules splitting longitudinally, white when empty, yellow when pollen-filled; ovary glandular-pubescent; style slender, often persistent until the capsule matures and opens; capsule splitting longitudinally along 4 sutures; seeds numerous, ellipsoid, 0.5–1 mm long, black to brown with longitudinal ridges.

The principal differences between the two taxa are summarized in the following key, and set forth below in the appended descriptions. It may be noted that the differences in flower-color appear to be more evident after drying than in the fresh condition. We have not compared them directly, but collectors' notes made in the field often refer to the flowers of *C. tripartita* as light yellow, pale yellow, lemon yellow, or sulphur yellow, and only seldom as golden yellow or bright yellow. The flowers of *C. mexicana* are seldom described as pale yellow, but more often as bright yellow or sulphur yellow, and sometimes as deep or rich yellow. The differences in the dried corollas are usually striking when the two are compared.

1. Lower locule of the anther fertile, polleniferous; corolla pale yellow when dry, 0.5–1 (–1.5?) cm long, 0.3–0.6 cm wide when pressed; capsule subglobose, at maturity 3–5 mm long, usually not surpassing the calyx-lobes; cauline leaves toothed, pinnately incised, or lobed, if deeply pinnatifid the sinuses seldom approaching the rachis (midvein), and the upper leaves and bracts mostly finely or coarsely toothed or irregularly lobulate; stem usually collapsing when dried; plant mostly decumbent, extensively rooting at the nodes. *C. mexicana.*
1. Lower locule of the anther infertile; corolla dark yellow when dry, mostly 1–1.5 cm long, 0.8–1.2 cm wide when pressed; capsule ovoid, at maturity (5–) 6–8 mm long, surpassing the calyx-lobes; cauline leaves at least in well-developed plants pinnate, the blades dissected to the rachis or essentially so, only the smallest bracts of the inflorescence less deeply pinnate or pinnatifid; stem remaining round and firm, not collapsing, when dried; plant normally erect, from a short primary root. *C. tripartita.*

Calceolaria mexicana Benth. Pl. Hartw. 47. 1839. *Calceolaria tracheliiifolia* Mart. & Gal. Bull. Acad. Brux. 12, pt. 2: 16 [repr. 2]. 1845. *Calceolaria urticina* Kränzlin, Repert. Sp. Nov. 1: 82. 1905.

Moist rocks along streams, shaded ravines and banks, in barranca-forests with deciduous trees, or with firs or in humid pine-oak forest, mostly 2000–3000 m, flowering Jul–Apr in Mexico, or throughout the year.

Sinaloa, western Durango, Jalisco, Michoacán (Angangueo, *Hartweg* 356, the type), Guerrero, México, Morelos, Veracruz (Peak of Orizaba, *Galeotti* 1056, type of *C. tracheliiifolia*), Hidalgo, Puebla, Oaxaca, Chiapas; through Central America to Panama. The type of *C. urticina* (*Uhde* 1203) came from some unknown locality in Mexico. We have seen photographs of the type of *C. mexicana* (MICH Neg. 817) and *C. urticina* (Field Mus. Neg. 14142), and of an isotype of *C. tracheliiifolia* (from W, Field Mus. Neg. 32918).

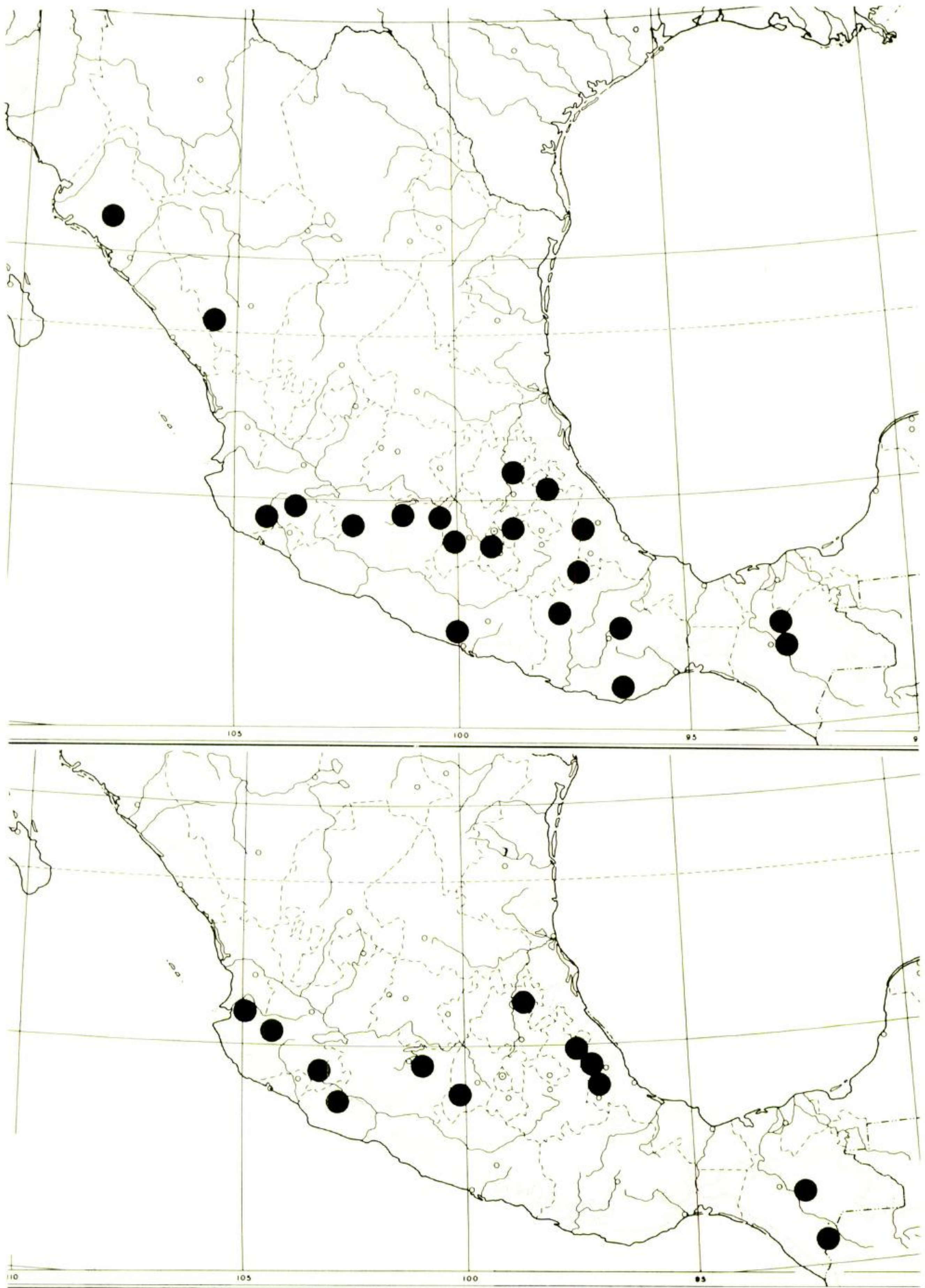


FIG. 1. Distribution in Mexico of *Calceolaria mexicana* (above) and *Calceolaria tripartita* (below). Localities are those of specimens cited in the text.

Plants mostly 20–40 cm tall, usually partially decumbent, arising from a stiff, gradually tapered primary root; fibrous roots arising from the primary root and usually from one or more nodes, these nodes with or without leaves; leaves often purplish beneath, the blades (1–) 3–10 (–12) cm long, (1–) 2–6 (–13) cm wide, pinnately lobed or unlobed; upper leaves and bracts gradually becoming smaller, proportionately narrower and less dissected toward the top of the plant; calyx-lobes ovate to lanceolate, acute, 2–5 mm long, 1.5–2 mm wide, each with ca 7–10 more or less distinct parallel veins; narrowest part of the isthmus between the corolla lips ca 1/2–2/3 the width of the wider lip; corolla 5–10 (–14) mm long, 3–6 mm wide when pressed, the lower lip elongate, the upper only 1–3 mm long; anther-connective ca 1 mm long, the proximal arm (that directed toward the upper lip) thicker than the distal; locules usually shorter than the connective; ovary globose, the style ca 1 mm long.

In the citations that follow, we have included most of the material from Mexico. Existing collections are fewer, and it is possible to document to a considerable extent the geographical separation of the two taxa as far as indicated by the specimens in hand. The number of existing specimens from Central America, particularly from Guatemala and Costa Rica, is very much greater, and our personal knowledge of the area is correspondingly less, so we have cited no more than a sample indicating the longitudinal range of each taxon as it is known to us. We have not attempted to follow either species beyond Central America.

Representative specimens examined: MEXICO: SINALOA: Sierra Surutato, *Breedlove* 16923, 17102, 18258, 18380 (all MICH). DURANGO: ca 29 km W of La Ciudad, *Cruden* 1169 (GH, MICH); between Villa Unión and El Salto, *Ownbey & Ownbey* 1934 (GH, MICH, US). JALISCO: La Estancia, camino a Tapalpa, *Villarreal* 5398 (MICH); Sierra de Manantlán, SE of Autlán above El Chante, *Wilbur* 1794, 1930; *McVaugh* 10305 (all MICH). MICHOACAN: Tancitaro, 9000 ft, *Leavenworth* 724 (F, GH); near Morelia, Cerro Azul, *Arsène* 6735 (MO, US); Zitácuaro to Cerro Pelón, *Hinton* 13231 (F, GH, MICH, US). MEXICO: Dist. Temascaltepec, Comunidad, *Hinton* 4194 (GH, MICH, US); ca 35 km N of Temascaltepec, *Anderson & Anderson* 5026 (MICH); Nevado de Toluca, *Rose & Painter* 7896 (PH); Mpio. de Texcoco, SE of San Pablo Ixayoc, *Rzedowski* 24183 (MICH); Río Frio, *Sharp* 44151 (GH, PH). MORELOS: Lakes of Zempoala, *Langman* 2662 (PH). GUERRERO: Dist. Mina, Campo Morado, *Hinton* 11172 (F, GH, MICH, US); Mpio. de Tlacotepec, Cerro Teotepec, *Hinton* 14797 (F, GH, US), *Rzedowski* 18143 (MICH), *Feddema* 2909A (MICH); ca 14 km SSW of Campamento El Gallo, 17°25' N., 100°14' W., *Rzedowski & McVaugh* 23 (MICH). HIDALGO: Trinidad, *Pringle* 13488 (US); road to Metztlán, between Zacualtipán and Olotla, *Moore* 2394 (GH). VERACRUZ: Orizaba, *Liebmann* 9481 (GH), *Botteri* 508 (US); Mt. Orizaba, *Seaton* 220 (F, GH, US). OAXACA: Between Cerro Machín and Llano de las Flores, *Beaman* 3684 (GH, US); Cerro [Sierra] San Felipe, *Nelson* 1081 (GH, US), *Andrieux* 177 (GH), *Camp* 2368 (MICH), *Pringle* 4712 (GH, MO, PH, US); Cerro Zempoaltepetl, *Hallberg* 927 (MICH); Sierra Madre del Sur, S of S. Miguel Suchixtepec, *Anderson & Anderson* 4799 (MICH); ca 50 km ["30 mi"] N of Puerto Escondido, *Lasseigne* 4957 (MICH). PUEBLA: Cerro de Gavilán, *Purpus* 3949 (F, GH, MO, US); 8 km N of Huauchinango, *Moreno G.* 74 (MICH). CHIAPAS: Mpio. de Tenejapa, *Breedlove* 9287 (F); Mpio. Pueblo Nuevo Solistahuacán, *Breedlove* 9001 (F, MICH, US), *Clarke* 276 (MICH), *Ton* 3981 (MICH).

CENTRAL AMERICA: GUATEMALA: Chimaltenango: Cerro Chichoy, *Williams & Molina* 15346 (F, GH). Chiquimula: Cerro Brujo, near Brujo, *Steyermark* 30942 (F, PH). Guatemala: 7 km SE of Guatemala City, *Harmon* 2251 (MO). Huehuetenango: ca 10 km SW of Huehuetenango, *Williams et al.* 22612 (F). Quezaltenango: Finca Pirineos, entre Santa María de Jesús y Calahuaché, *Steyermark* 35192 (F, PH); Volcán Zunil, *Steyermark* 34922 (PH). Retalhuleu: Finca Helvetia, *Muenschner* 12427 (GH). San Marcos: W of Ixchiguan, ca 3500 m, *Beaman* 3250 (GH); Tajumulco, *Steyermark* 36904 (PH); ca 10 km W of San Marcos, *Williams et al.* 27184 (F, US). Sololá: Above Lake Atitlán, W of Panajachel, *Williams et al.* 25379 (F, US). Totonicapán: Near Momostenango, *Molina* 21425 (F, GH).

EL SALVADOR: Chalatenango: Los Esesmiles, *Tucker* 1020 (F, MICH, PH, US).

COSTA RICA: Cartago: NW of Volcán Irazú, *Stork* 2006 (MICH); foot of Orosi waterfall, *Rodríguez C.* 429 (GH, MICH); Cerro de la Muerte, 3600 m, *Allen* 5679 (F, US), *Mori & Anderson* 124 (F); Volcán Turrialba, *Greenman & Greenman* 5594 (MO). Heredia: Between Poás and Barba volcanoes, *Skutch* 3533 (MO). San José: Ca 10 miles SE of La Asunción, *Wilbur & Almeda* 16969 (MO); S of Cartago, *Stork* 4505 (MICH); 20 km N of San Isidro del General, *Williams et al.* 28512 (GH, US); Las Nubes, *Hunnewell* 16738 (GH); páramo of Cerro Buena Vista, 3450 m, *Rodríguez C.* 442 (MICH).

PANAMA: Chiriquí: between Cerro Punta and Quebrado Bajo Grande, *Wilbur et al.* 11886 (GH, MICH); along Río Chiriquí Viejo above Guadalupe, *Croat & Porter* 16038 (MO); La Popa above Boquete, *D'Arcy & D'Arcy* 6421 (MO); Bajo Chorro, Boquete, *Davidson* 139 (F, GH).

Calceolaria tripartita Ruiz & Pavón. Fl. Peruv. 1: 14. pl. 20a. 1798.

Moist rocks, springy banks, shaded ravines and hillsides, in barranca-forests with deciduous trees, or with firs or in humid pine- or pine-oak forest, 550–2400 m over most of its range in Mexico, ascending to 2800–3000 m or more in Central America, flowering Jul–Apr in Mexico, or throughout the year.

Jalisco, Michoacán, México, Hidalgo, Puebla, Veracruz, Chiapas; Guatemala, Costa Rica, Panama; apparently the same species in Jamaica; South America.

Our description of this taxon is based primarily on Mexican and Central American material:

Plants 25–150 cm tall, erect (at least in Mexican and Central American populations), arising from a more or less horizontal primary root, this usually strongly tapered, with slender stiff secondary roots; leaf-blades (1–) 3–12 cm long, (1–) 3–10 cm wide, pinnately lobed, the most deeply dissected leaves appearing compound; margins sometimes obscurely toothed or subentire; upper leaves and bracts gradually becoming smaller and proportionately narrower above, the lobes becoming smaller and narrower, eventually intergrading with the teeth of the margin; petioles often connate; calyx-lobes ovate, acute to acuminate, 4–6 mm long, 3–4 mm wide, each with ca 9–12 more or less distinct parallel veins; narrowest part of the isthmus between the corolla-lips less than half the width of the wider lip; corolla 10–15 mm long, 8–12 mm wide when pressed, the lower lip broad, more or less round in outline when pressed, the upper lip only 2–3 mm long; distal anther-locule (that directed toward the lower corolla-lip) infertile and atrophied, the distal arm of the connective 1 mm long; proximal arm very short, the locule fertile, ca 1 mm long; ovary slightly elongated, the style ca 2 mm long; tips of the capsule valves commonly recurved after opening.

Representative material examined: MEXICO: JALISCO: San Sebastián, *Mexia* 1366 (F, GH, MICH, MO); Mpio. de Talpa, *McVaugh* 21527 (MICH), *González T.* 401 (MICH); 40 km W of Ayutla, NW of San Miguel de la Sierra, *McVaugh* 22039 (MICH); Mpio. de Tecalitlán, Sierra del Halo, *McVaugh & Koelz* 1124 (MICH); Guadalajara, *Palmer* 624 in 1886 (GH). MICHOACÁN: W of Aguililla, region of Aserradero Dos Aguas, *McVaugh* 22802, 24771 (both MICH); 19 miles E of Morelia, *Weber & Charette* 11868 (MICH). MEXICO: Rincón, Temascaltepec, *Hinton* 324 (GH, US); Comunidad, Temascaltepec, *Hinton* 4888 (GH, US). HIDALGO: Near Molango, *Moore* 2420 (GH). PUEBLA: Teziutlán, *Barnes & Land* 548 (F), *Orcutt* 4041 (F, GH, MO), *Seler* 3629 (GH). VERACRUZ: Sta. Ana Atzacán N of Orizaba, *Rosas R.* 284 (GH); Zacuapán, barranca de Tenampa, *Purpus* 3664 (F, GH, MO, US); Mpio. de Atzacán, Tomata, *Ventura A.* 593 (MICH); Teocelo, 1000 m, *Ventura A.* 9474 (MICH). CHIAPAS: Siltepec, *Matuda* 865 (F, MICH, MO); Finca Irlanda, *Purpus* 7169 (F, GH, US); Mt. Ovando, *Matuda* 2192 (MICH); Mpio. S. Cristóbal de las Casas, Zontehuitz near the summit, *Breedlove* 7806, 12354 (both MICH); Mpio. Zinacantán, Paraje Sequentic, 1350 m, *Breedlove* 28705 (MICH).

CENTRAL AMERICA: GUATEMALA: Alta Verapaz: Cobán, *v. Tuerckheim II* 636 (F); near San Cristóbal Verapaz, *Williams et al.* 42213 (F); San Pedro Carcha, *Williams et al.* 40500 (F, MO, US). Chimaltenango: Above Las Calderas, *Standley* 60006 (F); near Los Idolos bridge ca 5 km W of Patzún, *Williams et al.* 41586 (F). Jalapa: 6 mi S of Miramundo, *Steyermark* 32669 (F). San Marcos: Near Aldea Fraternidad, between San Rafael Pie de la Cuesta and Palo Gordo, *Williams et al.* 25962 (F, US). Quezaltenango: Along Río Samalá, near Santa María de Jesús, *Standley* 84686 (F). Quiché: W of Chichicastenango, *Molina et al.* 16315 (F, GH).

COSTA RICA: Alajuela: Near La Laguna, 6–8 km S of Villa Quesada, *Williams et al.* 17500 (F, GH, US); ca 4 mi N of Varablanca, *Wilbur & Teeri* 13822 (MICH). Cartago: Near La Sierra ca 25 km S of Cartago, *Williams et al.* 28170 (F, GH, US). Heredia: Vara Blanca de Sarapiquí, between Poás and Barba volcanoes, *Skutch* 3548 (MO, US). San José: 7.4 km by winding road west of Sta. María de Dota, *Wilbur & Stone* 10515 (F, MICH, MO).

PANAMA: Chiriquí: Ca 4 mi NW of Boquete, *Wilbur et al.* 13497 (MICH, MO); Río Caldera beyond Bajo Mono, near Boquete, *Wilbur et al.* 11049 (MICH, MO).

We have no evidence that *C. mexicana* and *C. tripartita* hybridize, but we do not reject this possibility. When the two species are recognized in the field, growing near together or at the same locality, it would be useful to search for hybrids.