

**A revision of the Central American genus *Solenophora*
(Gesneriaceae).**

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KEYWORDS:

**Central America, Costa Rica, El Salvador, Guatemala, Honduras, Mexico,
Morphology, Panama, *Solenophora***

A REVISION OF THE CENTRAL AMERICAN GENUS *SOLENOPHORA* (GESNERIACEAE)

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Abstract. The genus *Solenophora* is revised on the basis of herbarium studies and field studies in Guatemala. A total of 18 taxa (16 species and three subspecies) are recognized, three of which are new to science: *S. glomerata* and *S. modesta* from southern Mexico and *S. schleehaufii* from northern Guatemala. *Solenophora australis* is reduced to infraspecific rank under *S. calycosa*, and *S. calycosa* subsp. *purpurascens* is described as an additional new subspecies under this species. Calyx and leaf morphology and indument are considered as the most reliable systematic characters in this group and are primarily used in delimiting taxa. With the new taxa here proposed it becomes clear that the centre of diversity for this genus lies in southern Mexico and northern Guatemala.

Keywords: Central America, Gesneriaceae, *Solenophora*, taxonomy.

The family Gesneriaceae, with approximately 125 genera and an estimated 3000 species, is widely distributed in all tropical areas throughout the world. Many of the species are cultivated as ornamentals, but otherwise the family is of little economic importance. The members of the genus *Solenophora*, however, are rarely seen in cultivation because they are relatively large and have very specific demands with regards to temperature and humidity.

Gesneriaceae attracted the attention of botanists early on because of their very conspicuous flowers, but their taxonomy, especially at species level, is still very unsatisfactory. Recent treatments consistently show that there is a lot more diversity in the group than previously thought. The three main reasons for the usually poor knowledge about Gesneriads are the abundance of often narrowly endemic taxa in poorly known tropical zones, the generally difficult preservation of herbarium specimens (discoloration, loss of corollas), and the relative scarcity of clear morphological

characters. These problems are highlighted, e.g., in a recent revision of the genus *Gasteranthus* (Skog and Kvist, 2000) and *Solenophora* is also a good example for this situation. Most of its taxa (as here defined) have relatively local distributions, the large flowers are often poorly preserved and difficult to analyse from herbarium material, and the number of specimens per species is highly unequal. Some species are known only from the type collection or a maximum of two to three specimens. This contrasts strongly with the overrepresentation of, e.g., *S. calycosa* from Costa Rica in the herbaria—nearly every second specimen of *Solenophora* in the herbaria revised belongs to this species.

The genus *Solenophora* Benth. was established in 1839 by G. Bentham and was until recently believed to comprise eleven species distributed from southern Mexico to Panama. The genus is traditionally considered as belonging to the Tribe Solenophoreae of the New World Gesneriaceae subfamily Gesnerioideae (Fritsch, 1895: 182). Originally

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this tribe contained two genera, *Solenophora* and *Hippodamia*, but the latter has since been reduced to synonymy under *Solenophora*. Even in recent treatments the precise affinities of *Solenophora* remain obscure and it is often treated as a genus "incertae sedis" (Weber, in prep.). Thus the recognition of a monogeneric tribe reflects the uncertainty about its actual relationship.

The genus *Solenophora* consists of mostly large-flowered, subshrubby to shrubby plants and is systematically defined mainly by the presence of 1–3 nectar glands in each flower and a completely inferior ovary, both of which are considered as key synapomorphies, since most other Gesneriad genera have a nectar disc or more than three glands, and at least partially superior ovaries. The floral morphology strongly indicates that *Solenophora* is adapted to hummingbird pollination.

By far the largest number of species in this exclusively Central American genus is found in Mexico and adjacent Guatemala. The taxa as formerly defined were rather difficult to distinguish and no determination key to the entire genus has been published in recent years (the last key for the taxa then known was published by Hanstein, 1865). We therefore intend to provide a preliminary overview for the genus including a key, diagnoses and illustrations. Four new taxa are described, three species and one subspecies. Additionally, we propose new taxonomic status for some taxa and try to group the species according to their apparent morphological coherence. The taxa of *Solenophora* as here defined are easy to key out and represent well-defined entities. This will hopefully provide the basis for a more detailed phylogenetic analysis in the future. Also, field studies could not be carried out in some of the important regions and we strongly hope that the overview provided here prepares the ground for field work and a more concentrated collecting effort, especially by the local botanists in the countries concerned. Well documented collections and detailed ecological data would be especially desirable for such enigmatic species as *S. abietorum* or *S. maculata*.

MATERIALS AND METHODS

The synopsis of *Solenophora* given here is based on studies of ca. 1000 herbarium specimens.

Additionally, field work was carried out by one of us (H. F.) in northern Guatemala (Alta Verapaz, Baja Verapaz, Izabal, San Marcos) at various times in the years 1989, 1998, 1999 and 2001.

RESULTS

Characters

The genus *Solenophora* is comparatively poor in systematically useful characters. An additional complication arises from the fact that much if not most of the herbarium material is poorly preserved and often rather scanty. Frequently, there are few if any flowers available, so that destructive analysis could not be carried out for the majority of taxa. In the species definitions below we mainly use the following character complexes: leaf size and indument, leaf colour, inflorescence morphology, calyx morphology and indument, corolla morphology and indument. These characters can be shown to be stable and highly correlated in the taxa of which copious herbarium material is available such as *S. calycosa* and *S. toucana*. We therefore extrapolate for the rarely collected taxa that these characters can also be considered as informative, even if the material available is so scanty to test this assumption for each and every taxon recognized.

The leaves of a pair are always slightly unequal and each leaf has a slightly asymmetrical lamina base. This is, of course, much more visible in the large-leaved taxa (*Solenophora calycosa* group). The leaf margin can be simply serrate or biserrate. What has been called biserrate in the literature is often really lobulate with serrate lobule margins, i.e., there are small lobules with three to four gradually larger serrations. Clearly simply serrate leaf margins are relatively rare and restricted to the *S. obscura* group, where they are nearly universally present. The indument varies from very dense (*S. abietorum*) to rather sparse (*S. calycosa* subsp. *australis*) to nearly or entirely absent (*S. erubescens*). Density of the indument usually correlates well with other characters and varies only slightly between individual specimens or different organs of the same plant at different ages. The trichomes are always uniseriate, gland-tipped and variable in length. This situation with the entire range of conceivable indument densities (glabrous to densely pubescent) present in a single and rather small genus is not

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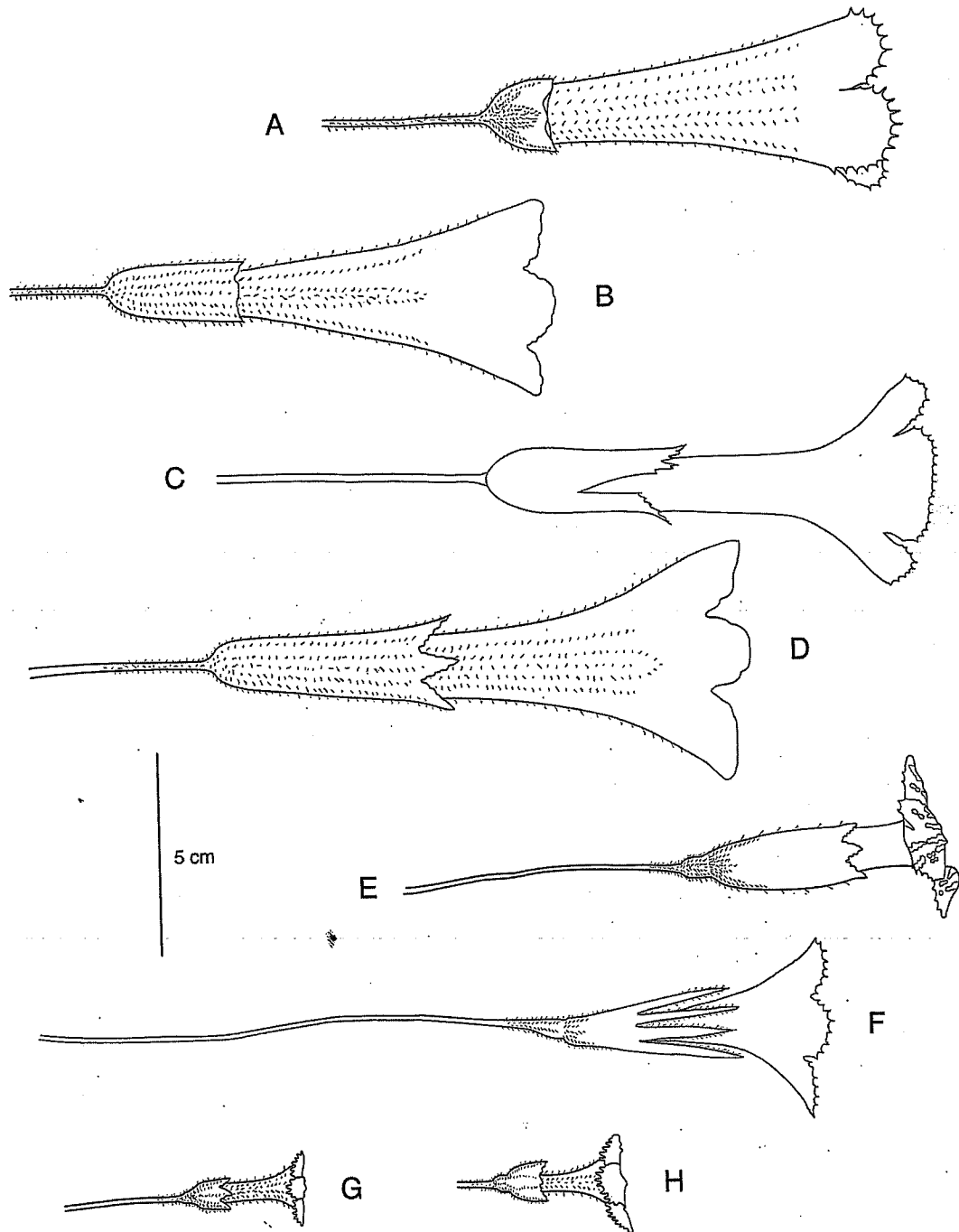


FIGURE 1. Schematic drawings of typical flower shapes in *Solenophora*: A, *S. insignis* (Webster and Breckon 17442); B, *S. toucana* (Molina and Molina 14072); C, *S. purpusii* (Matuda 2454); D, *S. calycosa* subsp. *purpurascens* (Lent 2074); E, *S. tuxtliensis* (Stone 136); F, *S. coccinea* (Hartweg 497); G, *S. modesta* (Breedlove 33518); H, *S. obscura* (Holmes 4389).

unique in *Solenophora*, but is also found in other gesneriad genera (*Streptocarpus*: Humbert, 1971; *Gasteranthus*: Skog and Kvist, 2000).

The inflorescences of *Solenophora* differ mainly in quantitative characters: they can be one- to many flowered, the peduncles may be short and stout (*S. glomerata*) or rather long (*S. pirana*). Similarly, the pedicels are sometimes very short, sometimes long. Bracts are always present, but these can be small, narrow and poorly differentiated (most taxa) or ovate and well differentiated with a ciliate margin (*S. glomerata*). The overall number of flowers per inflorescence differs between species, but can vary considerably and even in typically one- to two-flowered taxa occasionally many-flowered inflorescences are found (e.g., *S. calycosa*).

Calyx morphology is the single most important character complex in *Solenophora*, not least because calyces are usually well preserved in the herbarium. The calyx is united and encloses the inferior ovary. Above this ovarian portion there is a free part of the calyx tube, which may be long or very short. Also, this calyx tube may be deeply divided into five calyx lobes (especially in *S. coccinea*, but also in all species of the *S. obscura* group), or the lobes are very short to nearly absent (truncate or subtruncate calyx tube: *S. toucana*). In one species, *S. insignis*, the relatively short calyx lobes are reflexed so as to make the calyx tube appear truncate. The calyx is usually very slightly zygomorphic, but in some cases the adaxial side of the calyx tube has a deep incision (*S. schleehaufii*, *S. purpusii*). The calyx is usually green, but some species of the *S. obscura* group have either bright red or pale yellow calyces which contrast strongly with the corolla and/or the foliage (e.g., *S. tuxtensis*, *S. chiapasensis*).

The corolla differs widely between species, but the preservation in the herbarium is usually too unsatisfactory to permit reliable conclusions. The differences in size and colour can thus not be evaluated reliably. The margins of the corolla lobes are often fimbriate (e.g., *Solenophora obscura*, *S. insignis*), but this character is variable and does not correlate well with other characters—it is therefore not here used for delimiting taxa.

Infrageneric affinities

The affinities between the various species of *Solenophora* are still poorly understood and a molecular analysis would clearly be required to establish a sensible outgroup to polarize the character states. A formal subdivision would therefore be clearly premature. On the basis of what we know at the moment we can informally distinguish species groups. The majority of taxa fall into weakly differentiated groups:

The taxa of what is here called the *Solenophora obscura* group have relatively small corollas (18–45 mm long) and a calyx tube that shows a more or less distinct constriction between the ovarian portion and the free part of the calyx tube. In these plants the free part of the calyx tube is often distinctly flaring. This group comprises a total of seven species distributed from southern Mexico to southern Guatemala and only just enters Honduras with its most widespread species *S. obscura*. This group is very variable with regard to characters such as calyx colour, corolla shape and colour, indument (there are glabrous species), and habit. This heterogeneity indicates that this group may be a (paraphyletic) ancestral complex in the genus. This agrees with the fact that these are small to medium-sized shrubs with relatively moderate sized flowers, which means that they are comparatively more similar to other typical genera of the Gesnerioideae.

The second large group is the *Solenophora calycosa* group with larger corollas [(45–) 50–80 mm long], without a constriction between ovarian portion and the free part of the calyx tube and an always cylindrical calyx tube. This group is even more widespread and ranges from southern Mexico to Panama, but has only five species that are generally more widespread and morphologically less strongly differentiated. The relatively clear-cut species are found in southern Mexico (*S. pirana*, *S. glomerata*), whereas the three other, allopatric species—*S. insignis*, *S. toucana* and *S. calycosa* with its three subspecies—cover a wide range from southern Mexico to Panama and show very weak morphological differentiation.

Three of the remaining four species are more or less close to the *Solenophora calycosa* group: *S. schleehaufii* and *S. purpusii* from

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southern Mexico and northern Guatemala are very similar in overall morphology, corolla shape and calyx structure and differ only in the fact that the calyx has one deep incision, which is clearly autapomorphic. They are here treated as the *S. purpusii* group.

Solenophora maculata is very poorly known, there is only the type collection and it seems that the calyx closely corresponds to the calyx found in *S. calycosa*. The corolla, however, is very short and stamens and style are exerted. As long as no better material is available it probably seems best to treat this species as an isolated taxon separate from the other groups. The only species that really cannot be readily correlated with any informal group is the type species of the genus, *S. coccinea* Benth.—this species has a very deeply divided calyx and may be truly isolated in the genus.

Phytogeography

We come to the conclusion that the mountains of southern Mexico and northern Guatemala are not only home to the largest number of taxa, but also home to the most divergent lineages and can therefore safely be assumed to be the likely ancestral home of the genus *Solenophora*. Only three of 16 species of the genus are found south of Guatemala, two of these species are also found in Guatemala and only range slightly further south (*S. obscura*, *S. toucana*). Only *S. calycosa* is found exclusively south of Guatemala and it shows weak morphological differentiation, which is here reflected in the recognition of three subspecies. It seems clear that *S. calycosa* diverged from northern ancestors similar to *S. toucana* rather recently.

Ecologically the genus is rather demanding and is largely restricted to undisturbed tropical and subtropical montane forest with regular rainfall throughout the year. *Solenophora* species grow in shaded situations and require relatively low temperatures (absent from the tropical lowlands). Large stands are usually found only in deep humus-rich soil in rocky ravines or along forest streams. Drought conditions are not tolerated well and populations react rapidly with a dramatic decline in exceptional drought conditions. The stands of *Solenophora tuerckheimiana* in the cloud forests of the Verapaces in Guatemala were heavily damaged in 2001 when rain failed for an extended period of time because of the effects of the El Niño phenomenon.

TAXONOMIC TREATMENT

Solenophora Benth., Pl. Hartw.: 68. 1840.

TYPE: *Solenophora coccinea* Benth.

Synonyms: *Arctocalyx* Fenzl, Allg. Gartenzeitung 16: 305. 1848. TYPE: *Arctocalyx endlicherianus* Heller ex Fenzl [= *Solenophora endlicheriana* (Heller ex Fenzl) Hanst., Linnaea 34: 314. 1865].

Hippodamia Decne., Rev. Hort. 20: 464. 1848. TYPE: *Hippodamia insignis* (M. Martens & Galeotti) Decne. [= *Solenophora insignis* (M. Martens & Galeotti) Hanst., Linnaea 34: 314. 1865].

Herbs or shrubs, terrestrial, 0.3–6.5 m tall, erect or basally decumbent, stems usually elongate and coarse, branched from base, densely covered with uniseriate trichomes, rarely glabrescent to glabrous, pith brown to gray at maturity. Leaves opposite, petiolate, petioles usually much shorter than the lamina, 30–100 mm long, leaves of a pair equal to unequal, lamina asymmetrical, up to 30 mm longer on one side, membranous, outline ovate to elliptic, base oblique, cuneate to rounded, margin serrate to biserrate. Inflorescences axillary, cymose, pedunculate or sessile; flowers zygomorphic, large and showy, 1–many in each inflorescence, pedicels 10–30 mm long, bibracteate, bracts sessile, narrowly ovate, 10–15 mm long, 3–16 mm wide; calyx tube campanulate to cylindrical, subtruncate or with 5 distinctive lobes or with oblique incision on adaxial side, much exceeding the ovary in length, distal margin usually with gland-teeth, never entire, calyx glabrous to pubescent; corolla with elongate tube, yellow, orange or red, often with darker patterns, tube cylindrical to funnel-shaped, sometimes oblique, limb spreading with five ± equal corolla lobes or sometimes slightly bilabiate, corolla lobes obtuse, wider than long; stamens 4, epipetalous, filaments united with corolla tube at base, free in lower third of tube, included or rarely exerted, thecae coherent or slightly divergent, longitudinally dehiscent; one small staminode sometimes present; disc present, usually of 2–3 glands, sometimes 5; ovary inferior, apex flat or slightly convex, style elongated, slightly dilated towards apex, stigma stomatomorphic or shallowly bilobate. Fruit a capsule; seeds numerous, minute, more or less fusiform, brown to blackish.

The genus *Solenophora* comprises 16 species and three subspecies.

KEY TO THE SPECIES OF THE GENUS *SOLENOPHORA* IN CENTRAL AMERICA

- 1a. Free part of calyx lobes very long (20–30 mm), equalling the calyx tube in length 1. *Solenophora coccinea*
- 1b. Free part of calyx lobes much shorter (usually less than 10 mm), shorter than the calyx tube.
- 2a. Calyx strongly asymmetrical with deep incision on one side 10.–11. *Solenophora purpusii* group
- 3a. Stems glabrous to slightly puberulous; calyx ca. 25–45 mm long, entirely glabrous 10. *Solenophora purpusii*
- 3b. Stems, especially the young ones, very densely pubescent; calyx ca. 20–25 mm long, densely pubescent, especially proximally 11. *Solenophora schleehaufii*
- 2b. Calyx tube symmetrical, all incisions between the lobes ± equal in depth.
- 4a. Corolla tube less than twice as long as the calyx tube; style long exserted. 2. *Solenophora maculata*
- 4b. Corolla tube more than twice as long as the calyx tube, style included.
- 5a. Ovarian portion of the calyx strongly set off from calyx tube by a clear constriction or abruptly dilated above, calyx tube often yellowish, red, or beige in colour; corolla tube 18–45 mm long 3–9. *Solenophora obscura* group
- 6a. Entire plant glabrous 3. *Solenophora erubescens*
- 6b. At least the calyx, usually the stems and leaves somewhat pubescent.
- 7a. Calyx widely conical, very short (less than 10 mm), ovarian portion covered with dark red uniseriate trichomes, lobes subglabrous; leaves with scattered uniseriate trichomes on adaxial surface, glabrous near the margin 9. *Solenophora modesta*
- 7b. Calyx conical to (sub-) cylindrical, usually longer (10–20 mm), ovarian portion covered trichomatose, but not with dark red uniseriate trichomes, lobes pubescent; leaves usually with numerous uniseriate trichomes on adaxial surface, always more densely pubescent near the margin.
- 8a. Corolla tube 40–45 mm long; calyx 30–37 mm long, yellowish, sometimes blushed with red proximally. 8. *Solenophora tuxtensis* ←
- 8b. Corolla tube 25–30 (–40) mm long; calyx 10–20 (–35) mm long, dark green or dark greenish-red. 5. *Solenophora tuerckheimiana* ←
- 9a. Inflorescence with long peduncle (mostly more than 40 mm long). 5. *Solenophora tuerckheimiana* ←
- 9b. Inflorescence without peduncle or with short peduncle (less than 20 mm long).
- 10a. Leaves very densely pubescent, young leaves appearing canescent. 7. *Solenophora abietorum*
- 10b. Leaves more sparsely pubescent, young leaves never canescent.
- 11a. Calyx reddish to red; corolla orange; pedicel 15–20 mm long; bracts inconspicuous. 4. *Solenophora chiapasensis*
- 11b. Calyx green; corolla yellow; pedicel less than 10 mm long; bracts conspicuous. 6. *Solenophora obscura*
- 5b. Ovarian portion of the calyx not strongly set off from calyx tube by a clear constriction or abruptly dilated above, calyx tube always dark green; corolla tube (45–) 50–80 mm long 12–16. *Solenophora calycosa* group
- 12a. Peduncles longer than 30 mm.
- 13a. Ovarian portion of calyx densely pubescent. 14. *Solenophora pirana*
- 13b. Ovarian portion of calyx glabrous. 12.2. *Solenophora calycosa* subsp. *australis*
- 12b. Peduncles shorter than 30 mm.
- 14a. Calyx ca. 10–15 (–20) mm long overall, cylindrical from orbicular base, calyx lobes short, widely triangular (up to 4 mm long and 6 mm wide), usually spreading or reflexed and calyx therefore appearing truncate 15. *Solenophora insignis*
- 14b. Calyx ca. (20–) 25–40 mm long overall, cylindrical from orbicular or conical base, calyx lobes either very short or very distinct, usually porrect, if calyx appearing truncate then because of very short calyx lobes. (S. *toucana*).
- 15a. Axillary inflorescences with numerous flowers (4–12), peduncle short and stout (5–10 mm long), pedicels 5–10 (–13) mm long; calyx conical, with distinct, coarsely toothed lobes ca. 3 × 5 mm; bracts very conspicuous, marginally ciliate, ca. 20 × 10 mm, strongly veined. 16. *Solenophora glomerata*
- 15b. Axillary inflorescences with 1–2 (–4) flowers, peduncle, if present, thin and 20–55 mm long, pedicels 15–30 (–40) mm long; calyx cylindrical from conical base; bracts inconspicuous, marginally not ciliate, ca. 15 × 4 mm, not strongly veined.
- 16a. Calyx subtruncate, calyx lobes less than 3 mm long 13. *Solenophora toucana*
- 16b. Calyx deeply lobed, calyx lobes less than 6–12 mm long.
- 17a. Abaxial leaf surface and calyx bright purple; ovarian portion of calyx with scattered, uniseriate trichomes (ca. 2–3 per 1 mm) 12.3. *Solenophora calycosa* subsp. *purpurascens*
- 17b. Abaxial leaf surface and calyx green, rarely very slightly blushed with purple; ovarian portion of calyx glabrous or with numerous, uniseriate trichomes (ca. 10 per 1 mm).
- 18a. Ovarian portion of calyx glabrous. 12.3. *Solenophora calycosa* subsp. *australis*
- 18b. Ovarian portion of calyx with numerous, uniseriate trichomes (ca. 10 per 1 mm). 12.1. *Solenophora calycosa* subsp. *calycosa* ←

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1. *Solenophora coccinea* Benth., Pl. Hartw.: 68. 1839. TYPE. MEXICO. [Oaxaca:] In umbrosis ad-Lobani, in montibus Chinantla, Hartweg 497 (Holotype: BM!; Isotypes: K!, NY!, W!; photo Field Museum, neg.no. 32832!). Figs. 1F, 2; additional illustrations: Linnaea 26: tab. 1, fig. 36. 1853-1855; Nat. Pflanzenfam. IV (3b): 183. 1894.

Lignescent herb to 3 m tall, internodes ca. 25-35 mm long, stems densely covered with uniseriate trichomes of 2-4 (-5) cells and <0.5 mm long. Leaves of a pair typically very unequal (one 1.5-2.5 × as large as the other), petioles 15-35 mm long, lamina (ob-)ovate, asymmetrical, 80-190 mm long, 40-80 mm wide, base oblique (one side 3-7 mm longer), cuneate, apex long acuminate, margin biserrate, not blushed with red abaxially, abaxial surface pilose primarily on veins, adaxial surface pilose between veins, both covered with uniseriate trichomes of 2-4 (-5) cells and <0.5 mm long. Inflorescences with 1 (-3) flowers, peduncle 40-55 mm, pedicels 30-40 mm long, bracts 4-6 × 1-2 mm; calyx 40-45 mm long, tube funnel-shaped, constriction between distal and proximal part of calyx poorly differentiated, proximally densely, distally very sparsely covered with uniseriate trichomes of 1-3 (-4) cells and <0.5 mm long, with distinctive, triangular-ovate, long acuminate lobes 20 (-30) mm long and 5 mm wide at base, united about half of the length of the free part of the calyx, lobe margin with distant gland-teeth, calyx strongly blushed with red; corolla with tube ca. 40 mm long, pilose on the outside, slightly dilate distally, limb with subcircular lobes ca. 6-8 × 13-15 mm, lobe margin finely dentate, corolla deeply yellow without, limb yellow with dark red patterns; stamens included. Fruit 45 mm long overall (including calyx), inferior part globose, ca. 10 mm in diameter.

Distribution: *Solenophora coccinea* is only known from two collections from the state of Oaxaca in Mexico. It appears to be an extremely rare species restricted to montane mesophilic forests. *Solenophora coccinea* is very characteristic and cannot be confused with any other species of the genus: its very long and narrow calyx lobes are not equalled by any other species of this genus.

Additional specimens examined: MEXICO: Oaxaca: 34 km S of Valle Nacional, 4.5-5 km S of Vista Hermosa, 1550 m, 21 October 1987, Grether and Quero 2158 (MEXU).

2. *Solenophora maculata* D. N. Gibson, Phytologia 23(4): 339. 1979. TYPE: GUATEMALA. San Marcos: Todos Santos to El Porvenir, middle slopes of Volcán Tajumulco, 1300-3000 m, 1 March 1940, Steyermark 36992 (Holotype: F!; Isotype: F!). Fig. 3; additional illustration: Fieldiana Bot. 24/10(2/3): 306, fig. 64. 1974.

Lignescent herb 3-3.5 m tall, trunk to 10 cm wide, internodes ca. 20-45 (-50 mm long), stems pubescent from uniseriate trichomes of 8-15 cells and 1-1.5 mm long (later glabrescent). Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 50-60 (-100) mm long, lamina ovate, asymmetrical, 110-280 mm long, 60-145 mm wide, base oblique (one side 4-20 mm longer), cuneate, apex shortly acuminate, margin lobulate, lobules 3 × 7 mm, densely serrate, strongly blushed with red abaxially, both surfaces pilose, pubescent from uniseriate trichomes of 8-15 cells and 1-1.5 mm long between the veins on adaxial side and from uniseriate trichomes of 1-2 (-5) cells and <0.5 mm long primarily on veins on the abaxial side. Inflorescences with 1-2 flowers, peduncle 0-15 mm, pedicels 30-40 mm long, bracts ca. 6-7 × 2.5 mm; calyx 23-25 mm long, tube cylindrical from turbinate base, constriction between distal and proximal part of calyx absent, sparsely covered with uniseriate trichomes of 3-8 cells and ca. 0.5 mm long, with distinctive, rounded lobes 2-3 mm long, lobe margin with gland-teeth, calyx strongly blushed with red; corolla with tube ca. 20 mm long, glabrous on the outside, slightly dilate distally, limb with subcircular lobes ca. 5-6 × 7-9 mm, lobe margin undulate or entire, corolla deeply yellow without, limb yellow with dark red patterns; stamens included, stigma long exserted (ca. 20 mm from limb). Fruit unknown.

Additional specimens examined: known from type only.

As far as can be judged from the only extant specimen, this appears to be an extremely characteristic species, possibly associated to the *Solenophora calycosa* group as discussed above. This morphologically aberrant species should clearly be studied in the field.

3-9. *Solenophora obscura* group

3. *Solenophora erubescens* Donn.Sm., Enum.

3-9. *Solenophora obscura* group
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Sheet 1 of 2

36992 PLANTS OF GUATEMALA

1st label Field Museum of Natural History Expedition, 1929-30

Volcán Tajumulco

Solenophora
Solenophora maculata
Herbs 10 ft tall. Corolla orange-yellow
with purplish-rose in middle of lobes.
Sepals soft-membranaceous, rich
olive-green above, gray green beneath.
Petals and side lobes reddish beneath.
Pale brown-rose. Petioles chief green.

Dept. San Marcos: between Todos Santos and Finca El Porvenir, lower
to middle slopes of Volcán Tajumulco, alt. 1800-2000 m.

JULIAN A. STEYERMARK

MARCH 1, 1929

36992 PLANTS OF GUATEMALA

2nd label Field Museum of Natural History Expedition, 1929-30

Volcán Tajumulco

Solenophora Pirana Marten
suffused with brown-rose.
Calyx greenish with suffusion of
rose-purple veins and on margin
corolla lobes deep yellow spotted
margin. Slight red cream-
white. Anthers purplish filament white.

Dept. San Marcos: between Todos Santos and Finca El Porvenir, lower
to middle slopes of Volcán Tajumulco, alt. 1800-2000 m.

JULIAN A. STEYERMARK

MARCH 1, 1929

Studies for Flora of Guatemala

Holotype:

Solenophora maculata D. Gilman

Dorothy N. Gibson, 1971

S. Endlicheriana (Fernald) ^{Hansen}
Corolla very small!

FIGURE 3. *Solenophora maculata* (Steyermark 36992).

pl. Guatem. II: 56. 1891, *nomen*; Bot. Gaz. 16: 197. 1891. TYPE: GUATEMALA. Alta Verapaz: Rocks of a waterfall, Pansamalá, 3800 ft, May 1887, *von Türckheim 731* (Lectotype, here designated: US!; Isolectotypes: F!, K, M!, NY). Same locality, April 1889, *Donnell Smith 1684* (Syntype: US). Fig. 4.

Lignescens herb probably to 1 m tall, internodes ca. 30–45 (–50 mm long), stems glabrous. Leaves of a pair slightly unequal, petioles 10–30 (–35) mm long, lamina (ob-)ovate, subsymmetrical, 60–80 mm long, 35–45 mm wide, base slightly oblique (one side 1–2 mm longer), cuneate, apex shortly acuminate, margin serrate, strongly blushed with red abaxially, both surfaces glabrous. Inflorescences with 1–2 flowers, peduncle absent, pedicels 20–30 mm long, bracts ca. 6–7 × 2.5 mm; calyx 16–18 mm long, tube funnel-shaped, constriction between distal and proximal part of calyx poorly differentiated, glabrous, with distinctive, triangular-ovate lobes 2–3 mm long, lobe margin with gland-teeth, calyx strongly blushed with red; corolla with tube ca. 20–22 mm long, pubescent on the outside, cylindrical, limb with subcircular lobes ca. 5–6 × 6–7 mm, lobe margin undulate or entire, corolla deeply yellow without, limb yellow with dark red lines; stamens and stigma included. Fruit including calyx 18–22 mm long, inferior part ca. 5 mm in diameter.

Distribution: endemic to Guatemala; damp or wet, mixed montane forest, sometimes in rocky ravines, 1000–2600 m.

Additional specimens examined: GUATEMALA. Alta Verapaz: Coban, 1550 m, September 1907, *von Türckheim II/1924* (F, G, MO, NY, US, W). Chama to Coban, 1000 m, 15 August 1920, *Johnson 526* (F, US). Baja Verapaz: without precise locality, 1975, *Wiehler and Kunkel 7555* (US). Huehuetenango: Cerro Huitz, between Mimanhuítz and Yulhuítz, Sierra de los Cuchumatanes, 1500–2600 m, 14 July 1942, *Steyermark 48597* (F, NY). Ditto, 1500–2600 m, 14 July 1942, *Steyermark 48605* (F, US). Vicinity of Maxbal, 17 miles N of Barillas, Sierra de los Cuchumatanes, 1500 m, 15–16 July 1942, *Steyermark 48868* (F, US).

Solenophora erubescens is easily one of the most distinctive species and can be readily recognized on the basis of the absence of any conspicuous indument. Even such comparatively glabrous taxa as *S. calycosa* subsp. *australis* have at least some trichomes on the ovary.

4. *Solenophora chiapasensis* D. N. Gibson, Phytologia 23(4): 337. 1972. TYPE: MEXICO. Chiapas: Municipio de Tenejapa, 3000 m, 23 August 1966, *Breedlove 15187* (Holotype: F!; Isotype: US). Fig. 5; additional illustrations: Phytologia 23(4): 338. 1972.

Lignescens herb 1 m tall, internodes ca. 15–30 (–55 mm long), stems covered with uniseriate, often gland-tipped trichomes of 3–5 (–8) cells and ca. 1 mm long. Leaves of a pair typically very unequal (one 1.5–2 × as large as the other), petioles 8–25 (–30) mm long, lamina (ob-)ovate, 30–95 mm long, 15–35 mm wide, base symmetrical, long cuneate, apex long acuminate, margin serrate, slightly blushed with red abaxially, abaxial surface pilose on veins, uniseriate trichomes of 3–7 cells and ca. 1 mm long, adaxial surface pilose between veins with few uniseriate trichomes of 5–10 cells and 1–1.5 mm long. Inflorescences with 1–3 flowers, peduncle absent, pedicels 15–20 mm long, bracts inconspicuous, ca. 3 × 1 mm; calyx 10–13 mm long, tube campanulate, constriction between distal and proximal part of calyx poorly differentiated, sparsely pubescent (more towards base) with few uniseriate trichomes of 5–10 cells and 1–1.5 mm long, with distinctive, triangular-ovate lobes up to 3 mm long, lobe margin with gland-teeth, calyx strongly blushed with red or red throughout; corolla with tube ca. 30 mm long, pilose on the outside, slightly dilate distally, limb with subcircular lobes ca. 6–8 × 12–13 mm, lobe margin finely dentate, corolla orange without, stamens included. Entire fruit including calyx 12–18 mm long, 5–6 mm wide.

Distribution: endemic to Chiapas in Mexico; cloud forest with *Quercus*, *Pinus*, *Magnolia*, *Drimys*, *Clethra*, *Persea*, *Abies*, *Olmediella*, *Podocarpus*, *Photinia*, mesophilic montane forest and montane rain forest at 2000–3000 m.

Additional specimens examined: MEXICO. Chiapas: Slopes above Sumidero at Tenejapa Center, 2500 m, 7 August 1964, *Breedlove 6996* (F, US). Ditto, 2200 m, 11 July 1965, *Breedlove 10741* (F, US). Municipio Tenejapa, Paraje Banabil, 2590 m, 14 November 1981, *Breedlove and Bartholomew 55522* (MO, NY). Ditto, 2713 m, 8 October 1981, *Breedlove 53351* (MO). Municipio Tenejapa, Colonia Ach'um, 3000 m, 12 December 1966, *Shilom Ton 1768* (US). Ditto, 2700 m, 10 February 1981, *Breedlove 49758* (MO). Municipio

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FIGURE 4. *Solenophora erubescens* (v. Tuerckheim II/1924).



FIGURE 5. *Solenophora chiapasensis* (Breedlove 15187).

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Tenejapa, 1.5 km before Matzam above the path from Las Ollas, 2400 m, 4 July 1994, *González-Espinosa et al.* 2044 (MEXU). Municipio La Independencia, road Las Margaritas to Campo Alegre, 2300 m, 3 July 1981, *Breedlove* 51333 (MO). Municipio Huixtán, 4.9 km NW of the Los Ranchos turnoff and the road Huixtán to Oxchuc, 2170 m, 27 June 1995, *Mejía and Luna* 523 (MEXU).

Solenophora chiapasensis is superficially very close to *S. modesta*, but differs clearly in the more narrowly serrate leaf margins, the less distinctly flaring calyx and the much denser indument. Since both taxa are more or less sympatric, it seems likely that there is some degree of ecological separation, but this would have to be studied in the field.

→ 5. *Solenophora tuerckheimiana* Donn. Sm., Bot. Gaz. 46(2): 114–115. 1908. TYPE: GUATEMALA. Alta Verapaz: Cobán, 1600 m, December 1907, v. *Türckheim II/2028* (Holotype: US!; Isotypes: F! F neg.no. 52781, G, MO!, NY!, US!, W!). Fig. 6.

Lignescent herb 1–1.5 m tall, internodes ca. 20–45 mm long, stems usually pubescent from uniseriate trichomes of 8–15 cells and ca. 1 mm long, later glabrescent, sometimes ± glabrous. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 23–65 mm long, lamina ovate, slightly asymmetrical, 80–140 (–190) mm long, 50–90 (–100) mm wide, base oblique (one side 2–5 mm longer), cuneate, apex shortly acuminate, margin serrate, strongly blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 4–6 cells and <1 mm long primarily between the veins, abaxial surface covered with uniseriate trichomes of 5–10 cells and ca. 1 mm long primarily on veins. Inflorescences with 1–5 flowers, peduncle 40–55 mm, pedicels 10–20 mm long, bracts linear, ca. 2–3 × 0.5 mm; calyx 12–15 mm long, tube turbinate, constriction between distal and proximal part of calyx clearly differentiated (esp. postflorally), densely covered with uniseriate trichomes of up to 5–8 cells and ca. 1 mm long, with clear, triangular-ovate lobes 1.5–3 mm long, lobe margin with gland-teeth, calyx green, richly suffused with red, especially the veins; corolla with tube ca. 30 mm long, sparsely covered with uniseriate trichomes of 5–7 cells and ca. 1 mm long on the outside, slightly dilate distally,

limb with subcircular to truncate lobes ca. 6 × 11 mm, lobe margin entire (sometimes one lobe very slightly denticulate), densely set with uniseriate, gland-tipped trichomes, corolla yellow (rarely whitish), base orange, lobes yellow, stamens and stigma included. Fruit (including calyx) 13–16 mm long, inferior part 5–8.5 mm in diameter.

Distribution: endemic to Guatemala; montane mesophilic forest in damp or wet ravines at 1600–2800 m.

Additional specimens examined: GUATEMALA. Huehuetenango: Cerro Huitz, between Barillas and Mimanhuitz, Sierra de los Cuchumatanes, 1600–2600 m, 14 July 1942, *Steyermark* 48537 (F, US). Cerro Cananá, between Nucapuxlac and Cananá, Sierra de los Cuchumatanes, 2500–2800 m, 19 July 1942, *Steyermark* 49017 (F, US). Alta Verapaz: Montaña de Caquiepec, Chicacnab, 2100–2170 m, 5 April 1998, *Förther et al.* 10039 (MSB, US, UVG, W). Ditto, 1700–1900 m, 4 September 1999, *Förther et al.* 10410 (MSB, UVG). Ditto, 4 September 1999, *Förther* 10433 (MSB, UVG). Ditto, 4 September 1999, *Förther* 10473 (MSB, UVG). Ditto, 30 September 1998, *Robles* 187 (MSB, UVG). Ditto, 2100–2200 m, 19 September 2001, *D. Unger* s.n. (MSB).

Solenophora tuerckheimiana differs from the closely related taxa *S. chiapasensis* and *S. modesta* in much larger and especially wider leaves, longer peduncles and deeply purple abaxial leaf surfaces (– the other taxa have either entirely green abaxial leaf surfaces or they are slightly blushed with purple).

6. *Solenophora obscura* Hanst., *Linnaea* 34: 315. 1865–66. TYPE: MEXICO. Oaxaca: Chinantla, Lacoba, June 1842, *Liebmann* 9322 (B+, C! - F neg.no. 22715, CP, NY!, US!, W!), *Liebmann* 9321 (W!). Fig. 7.

Synonyms: *Solenophora wilsonii* Standl., Publ. Field Mus. Nat. Hist., Bot. Ser. 17(2): 210. 1937. TYPE: GUATEMALA. Alta Verapaz: Chacirociha, Finca Seamay, Senahú, 1 August 1936, *Hatch and Wilson* 201 (Holotype: F! F neg.no. 49148). Figs. 1H, 7; additional illustrations: *Fieldiana Bot.* 24/10(2–3): 312, fig. 67. 1975. *Arctocalyx obscurus* Oerst., *Kongl. Dansk Vid. Selsk. Skr. Nat. Mat. Afd. V*, 5(1): 143. 1858, *nomen nudum*. *Arctocalyx liebmanni* Oerst., *Kongl.*

C = holotype
acc = to synonym
1858

with Bracts (A, W) 1858
in our collection



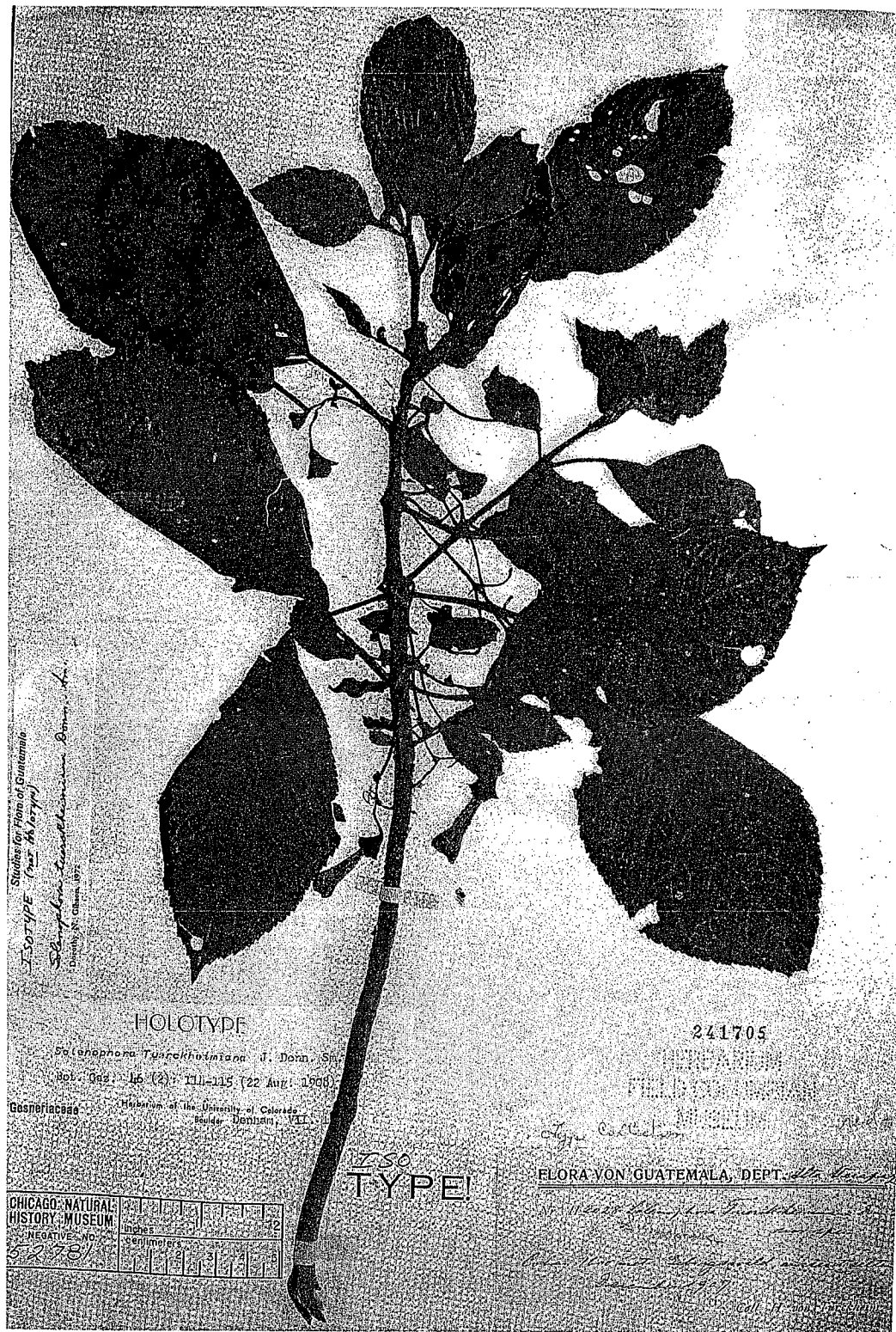


FIGURE 6. *Solenophora tuerckheimiana* (v. Türckheim II/2028).



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Plantas de México: OAXACA
 Instituto de Biología
 Herbario Nacional (MEXU)

Solenophora obscura Hanst.

CESNERIACEAE

Det. A. Ramírez R., 1994

Loc. Dto. Ixtlán, Sierra de Juárez, Ruta 175 a
 5 Km al NE de Vista Hermosa hacia Puerto Eligio,
 (Puerto Antonio); bosque mesófilo de montaña,
 Alt. 1250 m.
 Hierba de 30-50 cm, terrestre, Corola amarilla.
 Frecuente.

Col. David H. Lorence Nº 4729, A. García M., C.
 Allen.
 4 Ago 1985.

FIGURE 7. *Solenophora obscura* (Lorence et al. 4729).

Dansk Vid. Selsk. Skr. Nat. Mat. Afd. V, 5(1): 143. 1858, *nomen nudum*.

Lignescent herb 0.3–0.5 (–1.5) m tall, internodes ca. 20–45 mm long, stems pubescent from uniseriate trichomes of 3–5 cells and ca. 0.5 mm long, later glabrescent. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 25–35 mm long, lamina ovate, slightly asymmetrical, 80–160 mm long, 40–65 mm wide, base oblique (one side 2–7 mm longer), cuneate, apex shortly acuminate, margin regularly serrate, not blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 3–5 cells and ca. 0.5 mm long only between the veins, abaxial surface covered with uniseriate trichomes of 3–5 cells and ca. 0.5 mm long primarily on veins. Inflorescences with 1–5 flowers, peduncle 0–10 mm, pedicels 3–7 mm long, bracts ovate, ca. 6–7 × 1 mm; calyx 12–15 mm long, tube turbinate, constriction between distal and proximal part of calyx clearly differentiated (esp. postflorally), proximal part pubescent from uniseriate trichomes of 5–8 cells and ca. 1 mm long, distal part sparsely pubescent from uniseriate trichomes of 2–4 cells and ca. 0.5 mm long, with clear, regularly triangular lobes 5 mm long, lobe margin with gland-teeth, calyx green; corolla with tube ca. 35–40 mm long, sparsely covered with uniseriate trichomes of 8–10 cells and ca. 1–1.5 mm long on the outside, clearly dilate distally, limb with subcircular to truncate lobes ca. 6 × 15 mm, lobe margin fimbriate with ciliae 1–1.5 mm long and densely covered with sessile glands, corolla uniformly yellow, stamens and stigma included. Fruit (including calyx) 16–24 mm long, ca. 5 mm wide.

Distribution: damp or wet montane forest of Mexico, Guatemala and Honduras; ravines or along rivulets at 300–2000 m.

Additional specimens examined: MEXICO. Oaxaca: Cerro Mirador, 15 km NNW of Valle Nacional, Municipio Valle Nacional, 1000–1200 m, 16 October 1992, *Meave del Castillo et al.* 1534 (BM, MEXU). Distrito Ixtlán, Sierra de Juárez, Ruta 175, 5 km NE of Vista Hermosa towards Puerto Eligio, 1250 m, 4 August 1985, *Lorence et al.* 4729 (MEXU). Municipio Comaltepec, Puerto Antonio, 5.3 km N of Vista Hermosa, 1230 m, 3 November 1986, *Tenorio and Frame* 12293 (MEXU). Chiapas: Municipio Ocosingo, 70 km SW of Palenque on road to Ocosingo, along the Jol Uk'um, 550 m,

4 December 1980, *Breedlove and Almeda* 48277 (MEXU). Municipio La Trinitaria, 15 km ENE of Dos Lagos above Santa Elena, 29 December 1981, *Breedlove* 56546 (MEXU). Ejido Cuauhtémoc, 21 August 1984, *Méndez* 7875 (MEXU, MO). GUATEMALA. Alta Verapaz: 62 km from Coban on road to Sebol, Chapultepec Farm, 25 May 1964, *Contreras* 4789 (MEXU). Chamá to Cobán, 800 m, 15 August 1920, *Johnson* 518 (F, US). Mountains E of Tactic, on road to Tamahú, 1500–1650 m, 9 April 1939, *Standley* 71200 (F). Mountains between Tactic and Tamahú, 1500–1650 m, 1.–7 April 1941, *Standley* 90749 (F). Forest near Chiriacté, on Petén highway, 900 m, 9 April 1941, *Standley* 91657 (F). Coban, am Wege nach Chisec, 1500 m, IX.1906, *Türckheim II/1419* (W). Cobán, 1350 m, August 1912, v. *Türckheim II/1419* (M, NY). Pansamalá, 1200 m, June 1885, v. *Türckheim* 730 (K, NY). Tucuru, Finca de la Concepción, 19 August 1979, *Boeke and Utzschneider* 2929 (NY, US). 2 km S of Jolomix, Telemán, Panzós, Sierra de Las Minas, 750 m, 20 July 1988, *Martínez S.* 22904 (BM, MEXU). Cubilquitz, 350 m, August 1903, v. *Türckheim* 8541 [=II/777] (US). Baja Verapaz: Niño Perdido, Quebrada La Luna, 22 June 1977, *Lundell and Contreras* 21184 (F, MEXU, US). Niño Perdido, near Río San José, 8 km N, 30 May 1977, *Lundell and Contreras* 21024 (F). Along dirt road 4 miles NE of Purulhá, 1500 m, 17 July 1977, *Croat* 41336 (MEXU, MO). Huehuetenango: Near Maxbal, 17 miles N of Barillas, Sierra de los Cuchumatanes, 1500 m, 15–16 July 1942, *Steyermark* 48712 (F, US). Cerro Chiblac, between Finca San Rafael and Ixcán, Sierra de los Cuchumatanes, 1200–2000 m, 22 July 1942, *Steyermark* 49167 (F). Between Finca San Rafael and Ixcán, Sierra de los Cuchumatanes, 200–800 m, 24 July 1942, *Steyermark* 49390 (F). Izabal: Cerro San Gil, 300–900 m, 25 December 1941, *Steyermark* 41927 (F, US). Ditto, uppermost ridges and summit, 1200–1300 m, 26–27 December 1941, *Steyermark* 41977 (F). En la Torre de GUATEL, Sierra del Mico, Municipio Puerto Barrios, 940 m, 8 September 1988, *Martínez S. et al.* 23589 (BM, MEXU). HONDURAS: Yoro. Río Pijol valley, 6–7 km S of Nueva Esperanza, 1570–1670 m, 27 May 1993, *Liesner* 26574 (MO, US). 16 km from Yarucha on Quebrada de Oro to Cerro Bufalo, 900–950 m, 15 August 1982, *Holmes* 4389 (MEXU, NY).

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The differences which have been used for the recognition of *Solenophora wilsonii* as a taxon distinct from *S. obscura* are evidently insufficient. Traditionally *S. obscura* has been considered as endemic to Mexico, while the material from Guatemala and Honduras has been referred to *S. wilsonii*. Gibson (1974) argues with the difference in flower colour. This is given as "albidis" in Hanstein (1865), but the flowers are in reality yellow like those of *S. obscura*. The differences in bract size and the presence of regularly triangular calyx lobes can also not be used to distinguish the two taxa as there are many specimens from Guatemala (*S. wilsonii*) which exactly match the specimens *S. obscura* from Oaxaca. Moreover, there are now much more herbarium specimens at our disposal and we thus know that the species is not only present in Oaxaca, but also present in adjacent Chiapas, in Guatemala in Baja Verapaz and even in Honduras, so that it seems that the species is actually widespread. This means that the argument of a possible disjunction, which probably led to the description of *S. wilsonii* in the first place, can be clearly refuted. We have been unable to trace any consistent morphological trend that would justify segregating the specimens from any particular geographical area as separate taxon.

7. *Solenophora abietorum* Standl. & Steyerl., Publ. Field Mus. Nat. Hist. Bot., Ser. 23(5): 195–265. 1947. TYPE: GUATEMALA. Huehuetenango: Cerro Huitz, between Mimanhuitz and Yulhuitz, Sierra de los Cuchumatanes, alt. 1500–2600 m, 14 July 1942, *Steyermark 48643* (Holotype: F!, F neg. no. 49147; Isotype: US). Fig. 8.

Lignescent herb 30–60 cm tall, internodes ca. 25–40 (–50 mm long), stems densely covered with uniseriate trichomes of 3–18 cells and up to 2 mm long. Leaves of a pair subequal, petioles 35–50 mm long, lamina ovate, 80–100 mm long, 60–70 mm wide, base slightly oblique (one side 2–4 mm longer), rounded, apex shortly acuminate, margin serrate (rarely nearly biserrate), abaxially (and rarely adaxially) slightly to strongly blushed with red abaxially, adaxial surface very densely pubescent with uniseriate trichomes ca. 1 mm long, adaxial surface pubescent on veins, uniseriate trichomes 1–1.5 mm long. Inflorescences with 1–3 flowers, peduncle 10–20 mm, pedicels 15–20 mm long, bracts ovate, ca. 4 × 2 mm;

calyx 11–15 mm long, tube campanulate, constriction between distal and proximal part of calyx absent, densely long pubescent with uniseriate trichomes of 10–18 cells and 1–1.5 mm long, especially near base, with distinctive triangular-ovate lobes up to 3 mm long, lobe margin with gland-teeth, calyx green; corolla with tube ca. 35 mm long, pubescent on the outside, slightly dilate distally, limb with subcircular lobes ca. 10 × 18 mm, lobe margin finely dentate, corolla deeply yellow without, limb yellow with dark red patterns or brown-purple interrupted lines. Stamens and stigma included. Fruit unknown.

Distribution: endemic to Guatemala (Sierra de los Cuchumatanes); damp cloud forest with *Abies* at 1500–2800 m.

Additional specimens examined: GUATEMALA. Huehuetenango: Cerro Huitz, between Mimanhuitz and Yulhuitz, Sierra de los Cuchumatanes, alt. 1500–2600 m, 14 July 1942, *Steyermark 48637* (F). Cerro Cananá, between Nucapuxlac and Cananá, Sierra de los Cuchumatanes, 2500–2800 m, 18 July 1942, *Steyermark 49067* (F, US).

S. abietorum is clearly defined on the basis of its extremely dense indument. The copious material collected by Steyermark clearly indicates that this is not just one aberrant specimen, but really an abundant species of this area. It is all the more surprising that no new material has come to light.

8. *Solenophora tuxtliensis* Ramírez-Roa & Ibarra-Manríquez, Novon 7: 281. 1997. TYPE: MEXICO. Veracruz: Municipio San Andrés Tuxtla, Estación de Biología Tropical Los Tuxtles, Lote 71, 18°34'–36'N, 95°05'–09'W, 400 m, 18 January 1991, *Ibarra and Sinaca 3533* (Holotype: MEXU!; Isotypes: BM, ENCB, F, K, LE, MO, US, XAL). Figs. 1E, 9; additional illustrations: Novon 7: 282. 1997.

Lignescent herb 0.5–2 (–3) m tall, internodes ca. 40–70 mm long, stems pubescent from uniseriate trichomes of 5–12 cells and ca. 0.5–1 mm long, later glabrescent. Leaves of a pair slightly unequal (one up to 1.2 × as large as the other), petioles 35–50 mm long, lamina ovate, slightly asymmetrical, 80–150 mm long, 60–90 mm wide, base oblique (one side 2–4 mm longer), cuneate, apex shortly acuminate, margin irregularly serrate to biserrate, blushed with red abaxially on veins only or rarely green, adaxial and abaxial surface covered with unise-



HOLOTYPE
Solenophora abietorum Steud. & Steyermark.
 Fideb. Bot. 20. (5): 236-237 (22 Oct. 1917).
 Chas. Brinkley. Herbarium of the University of Colorado.
 Boulder, Denham. VIII: 1962.

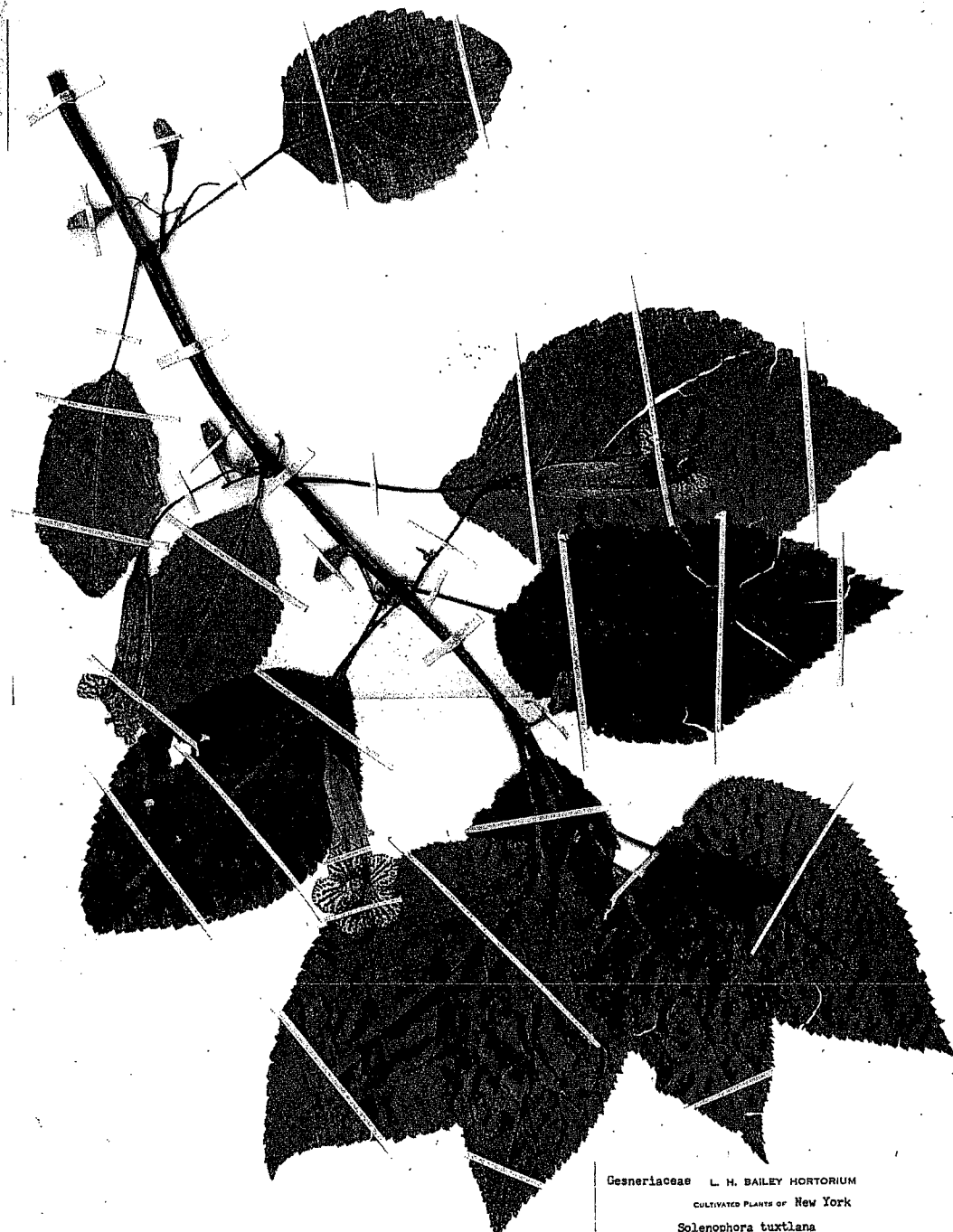
TYPE

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 PLANTS OF GUATEMALA
 48643
Solenophora abietorum Steud. & Steyermark
 Shrubby 1-2 ft. tall; corolla rich
 yellow without, yellow within with
 wine-purple broken dashes or lines.

CHICAGO NATURAL HISTORY MUSEUM
 NEGATIVE NO. 49147
 INCHES
 CENTIMETERS

Dist. Rubi-Quetzal, Cerro Hato, between Mismalá and
 San Pedro, Dept. Guatemala, alt. 1900-2000 m.
 JULIAN A. STEYERMARK

FIGURE 8. *Solenophora abietorum* (Steyermark 48643).



UNITED STATES

2771694

NATIONAL HERBARIUM

Gesneriaceae L. H. BAILEY HORTORIUM

CULTIVATED PLANTS OF New York

Solenophora tuxtiana

Cutting received from D. Denham, 11 May 1965;
originally collected in Mexico.

Grown in the Cornell University Conservatory,
Ithaca, as G-911. n=10 Lee

coll. M. H. Stone 136

23 June 1966



FIGURE 9. *Solenophora tuxtiana* (Stone 136).

riate trichomes of 5–12 cells and ca. 0.5–1 mm long, only between the veins on abaxial and mainly on veins on the abaxial surface. Inflorescences with 1–2 (–3) flowers, peduncle 10–13 mm, pedicels 30–35 mm long, bracts linear, ca. 2–6 × 0.5–1 mm; calyx 30–35 mm long, tube turbinate, constriction between distal and proximal part of calyx clearly differentiated (esp. postflorally), proximal part densely pubescent from red, uniseriate trichomes of 8–18 cells and ca. 1–2 mm long, distal part sparsely pubescent from uniseriate trichomes of 3–8 cells and ca. 0.5 mm long, with clear, triangular-ovate lobes 5 (–6) × 7 (–10) mm, lobe margin with gland-teeth, calyx pale yellowish, blushed with red in proximal portion; corolla with tube ca. 35–40 mm long, sparsely covered with uniseriate trichomes of 2–3 (–6) cells and less than 0.5 mm long on the outside, clearly dilate distally, limb with subcircular ca. 12 mm in diam., lobe margin entire to distantly denticulate, with scattered stalked glands, corolla yellow with dark markings, stamens included and stigma distinctly exerted. Fruit (including calyx) 38–45 mm long, inferior part ca. 6–8 mm in diameter.

Distribution: endemic to Mexico; cloud forest with *Hedyosmum*, *Siparuna*, *Liquidambar*, *Posoqueria*; mesophilic montane forest at 200–1500 m.

Additional specimens examined: MEXICO. Veracruz: Volcán San Martín Tuxtla, El Paraje, 1500 m, 18 February 1962, *MacDougall* 492 (K, P, US, W). Between Adolpho Ruíz Cortínez and La Perla de San Martín, 15 km N of Catemaco, 950 m, 21 February 1972, *Beaman* 5760 (F, MEXU, US). 500 m S of Laguna Escondida, Catemaco, 29 April 1972, *Villagas* 7 (F, MEXU, US). Lote 71, Pedregal, Estación de Biología Tropical Los Tuxtlas, Municipio San Andrés de Tuxtla, 600 m, 1 August 1986, *Ibarra et al.* 2975 (MEXU, US). Ditto, *Sinaca et al.* 521 (US). Laguna Azul, 4 km NO of Estación de Biología Tropical Los Tuxtlas, Municipio San Andrés de Tuxtla, 200 m, *Sinaca* 486 (MEXU, US). Estación de Biología Tropical Los Tuxtlas, Cerro Lázaro Cárdenas, 550 m, 17 February 1986, *Ibarra and Sinaca* 2824 (MEXU). Ditto, 350 m, 22 September 1994, *Sinaca* 2044 (MEXU). Ditto, 200 m, 21 April 1985, *Sinaca and Aparicio* 73 (MEXU). Municipio Soteapan, along dirt road 13 km E of Tebanca, 800–950 m, 5 July 1980, *Nee and Hansen* 18768 (MEXU). Oaxaca: Municipio

Santa María Chilchotla, Cuahatemoc, 4 km NE of Santa María Chilchotla, near Clemencia and Santa Rosa, N 18°14', W 96°50', 1200 m, 16 January 1984, *Solheim and Reisfield* 1365 (MEXU).

This extremely characteristic species has been described very recently. It is one of the northernmost species of the genus and clearly allied to other species of the *S. obscura* group.

9. *Solenophora modesta* Weigend & Förther, *spec. nov.* TYPE: MEXICO. Chiapas: Municipio La Independencia, road from Las Margaritas to Campo Alegre, 2300 m, 18 February 1973, *Breedlove* 33518 (Holotype: MEXU; Isotype: MO!, N!). Figs. 1G, 10. + OS (coll. S. S. S. S. S.)

Differt ab omnibus speciebus generi habitu humili, 0.3–0.5 m alta, ab Solenophora erubescence statura humili et indumento imprimis in caule, foliis calyceque conspicuo, ab S. chiapasense calyce brevi, 7–11 mm longo; late conico, margine foliorum late serrato.

Lignescent herb 0.3–0.5 (–1) m tall, internodes ca. 5–20 (–35) mm long, stems pubescent from uniseriate trichomes of 3–5 cells and ca. 0.5 mm long, later glabrescent. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 12–18 mm long, lamina ovate, slightly asymmetrical, 40–65 (–80) mm long, 15–25 (–30) mm wide, base oblique (one side 2–4 mm longer), cuneate, apex shortly acuminate, margin regularly serrate, blushed with red abaxially, adaxial surface subglabrous or covered with very few uniseriate trichomes of 3–5 cells and ca. 0.5 mm long only between the veins, abaxial surface subglabrous, with few uniseriate trichomes of 3–5 cells and ca. 0.5 mm long only on veins. Inflorescences with usually 1 flower, rarely with up to 4 flowers, peduncle 0–16 mm, pedicels 10–17 mm long, bracts narrowly ovate, ca. 2–4 × 1.5 mm, subglabrous with a few uniseriate trichomes; calyx 7–11 mm long, tube ovoidal, constriction between distal and proximal part of calyx clearly differentiated (esp. postflorally), proximal part pubescent from red, uniseriate trichomes of 8–12 cells and ca. 1 mm long, distal part glabrous or subglabrous with few uniseriate trichomes, with clear, regularly triangular lobes 3–3.5 mm long, lobe margin entire or with one or two gland-teeth, calyx green, usually strongly blushed with red, distinctly conical, ca. 10 mm wide distally; corolla with tube ca. 18–23 mm long, sparsely covered with

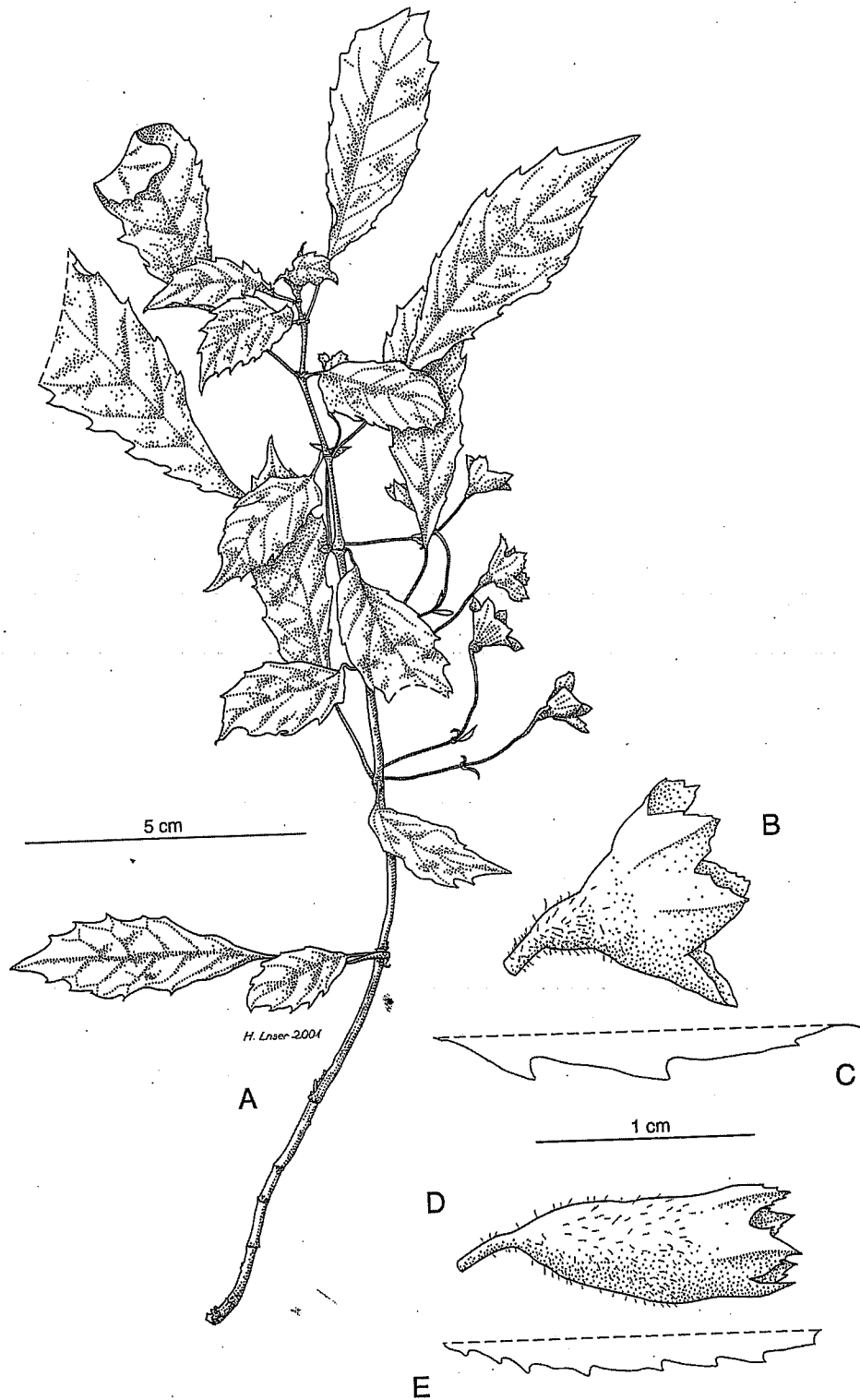


FIGURE 10. *Solenophora modesta*: A, habit; B, calyx; C, leaf margin (Breedlove 33518); *Solenophora chiapasensis*: D, calyx; E, leaf margin (Breedlove 15187).

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uniseriate trichomes of 8–10 cells and ca. 1–1.5 mm long on the outside, slightly dilate distally, limb with subcircular to truncate lobes ca. 3–4 × 5–6 mm, lobe margin entire and densely covered with sessile glands, corolla orange outside, probably yellow inside, stamens and stigma included. Inferior part of fruiting calyx ca. 3 mm in diameter.

Distribution: endemic to Mexico (Chiapas); montane forest with *Pinus*, *Quercus*, *Podocarpus*, and *Magnolia* at about 2000 m.

Additional specimens examined: MEXICO. Chiapas: Municipio La Independencia, road from Las Margaritas to Campo Alegre, 2300 m, 24 October 1976, *Breedlove 41086* (MEXU, MO, NY). Ditto, 5 November 1984, *Breedlove 62140* (MEXU, MO, NY).

This new species of *Solenophora* is the smallest species of the entire genus. Its leaves are diminutive in comparison to most other species and its calyx is also very short and wide. Its sparse indument is another good character and approaches *S. erubescens* from Guatemala, which, however, differs widely in size and is entirely glabrous. The closest ally of *S. modesta* seems to be *S. chiapasensis* from the same area (for a comparison see there).

10–11. *Solenophora purpusii* group

10. *Solenophora purpusii* Brandegee, Univ. Calif. Publ. Bot. 6(4): 65. 1914 = *Episcia purpusii* (Brandegee) Brandegee, Univ. Calif. Publ. Bot. 6(8): 194. 1915. TYPE: MEXICO. [Chiapas]—Cerro del Boquerón, Sept. 1913, *Purpus 6857* (Holotype: UCA!, Isotypes: BM!, K!, F!, MO!, NY!). Fig. 1C, 11; additional illustrations: Fieldiana Bot. 24/10(2–3): 307, fig. 65. 1974.

Synonym: *Solenophora obliqua* D. L. Denham & D. N. Gibson, Phytologia 23(4): 340. 1979. TYPE: GUATEMALA. Quezaltenango: Western slopes of Volcán Zuñil, opposite Santa María de Jesús, 1500 m, 21 January 1940, *Steyermark 35182* (Holotype: F! - F neg.no. 52780).

Lignescent herb 1.5–4.5 (–6) m tall, internodes ca. 20–45 mm long, stems pubescent from uniseriate trichomes of 3–6 cells and <1 mm long, later glabrescent. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 25–35 mm long, lamina ovate, slightly asymmetrical, 160–300 mm long, 100–200 mm wide, base oblique (one side up to 18 mm

longer), cuneate, apex shortly acuminate, margin regularly lobulate, lobules serrate, not blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 3–5 cells and ca. 0.5 mm long only between the veins, abaxial surface subglabrous with very few tiny papillae on the veins. Inflorescences with (1–) 3–5 flowers, peduncle 15–20 mm, pedicels 20–30 mm long, bracts ovate, large, up to 30 × 16 mm; calyx 25–45 mm long, cylindrical from rounded to turbinate base, apically narrowed, especially in bud, constriction between distal and proximal part of calyx inconspicuous, glabrous, with deep incision on adaxial side of calyx (15–20 mm versus <5 mm between the other calyx lobes), lobes distinctive, irregular, ovate, 2–5 mm long, lobe margin densely set with gland-teeth, calyx green or blushed with red; corolla with tube ca. 60–70 mm long, covered with few uniseriate trichomes of 8–15 cells ca. 1–1.5 mm long, dilate distally, limb with subcircular to truncate lobes ca. 8 × 18 mm, lobe margin finely denticulate, glabrous, corolla outside reddish-orange or orange, inside orange-yellow, limb yellow with red-purple spots. Inferior part of fruiting calyx 10–12 mm in diameter.

Distribution: Mexico to Guatemala; damp or wet, montane mesophilic forest, often dominating in thickets along ravines or rivulets, 1000–2700 [–3000] m.

Additional specimens examined: MEXICO. Chiapas: Municipio Unión Juárez, Slopes of Volcán Tacaná, 8 km E of Unión Juárez, 1700 m, 9 August 1986, *Fernández 3537* (F, MEXU, MO, NY). Tacaná Mountains, 1000–2000 m, August 1939, *Matuda 2454* (F, MEXU, NY). Municipio Unión Juárez, lower slopes of Volcán Tacaná, E of Unión Juárez, 1700–2300 m, 3 May 1987, *Miller et al. 2651* (MEXU). Ditto, 500 m E of Talquián, 1700 m, *Martínez et al. 19757* (MEXU). Ditto, 500 m E of Talquián, 1700 m, *Martínez and Reyes 20321* (MEXU). Municipio Unión Juárez, between Talquián and the border to Guatemala, 1700–2300 m, *Martínez 20635* (MEXU). Cerro El Boquerón, June 1914, *Purpus 7116* (BM, F). 8 km S of Unión Juárez, Agualud, 2000 m, 10 June 1987, *Ventura and López 4539* (MEXU). Municipio Tapachula, El Dormitorio, Ladera W of Volcán Tacaná, 22 May 1984, *Tenorio et al. 5915* (BM, MEXU). GUATEMALA. San Marcos: Finca El Povenir along Río Chopal, S slopes of Volcán Tajumulco, 1300–1500 m, 11 March 1940, *Steyermark 37505* (F). Aldea

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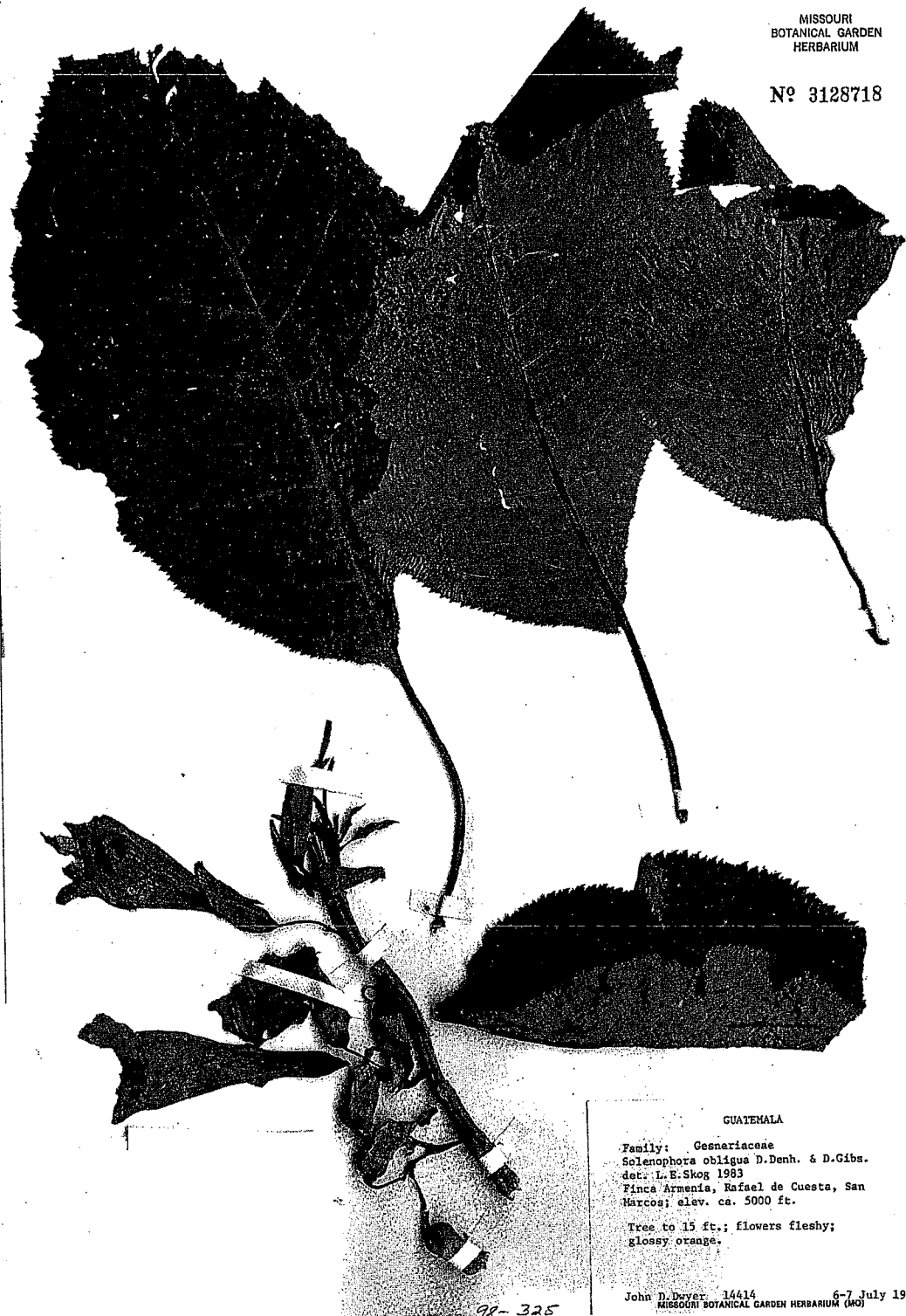
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MISSOURI
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GUATEMALA

Family: Gesneriaceae
Solenophora obliqua D. Donh. & D. Gibs.
det. L. E. Skog 1983
Finca Armenia, Rafael de Cuesta, San
Marcos; elev. ca. 5000 ft.

Tree to 15 ft.; flowers fleshy;
glossy orange.

John D. Dwyer 14414 6-7 July 1977
MISSOURI BOTANICAL GARDEN HERBARIUM (MO)

FIGURE 11. *Solenophora purpusii* (Dwyer 14414).

Fraternidada, between San Rafael Pie de La Cuesta and Palo Gordo, W slopes of Sierra Madre, 1800–2400 m, 10–18 December 1963, *Williams et al.* 26209 (F, NY, US). Ditto, *Williams et al.* 26251 (F). Río Vega, between San Rafael Pie de La Cuesta at NE part of Volcán Tacaná and border between Mexico and Guatemala, 2500–3000 m, 21 February 1940, *Steyermark* 36371 (F). Between San Rafael Pie de La Cuesta and Palo Gordo, Finca La Lucha, 2050–2150 m, 2 May 1989, *Förther* 2533 (M). San Rafael Pie de La Cuesta, Finca Armenia, 1700 m, 6–7 July 1977, *Dwyer* 14414 (MEXU, MO, US). Barranco Eminencia between San Rafael Pie de La Cuesta and San Marcos, between Finca La Lucha and Buena Vista, 2500–2700 m, 6 February 1941, *Steyermark* 86401 (F). Slopes of Volcán Tajumulco, Sierra Madre 8–10 km W of San Marcos, 2300 m, 31 December 1964, *Williams et al.* 26951 (F, NY). Quezaltenango: Slopes and ridges between Quebrada Chicharro and Montaña Chicharro, SE slopes of Volcán Santa María, 1300–1400 m, 18 January 1940, *Steyermark* 34329 (F). Above Mujuliá, between San Martín, Chile Verde and Colomba, 1800 m, 1 February 1941, *Standley* 85523 (F - corolla pilose without!). Ditto, *Standley* 85478 (F, US). El Pocito, S of San Martín Chile Verde, road to Colomba, 2200 m, 27 January 1941, *Standley* 85049 (F, US). San Martín Chile Verde, 8 February 1941, *TRT* 1785 (F). Suchitupéquez: Volcán Santa Clara, between Finca El Naranjo and upper slopes, 1250–2650 m, 23 May 1942, *Steyermark* 46600 (F, US).

Solenophora purpusii and *S. obliqua* cannot be separated. There is a trend for the specimens from Guatemala ("*S. obliqua*") to have slightly longer calyces (3.5–4.5 versus 2.5–3 cm). Nevertheless in the northernmost part of the range (Chiapas, Municipio Unión Juárez), there are specimens from apparently exactly the same locality and sometimes even the same collection number (*Fernández* 3537) which would under this definition fall into different species. Since calyx size is the only character used separating the two taxa and since this character can be shown to be useless, we advocate sinking *S. obliqua* in favour of the older name *S. purpusii*. This redefinition renders *S. purpusii* a supremely easily defined species. The only other species with an asymmetrical calyx tube is *S. schleehaufii* which can be very easily distinguished on the basis of its very dense pubescence (*S. purpusii* is glabrous).

11. *Solenophora schleehaufii* Weigend & Förther, *spec. nov.* TYPE: GUATEMALA. Alta Verapaz: Municipio San Juan Chamelco, Montaña Caquiepec, Chicacnab I, entlang des Weges zur Laguna [15° 23' 04" N–090° 09' 50" W], 2100–2200 m, 4 September 1999, *Förther et al.* 10474 (Holotype: MSB!; Isotypes: BM, F, M, MO, US, UVGI, W). Fig. 12.

Species insignis ob calycem asymmetricum latere adaxiali ad 10 mm inciso, differt insuper ab Solenophora purpusii (incl. S. obliqua) indumento imprimis caulium calyciumque dense pubescente.

Lignescent herb or shrub 2–4.5 m tall, internodes ca. 20–50 mm long, stems pubescent at first, with uniseriate trichomes of 2–7 cells, later glabrescent. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 30–70 (–150) mm long, lamina ovate, slightly asymmetrical, 110–170 (–200) mm long, 60–100 (–120) mm wide, base oblique (one side 4–7 mm longer), cuneate, apex shortly acuminate, margin lobulate, lobules 3 × 7 mm, serrate, not or slightly blushed with red abaxially, both surfaces pubescent, trichomes primarily on veins on abaxial side and primarily between the veins on adaxial side. Inflorescences with 1–2 flowers, peduncle 0–10 (–17) mm long, pedicels 25–30 mm long, bracts ca. 3 × 1 mm; calyx 20–25 mm long, tube cylindrical from turbinate or rounded base, constriction between distal and proximal part of calyx poorly differentiated, with deep incision on adaxial side of calyx (10 mm versus 3–4 mm between other calyx lobes), very densely covered with uniseriate trichomes of 5–7 (–10) cells, with distinctive, triangular lobes ca. 2–3 mm long, with oblique incision adaxially (to 10 mm deep), lobe margin with gland-teeth, calyx not blushed with red; corolla with tube ca. 55–65 (–90) mm long, densely covered with long, uniseriate trichomes of up to 10 cells on the outside, slightly dilate distally, limb with subcircular to truncate lobes ca. 10–12 × 15–17 mm, lobe margin entire, corolla deeply orange without, limb yellow or rarely orange with dark red patterns; stamens and stigma included. Fruit (including calyx) 26–38 mm long, inferior part 10–12 mm in diameter.

Distribution: endemic to the Alta Verapaz of Guatemala. The new species is an under storey shrub of the cloud forest, dominated by *Quercus*, *Persea*, *Podocarpus* and *Drimys*. It always grows in shaded places along humid barrancos or ravines and rivulets at 1800–2400 m. The flowers are pollinated by hummingbirds.

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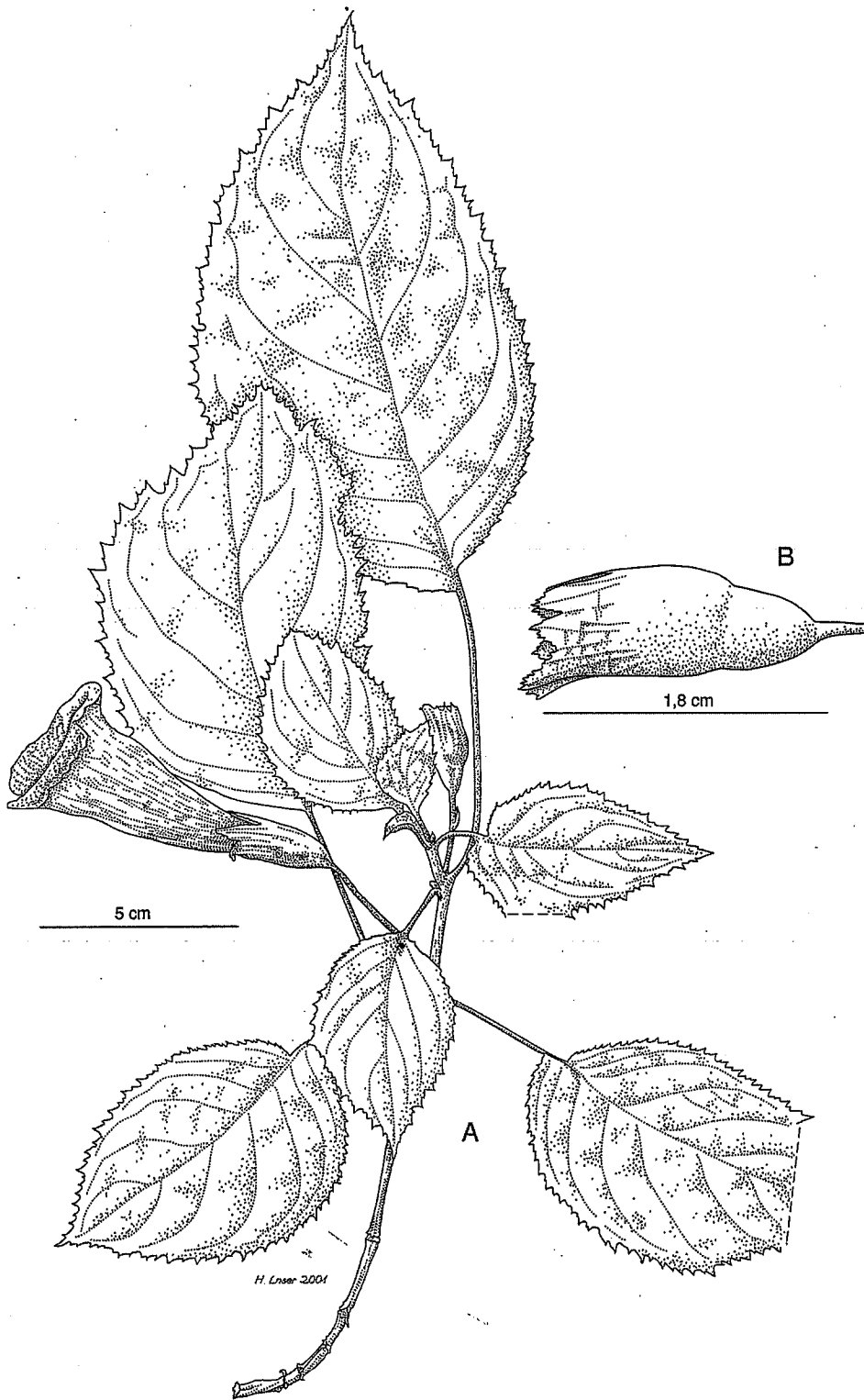


FIGURE 12. *Solenophora schleehaufii*. A, habit; B, calyx (Förther et al. 10474).

Additional specimens examined: GUATEMALA. Alta Verapaz: Sierra de Chamá, Montaña Yalijux, 1 km N Chelem-há, ca. 16 km NE of Tucuru, 2150 m, 20 March 1989, *Förther 2032* (GUAT, M). Ditto, 2100 m, 26 May 1989, *Förther 2703* (GUAT, M). Ditto, 10 May 1991, *Unger s.n.* (MSB). Ditto, ca. 17 km NE Tucuru, 2100 m, 13 April 1998, *Förther 10180* (MSB, US, UVG, W). Montaña Caquiepec, Chicacnab I, ca. 5 km SE Chicacnab, 2100–2200 m, 7 April 1998, *Förther 10056* (F, K, MO, MSB, NY, US, UVG, W). Ditto, 8 April 1998, *Förther 10081* (BM, MSB, US, UVG, W). Municipio San Juan Chamelco: Montaña Caquiepec: Chicacnab I, Umgebung der biologischen Station des "Proyecto Ecológico Quetzal" [15° 22' 53" N–90° 11' 09" W], 2100–2170 m, 4 September 1999, *Förther 10437* (MSB, UVG). Chicacnab, entlang des Weges zur Laguna [15° 23' 04" N–90° 09' 50" W], 2100–2200 m, 19 September 2001, *D. Unger s.n.* (BM, MSB, US, W).

This new species is at first glance rather similar to *S. toucana*, but differs clearly by its asymmetrical calyx. It shares this character with *S. purpusii* (see there for comparison).

The new species is named in honor of Alfredo Enrico Schleeauf (1926–1995), the former landowner of Chelem-há and dedicated environmentalist who worked to save the Quetzal birds in the cloud forests of the Montaña Yalijux.

12.–16. *Solenophora calycosa* group

12. *Solenophora calycosa* Donn.Sm.

Solenophora calycosa as here defined includes three subspecies: *S. calycosa* subsp. *calycosa*, *S. calycosa* subsp. *australis* and *S. calycosa* subsp. *purpurascens*. *S. calycosa* subsp. *calycosa* is found in Costa Rica and part of Panamá, and *S. calycosa* subsp. *australis* is restricted to Panamá, the two subspecies show marginal overlap. *S. calycosa* subsp. *purpurascens* is only known from one small area (San José, Cascajal) and grows basically sympatric with subsp. *calycosa*, but it is here recognized in spite of the scarcity of material because its characters are strikingly aberrant. Because overall similarity is very high between these taxa, we prefer recognizing them only at subspecific level. It may well be that with sufficient field data patterns would emerge to justify a recognition at species rank for all of them. Irrespective of that, there does not seem to be any doubt about the clear and close affinities between these three taxa and the fact that they

are more closely allied than any other taxa in *Solenophora* which are here recognized at species rank.

12.1. *Solenophora calycosa* Donn.Sm. subsp. *calycosa*, Bot. Gaz. 25: 152. 1898. TYPE: COSTA RICA. Heredia: Slopes of Volcán Barba, 2300 m, July 1888, *Pittier 283* (CR, photo F!). Borders of Río Mancaron, Volcán Barba, atlantic side, 2100 m, 15 February 1890, *Tonduz 2022* (CR, photo F!, US!). Fig. 13.

Lignescens herb or shrub 2–6.5 m tall, internodes ca. 40–80 (–110 mm long), stems erect, to 150 mm in diameter, branched from base, (densely) pubescent with uniseriate trichomes of 8–15 cells and ca. 1 mm length. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 80–130 mm long, lamina ovate, slightly asymmetrical, 250–350 (–400) mm long, 160–230 mm wide, base oblique (one side 4–18 mm longer), cuneate, apex shortly acuminate, margin biserrate to lobulate, lobules 3 × 7 mm, serrate, not blushed with red abaxially or completely purple, adaxial surface covered with uniseriate trichomes of 5–8 cells and <1 mm long primarily between the veins, abaxial surface sparsely covered with uniseriate trichomes of 5–8 cells and ca. 1 mm long on veins. Inflorescences with 1–3 (–5) flowers, peduncle 15–20 (–30) mm, pedicels 30–40 mm long, bracts narrowly ovate, up to 15 × 3 mm; calyx 30–40 mm long, tube cylindrical from turbinate base, constriction between distal and proximal part of calyx absent, usually densely pubescent, especially towards base, covered with uniseriate trichomes of 8–15 cells and 1–1.5 mm long, with distinctive, triangular-ovate calyx lobes up to 12 mm long and 7 mm wide (basally), lobe margin with gland-teeth, calyx usually green or blushed with red distally; corolla with tube ca. 65–80 mm long, densely covered with long, uniseriate trichomes of 8–15 cells and ca. 1.5 mm long on the outside, slightly dilate distally, limb with subcircular lobes ca. 10–12 × 18–20 mm, lobe margin entire, corolla deeply orange without, limb yellow with dark red patterns; stamens and stigma included. Entire fruit (incl. calyx) 30–32 mm long and 10–12 mm wide.

Distribution: *Solenophora calycosa* subsp. *calycosa* is essentially restricted to Costa Rica, with a few collections from adjacent Panamá (Chiriquí).

Additional specimens examined: COSTA RICA. Puntarenas: Upper Río Burú, 2010 m,



MISSOURI BOTANICAL GARDEN
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PLANTS OF COSTA RICA
 SAN JOSÉ PROVINCE
 No. Solenophora calycosa D. Sm.
 Corolla: outside bittersweet-orange,
 inside light orange-yellow,
 red specks on edge.
 Wooded banks of quebrada north of Jarabouco,
 FINCA GUAYARILLOS, 2250-2375 m.
 G. W. Denno and V. P. Goertzen July 2, 1972

FIGURE 13. *Solenophora calycosa* subsp. *calycosa* (Dodge and Goerger s.n.).

- 19 August 1983, *Gómez et al. 21668* (CR, MEXU, MO, US). Monteverde Nature Reserve, 1500 m, 11 August 1985, *Haber and Bello 2313* (F, MEXU, MO, US). El Valle, Monteverde Nature Reserve, 8 June 1979, *Lumer and Guindon 1094* (NY). Road from Guindon to San Luis Valley, 10° 17' N, 84° 47' W, 800–1000 m, 15 July 1989, *Nepokroeff et al. 538* (WIS). Río de San Luis, 10° 17' N, 84° 47' W, 1200 m, 15 July 1989, *Whitlock 233* (WIS). Cantón de Coto Brus, Las Tablas, Cuenca Térraba-Sierpe, path to Cerro Ehandi, 8° 58' 20" N, 82° 50' 05" W, 1840–2200 m, 10 August 1997, *Gamboa et al. 1633* (MO). Alajuela: Upper drainage area of Río Peñas Blancas below Monteverde N.R., 1250–1350 m, 25–26 February 1977, *Burger et al. 10729* (F, MEXU). Falls of Río La Paz along the road to Puerto Viejo, 1400–1500 m, 19–21 February 1982, *Burger et al. 11884* (F). Cordillera de Tilarán, Monteverde Nature Reserve, 1520–1580 m, 10 June 1976, *Dryer 799* (F). Ditto, 1540–1600 m, 21 February 1986, *Almeda et al. 4998* (MO, NY). Quebrada Celeste, Río Peñas Blancas, Monteverde Nature Reserve, 900 m, 5 August 1988, *Bello 243* (MO). Zarcero, 2300 m, 4 March 1938, *Smith H389* (F). SW above Bajos del Toro (Toro Amarillo), 1850 m, 24 November 1990, *Döbbeler 3769* (M, USJ). Heredia: Río La Paz to Sarapiquí, waterfall El Angel, 1350 m, 26 July 1962, *Jiménez 284A* (F). Río La Paz Chiquita, 1300 m, 5 May 1901, *Pittier 14157* (F, NY). 2 km N by road from La Paz waterfall, 10 km N by road from Vara Blanca, 1400 m, 25 December 1974, *Cochrane et al. 6223* (F). Between Volcanoes Poás and Barba, near Vara Blanca, 1430 m, March 1938, *Skutch 3701* (K, MO, NY, US). 11 km below Volcán Poás Park entrance, 24 February 1980, *Lumer 1149* (NY). 5 miles N of Vara Blanca, near Río Paz waterfall, 26 May 1976, *Croat 35637* (MO). N of San Isidro, Cerro de las Caricias, 2000–2400 m, 11 March 1926, *Standley and Valerio 51952* (F, US). Ditto, *Standley and Valerio 52018* (F, US). 10–15 mi N San Isidro del General, 1000–2000 m, 22 January 1965, *Lems 5179* (F, US). S slope of Volcán Barba, 2000–2400 m, 29 January 1964, *Lems 5779* (NY). SW slopes of Volcán Barba near Sacramento, 2000–2100 m, 26 July 1971, *Burger and Burger 7676* (F). Río Ciruelas, S slope of Volcán Barba, 7.5 km N of San José de la Montaña, 30 March 1973, *Stolze 1594* (F, MO). Río La Paz Chiquita, between Vara Blanca and Cariblanco, 1340 m, 4 April 1953, *Moore 6637* (NY, US). Río La Paz Grande, ca. 5 mi N of Vara Blanca, 1270–1350 m, 26 May 1976, *Croat 35637* (MO). Cerro Zurquí (NE of Concepción) at the border of National Park Braulio Carrillo, 1600 m, 9 March 1991, *Döbbeler 4142* (M, USJ). National Park Braulio Carrillo, Estación Barva, 2600 m, 15 April 1990, *Fernández 24* (F, MO). Ditto, 2300 m, 24 June 1990, *Varela 98* (MO). National Park Braulio Carrillo, 3 km from Zurquí tunnel, road to Guápiles, 1200 m, 10 February 1993, *Morales et al. 1064* (MO, NY). National Park Braulio Carrillo, Volcán Barva, 2800 m, 6 October 1989, *Rivera 76* (MO). 35 km NE of Alajuela, 2500 m, 18 August 1967, *Taylor 4530* (NY). National Park Braulio Carrillo, La Montura, 25–30 July 1982, *Todzia et al. 1999* (NY). San José: Pacific slope of Chirripó massif, Abra, 2500 m, 2 April 1969, *Davidse and Pohl 1527* (F, MO). Cantón Pérez Zeledón, Interamerican highway km 110, 9° 29' 40" N, 83° 42' 00" W, 2300 m, 9 July 1992, *B. and I. Hammel 18572* (MO). Above Empalme, 2000 m, 18 January 1965, *Jiménez 2769* (CR, F). Volcanus Irazu in declivitate austro-occidentali, circa Guayabillos, 2250 m, 29 May 1930, *Cufodontis 395* (W). Finca Guayabillos, 2250–2275 m, 7 July 1936, *Dodge and Goerger s.n.* (F, MO, NY, US). Río Cascajal, 1900 m, 1 January 1977, *Lent 4027* (F). NE of El Copey, Laguna la Escuadra, 2000–2200 m, 16 December 1925, *Standley 41942* (F, US). Cerro del Roble, Forêts du Copey, 2700–2900 m, IV.1898, *Tonduz 11804* (W). Bords du rio de la Via Mala an Copey, 1800 m, IV.1898, *Tonduz 12264* (W). El Copey, 2300 m, 20 April 1928, *Stork 1580* (F). 0.5 mi SE Santa María, 8 August 1932, ca. 1700 m, *Stork 3137* (F). Cantón Pérez Zeledón, P.I. La Amistad, Cordillera de Talamanca, Finca San Carlos, 2640 m, 9 April 1995, *Aguilar and Garrote 4028* (K, MO). National Park Braulio Carrillo, between La Montura and Los Chorritos, 1200 m, 28 January 1984, *L.D. Gómez et al. 20913* (WIS). Cartago: Cartago, Santa Cruz, southern slopes of Volcan Turrialba, 1500 m, 9 August 1947, *DeWolf 484* (K). Tapantí, I.C.E. station, 21 June 1971, *Gentry 980* (F, MO). Near Tapantí, 11.6–20 km E of church in Orosi, 1500–1700 m, 29 December 1973, *Almeda et al. 2181* (F). 25 km S of Cartago, Cordillera de Talamanca, near La Sierra, 2000 m, 23 January 1965, *Williams et*

5179?

al. 28031 (F). 15 km S of Tapantí along road above Río Grande de Orosi, 1500 m, 13 March 1973, *Burger and Gentry* 8502 (F). Ditto, 12–17 December 1969, *Burger and Liesner* 6784 (F, NY). Ditto, 1400–1600 m, 10–24 June 1968, *Burger and Stolze* 5722 (BM, F, MO, NY, US). 10 km S of Tapanti, 1600 m, 14–17 July 1971, *Burger and Burger* 7607 (F, MO, NY). S of Orosi, Tapantí I.C.E. project, 1400–1600 m, 14 April 1975, *Utley and Utley* 2098 (F). Valley of Río Grande de Orosi, Tapantí to 7 km S, c. 20 km SW of Cartago, 1545 m, 23 December 1970, *Tryon and Tryon* 7126 (F). 3.5 km SE of Tapantí, hillside overlooking Río Grande de Orosi, 1350 m, 16 April 1967, *Lent* 761 (F). Río Grande de Orosí, 1500–1700 m, 23 June 1976, *Croat* 36090 (MO). National Park Tapantí, Oropéndola path, 1100 m, 2 June 1995, *Nilsson et al.* 653 (CR, F). Reserva de Tapantí, 1300–1800 m, November 1982, *Gómez* 18786 (CR, MO, US). Road Ipís to Tierra Blanca, near Río Tiribí bridge, 1600–1700 m, 4 July 1970, *Lellinger and White* 932 (MO, US). National Park Tapantí, Paraiso, Valle del Reventazón, confluence of Río Villegas and Grande de Orosí, 1500 m, 18 March 1994, *Lépiz et al.* 218 (NY, US). Limón: Cantón de Talamanca, Bratsi, headwaters of Río Dapari, 1700 m, 13 March 1992, *Herrera* 5335 (CR, MO). Not to localize: Cerro del Ingles, 24 December 1931, *Kupper* 180 (M). PANAMÁ. Chiriquí: Cerro Colorado, 50 km N of San Feliz on continental divide, 1200–1500 m, 17 August 1975, *Mori and Dressler* 7783 (MO, US). 4 km NE of Boquete, SE slopes of Cerro Pate Macho, 1700–2100 m, 26 May 1981, *Sytsma et al.* 4832 (MEXU, MO, NY, US). S slopes of Cerro Pate Macho along Río Palo Alto, 8° 47' N, 82° 22' W, 1300–1800 m, 11 November 1981, *Knapp et al.* 2064 (MO).

The typical subspecies of *Solenophora calycosa* is an extremely well-collected taxon. It is a shrub of the cloud forests, growing in quebradas or in ravines along rivulets at 800–2900 m. In spite of the abundance of specimens available, it is a very homogeneous taxon, with the only exception of a slight variability in leaf colour. There are a few specimens from the extreme north and the extreme south of its range (Costa Rica—Puntarenas: *Gamboa et al.* 1633; Panamá—Chiriquí: *Sytsma et al.* 4832) with relatively poorly developed indument approaching *S. calycosa* subsp. *australis*.

12.2. *Solenophora calycosa* Donn.Sm. subsp. *australis* (Morton) Weigend & Förthner, *stat. nov.*
 Basionym: *Solenophora australis* Morton, Ann. Missouri Bot. Gard. 26(4): 311. 1939.
 TYPE: PANAMÁ. Chiriquí: Vicinity of Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m, 28 June–2 July 1938, *Woodson, Allen and Seibert* 847 (Holotype: US, sheet no. 1746987). Fig. 14; additional illustrations: Ann. Missouri Bot. Gard. 65(3): 988, fig. 34. 1978.

Lignescent herb 2–5 m tall, internodes ca. 40–80 (–110 mm long), stems glabrous or (rarely) youngest parts covered with uniseriate trichomes of 5–10 cells and ca. 1 mm long, later glabrescent. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 80–130 mm long, lamina ovate, slightly asymmetrical, 250–350 (–400) mm long, 160–230 mm wide, base oblique (one side 4–18 mm longer), cuneate, apex shortly acuminate, margin biserrate to lobulate, lobules 3 × 7 mm, serrate, not or strongly blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 4–6 cells and ca. 0.5 mm long primarily between the veins, abaxial surface sparsely covered with uniseriate trichomes of 4–6 cells and ca. 0.5 mm long on veins. Inflorescences with 1–5 flowers, peduncle 60–70 mm, pedicels 25–35 mm long, bracts linear, up to 12 × 1 mm; calyx 25–30 mm long, tube cylindrical from turbinate base, constriction between distal and proximal part of calyx absent, completely glabrous or ± densely covered with uniseriate trichomes of 1–3 cells and <0.5 mm long especially in distal part, with distinctive, triangular calyx lobes up to 12 mm long and 7 mm wide (basally), lobe margin with gland-teeth, calyx usually blushed with red; corolla with tube ca. 65–75 mm long, densely covered with long, uniseriate trichomes of up to 8–15 cells and ca. 1.5 mm long on the outside, slightly dilate distally, limb with sub-circular lobes ca. 10–12 × 18–20 mm, lobe margin entire, corolla deeply orange without, limb yellow with dark red patterns; stamens and stigma included. Entire fruit (including calyx) 28–35 mm long, 10–13 mm wide.

Distribution: endemic to western Panama (Chiriquí and Bocas del Toro); cloud forest, e.g. with *Weinmannia* and *Podocarpus*, along streams at 1400–3000 m.

Additional specimens examined: PANAMÁ. Chiriquí: Trail from Cerro Punta to Río

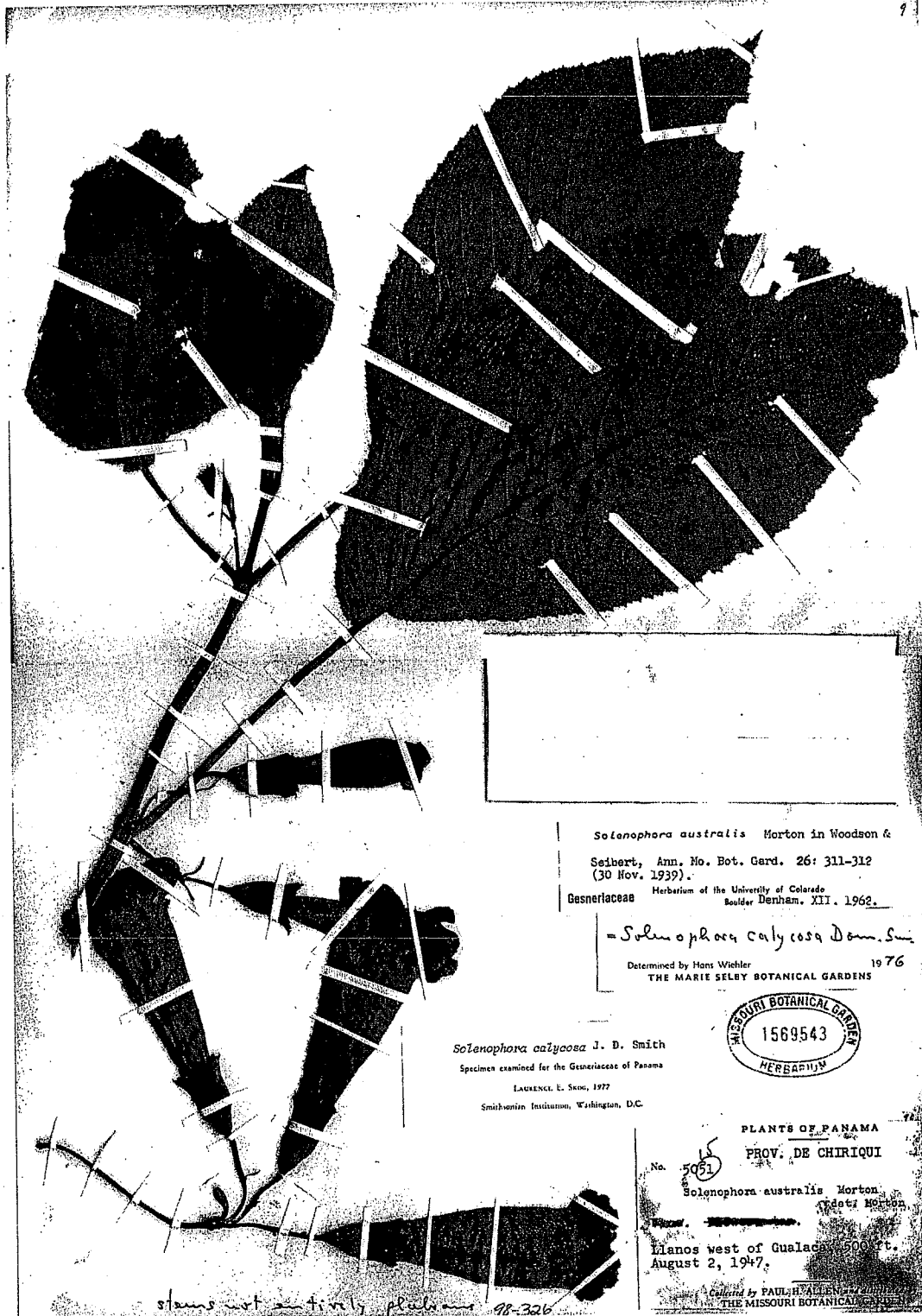


FIGURE 14. *Solenophora calycosa* subsp. *australis* (Allen 5015).

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Caldera, 2250–2500 m, 14 January 1939, *Allen 1450* (F, MO, NY, US). Bajo Chorro Trail to Cerro Punta, 1800–1900 m, 1 June 1972, *Luteyn and Utley 17294* (MO). 1.5 miles W of Cerro Punta, near Río Chiriquí Viejo, 1700 m, 19 January 1968, *McDaniel 10116* (NY). Between Bambito and Cerro Punta, 30 May 1970, *Croat 10556* (F, MO, NY). Between Cerro Respinga and Cerro Punta, 8 August 1972, *W.G. and J.J. D'Arcy 6579* (BSB, MO). 7 km NW of Cerro Punta, Las Nubes Region, 2400 m, 11 February 1978, *Hammel 1462* (BSB, MO). W slopes of Cerro Horqueta, Bajo Mono to Robalo trail, ca. 2000 m, 27 July 1947, *Allen 4784* (MO, US). Cerro Horqueta, 2200 m, 5 May 1940, *von Hagen and von Hagen 2079* (NY). Ditto, 1500 m, 1 July 1968, *Dwyer 8754* (F, MO). Ditto, 1600–2300 m, 8 August 1967, *Kirkbride 151* (F, MO, NY). Above Palo Alto, Cerro Pate Macho, 1700–2100 m, 24 April 1982, *Knapp and Schmalzel 4775* (M, US). Near Boquete, Cerro Pate de Macho, 1900–2000 m, 19 June 1987, *Croat 66461* (MO, US). Distr. Boquete, Bajo Chorro, 2000 m, 5 January 1938, *Davidson 39* (F, MO, US). Las Nubes, near Río Chiriquí Viejo, W of Cerro Punta, 2200 m, 27 February 1973, *Croat 22402* (F, MO). W of Las Nubes, 5 km NW of Cerro Punta towards Cerro Picacho, 2000–2100 m, 6 January 1975, *Wilbur and Luteyn 19359* (MO). Ditto, 19 July 1975, *Mori and Bolten 7253* (MO, US). 7 km NW Cerro Punta, 2200 m, 11 February 1978, *Hammel 1462* (MO, US). Chiriquí Viejo valley near El Volcán, 12 August 1938, *White 229* (MO, US). Ditto, *White 230* (MO, US). Near Cerro Punta, 2100 m, 31.5–1 June 1967, *Ridgeway and Solís 2407* (MO). Cerro Punta, 2100 m, 3 July 1966, *Dwyer 2414* (MO). Near Las Nubes, Parque La Amistad, 3.5 miles W of Cerro Punta, 800 m, 28 March 1993, *Croat 74898* (MO, US). 2.5 mi S Cerro Punta, 1650 m, 5 March 1967, *Sawyer s.n.* (MO). Stream behind Audobon Cabin, below Cerro Punta, 6 April 1979, *Hammel et al. 6821* (MO). Bajo Chorro, 1900 m, 20–22 July 1940, *Woodson and Schery 611* (MO, US). Alto Pineda, Cerro Punta, 2900 m, 11 April 1979, *Hammel 7001* (MO). Bajo Chorro, near Río Caldera, 1900 m, 24 March 1977, *Skog and D'Arcy 4094A* (MO, US). Potrero Muleto, Volcán de Chiriquí, 3500–4000 m, 13–15 July 1940, *Woodson and Schery 459* (MO, US). Boquete, 1400 m, 1933, *Davidson 9* (F). Distrito Bugaba, Santa Clara, 8°50'N,

82°44'W, 28 February 1985, *van der Werff and Herrera 7182* (MEXU). Cerro Punta, 8°52'N, 82°33'W, 2200 m, 23 January 1985, *van der Werff and Herrera 6238* (MEXU). Volcán de Chiriquí, Boquete, 3200 m, 16 July 1938, *Davidson 989* (F, MO). Sierra Chiriquí, ca. 1400 m, Feb. 1938, *Maurice 859* (F, MO, US). Quebrada El Velo near Finca Lerida, 6 km NW of Boquete, 1700 m, 17 March 1974, *Nee 10620* (MO, US). Quebrada Velo, 1800 m, 8 July 1940, *Woodson and Schery 255* (MO, US). Above Guadeloupe, 2400 m, 25 December 1977, *Folsom et al. 7130* (MEXU, MO, US). Above Guadeloupe, 8°52' N, 82°33' W, 2100 m, 23 July 1989, *de Nevers and Charnley 6064* (MEXU). Path above Cerro Punta to Boquete, 2500 m, 16 March 1983, *Hamilton and Stockwell 3325* (MO, US). Alot Quile to Boquete, 4 km from Finca La Fortuna, ca. 2000 m, 15 August 1977, *Béliz 239* (MO). 8 km W of Cerro Punta near Las Nubes, ca. 2100 m, 11.2.1978, *Almeda and Nakai 3534* (MO). Bambito, 1 mi SW Cerro Punta, 1700 m, 26 June 1969, *Tyson 5643* (MO). Ditto, *Tyson 5648* (MO). Above Cerro Punta along trail to Alta Respinga, 2500–2800 m, 16 March 1977, *Skog et al. 4011* (MO, US). Between Guadeloupe and Paseo de Respinga, 2700 m, 2 April 1979, *D'Arcy et al. 12850* (MO, US). Guadalupe, above Cerro Punta, 1800–2100 m, 22 October 1977, *Folsom 6027* (MEXU, MO, US). Trail through Paseo de Respinga to Boquete, 2500 m, 14 January 1971, *Wilbur et al. 13151* (MO). Between Baru and Respinga, 3000 m, 27 November 1975, *D'Arcy 10127* (MO, US). Lower N. slope of Baru, E of Bajo Chorro region, 2000–2200 m, 7 May 1978, *Hammel 2956* (MO). Near Bajo Chorro, 24 March 1977, *D'Arcy 11100* (MO, US). Near Monte Azul, 1.4 miles N of Entre Ríos on E slope of Cerro Punta, 3 miles from town of Cerro Punta, 2250 m, 25 November 1979, *Croat 48629* (MO). Monte Azul, 1.4 miles N of Entre Ríos on E slope of Cerro Punta, 3 miles by road from Cerro Punta town, 2250 m, 22 November 1979, *Antonio 2717* (MO, US). Llanos W of Gualaca, ca. 2000 m, 2 August 1947, *Allen 5015* (MO, US). Bocas del Toro: Cordillera de Talamanca, 2–5 km NW of Cerro Ehandi, 2600–2850 m, 1–9 March 1984, *Davidse et al. 25116* (MO). Ditto, *Davidse et al. 25117* (MO, US).

The holotype was explicitly designated by Morton (1939), but there is a sheet from the

same locality at the herbarium MO with a different number: *Woodson, Allen and Seibert 846*, this is therefore not a formal isotype.

Solenophora calycosa subsp. *australis* basically differs only in the absence of the dense indument from the typical subspecies, which is why it is here reduced to subspecific rank. There is some degree of morphological overlap where the ranges of the two subspecies touch, but otherwise the differences in indument are very consistent. There are some specimens (*Wilbur and Luteyn 19359, Davidson 39; Croat 22402*) in which the abaxial surface of the leaves is very slightly blushed with purple, but nowhere as strongly as in subsp. *purpurascens*, which also differs in indument characters.

12.3. *Solenophora calycosa* Donn.Sm. subsp. *purpurascens* Weigend & Förther, *subspec. nov.* TYPE: COSTA RICA. San José: 2 km NE Cascajal, Quebrada Bajo Máquina, 1700 m, 29 August 1971, *Lent 2074* (Holotype: BM!; Isotype: F!). Figs. 1D, 15.

Differt ab Solenophora calycosa subsp. calycosa foliis subtus calycibusque distincte rubropurpurascens, indumento in caule calyceque laxo, pilis in caule foliisque cellulis 3-6 compositis, minus quam 0.5 mm longis, bracteis angustioribus (12 x 1 mm).

Lignescent herb 2-4 m tall, internodes ca. 40-80 (-110 mm long), stems glabrous or slightly pubescent on youngest parts (with uniseriate trichome of 4-5 cells and ca. 0.1 mm long). Leaves of a pair slightly unequal (one up to 1.5 x as large as the other), petioles 80-130 mm long, lamina ovate, slightly asymmetrical, 250-350 (-400) mm long, 160-230 mm wide, base oblique (one side 4-18 mm longer), cuneate, apex shortly acuminate, margin biserrate to lobulate, lobules 3 x 7 mm, serrate, abaxial surface bright purple, adaxial surface covered with uniseriate trichomes of 4-6 cells and ca. 0.5 mm long primarily between the veins, abaxial surface sparsely covered with uniseriate trichomes of 4-6 cells and ca. 0.5 mm long on veins. Inflorescences with 1-3 (-4) flowers, peduncle 25-30 mm, pedicels ca. 25 mm long, bracts linear, up to 12 x 1 mm; calyx 30-40 mm long, tube cylindrical from turbinate base, constriction between distal and proximal part of calyx indistinct, covered with scattered uniseriate trichomes of 3-5 cells and ca. 1 mm long, with distinctive, triangular calyx lobes up to 12 mm long and 7 mm wide (basally), lobe margin with gland-teeth, calyx blushed with

purple; corolla with tube ca. 65-75 mm long, covered with long, uniseriate trichomes of up to 8-15 cells and ca. 2 mm long on the outside, slightly dilate distally, limb with subcircular lobes ca. 10-12 x 18-20 mm, lobe margin entire, corolla deeply orange without, limb yellow with dark red patterns; stamens and stigma included. Fruit unknown.

Distribution: endemic to Costa Rica (San José); cloud forests, growing in quebradas or along rivulets at 1400-1700 m.

Additional specimens examined: COSTA RICA. San José: Pastures along Río Cascajal, 1600 m, 5 November 1978, *Antonio and Lent 780* (F). 7 and 12 km S of bridge over the Río Grande de Orosi at Tapanti, 1400-1600 m, 5 December 1975, *Baker and Utley 193* (F). Paraíso, Orosí, Tapantí, Quebrada Carne, 1200 m, 22 December 1992, *Herrera 5822* (CR, K). Tapantí Reserve, 1400-1700 m, 7 December 1982, *Gómez 19254* (CR, MO).

We decided to describe this new subspecies after considerable hesitation, since it seems to be sympatric with the typical subspecies of *Solenophora calycosa*. However, there are quite a few collections of this form and we know from the other species of *Solenophora* that leaf colour is usually a good character. Subspecies *purpurascens* also differs from subsp. *calycosa* in a very weakly developed indument. It would be clearly desirable to study this taxon closely in the wild and compare it with the sympatric subsp. *calycosa*. On the basis of the available data it seems perfectly justified to recognize the taxon at infraspecific rank.

13. *Solenophora toucana* D. L. Denham & D. N. Gibson, *Phytologia* 23(4): 341. 1972. TYPE: EL SALVADOR. Chalatenango: Banks of Río Sumpul at boundary between El Salvador and Honduras, 2250 m, 29 March 1942, *Tucker 1172* (Holotype: UC; Isotypes: K!, F! NY!, PH, US). Figs. 1B, 16; additional illustrations: *Fieldiana Bot.* 24/10(2-3): 311, fig. 66. 1975.

Lignescent herb 2-4 m tall, internodes ca. 20-45 (-100 mm long), stems pubescent from uniseriate trichomes of 5-10 cells and ca. 1 mm long, later glabrescent. Leaves of a pair slightly unequal (one up to 1.5 x as large as the other), petioles 50-60 (-70) mm long, lamina ovate, slightly asymmetrical, 110-250 mm long, 60-130 mm wide, base oblique (one side 4-10 mm longer), cuneate, apex shortly acuminate, margin lobulate, lobules 3 x 7 mm, densely ser-

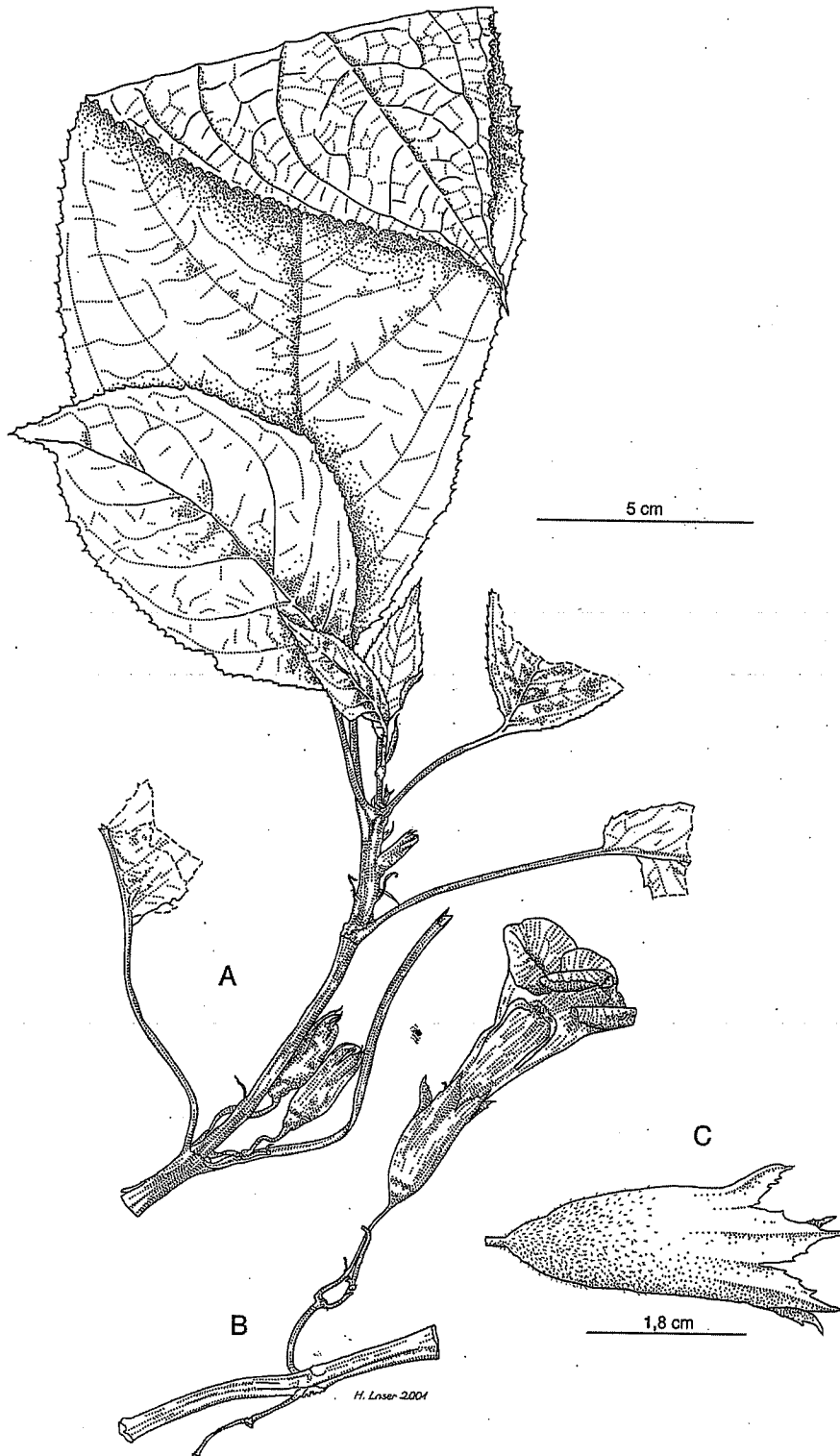
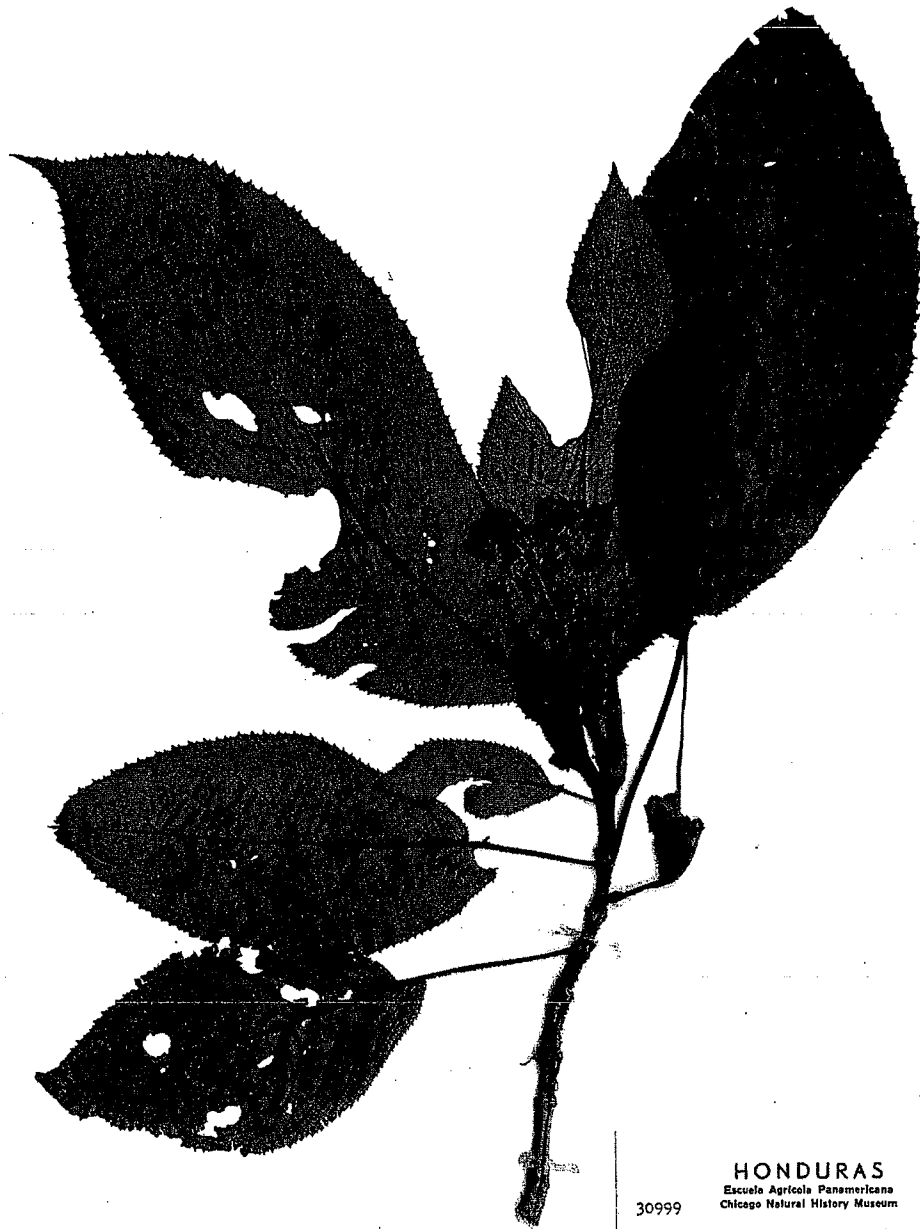


FIGURE 15. *Solenophora calycosa* subsp. *purpurascens*: A, B, habit; C, calyx (Lent 2074).



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Solenophora toucana Denham

Fls. orange, weak tree 5 m. common in
wet & dense cloud forest of cordillera
Morandón, vicinity El Portillo, Dept.
Ocotepeque, alt. 2000 m., Sept. 2,
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FIGURE 16. *Solenophora toucana* (Molina and Molina 30999).

rate, not or slightly blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 5–7 cells and ca. 1 mm long primarily between the veins, abaxial surface covered with uniseriate trichomes of 5–10 cells and ca. 1 mm long primarily on veins. Inflorescences with 1–5 flowers, peduncle 0–15 mm, pedicels 10–20 mm long, bracts ca. 4–5 × 2 mm; calyx 20–25 mm long, tube cylindrical from turbinate or rounded base, constriction between distal and proximal part of calyx poorly differentiated, very densely covered with uniseriate trichomes of up to 8–15 cells and ca. 1.5 mm long, truncate or with with indistinctive, rounded lobes ca. 1 mm long, sometimes with oblique incision adaxially (to 5 mm deep), lobe margin with gland-teeth, calyx not or weakly blushed with red; corolla with tube ca. 55–65 mm long, densely covered with long, uniseriate trichomes of up to 8–15 cells and ca. 1.5 mm long on the outside, slightly dilate distally, limb with subcircular to truncate lobes ca. 10–12 × 15–17 mm, lobe margin finely denticulate, corolla deeply orange without, limb yellow with dark red patterns; stamens and stigma included. Fruit including calyx 20–28 mm long, inferior part 10–13 mm in diameter.

Distribution: El Salvador and Honduras; evergreen broad-leaved montane forest with *Quercus* and *Podocarpus*, barrancos in dense and wet cloud forest at 1800–2400 m.

Additional specimens examined: EL SALVADOR. Santa Ana: Cerro Monte Cristo, 14 miles NE of Metapán, 2100–2400 m, 31 July 1977, *Croat 42432* (MO). Bosque Nebuloso de Montecristo, 2300 m, 20 August 1989, *Reyna 1457* (B, F, MO, US). HONDURAS. Santa Barbara: 10 km W of Lago Yojoa, Cerro Santa Barbara, 2200–2350 m, 28–30 April 1973, *Clewell and Hazlett 3889* (MO, US). Ocatepeque: El Portillo on Cordillera Merendón, 20 km from Nueva Ocatepeque, 1800 m, 28 August 1968, *Molina 22359* (F, NY). Ditto, 2000 m, 2 September 1975, *Molina and Molina 30999* (F, MO). 18 km E of Nueva Ocatepeque, 1800 m, 15 July 1971, *Harmon and Fuentes 6488* (NY). Between Nueva Ocatepeque and Santa Rosa de Copán, 19 August 1970, *Harmon and Dywer 4108* (MO, US). Ditto, 19 August 1970, *Harmon and Fuentes 4108* (MO, NY). Cordillera Merendón, 2000 m, 10 September 1973, *Hazlett 821* (MO). La Paz: Montaña Verde, Las Marías, Cordillera Guajiquiro, 2100 m, 23 May 1964, *Molina and Molina 14072* (F,

NY, US, W). Comayagua: Cordillera de Montecillos, Montaña de San Juanillo, trail between La Danta and Cerro San Juanillo, 14°29'N, 87°53'W, 1900–2000 m, 10 May 1991, *Davidse 34279* (MO).

Solenophora toucana is closely related to *S. calycosa*, but differs in the subtruncate calyx and the generally much smaller flower. It is fairly widespread, but morphologically very homogeneous.

14. *Solenophora pirana* C.V. Morton, *Phytologia* 1(4): 149. 1935. TYPE: GUATEMALA. Chimalteango: Chichavac, along a stream in deep ravine at 2550 m, 11 November 1933, *Skutch 680* (Holotype: US!; Isotype: US!). Fig. 17.

Lignescent herb 1.5–2 m tall, internodes ca. 20–45 mm long, stems densely pubescent from uniseriate trichomes of 8–12 cells and ca. 1 mm long but glabrous around the nodes. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles 60–90 mm long, lamina ovate, slightly asymmetrical, 160–300 mm long, 100–200 mm wide, base oblique (one side up to 18 mm longer), cuneate, apex shortly acuminate, margin regularly lobulate, lobules serrate, not blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 5–10 cells and ca. 0.5 mm long only between the veins, abaxial surface with uniseriate trichomes of 3–5 cells ca. 0.5 mm long. Inflorescences with 3–5 flowers, peduncle 50–110 mm, pedicels 20–40 mm long, bracts ovate, large, up to 20 × 8 mm; calyx 17–22 mm long, cylindrical to funnel-shaped from rounded to turbinate base, constriction between distal and proximal part of calyx inconspicuous, densely pubescent from uniseriate trichomes of 8–15 cells and ca. 1 mm long, lobes distinctive, regular, triangular-ovate, 3–5 mm long, lobe margin set with gland-teeth, calyx green and blushed with red; corolla with tube ca. 45 mm long, covered with numerous uniseriate trichomes of 10–15 cells ca. 1–1.5 mm long, dilate distally, limb with subcircular to truncate lobes ca. 7 × 15 mm, lobe margin denticulate, glabrous to slightly pubescent from uniseriate trichomes, corolla yellow. Stamens and style not exerted. Entire fruit (incl. calyx) 22–26 mm long, inferior part 10–13 mm in diameter.

Distribution: Mexico and Guatemala; montane rain forest with *Quercus*, *Pinus*, *Photinia*, *Symplocos*, *Turpinia*, *Billia*, *Styrax*, *Matudaea*, *Saurauia*, *Abies*, *Cornus*, *Drimys*, *Clethra*, mostly in wet ravines at 2000–3900 m.

Solenophora



FIGURE 17. *Solenophora pirana* (Skutch 346).

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Additional specimens examined: MEXICO. Chiapas: Volcán Tacana, Chiquihuite, 2800 m, 27 March 1939, *Matuda* 2832 (F, NY). Ditto, 27 March 1939, *Matuda* S-227 (K, NY). Municipio Siltepec, ridge above Siltepec on the road to Huixtla, 2000–2400 m, 18 January 1973, *Breedlove and Smith* 31868 (MEXU, MO). Cerro Mozotal, western slope, along Huixtla/El Porvenir/Siltepec road, 3000 m, September 1076, *Breedlove* 40433 (MO). Municipio Union Juárez, SE side of Tacaná volcano above Talquián, 2700 m, 12 November 1972, *Breedlove* 29453 (MEXU, MO). GUATEMALA. Quetzaltenango: W slope of Volcán Zunil, Fuentes Georginas, 2850 m, 4 March 1939, *Standley* 67352 (F). Ditto, 2850 m, 4 March 1939, *Standley* 67491 (F, US). Ditto, 2300–2500 m, 3 February 1941, *Standley* 85936 (F). San Marcos: Upper slopes of Volcán Tajumulco, between Las Canoas and top of ridge, 7 miles from San Sebastián, 3300–3900 m, 16 February 1940, *Steyermark* 35819 (F, US). Along Quebrada Canjulá, between Sibinal and Canjulá, Volcán Tacaná, 2200–2500 m, 28 February 1940, *Steyermark* 36066 (F). El Quiché: El Boquerón, 2700 m, 15 August 1964, *Proctor* 25528 (MEXU, MO, US). Chimaltenango: Santa Elena, 2400–2700 m, 2 June 1933, *Skutch* 346 (US).

Solenophora pirana cannot be confused with any other species of *Solenophora*. It has very long peduncles and very large flowers, a combination not found in any other species. Over its entire range it is sympatric with other species of *Solenophora*, but no intermediates have been found so far.

15. *Solenophora insignis* (M. Martens & Galeotti) Hanst., *Linnaea* 34: 314. 1865–66.

Basionym: *Besleria insignis* M. Martens & Galeotti, *Bull. Acad. Roy. Sci. Bruxelles* 9(7): 37. 1842. = *Arctocalyx insignis* (M. Martens & Galeotti) Fenzl, *Allg. Gartenzeitung* 16: 308. 1848 = *Hippodamia insignis* (M. Martens & Galeotti) Decne., *Rev. Hort.* 20: 464. 1848. TYPE: [MEXICO. Oaxaca:] Cord. Oriental de Oaxaca, near Villa Alta, 4000 ft., *Galeotti* 1910 (Holotype: BR; Isotypes: B, BR, K, P, W!).

Synonym: *Solenophora endlicheriana* (Heller ex Fenzl) Hanst., *Linnaea* 34: 314. 1865.

Basionym: *Arctocalyx endlicherianus* Fenzl, *Allg. Gartenzeitung* 16: 305–308. 1848. TYPE: MEXICO, prope Mirador in

sylvis regionis calidae, Heller s.n. (Holotype: W!; Isotype: W! [one leaf only]). *Solenophora guttata* Decne. ex Benth. & Hook.f., *Gen. pl.* 2: 1005. 1876, *nomen nudum*. Fig. 1A, 18; additional illustrations: *Flore des Serres* ser. 1, 6: 23, tab. 546. 1850–1851; *Pact. Fl. Gard.* 1: 95. 1850–1851; *Linnaea* 26: tab. 1, fig. 35. 1853–55.

Lignescient herb 1.5–2 m tall, internodes ca. 20–45 mm long, stems densely pubescent from uniseriate trichomes of 8–12 cells and ca. 1 mm long but glabrous around the nodes. Leaves of a pair slightly unequal (one up to 1.5 × as large as the other), petioles (35–) 60–90 mm long, lamina ovate, slightly asymmetrical, 160–270 (–350) mm long, 100–160 mm wide, base oblique (one side up to 11 mm longer), cuneate, apex shortly acuminate, margin regularly lobulate, lobules serrate, not or very poorly blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 5–10 cells and ca. 0.5 mm long only between the veins, abaxial surface with very few uniseriate trichomes of 3–5 cells ca. 0.5 mm long. Inflorescences with 1–5 flowers, peduncle 5–10 (–15) mm, pedicels (10–) 15–25 mm long, bracts narrowly ovate, up to 8 × 2 mm; calyx 10–15 mm long, cylindrical from rounded to turbinate base, constriction between distal and proximal part of calyx inconspicuous, densely pubescent from uniseriate trichomes of 8–15 cells and ca. 1 mm long, distally subtruncate, lobes indistinctive, recurved, lobe margin set with gland-teeth; corolla with tube ca. 55–65 (–75) mm long, covered with numerous uniseriate trichomes of 5–10 cells ca. 1 mm long, dilate distally, limb with subcircular to truncate lobes ca. 8 × 15 mm, lobe margin typically fimbriate (ciliae 1–4 mm long) and set with short, stalked, gland-tipped trichomes and few uniseriate trichomes, very rarely subentire and without stalked glands, corolla tube orange, limb yellow to orange with dark markings. Stamens and style not exerted. Fruit including calyx 16–25 mm long, 9–13 mm wide.

Distribution: endemic to Mexico; montane mesophilic forest with *Quercus*, *Carpinus*, *Pinus*, *Weinmannia*, *Podocarpus*, *Persea*, *Ardisia*, *Phyllonoma*, *Dendropanax*, along rivulets at 1200–2600 m.

Additional specimens examined: MEXICO. Guerrero: 6 km from Puerto del Gallo on Puerto de la Piedra Acanalada road, 14 km

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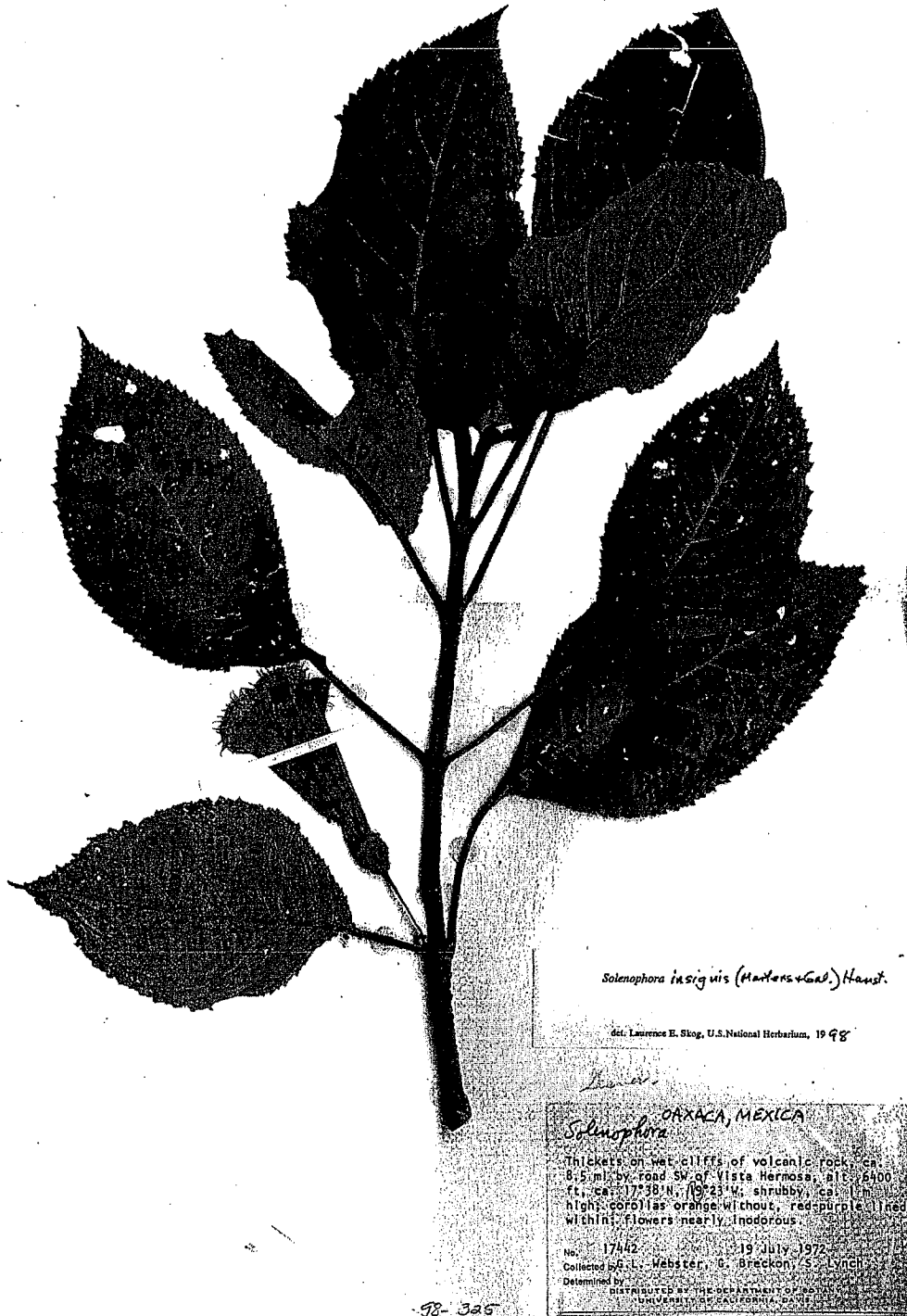


FIGURE 18. *Solenophora insignis* (Webster et al. 17442).

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Cházaro et al. 5428 (WIS). Municipio Xico, Texolo 3 km SW of Xico, 22 May 1971, *Dorantes 96* (MEXU). 3 km NW of Xico on trail to Perote, 1700 m, 5 February 1984, *Solheim and Reisfield 1480* (MEXU). Bridge Acobayola, between Xico and Xico Viejo, 1600 m, 24 March 1983, *Narave et al. 227* (MEXU, XAL).

Formal typification of the species is not undertaken here as there are various specimens collected by Heller in the Vienna herbarium (W), some with and some without a number (Barranca de Agua Santa, anno 1846, *C. Heller 212*). However, since all specimens belong to the same species, this does not cause any problems. *Solenophora insignis* can be very readily defined on the basis of its very short and often (sub-) truncate calyx tube in combination with a very long corolla that usually has a lacinate limb. After segregation of some specimens traditionally referred to this taxon into a new species (*S. glomerata*, q.v.) there remains only one problem. The northernmost specimens of *S. insignis* (and indeed of any *Solenophora*) from the State of Guerrero have an entire limb (not lacinate) and a distinctly longer calyx (ca. 16 mm). Denham used the nomen nudum "*S. occidentalis* Denham" on the label of one of the specimens (*Hinton et al. 14747*), but never published this name to the best of our knowledge. We prefer to leave these specimens in *S. insignis*, since we argue elsewhere that both the size of the calyx and the margin of the corolla limb are somewhat unreliable (compare, e.g., *Solenophora purpusii*). A lot more material and critical field studies will be required before the recognition of that form as a separate taxonomic entity at any level can be sensibly discussed.

16. *Solenophora glomerata* Weigend & Förthner, *spec. nov.* TYPE: MEXICO. Chiapas: Municipio Jaltenango, El Triunfo Reserve, Campamento to Deslave, 15° 39' N, 92° 48' W, 1850 m, 13 June 1990, *Heath and Long 982* (Holotype: MEXU). Fig. 19.

Differt ab Solenophora toucana inflorescentiis dense glomeratis 4-12-floribus, pedunculo pedicellisque brevibus 5-10 mm longis, bracteis conspicuis, ca. 20 × 10 mm margine ciliatis nervatura distincta, calyce conico-campanulato dentibus triangulari-ovatis, 3-5 mm longis.

Lignescens herb 1.5–4 m tall, internodes ca. 30–45 (–65) mm long, stems pubescent from uniseriate trichomes of 8–12 cells and ca. 1 mm long but glabrous around the nodes. Leaves of

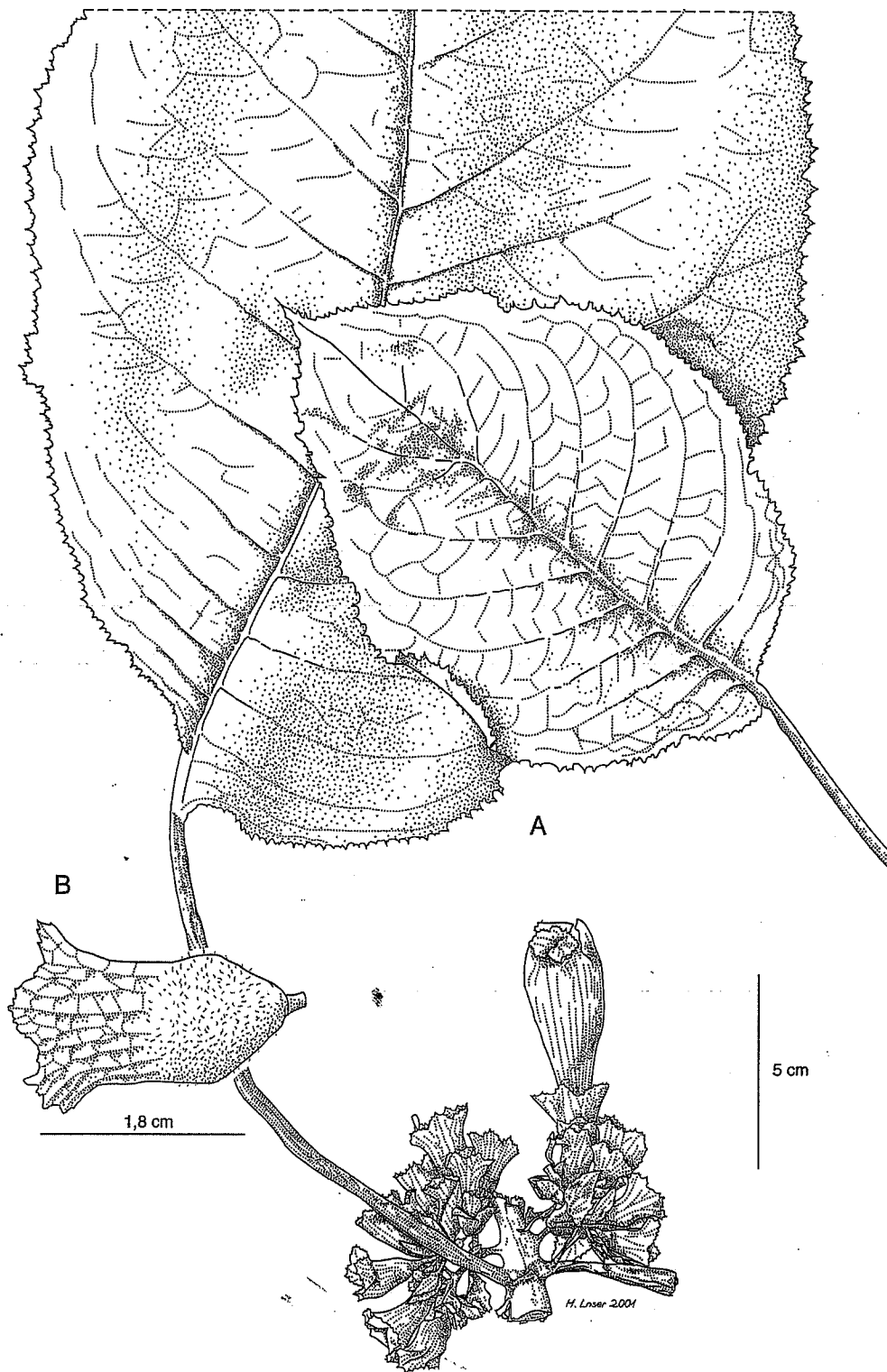


FIGURE 19. *Solenophora glomerata*: A, habit; B, calyx (Heath and Long 982).

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a pair slightly unequal (one up to 1.5 × as large as the other), petioles 60–120 (–200) mm long, lamina ovate, slightly asymmetrical, 160–360 mm long, 100–210 mm wide, base oblique (one side up to 11 mm longer), rounded to subcordate, apex shortly acuminate, margin regularly lobulate, lobules serrate, not blushed with red abaxially, adaxial surface covered with uniseriate trichomes of 3–6 cells and ca. 0.5 mm long only between the veins, abaxial surface with very few uniseriate trichomes of 8–12 cells and ca. 1 mm long. Inflorescences with (3–) 4–12 flowers, peduncle short, stout, 5–10 mm long, pedicels 5–10 (–13) mm long, bracts very conspicuous, marginally ciliate, ca. 20 × 10 mm, strongly veined; calyx 20–25 mm long, campanulate from conical base, constriction between distal and proximal part of calyx inconspicuous, very sparsely to densely pubescent from uniseriate trichomes of 5–8 cells and ca. 1 mm long, lobes distinct, regular, triangular-ovate, 3–5 mm long, lobe margin set with gland-teeth, lobes with very distinct veins, calyx green and ± blushed with red, especially along the veins and in distal half, corolla with tube ca. 55–60 (–75) mm long, covered with numerous uniseriate trichomes of 5–10 cells ca. 1 (–2.5) mm long, dilate distally, limb with subcircular to truncate lobes ca. 8–12 × 15 mm, lobe margin erose (ciliae <1 mm long) and set with short, stalked, gland-tipped trichomes and few uniseriate trichomes, very rarely subentire and without stalked glands, corolla tube orange, limb yellow or orange with dark mark-

ings. Stamens and style not exerted. Entire fruit (incl. calyx) 18–20 mm long and 10–12 mm wide.

Distribution: endemic to Mexico (Chiapas); mesophilic montane forest along ravines at 1800–2000 m.

Additional specimens examined: MEXICO. Chiapas: Municipio Siltepec, Cascada, 6 August 1937, *Matuda 1677* (MEXU). Municipio Jaltenango, El Triunfo Reserve, trail NNW of El Triunfo Camp to Palo Gordo Camp, 15° 39' N, 92° 50' W, 2000 m, 21 February 1990, *Hampshire et al. 508* (BM, MEXU). NW of the El Triunfo Reserve, path to Tres Picos, 1800 m, 12 May 1982, *Calzada et al. 8821* (MEXU). El Triunfo Reserve, 1900 m, 1 June 1987, *Martínez et al. 21504* (MEXU). El Triunfo Reserve, path from Finca Prussia to Mapaxtepec, February 1954, *MacDougall 7936* (MEXU). Mount Ovando, 2000 m, 14–18 November 1939, *Matuda 3957* (MEXU, NY). El Triunfo, S of Finca Prusia, 2000 m, February 1954, *MacDougall s.n.* (US).

This new species of *Solenophora* has been traditionally identified as either *S. toucana* (which differs in a longer calyx with very short lobes and a dense, soft indument, and flowers borne single or few on long, thin peduncles and pedicels) or *S. purpusii* (which differs, e.g., in having an oblique, largely glabrous calyx). The combination of characters displayed by the specimens here referred to *S. glomerata* (inflorescence structure, bracts, indument) is utterly distinctive.

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John Boggan - Solenophora typifications

From: John Boggan
To: Laurence Skog
Subject: Solenophora typifications

I ran into some problems with the type citations of two J.D. Smith names, *S. calycosa* and *S. erubescens*, so I looked up the original descriptions and compared them to the type citations in the revision as well as what we already had in the synonymy list:

Solenophora calycosa J.D. Smith:

Originally citation: "Slopes of Volcán Barba, Costa Rica, alt. 2300 m, July 1888, Pittier, no. 283 herb. nat. C.R. - Borders of Rio Mancaron, Volcán Barba, Atlantic side, alt. 2100 m, Feb. 1890, Tonduz, no. 2022 herb. nat. C.R."

This makes Pittier 283 and Tonduz 2022 syntypes. Weigend & Förther cite both collections as comprising the "type"; they do not cite or designate a lectotype.

Our synonymy list originally listed Pittier 283 as "holotype" (CR) and "isotype" (BR) but at best I think these would be lectotype and lectoisotype. Morton (1938, Flora of Costa Rica) cites only Pittier 283 as type. Would this constitute valid lectotypification, or should we cite both collections as syntypes with a comment that lectotypification is still required?

There is also a cryptic note in the synonymy list that Tonduz 7420 (K) is marked as type material. We have 3 sheets of this collection at US, but I see no reason why this would be type material (for one thing, they come from a different locality than either cited in the protologue).

Solenophora erubescens J.D. Smith:

Original citation: "Rocks of a waterfall, Pansamála, alt. 3,800 ft. May 1887, v. Türckheim, (Ex Pl. cit. 731); same locality, Apr. 1889, J.D.S., (Ex Pl. cit. 1,684)"

This makes Türckheim 731 and J.D. Smith 1684 syntypes; Weigend & Förther clearly designate Türckheim 731 (US) as lectotype.

The only confusion here arises because Gibson (1974, Flora of Guatemala) cites the type as Tuerckheim 631, presumably in error. I don't know if there are any sheets of *S. erubescens* labeled as Türckheim 631 (we have no records of such in our specimen database).

From: Dan Nicolson
To: John Boggan, Laurence Skog
Date: 11/26/02 11:41AM
Subject: Re: Another typification problem

Art. 8.3 pertains:

8.3. A specimen may be mounted as more than one preparation, as long as the parts are clearly labelled as being part of that same specimen. Multiple preparations from a single gathering which are not clearly labelled as being part of a single specimen are duplicates, irrespective of whether the source was one plant or more than one.

Ex. 4. The holotype of *Cephaelis acanthacea* Steyerl., *Cuatrecasas 16752* (F), consists of a single specimen mounted on two herbarium sheets, labelled "sheet 1" and "sheet 2". Although the two sheets have separate herbarium numbers, F-1153741 and F-1153742, respectively, the cross-labelling indicates that they constitute a single specimen. A third sheet of *Cuatrecasas 16572*, F-1153740, is not cross-labelled and is therefore a duplicate.

However, as John points out, this involves a possible complexity... ex post facto numbering.... when, exactly did the specimens get numbered? When in doubt, why not assume it occurred at or before publication?

I can comment that it has driven me to distraction (in palms) that people have numbered the sheets but don't add "of how many", an annotation I add "of x"... not just sheet 1, sheet 2 ... but Sheet 1 of 6, Sheet 2 of 6 etc.

My sense of this part of the Code, and its spirit, is that for Morton... these were clearly part of the same specimen and the fact that he annotated one as "sheet II" and put them in a single type folder, is sufficient indication that these can be interpreted "as a single specimen mounted on two herbarium sheets ..."

Fred Barrie may have an opinion.

Note: if we were to give away one of those sheets then it would become an isotype under Ex. 5. "... "no longer conserved in the same herbarium as the holotype."

Dan

>>> John Boggan - 11/25/02 2:00 PM >>>

Skutch 680, the type of *Solenophora pirana* Morton, is mounted on 2 sheets in a single folder in the type herbarium. One of them (leaves & either buds or fruit) was annotated "sheet II" in Morton's hand. The other (with buds, flowers and fruit, but no foliage) was labeled "sheet I" at some later date (looks like your handwriting). Both sheets are annotated as "type" in Morton's hand. "Sheet I" is annotated as holotype by Denham (1962) and is cited as holotype in the Weigend & Förther revision; "Sheet II" was not annotated by Denham at all, but is cited by Weigend & Förther as an isotype.

According to the protologue (Morton 1935), "Type in the U.S. National Herbarium, nos. 1,587,684 and 1,587,685...."

Can both sheets be considered the holotype, or must one be the holotype and the other an isotype? If neither sheet was clearly the holotype at the time of publication, shouldn't one be considered a lectotype?

CC: John Boggan, Laurence Skog, Barrie, Fred