



Two new species of *Lycianthes* (Capsiceae, Solanaceae) from Mexico and Guatemala

ELLEN DEAN^{1*}, FREDY ARCHILA², JENNIFER POORE¹, HANNAH KANG¹, MARCO ANTONIO ANGUIANO-CONSTANTE³, THOMAS STARBUCK¹ & ANNAMARIE RODRIGUEZ¹

¹Center for Plant Diversity, Department of Plant Sciences Mail Stop 7, University of California, Davis, One Shields Avenue, Davis, California 95616, U. S. A., email: eadean@ucdavis.edu

²Herbarium BIGU, Universidad de San Carlos de Guatemala, Guatemala

³Maestría en Ciencias en Biosistemática y Manejo de Recursos Naturales y Agrícolas (BIMARENA), Centro Universitario de Ciencias Biológicas y Agropecuarias, Universidad de Guadalajara, Camino Ing. Ramón Padilla Sánchez 2100, 45200 Nextipac, Zapopan, Jalisco, México

*author for correspondence email: eadean@ucdavis.edu

Abstract

Two cloud forest species of *Lycianthes* are newly described: *L. breedlovei* from the state of Chiapas, Mexico and *L. fredyclaudiae* from the state of Baja Verapaz, Guatemala. Both species have orange-brown, multangulate-stellate trichomes in which the rays of the trichome are rebranched, white to pale lilac flowers (with darker violet-purple lobes in *L. breedlovei*), and unequal stamens. Morphologically, they resemble *L. hortulana* of Honduras, but both new species have previously been misidentified as *L. cuchumatanensis*. This article provides species descriptions, maps of geographic distributions, drawings of trichomes, and images of the flowers and specimens of the two new species, as well as a comparison chart of morphological characters used to separate *L. breedlovei* and *L. fredyclaudiae* from similar species.

Keywords: Central America, *Lycianthes*, plant taxonomy

Introduction

Lycianthes (Dunal 1852: 29) Hassler (1917: 180) (Solanaceae) comprises 150 to 200 species with a distribution that includes the New World (from Mexico to Argentina and the Caribbean), southeast Asia, China, Japan, and the Pacific (D'Arcy 1991, Hunziker 2001). The genus can be recognized by its combination of poricidal anthers and a calyx that lacks sepals but usually has five to ten appendages that emerge below the calyx rim (D'Arcy 1986, Hunziker 2001). The genus as a whole was last studied by Georg Bitter (1919), whose monograph included 189 terminal taxa (divided into subgenera, sections, and series) but no identification keys. As part of a project that will provide online species descriptions for all New World *Lycianthes* species at the Solanaceae Source website (<http://solanaceaesource.org/>), we examined herbarium specimens (including types) of all species of *Lycianthes* from Mexico and Central American. It became clear that specimens from the states of Chiapas, Mexico, and Baja Verapaz, Guatemala, that had previously been determined as *Lycianthes cuchumatanensis* J.L. Gentry (1973: 273) were two previously undescribed species. The two new species, *Lycianthes breedlovei* E. Dean and *Lycianthes fredyclaudiae* E. Dean, are described below.

Materials and methods

The species concept used here is a morphological one (Cronquist 1978). The circumscriptions of the species described are based on examination of herbarium specimens and field observations. Throughout this work, herbarium specimens are cited with the herbarium code followed by a number. In cases where the specimen has an accession number and a barcode number, only the barcode number is cited. If no accession or barcode number is cited, none was attached to the specimen (this is true of most specimens from NY). Herbarium codes were obtained from *Index Herbariorum* (Thiers continuously updated).

To delineate the new species and separate them from similar species, we examined 222 specimens from the following herbaria: BRIT, CAS, DAV, DS-CAS, DUKE, F, GH, IEB, LL, MEXU, MO, NY, TEX, WIS, XAL. We also observed both species in the field in 2017. Although the individuals of *L. breedlovei* we encountered in the field were sterile, we were able to obtain photographs of flowering material of *L. breedlovei* from the UC Berkeley Botanical Garden. In addition, we examined all known specimens of *L. cuchumatanensis*. This included the holotype and paratype at F, a previously unreported isotype at GH, and a third collection from the same location as the paratype at GH. The first author also attempted to visit the type location of *L. cuchumatanensis* in Guatemala in 2017, but she was unable to reach the location due to a fallen bridge.

This study was part of a much larger study carried out by the first author in which all *Lycianthes* species of Mexico and Central America were examined. This allowed us to determine which species are most similar to the new species described here. To construct a comparison table of species characteristics, the first author examined 70 herbarium specimens of *L. chiapensis* (Brandege 1914: 192) Standley (1936: 173) and 42 herbarium specimens of *Lycianthes hortulana* Standley & L.O. Williams (1952: 58), and the first and second authors observed flowering material of the more common variety of *L. chiapensis* (*L. chiapensis* var. *sparsistellata* Standley & Steyermark (1940: 274)) in the field in Guatemala in 2017.

In order to create maps of the Mexican species, specimens were georeferenced by using either Geolocate, an online software-mapping package (Rios & Bart 2010), or manually using Google Earth Pro (Sullivan, 2009); for Mexican specimens, the latter was often used in conjunction with location data found in the Mexican Archivo Histórico de Localidades (INEGI, 2010). When coordinates were added to a specimen, we provide those coordinates in brackets.

Results

Terminology:—Much of the terminology used in this paper follows Radford *et al.* (1974) and Harrington and Durrell (1979), however some seed surface terms follow Gunn and Gaffney (1974). The terminology used to describe the sympodial branching pattern of the species follows that of Child and Lester (1991) and Bohs (1994) and has been used previously in *Lycianthes* (Dean 2004, Dean *et al.* 2017). Trichome terms are taken from Roe (1968, 1971) and follow current usage in the Solanaceae (Sampaio *et al.* 2014), although some current papers use the term *multiangulate* trichome rather than *multangulate* trichome (used by Roe and used here).

The erect plant body of the species described here has a basal segment with spirally arranged leaves that is considered the first sympodial unit of the plant. This unit terminates in a bud or a flower. Thereafter, all branches are short sympodial units consisting of two leaves and a flower. These sympodial units emerge either singly (monochasial branching) or in pairs (dichasial branching) beneath the inflorescence of the prior sympodial unit. When the branching is monochasial, the leaf arrangement is usually geminate. New branches from lower leaf axils can repeat the pattern from the beginning.

The trichomes in both of the species described here are multangulate-stellate, however they differ from those illustrated in Roe (1968, 1971) in that some of the three to five primary trichome rays often bear another set of two to three stellate rays, and those can also be rebranched (Fig. 1A; Table 1). This type of trichome is also found in *L. hortulana* (Table 1). The trichomes of *L. chiapensis* are multangulate-stellate with three to five primary trichome rays that are not rebranched (Fig. 1B; Table 1), while those of *L. cuchumatanensis* are geminate-stellate with 5–8 primary trichome rays per whorl and these whorls are often stacked on top of each other (Fig. 1C; Table 1).

As described for other *Lycianthes* (Dean 2001, Dean *et al.* 2017), the corollas of many *Lycianthes* open and close each day for several days in a row (usually 3 days). Because many *Lycianthes* species only open their flowers very early in the morning, herbarium specimens of *Lycianthes* often have closed corollas. We were not able to observe the flowers of *L. breedlovei* in the field, as the plant that we encountered was sterile. However, most herbarium specimens of this species were collected and pressed when the corollas were open, indicating that the corollas are probably open for a longer time during the day than many species of *Lycianthes*. An accession of *L. breedlovei* (planted from seed collected by Dennis Breedlove in the 1970s and grown under the name *L. cuchumatanensis*) grows at the University of California, Berkeley Botanical Garden and was photographed in 2011 by James Gaither (Fig. 2A); this photograph enabled us to provide an accurate floral color description for *L. breedlovei*. The one fertile plant of *L. fredyclaudiae* we encountered in the field at 2 pm had only one closed corolla as well as immature fruits. The plant was placed in a plastic bag overnight, as recommended by Nee (1981), and the corolla opened in the plastic bag early the following morning and could be photographed, however the corolla was bruised and turning brown (Fig. 2B). The corollas of both species

described in this paper are sympetalous and rotate, with the five corolla lobes connected by interpetiolar tissue. The five stamens of the androecium have unequal filament lengths, with the lowest stamen filament the longest, while the other four filaments are equal in length and shorter. The anthers are all approximately the same length and free of one another.

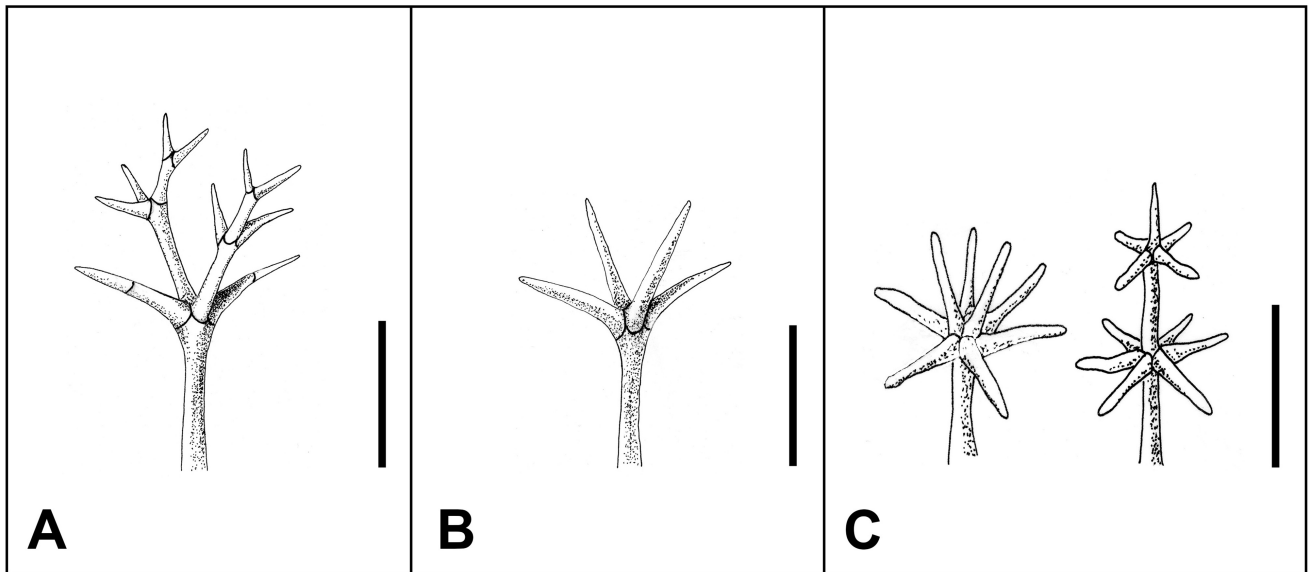


FIGURE 1. A. Multangulate-stellate trichome type found in *Lycianthes breedlovei* and *Lycianthes fredyclaudiae*. B. Multangulate-stellate trichome type found in *Lycianthes chiapensis*. C. Multangulate-stellate (left) and geminate-stellate (right) trichome types found in *Lycianthes cuchumatanaensis*. Drawings by first author. All scale bars equal 0.5 mm.

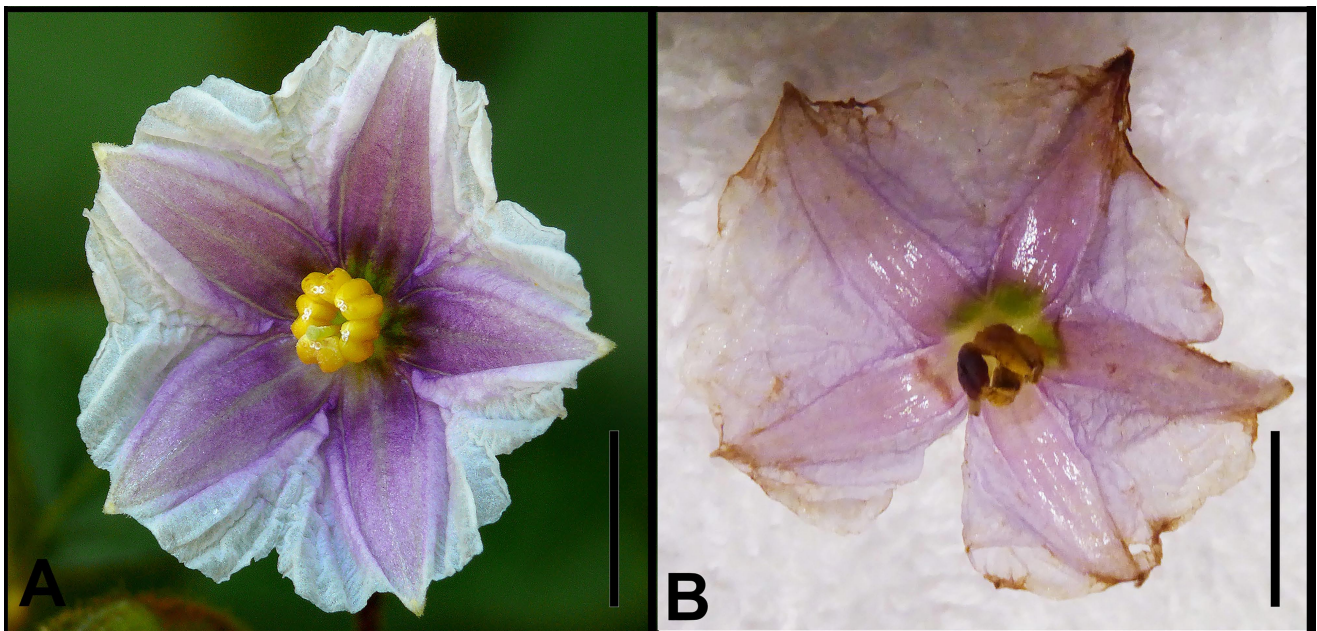


FIGURE 2. A. Flower of *Lycianthes breedlovei*. Photo taken by James Gaither of accession at the UC Berkeley Botanical Garden. Used with permission of UC Berkeley Botanical Garden. B. Flower of *Lycianthes fredyclaudiae*. Photo taken by the first author. Scale bars equal 1 cm.

TABLE 1. Comparison of six character in *Lycianthes breedlovei*, *Lycianthes fredyclaudiae*, *Lycianthes hortulana*, *Lycianthes chiapensis*, and *Lycianthes cuchumatensis*.

Species name	<i>Lycianthes breedlovei</i>	<i>Lycianthes fredyclaudiae</i>	<i>Lycianthes hortulana</i>	<i>Lycianthes chiapensis</i> var. <i>sparsistellata</i>	<i>Lycianthes cuchumatensis</i>
Habit	Weak shrub to low vine	Weak shrub to low vine	Weak shrub to low vine	High-climbing vine/liana	Weak shrub to low vine
Trichome type	Mostly multangulate-stellate, 3–5 rays per whorl, rebranched	Mostly multangulate-stellate, 3–5 rays per whorl, rebranched	Mostly multangulate-stellate, 3–5 rays per whorl, rebranched	Mostly multangulate-stellate, 3–5 rays per whorl, not rebranched	Mostly multangulate-stellate to geminate-stellate, 5–8 rays per whorl, rebranched
Upper branch characteristics	Dull light brown branches, strongly divaricate, with wide branching angles and strong zigzag pattern throughout	Shiny dark brown branches, not strongly divaricate, slight zig zag pattern	Dull light brown branches, strongly divaricate, with wide branching angles and strong zigzag pattern throughout	Shiny dark brown branches with sinuous appearance with one sympodial unit continuing the direction of the last	Dull light brown branches, strongly divaricate, with wide branching angles near the branch tips
Pedicel length in flower/fruit	9–16 mm/ to 25 mm	8–25 mm/ to 31 mm	3–9 mm/ to 13 mm	(5) 7–24 mm/ to 30 mm	ca. 10 mm/ to 15 mm
Corolla characteristics	0.9–1.5 cm long; white to lilac, with darker purple corolla lobes, with three green areas on the lobes at point of stamen insertion; shallowly stellate with abundant interpetiolar tissue	0.7–1.7 cm long; white to pale lilac, without darker purple corolla lobes, with three green spots at point of stamen insertion; entire (not stellate) with abundant interpetiolar tissue	0.6–1 cm long; white to lilac with darker purple corolla lobes (uncertain about green spots); shallowly stellate with abundant interpetiolar tissue	0.6–1.5 cm long; white with three green spots on the lobes near stamen insertion; entire to shallowly stellate with abundant interpetiolar tissue	0.7–0.8 cm long; white, no green spots near stamen insertion; deeply stellate, with scant interpetiolar tissue
Stamens	Slightly to very unequal in length with one filament 1–2 mm long and the other four 0.5–1 mm long	Very unequal in length with one filament 2–4 mm long and the other four 0.5–2 mm long	Equal in length	Very unequal in length with one filament 2.5–4 mm long and the other four 0.5–1 mm long	Equal in length

Species descriptions

Lycianthes breedlovei E. Dean, *sp. nov.* (Figs. 2A, 3)

Type:—MEXICO. Chiapas: Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, [16.4756, -91.8234], 2300 m, 6 May 1973, D.E. Breedlove 34793 (holotype: CAS barcode 480622; isotypes: LL barcode 00226970, MEXU acc. # 247663, MO acc. # 2602916).

Diagnosis. Scandent shrub to vine, endemic to Mexico, very similar to *Lycianthes hortulana* of Honduras, but differing in longer pedicels (9–16 mm in flower), larger corollas (0.9–1.5 cm long), and unequal stamens.

Scandent shrub to vine, 2–3.5 (5) m tall (perhaps taller, if a vine). Indument orange to pale yellow (yellow-grey), uniseriate, multicellular, stalked, spreading, multangulate-stellate trichomes with three to five primary rays, these often bearing another set of two to three stellate rays, and these often further rebranched. Stems pale green (drying tan) when young, terete in cross section, becoming brown and woody with age, moderately to densely pubescent with trichomes 0.25–1.5 (2) mm long, glabrate with age; upper branching a mixture of dichasial and monochasial, the branching divaricate (diverging at wide angles), the upper sympodial units 1–10 cm long, 1.5–4 mm in diameter. Leaves of upper sympodia simple, sometimes paired and unequal in size, the larger ones with blades 3.5–10 × 1.5–4.5 cm, the smaller ones with blades 1–3.5 × 0.5–2 cm, the leaf pairs similar in shape, the blades ovate, elliptic, or obovate, chartaceous, sparsely to moderately pubescent with spreading trichomes similar to the stem, both sides of the leaves with similar pubescence, denser on the abaxial side, the primary veins 4–6 on each side of the midvein, the base cuneate to rounded, sometimes oblique, the margin entire, usually irregularly undulate, the apex acute to acuminate, the petioles 0.3–1 cm long. Flowers in groups of 1–5, axillary, the inflorescence axes densely pubescent with spreading trichomes 0.25–1 mm long; peduncles absent; pedicels 9–16 mm long and erect in flower, 10–25 mm long and erect in fruit; calyx 2.5–3.5 mm long, 3.5–4.5 mm in diameter, campanulate, pale green (sometimes nearly translucent), with dark ribs, the margin truncate, the 10 spreading linear appendages 1–3 mm long, emerging ca. 0.5 mm below calyx margin, sparsely to densely puberulent with spreading trichomes 0.1–1 mm long; fruiting calyx enlarged, widely bowl-shaped to rotate, 2–3 mm long, 6–8 mm in diameter, the teeth to 5 mm long; corolla oriented horizontally, 0.9–1.5 cm long, shallowly stellate (lobed one quarter to halfway to the base), with abundant white to lilac interpetalar tissue, the adaxial side of the corolla lobes dark violet to purple with a few scattered trichomes, three of the lobes with a green area at their base, the abaxial side of the lobes usually densely puberulent with short yellow trichomes (best seen in bud); stamens slightly unequal, the four short filaments 0.5–1 mm long, the one long filament 1–2 mm long, glabrous, the anthers 3–4 mm long, elliptic, yellow, sometimes with small trichomes on the inner face along the connective, poricidal at the tips, the pores ovate, dehiscing distally, not opening into longitudinal slits; pistil with glabrous ovary, the style 6–8 mm long, linear, straight to curved, glabrous, the stigma capitate to oblong, decurrent down the sides. Fruit a berry, 4–10 mm long, 5–11 mm diameter, depressed globose, orange when mature, glabrous, lacking sclerotic granules. Seeds 5–30 per fruit, 3–3.5 × 2–2.5 mm, flattened, thickened on edges, usually reniform with small notch on one side, circular or depressed ovate in outline, orange-brown, surface reticulate, the closely arranged cells with serpentine-shaped walls and shallow lumina, the margin thickened and rougher in texture than the center.

Comments:—*Lycianthes breedlovei* is a cloud forest shrub to vine with zigzag branching due to widely divaricate branching angles, yellow to orange, multangulate-stellate trichomes with the rays rebranched, white to pale lilac flowers with violet to purple lobes, and unequal stamens. It is closely related to *L. hortulana*, described from Honduras. The two species are isolated from one another, with no populations of either species known to occur in Guatemala. They have diverged from one another in pedicel length, corolla size, and stamen length (Table 1). *Lycianthes breedlovei* has been most commonly misidentified as *L. cuchumatanensis*, and those misidentifications are the basis for reports of *L. cuchumatanensis* occurring in Mexico (Villaseñor, 2016). *Lycianthes breedlovei* differs from *L. cuchumatanensis* in trichome type (multangulate stellate (often rebranched) in *L. breedlovei* and geminate stellate in *L. cuchumatanensis*), corolla shape (shallowly stellate in *L. breedlovei* and deeply stellate in *L. cuchumatanensis*), and stamen length (unequal filaments in *L. breedlovei* and equal filaments in *L. cuchumatanensis*) (Table 1).

Range and habitat:—*Lycianthes breedlovei* is endemic to the Mexican state of Chiapas (Fig. 4). It grows in cloud forest, often in oak forest, sometimes associated with *Pinus*, *Abies*, *Magnolia*, or *Podocarpus*, sometimes near disturbed areas, such as milpas, from 2000–3000 m in elevation.

Conservation status:—*Lycianthes breedlovei* is known to occur in eight municipios in the state of Chiapas; we examined a total of 24 collections made at 19 different locations, only one of which is within a protected reserve. The preferred habitat of this species is cloud forest, a habitat that has been declining in area in Chiapas, and most areas of the world, over the past few decades; in 2006, it was estimated that cloud forest occupied approximately 1.4 percent

of the land area of the Central Highlands of Chiapas, and much of this was highly fragmented (Cayuela *et al.* 2006). As many of the collections we examined were collected over 25 years ago, and the one plant we were able to locate in 2017 was infertile, it is likely that at least some of the populations of this species have been extirpated. Using GeoCAT (Bachman *et al.*, 2011) and based on the number of localities, the Extent of Occurrence (EOO) is 2,592.2 km². In contrast the size of the Area of Occupancy (AOO) is 76 km², based on cells of 2 km. A preliminary category of endangered (EN (B2 b i,ii)) is proposed following the IUCN (2012) criteria.

Phenology:—Flowering specimens have been collected from April through July; fruiting specimens have been collected from August to November.

Indigenous names:—Chichol mut (Tzeltal) from specimen *C. Santíz R. 854*; Tunatzak (Tzeltal) from specimen *A. Méndez Ton 5054*; Penko antivo (Tzotzil) from specimen *C. Santíz R. 904*.

Etymology:—This species is named for Dennis Breedlove (1939–2012), whose collections over several decades have greatly increased our knowledge of the Chiapan flora. In the early 1990s, he tried to convince me to study this beautiful species, which he tentatively called *Lycianthes cuchumatanaensis*. Unfortunately, since he passed away in 2012, he won't be able to see that I finally found the time to examine the type specimens of *L. cuchumatanaensis* and unravel this mystery.

Additional specimens examined (paratypes):—MEXICO. Chiapas: Mpio. San Cristóbal de las Casas, near summit of Hueitepec near Las Casas, [16.7506, -92.6735], 22 Apr 1945, *E. J. Alexander 1212* (MEXU acc. # 54219, NY); Mpio. Tenejapa, in Colonia 'Ach'lum, [16.7753, -92.4467], 9100 ft, 23 Aug 1966, *D. E. Breedlove 15206* (NY); Mpio. Jitotol, about 7 miles north of Jitotol along a side road to an oil well, [17.1417, -92.8842], 6700 ft, 28 Aug 1966, *D. E. Breedlove 15412* (DUKE acc. # 206965); Mpio. San Andrés Larrainzar, near the summit of Chuchil Ton, northeast of Bochil [16.9958, -92.8932], 2700 m, 3 Aug 1972, *D. E. Breedlove 26811* (MO acc. # 2310584); Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, [16.4756, -91.8234], 2300 m, 18 Feb 1973, *D. E. Breedlove 33583* (CAS barcode 480626); Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, [16.4756, -91.8234], 2300 m, 6 May 1973, *D. E. Breedlove 34793* (CAS barcode 480622, MEXU acc. # 247663, LL barcode 00226970); Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, [16.4756, -91.8234], 2300 m, 24 Oct 1976, *D. E. Breedlove 41074* (CAS barcode 480617, MEXU acc. # 247329, MO acc. # 2607715); Mpio. La Independencia, third ridge along logging road from Las Margaritas to Campo Alegre, [16.4756, -91.8234], 2300 m, 3 Jul 1981, *D. E. Breedlove 51326* (CAS barcode 480625, MEXU acc. # 393514, MO acc. # 3491151); Mpio. Tenejapa, near Paraje Banabil, [16.7803, -92.5108], 2713 m, 8 Oct 1981, *D. E. Breedlove 53375* (LL barcode 00226943); Mpio. La Independencia, 6–10 km northeast of La Soledad along logging road from Las Margaritas to Campo Alegre, [16.42, -91.85], 1600, 19 Nov 1981, *D. E. Breedlove 55673* (CAS barcode 480615, NY); Mpio. Tenejapa, 25 km al noreste de San Cristóbal de las Casas, sobre el camino a Matzala [16.7365, -92.4239], 2350 m, 25 Nov 1982, *E. Cabrera C. 3800* (MEXU acc. # 418965, MO acc. # 3332742, NY); Mpio. Tenejapa, 3 Km al oeste de la carretera San Cristóbal de Las Casas-Tenejapa, sobre el camino a Matzala [16.758936, -92.58676], 29 Sep 1983, *E. Cabrera C. 5757* (MEXU acc. # 604711); Mpio. Tenejapa, along the road to the town of Matzam, ca. 1.5 km from the eastern outskirts of the town of Las Ollas, 16.78323, -92.52748, 2484 m, 13 Sep 2017, *E. Dean 9531* (DAV acc. # 226596); Mpio. San Cristóbal de las Casas, Estación Biológica Huitepec-PRONATURA, [16.7471, -92.6826], 2550 m, 3 Jun 1991, *M. González-Espinosa 1489* (MEXU acc. # 564074); Mpio. Pueblo Nuevo Solistahuacán, Clínica La Yerbabuena [17.1830, -92.900], 2100 m, 23 Oct 1989, *M. Heath 2062* (MEXU acc. # 951792); Mpio. Tenejapa, 22 Km from San Cristóbal de las Casas on the road to Tenejapa, then right 3 Km on the road to Matzam, [16.7988, -92.4728], 2400 m, 29 Sep 1984, *M. J. Huft 2195* (MEXU acc. # 604535); Mpio. Huixtán, Rancho Merced Bazom, 16.7014, -92.6097, 2450 m, 2 Jul 1994, *M. Ico 26* (MEXU acc. # 632927); Mpio. Pueblo Nuevo Solistahuacán, northern highlands of Chiapas, Jitotol Ridge, 3 km northwest of Pueblo Nuevo Solistahuacán, 17.5, -92.67, 6700 ft, 1 Jun 1971, *E. W. Lathrop 7487* (CAS barcode 480628); Mpio. Tenejapa, Paraje Navil, [16.8417, -92.5108], 2000 m, 15 Nov 1982, *A. Méndez Ton 5054* (MEXU acc. # 839246, MO acc. # 5046632); Mpio. Tenejapa, Rancho Banabil, [16.7833, -92.5139], 2200 m, 26 Apr 1983, *A. Méndez Ton 5918* (MEXU acc. # 879240, MO acc. # 3491145, WIS, XAL); Mpio. San Cristóbal de Las Casas, Santa Cruz en San Felipe, [16.7134, -92.6640], 15 Nov 1986, *A. Méndez Ton 9846* (CAS barcode 480613, GH, MEXU acc. # 724689, MO acc. # 3900365, NY, TEX barcode 00226973); Mpio. Chamula, Yaal Ichin (yoc sac lum), 16.846389, -92.67583, 2180 m, 15 Jun 1993, *M. de J. Ruíz Díaz 116* (CAS barcode 480618); Mpio. San Juan Chamula, Paraje Nab ta Kokontik, 7900 ft, 20 May 1988, *C. Santíz Ruíz 854* (CAS barcode 480619, MO acc. # 3859605, NY, TEX barcode 00226968); Mpio. San Juan Chamula, Bautista Grande, [16.797778, -92.72944444], 13 Jun 1988, *C. Santíz Ruíz 904* (CAS barcode 480624, MEXU acc. # 935581, MO acc. # 3862030, TEX barcode 0026969, WIS); Mpio. Tenejapa, Colonia of 'Ach'lum, [16.7753, -92.4467], 9100 ft, 15 May 1967, *A. Shilom Ton 2340* (CAS barcode 480627).



FIGURE 3. Scan of holotype of *Lycianthes breedlovei*. Image used with permission of the herbarium of the California Academy of Sciences.

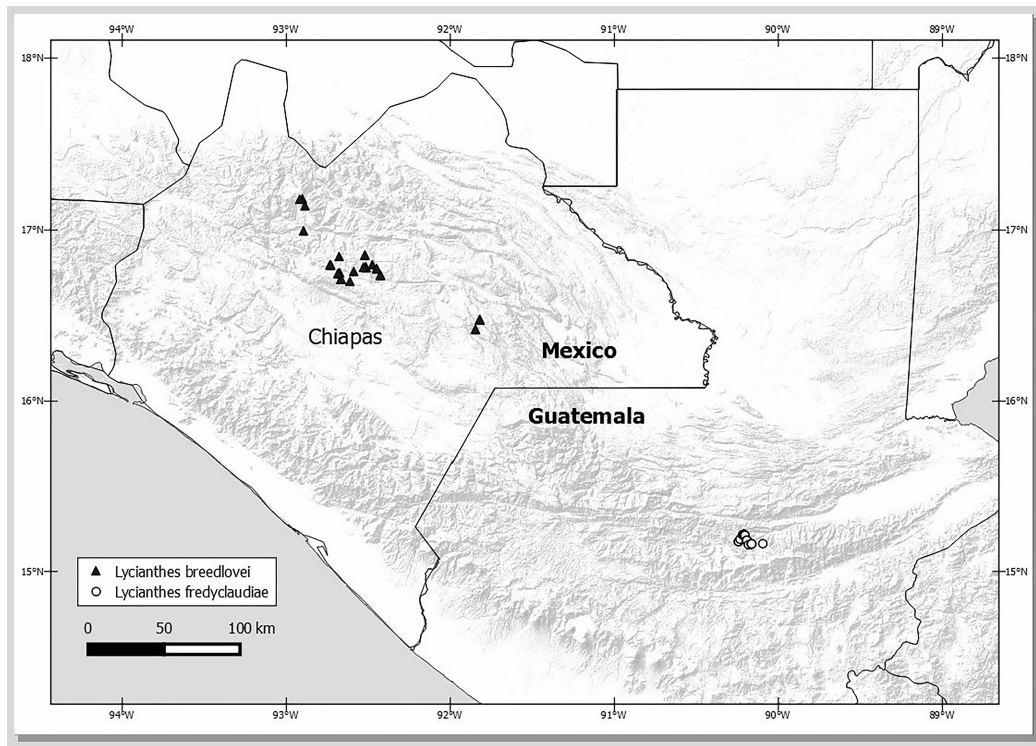


FIGURE 4. Distribution of *Lycianthes breedlovei* and *Lycianthes fredyclaudiae*.

Lycianthes fredyclaudiae E. Dean, *sp. nov.* (Figs. 2B, 5)

Type:—GUATEMALA. Baja Verapaz: Niño Perdido, Cerro Verde, east of km 150 of Cobán Road, in high forest, [15.1607, -90.1651], elevation not recorded, 3 Dec 1976, C. L. Lundell 20419 (holotype: LL barcode 00490012; isotypes: CAS acc. # 722867, F acc. # 1912542, LL barcode 00490006, MEXU acc. # 419739, MO acc. # 3342033).

Diagnosis. Shrub to weak vine, endemic to Guatemala. Similar to *Lycianthes breedlovei*, but differing in having the one long stamen filament 2–4 mm long (rather than 1–2 mm long in *L. breedlovei*), coriaceous leaves, and an entire corolla without dark violet-purple lobes. Similar to *L. chiapensis*, but differing in being a weak shrub to low vine, rather than a strong liana, with thicker leaves and multangulate-stellate trichomes with rays that are rebranched.

Scandent shrub to weak vine, sometimes epiphytic, 2–3 m tall. Indument of orange, pale yellow, or tan, uniseriate, multicellular, stalked, spreading, multangulate-stellate trichomes with three to five primary trichome rays, these often bearing another set of two to three stellate rays, and these often further rebranched. Stems tan-green to purple-green when young, terete in cross section, becoming dark brown and woody with age, the surface of the stems shiny and somewhat longitudinally wrinkled upon drying, moderately to densely pubescent with trichomes 0.25–1 mm long, glabrate with age; upper sympodial branching points mostly monochasial, with some dichasial branching points, the branching not widely divaricate, the adjoining sympodial units often forming straight, continuous branches, the upper sympodial units 1–10 cm long, 2–5 mm in diameter. Leaves of upper sympodia simple, usually paired and unequal in size, the larger ones with blades 3–8.5 × 1.5–4 cm, the smaller ones with blades 1–3.5 × 0.5–2.5 cm, the leaf pairs similar in shape, the blades ovate, elliptic, or obovate, the smaller leaf sometimes nearly round, coriaceous, sparsely to densely pubescent with spreading trichomes similar to the stem, sometimes nearly glabrous adaxially, usually densely pubescent on the abaxial side, especially along the veins, the primary veins 3–5 on each side of the midvein, the base cuneate to rounded, sometimes oblique, the margin entire, usually irregularly undulate, the apex obtuse, acute, or short acuminate, the leaf blade sessile or petiole 0.2–1.4 cm long. Flowers solitary or in groups of 2–8, axillary, the inflorescence axes moderately to densely pubescent with spreading trichomes 0.25–1 mm long; peduncles absent; pedicels 8–25 mm long and erect in flower, to 31 mm and erect in fruit; calyx 2–3.5 mm long, 3–4.5 mm in diameter, campanulate, the margin truncate, the 10 spreading linear appendages 0.5–2 mm long, emerging 0.25–0.5 mm below calyx margin, moderately to densely puberulent with spreading trichomes 0.1–0.5 mm long; fruiting calyx enlarged, widely bowl-shaped to rotate, 2–3 mm long, 5–8 mm in diameter, the appendages not elongating; corolla oriented horizontally, 0.7–1.7 cm long, entire, with abundant white to lilac interpetalar tissue, the adaxial side of the corolla lobes white to pale lilac like the interpetalar tissue, generally with a few scattered trichomes, three of

the lobes with a green spot at their base, the abaxial side of the lobes sometimes pale green, moderately to densely puberulent; stamens unequal, the four shorter filaments 0.5–2 mm long, the long filament 2–4 mm long, glabrous, the anthers 4–5 mm long, lanceolate, yellow to purple, usually with small, white, scattered trichomes on either the face of the anther or on the two lobes at the very bottom of the anther, poricidal at the tips, the pores ovate, dehiscing distally, not opening into longitudinal slits; pistil with glabrous ovary, the style 7–8 mm, linear, straight, glabrous, the stigma oblong, decurrent down the sides. Fruit a berry, 5–13 mm long, 4–12 mm diameter, globose to depressed globose, green to white when immature, yellow to orange when mature, sometimes with a few scattered trichomes, lacking sclerotic granules. Seeds 10–40 per fruit, 2.5–4 × 2–3.5 mm, flattened, thickened on edges, sometimes reniform with small notch on one side, circular to depressed ovate in outline, yellow-orange to orange-brown, surface reticulate, the cells with serpentine-shaped walls and deep lumina, the margin rougher in texture than the center.



FIGURE 5. Scan of the holotype of *Lycianthes fredyclaudiae*. Image used with permission of the herbarium at the University of Texas, Austin.

Comments:—*Lycianthes fredyclaudiae* is a cloud forest species that is known only from the area south of Cobán, Guatemala, in the Department of Baja Verapaz. In the 1970s, this species was often collected in primary forest in the vicinity of Unión Barrios, but when this area was revisited by the first and second authors in 2017, most of the forest had been cleared, and it was difficult to find the species in the forest remnants. After two days of searching the area, including two reserves, two plants were located, one in a roadside thicket and the other in a forest remnant. Therefore, we assume that the species may now be a rare plant. As stated above, *Lycianthes fredyclaudiae* was previously misidentified as *L. cuchumatanensis*, a species with very different corolla, stamen, and trichome characters (summarized above under *L. breedlovei*; Table 1). The habit and corolla characters of *L. fredyclaudiae* are intermediate between *L. breedlovei* and *L. chiapensis* var. *sparsistellata* (Table 1), while it shares the trichome characters of *L. breedlovei* and *L. hortulana*.

Range and habitat:—*Lycianthes fredyclaudiae* is endemic to the Department of Baja Verapaz, Guatemala (Fig. 4). It grows in cloud forest, deciduous forest, “tall forest,” and wet forest thickets (perhaps preferring undisturbed forest), sometimes along drainages or on slopes, from 1500–1800 m in elevation.

Conservation status:—*Lycianthes fredyclaudiae* is known to occur in two municipios in the state of Baja Verapaz; we examined a total of 17 collections made at approximately 11 different locations, some of which are within the Biotopo del Quetzal Reserve. The preferred habitat of this species is cloud forest, a habitat that has been declining in area in most areas of the world over the past few decades (Cayuela *et al.* 2006). As many of the collections we examined were collected over 25 years ago, and the habitat for this species near Unión Barrios (where it was collected multiple times in the 1970s) has become extremely fragmented and reduced, it is likely that at least some of the populations of this species have been extirpated. Using GeoCAT (Bachman *et al.* 2011) and based on the number of localities, the Extent of Occurrence (EOO) is 53.6 km². In contrast the size of the Area of Occupancy (AOO) is 44 km², based on cells of 2 km. A preliminary category of endangered (EN (B2 abii)) is proposed following the IUCN (2012) criteria.

Phenology:—Flowering specimens have been collected all months of the year except September to November and January to February; specimens with fruits have been collected all months of the year except April and May.

Etymology:—This species is named for eminent Guatemalan botanist Professor Fredy Archila and his wife Dr. Claudia Cortez. Without the organizational and field help of Professor Archila, we would not have located this species during our trip to Guatemala in 2017. Unfortunately, our late return from the field on the day we finally encountered the species resulted in Claudia being quite late to work. We hope that in naming this species for both Fredy and Claudia, we can partially repay this debt.

Additional specimens examined (paratypes):—GUATEMALA. Baja Verapaz: Along hwy 3 to Cobán, 15 km by rd. S-SW of Purulhá, [15.1752, -90.2449], 1800 m, 16 Jul 1976, *G. J. Breckon 2148* (DAV acc. # 87441, F acc. # 1855278, MO acc. # 2697733); Unión Barrios, [15.1820, -90.1943], 28 Feb 1972, *E. Contreras 11080* (CAS acc. # 722691, F acc. # 1909859, LL barcodes 00490011 & 00490005, MO acc. # 3230286); Unión Barrios, [15.1820, -90.1943], 12 Mar 1972, *E. Contreras, 11260* (CAS acc. # 722684, F acc. # 1909823, LL barcodes 00490015 & 00490004, MO acc. # 3727506); En aldea Unión Barrios, Km 150 de la carretera que conduce a Cobán A.V. en el lado oeste de la aldea en la parte media de un cerro, [15.1825, -90.2147], 7 Nov 1973, *E. Contreras 11601* (MEXU acc. # 1053933 & 1045858, TEX barcode 00490014); On Highway CA 14 to Cobán, 3 miles south of Purulhá, [15.2156, -90.2134], 1500 m, 16 Jul 1977, *T. B. Croat 41222* (MO acc. # 2586563); Mpio. Purulhá, along Hwy CA 14 between El Progreso and Cobán, 3 mi S of Purulhá, 17 mi N of junction with Hwy 17 to Salamá and San Jeronimo vic. km marker 160, 15.2172, -90.2108, 1620–1720 m, 26 Jan 1987, *T. B. Croat 63719* (DAV acc. # 229050, MO acc. # 3695482, MO acc. # 6866837); Along Cobán-Guatemala Highway 14 between Unión Barrios and Niños Perdidos. west side of the road, 15.15616, -90.1841, 1558 m, 9 Aug 2017, *E. Dean 9506* (DAV acc. # 226626); Along Guatemala Highway 14 just south of highway marker 158 and La Ram Tzul nature reserve, west side of the road, 15.20637, -90.20648, 1610 m, 11 Aug 2017, *E. Dean 9508* (BIGU, DAV acc. # 226622); Unión Barrios, in high forest, top of hill, east of Km 154, [15.1903, -90.17608], 7 Jun 1975, *C. L. Lundell 19388* (CAS acc. # 722889, F acc. # 1911926, LL barcodes 00490009 & 00490008, MEXU acc. # 419295, MO acc. # 3342079); Niño Perdido, on Cerro Verde, [15.1607, -90.1651], 12 Jun 1977, *C. L. Lundell 21085* (CAS acc. # 722950, F acc. # 1909870, LL barcodes 00490010 & 00490007, MEXU acc. # 419566, MO acc. # 3342053); A 4 km al S de Purulhá, camino Guatemala-Cobán, cerca Biotopo, [15.2114, -90.2063], 1660 m, 15 Jun 1985, *E. M. Martinez S. 13132* (MEXU acc. # 411556, NY); Biotopo del Quetzal, [15.2138, -90.2189], 1630 m, 22 Jul 1988, *E. M. Martinez. S. 23082* (DAV acc. # 229051, MEXU acc. # 605522, MO acc. # 4243642, MO acc. # 6866804, NY); Mpio. Purulhá, Biotopo del Quetzal, [15.2138, -90.2189], 1590 m, 5 Sep 1988, *E. M. Martinez. S. 23514* (MEXU acc. # 604800, MO acc. # 3695675, MO acc. # 4239439); Mountain of Purulhá between La Unión and Purulhá, [15.2103, -90.2073], 1600 m, 1 Oct 1972, *A. Molina R. 27743* (F acc. # 1824038, MEXU acc. # 1055273 & 1054029, TEX barcode 00490013); Sierra de las Minas, about 5 km south of Purulhá [15.1885, -90.2353], 1600 m, 2 Jan 1973, *L. O. Williams 41952* (F acc. # 1721570, NY); Sierra de la Minas, 3 km. southeast of Purulhá, [15.2146,

-90.2188], 1800 m, 2 Jan 1974, *L. O. Williams 43119* (F acc. # 1784700); About three miles north of Chilascó in mountains east of Salamá and San Gerónimo, [15.1624, -90.09657], 23 May 1971, *R. L. Wilbur 14788* (DUKE acc. # 216950).

Discussion of affinities of *Lycianthes cuchumatanensis*

After examination of available specimens, we found that the trichome type (geminate stellate), corolla shape (deeply stellate), and stamen length (equal) of *L. cuchumatanensis* (Table 1) are most similar to those of *L. sideroxyloides* (Schlechtendal 1833: 253) Bitter (1919: 403), with which it also shares the character of obovate calyx appendages. Therefore, *L. cuchumatanensis* is not closely related to the two species described above, but most likely is closely related to *L. sideroxyloides*, and further study is needed to determine the species limits of the two taxa. At the present time, *L. cuchumatanensis* is only known from three collections from cloud forest habitat in a remote region of the Department of Huehuetenango, Guatemala.

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