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Research article

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Aristolochia quiricoana (Aristolochiaceae), a new species from southern Costa Rica

Aristolochia quiricoana (Aristolochiaceae), una nueva especie del sur de Costa Rica

José Esteban Jiménez[1,2,5], Marco Cedeño-Fonseca[1,3], Mario A. Blanco[1,4]

Abstract:

Background and Aims: *Aristolochia* is the largest genus in Aristolochiaceae and is widely distributed in the world. A recent synopsis of *Aristolochia* in Costa Rica recognized 19 species; nevertheless, recent botanical exploration in southwestern Costa Rica has revealed yet another new species of this genus.

Methods: The new species resulted from fieldwork in Buenos Aires, Puntarenas Province. Specimens from several herbaria were examined, as well as the type material of the most morphologically similar species. Comments about its distribution, habitat, phenology, conservation status and morphological distinction from related species are provided.

Key results: *Aristolochia quiricoana*, a member of *Aristolochia* series *Thyrsicae*, is described and illustrated from the southern Pacific region of Costa Rica, where it is apparently endemic. It is similar to *A. ornithorhyncha*, from which it is distinguished by its shorter pedicels, wider, oblong perigone limbs with a shorter appendix, and a different floral color pattern.

Conclusions: The new taxon described here represents the 22nd species documented in *Aristolochia* series *Thyrsicae*, as well as the 20th species of the genus from Costa Rica.

Key words: *Aristolochia chapmaniana*, *Aristolochia ornithorhyncha*, endemic species, flora of Costa Rica, taxonomy.

Resumen:

Antecedentes y Objetivos: *Aristolochia* es el género más grande de Aristolochiaceae y está ampliamente distribuido en el mundo. Una sinopsis reciente de *Aristolochia* en Costa Rica reconoció 19 especies; sin embargo, una reciente exploración botánica en la parte suroeste de Costa Rica ha revelado otra nueva especie del género.

Métodos: La nueva especie resultó del trabajo de campo en Buenos Aires, Provincia de Puntarenas. Se examinaron ejemplares de varios herbarios, así como el material tipo de las especies más similares morfológicamente. Se proporcionan comentarios sobre su distribución, hábitat, fenología, estado de conservación y distinción morfológica de especies relacionadas.

Resultados clave: *Aristolochia quiricoana*, miembro de *Aristolochia* serie *Thyrsicae*, se describe e ilustra de la región del Pacífico sur de Costa Rica, donde aparentemente es endémica. Es semejante a *A. ornithorhyncha*, de la cual se distingue por sus pedicelos más cortos, los limbos del perigonio más anchos y oblongos, con un apéndice más corto, y un patrón diferente de colores de la flor.

Conclusiones: El nuevo taxón descrito aquí representa la 22ª especie documentada de *Aristolochia* serie *Thyrsicae*, así como la 20ª especie del género para Costa Rica.

Palabras clave: *Aristolochia chapmaniana*, *Aristolochia ornithorhyncha*, especie endémica, flora de Costa Rica, taxonomía.

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Introduction

Aristolochia L. is the largest genus in Aristolochiaceae and is widely distributed in the world, with a high diversity recorded in tropical regions (González, 1990; Wanke et al., 2006; González and Pabón-Mora, 2017). Despite the lack of a current list of accepted species worldwide, it has more than 550 known species (González and Pabón-Mora, 2017), which grow in a wide variety of climates and ecosystems, from xerophytic environments to very humid forests (González, 1990).

Aristolochia series *Thyrsicae* F. González is a monophyletic group comprised of 21 Neotropical species distributed from Mexico to Bolivia (with one species also present in Florida, Cuba and Martinique), with its highest diversification in the humid tropical forests of Central America and the Pacific slope of Colombia and northern Ecuador (González, 1990, 1994, 1997; Wanke et al., 2006; González and Pabón-Mora, 2017; Jiménez et al., 2021).

A synopsis of the species of *Aristolochia* in Costa Rica has recently been published by Jiménez and Blanco (2020), who recognized 19 species for the country, including four undescribed species. Two of the latter, members of series *Thyrsicae*, were formally described by Jiménez et al. (2021), and the other two are to be described elsewhere. However, recent botanical exploration in the southwestern part of Costa Rica has revealed yet another new species of *Aristolochia* series *Thyrsicae*. Here, we describe and illustrate this new species.

Materials and Methods

During several plant-collecting trips in the Buenos Aires region, Puntarenas Province, Costa Rica, from 2019 to 2021, an unusual species of *Aristolochia* was collected. Specimens from the herbaria CR (including INB), DUKE, EAP, MO, NY, UCH, US and USJ were examined physically. The type material of the species related to the one described here was studied either physically or through high resolution images obtained from the JSTOR Global Plants database (JSTOR, 2021 (continuously updated)) and from the websites of the Field Museum of Natural History (F, 2021), the Harvard University Herbaria (Harvard University, 2021 (A, AAH, AMES, ECON, FH, GH)), and the Missouri Botanical Garden (TROPICOS, 2021 (MO)). The acronyms of all herbaria mentioned in this work are according to Thiers (2021 (continuously updated)). The distribution map account for all the specimens examined and were made using Quantum GIS v. 3.10.10 (QGIS Development Team, 2021). The species described here is illustrated with a photographic plate adapted from the "Lankester Composite Dissection Plate" technique proposed for Orchidaceae (Pupulin and Bogarín, 2004), as well as with drawings. These two illustration methods are complementary and emphasize different traits of the structures. Flower measurements, color and scent were recorded at anthesis or from pre-anthesis buds (about the same size as open flowers). Terminology mostly follows Pfeifer (1966). Distributions and habitats follow the Life Zone System by Holdridge et al. (1971).

Results

Aristolochia quiricoana J.E. Jiménez, M.A. Blanco & M. Cedeño, sp. nov. Figs. 1, 2, 3.

TYPE: COSTA RICA. Puntarenas, Potrero Grande, Las Vueltas, Centro Turístico Los Chocuacos (Laguna Las Vueltas), bosque secundario, 236 m, 8°57'51.99''N, 83°10'41.85''W, 23.IV.2020, fl, fr, *J. E. Jiménez et al. 5482* (holotype: USJ! (2 parts, 1 part fl in spirit), isotype: CR!).

Similar to *Aristolochia ornithorhyncha* J.E. Jiménez, M.A. Blanco & Aguilar by its oblong leaves with pellucid gland-dots and flowers light green to green externally, with a conduplicate-navicular appendix apically, but differs from that species by its conspicuous, small, semicircular or teardrop-shaped leaf blade sinuses 0.3-0.7 cm in diameter (*vs.* truncate to subcordate blades with widely open V-shaped sinuses in *A. ornithorhyncha*), shorter flower pedicels (2.5-2.7 cm long *vs.* 4.2-6 cm), an oblong, wider (2-2.5 cm) and acuminate perigone limb that is markedly bent backward on its distal third (*vs*. 1.3-1.6 cm wide, lanceolate-attenuate, and lacking a distal backward bend) with a shorter appendix (0.5-0.8 cm long *vs*. 2-2.5 cm), and a different internal color pattern (uniformly light green in the proximal half, with an irregular purple blotch in the middle surrounded by purple dots, and yellowish distally with brownish to purplish spots; *vs*. yellowish white proximally with pur-

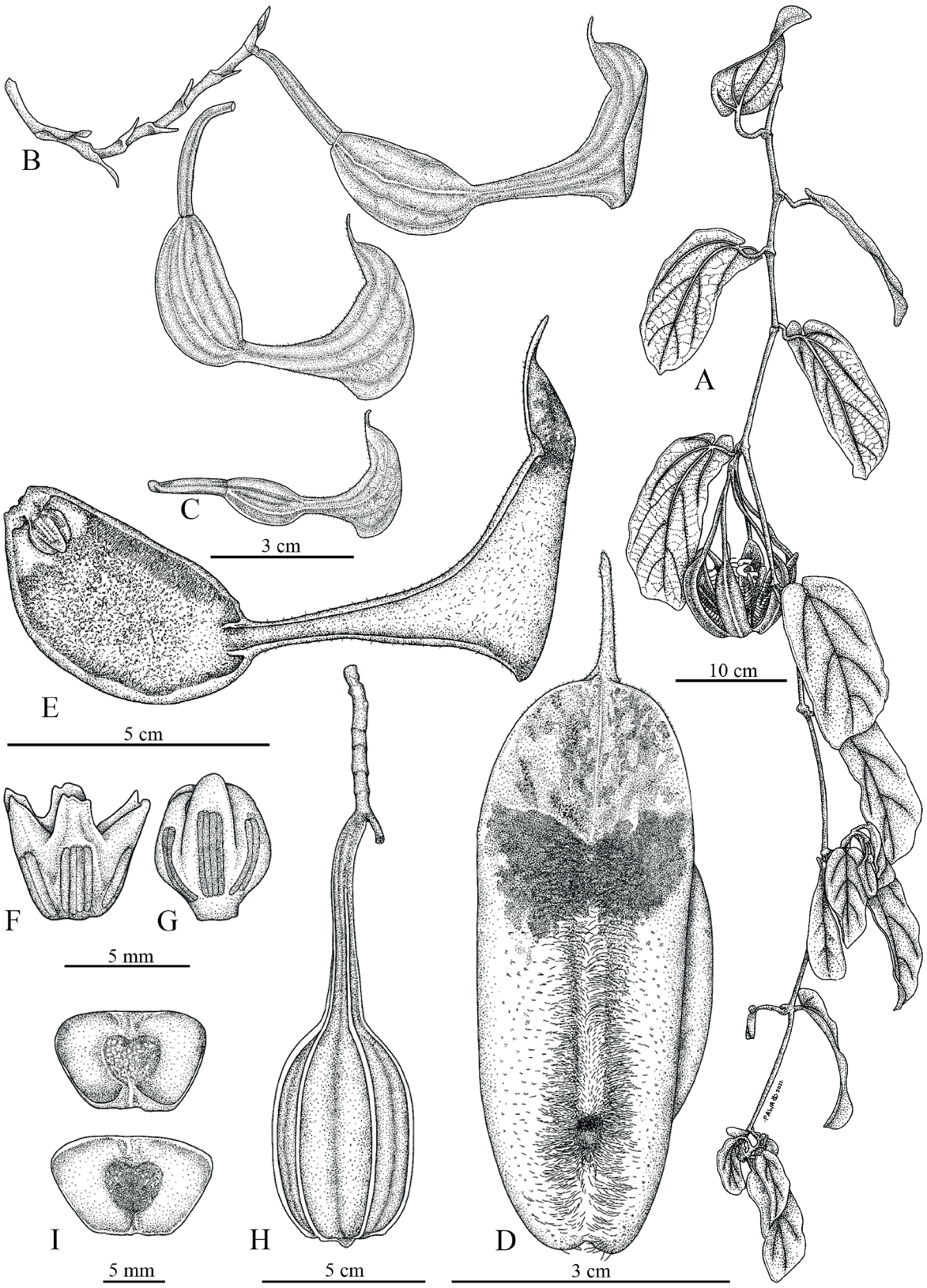

Figure 1: *Aristolochia quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño. A. habit showing a mature fruit, note semicircular or teardrop-shaped leaf blade sinuses; B. cymose inflorescence, with a flower in lateral view; C. flower buds; D. flower limb in frontal view; E. longitudinal section of flower; F. gynostemium in female phase (with the stigmatic surface exposed and anthers closed); G. gynostemium in male phase (with stigma closed and anthers dehisced); H. capsule before dehiscence; I. seeds. Drawings by María Fernanda Cordero Pagoga after specimen vouchered by *J. E. Jiménez et al. 5482* (USJ).

ple-brown spots, and greenish-yellow medially and distally, with light brown spots).

Liana, stems with corky bark when mature; young stems puberulous and with hirsute indument; prophylls not atrophied (pseudostipules absent); leaves deciduous (with an abscission layer at the base of the petiole), simple, alternate, distichous; petiole 1.2-2 cm long; blade oblong, 11.4-15.6 × 3-4.7 cm, concolorous, with pellucid gland-dots, cordate, the sinus semicircular or teardrop-shaped, 0.2-0.4 cm wide, 0.3-0.7 cm deep, apically acuminate, adaxial and abaxial surfaces glabrous to sparsely hirsute, trinervate; inflorescence axillary, cymose, with 4-8 sequentially produced flowers; inflorescence axis 1-11.2 cm long; bracts ovate to lanceolate, 0.3-0.4 × 0.1-0.2 cm; pedicel plus ovary 2.5-2.7 cm long, puberulous; perigone slightly geniculate, with an angle of 150-170° between utricle and tube and an angle of 70-100° between tube and limb, externally hirsute, light green with green-translucent veins, without detectable scent; utricle ellipsoid, gibbous, 3-3.6 × 2.5-2.8 cm, the inner surface creamy white with small red spots throughout (except immediately around the gynostemium), covered by white trichomes; syrinx equilateral, cylindrical, extending up to 0.5 cm inside the utricle, creamy; tube cylindric, straight or slightly curved, 3.5-4.2 cm long, 0.4-0.5 cm in proximal diameter, 0.5-0.8 cm in distal diameter, the inner surface creamy, covered by white trichomes; fauces rounded; limb 1-lobed, oblong, not opening widely, the distal third markedly bent backward in side view (ca. 45°), with slightly revolute lateral margins, the internal surface covered with white trichomes 5.8-6.2 × 2-2.5 cm, with an acuminate appendix with involute margins, acute at base, proximally light green, medially with an irregular purple blotch surrounded by purple dots, and distally yellowish green with an irregular brownish blotch surrounded by brownish dots; gynostemium coroniform, 0.7-0.9 × 0.4-0.5 cm, glabrescent or slightly pubescent; stigmatic lobes 6, 0.3 cm long, creamy white; anthers 6, oblong-linear, 0.4 × 0.2 cm; capsule ellipsoid, 6-6.5 × 4.3-5.1 cm, apically rounded, with lateral dehiscence and fenestrated septa; seeds subtrapezoid, 2-winged, 0.8-1 × 1.3-1.6 cm (wings included), brownish.

Distribution and habitat: endemic to Costa Rica. Currently known from southwestern Costa Rica at 200-300 m a.s.l. in the Pacific lowlands, in the towns of Clavera and Las Vueltas, Potrero Grande District, Buenos Aires Cantón, Puntarenas Province (Fig. 4). This region is part of the Biological Corridor Amistosa, which connects the forests of the Osa Peninsula with those of the Parque Internacional La Amistad (SINAC, 2018; Cedeño-Fonseca et al., 2020). *Aristolochia quiricoana* occurs in the tropical humid forest life zone (*sensu* Holdridge, 1971), specifically in secondary forest, where the vines reach the canopy.

Phenology: flowering has been documented during the dry season, from January to April. Fruits have been collected in March and April. However, it is possible that development of flowers and fruits occurs throughout the year, as in other species of series *Thyrsicae* documented in Costa Rica (Jiménez, 2016; Jiménez and Blanco, 2020).

Conservation status: *Aristolochia quiricoana* is a rare species known from only two sites 5 km apart from each other, as well as few and recent herbarium specimens. It is not known to occur in any governmental protected area, although it is protected in the small private reserve of the Centro Turístico Los Chocuacos in Las Vueltas de Potrero Grande, Buenos Aires, Puntarenas Province. Due to its limited occurrence in less than five locations, occupying an area of less than 500 km^2, and the agricultural (mostly pineapple, oil palm and livestock; Cedeño-Fonseca et al., 2020) and urban expansion threatening the natural populations, *A. quiricoana* may be considered as Endangered according to the IUCN categories and criteria (B2ab (I, ii, iii, iv, v) c; IUCN, 2012, 2019).

Etymology: the species is named in honor of Costa Rican botanist, professor, and conservationist Quírico Jiménez Madrigal, who has contributed to the documentation and description of the Costa Rican flora since 1984, teaching botany and dendrology courses in public universities, and who has been the mentor of several botanists in the country.

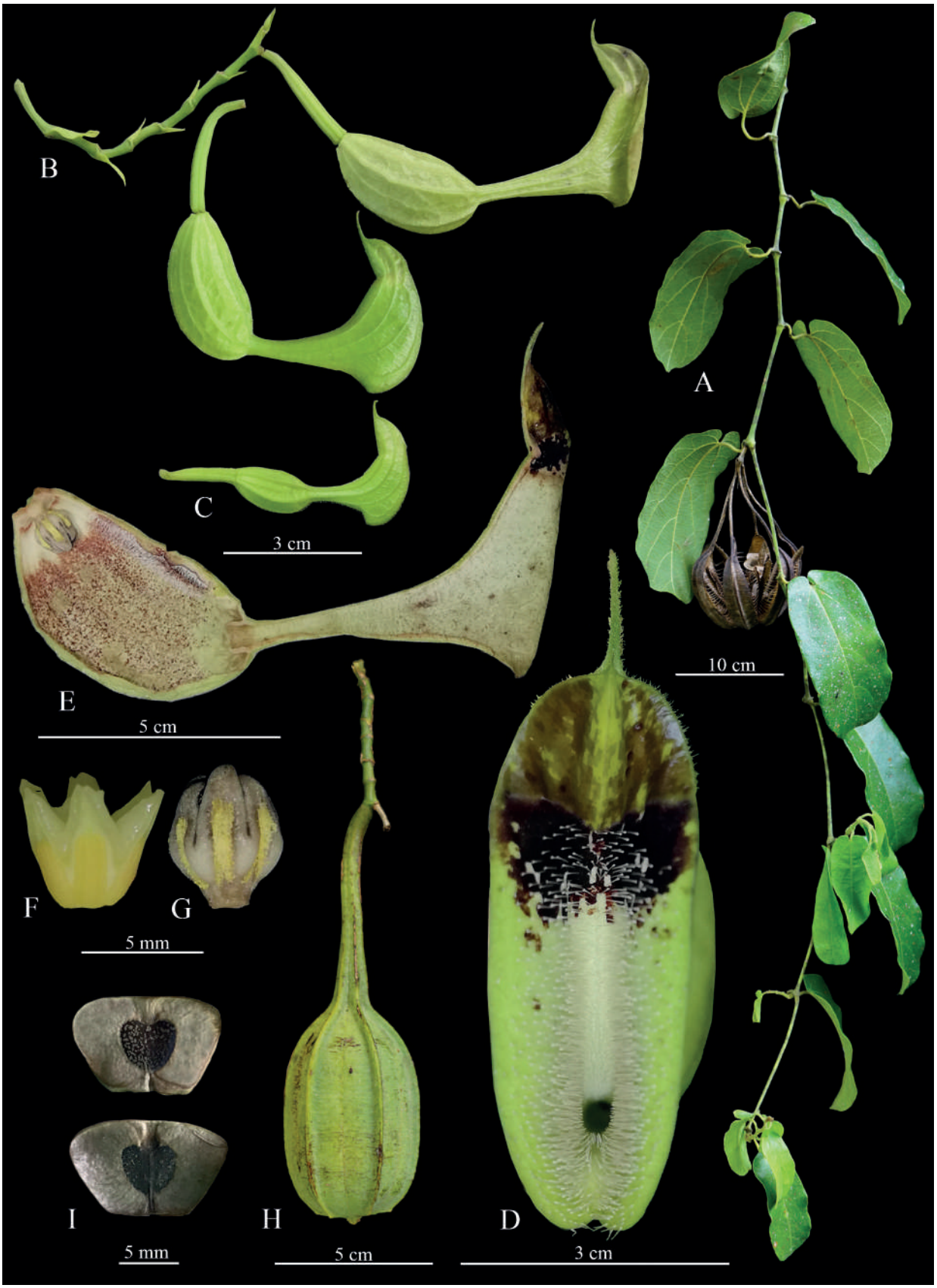

Figure 2: *Aristolochia quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño. A. habit showing a mature fruit, note semicircular or teardrop-shaped leaf blade sinuses; B. cymose inflorescences, with a flower in lateral view; C. flower buds; D. flower limb in frontal view; E. longitudinal section of flower; F. gynostemium in female phase (with the stigmatic surface exposed and anthers closed); G. gynostemium in male phase (with stigma closed and anthers dehisced); H. capsule before dehiscence; I. seeds. Photographs after specimen vouchered by *J. E. Jiménez et al. 5482* (USJ).

Additional specimens examined: COSTA RICA. Provincia Puntarenas, Cantón Buenos Aires, Distrito Potrero Grande, Las Vueltas, Centro Turístico Los Chocuacos (Laguna Las Vueltas), 296 m, 8°57'52.6''N, 83°10'26.48''W, 23.III.2018, fl, fr, *M. Cedeño and M. Flores 1348* (USJ); Distrito Potrero Grande, Clavera, Finca de Benito Cedeño Morales y Aníbal Cedeño Morales, 210 m, 8°58'30.1''N, 83°12'8.86''W, 25.I.2021, fl., *M. Cedeño 2302* (USJ); Las Vueltas, Centro Turístico Los Chocuacos, 281 m, 8°57'56.86''N, 83°10'34.36''W, 3.III.2019, fl, fr, *J. E. Jiménez et al. 4596* (USJ (2 parts, 1 in spirit)).

Specimens examined of *Aristolochia chapmaniana* Standl.: PANAMA. Province Panama, Canal Zone, Barro Colorado Island, Barbour Point, 15.XI.1931, fl, *O. Shattuck 413* (F (holotype of *A. chapmaniana*), MO (isotype), US (three isotypes)); Barro Colorado Island, Canal Zone, Gross Trail 6, 29.VII.1934, fr, *O. E. Shattuck 1076* (MO); Barro Colorado Island, Canal Zone, 25.VII.1960, fr, *J. E. Ebinger 601* (F, MO); Gallery along Río Mamoni, 21.IX.1962, fr, *J. A. Duke 5684* (MO); Isla del Rey near San Miguel, 27.II.1967, fr, *J. A. Duke 10424* (MO); Barro Colorado Island, Canal Zone, near Snyder Molina Trail, 12.IX.1968, fr, *T. Croat 5958* (MO); Barro Colorado Island, Canal Zone, shoreline of Miller Peninsula parallel to Bohio Beach, 5.X.1968, fl, *T. Croat 6733* (MO, SCZ); Barro Colorado Island, Canal Zone, clearing at lab, near S-M Trail, 8.I.1969, fl, *T. Croat 6969* (MO, SCZ); Chimán, 12.XII.1967 (sterile), *W. H. Lewis et al. 3294* (MO); between Chepo and El Llano along highway, second growth by stream, 1.IX.1971, fr, *A. Gentry and E. Tyson 1686* (DUKE, MO, SCZ); Canal Zone, Road K-6 east of Arraijan, 20.VI.1971, fr, *T. Croat 15031* (MO); selectively felled forest 1-2 mi S of Pan American Highway, 3 mi E of Cañazas checkpoint, Foothills of Serranía de Cañazas, 0-50 m, 8°52'N, 78°15'W, 27.II.1982, fl, fr, *S. Knapp 3884* (MO); Panamá, Isla de Barro Colorado, Parcela de 50 hectáreas, 120 m, 9°8'57.8''N, 67°51'19.8''W, 1.VI.2021, fr, *R. Pérez 2461* (PMA); P.N. Chagres, Cerro Azul, Sendero El Cantar, 18.III.1992, fr, *L. Carrasquilla and J. Ríos 3366* (PMA); Parque Nacional Altos de Campana, camino de acceso al parque, 8°41'46''N, 79°54'14''W, 10.X.2000, fl, *N. Flores and B. Araúz B2323* (PMA); Parque Nacional Altos de Campana, sendero hacia la Quebrada de las Ranas Doradas, 800-900 m, 8°40'N, 79°55'W, 2.III.1995, fr, *M. D. Correa and E. Montenegro 10993* (PMA); Arraiján, 24.IV.1952 (sterile), *J. Zetek 5573* (EAP); Panamá Canal Zone, Cerro Gordo, near Culebra, 50-290 m, 1911 (sterile), *H. Pittier 2304* (NY); Panama Canal Zone, Barro Colorado Island, shores of Gatun Lake, south of Lab, 28.VIII.1929, fr, *W. N. Bangham 455* (A (holotype of *Aristolochia maxima* Jacq. var. *cordata* Standl.), F (isotype)); alrededores de Chilibre, 28.V.1970, fr, *E. González 37* (DUKE). Province Coclé, between Las Margaritas and El Valle, 15.VII-3.VIII.1938, fr, *R. E. Woodson, Jr. et al. 1739* (MO). Province Veraguas, Montijo, Isla Coiba, Parque Nacional Coiba, Cerro de La Torre, 200 m, 7°30'N, 81°49'W, 1.V.1995, fr, *C. Galdames et al. 2295* (PMA); Isla Coiba, Parque Nacional Coiba, Playa Blanca, camino Barco Quebrado, 0 m, 28.VIII.1996, fr, *R. Duno et al. 1187MAG* (PMA).

Specimens examined of *Aristolochia ornithorhyncha* J.E. Jiménez, M.A. Blanco & Aguilar: COSTA RICA. Province Puntarenas, Cantón Golfito, Jiménez, bosque primario, 8°29'43.79''N, 83°18'46.84''W, 75 m, 4.II.2016, fl, fr, *J. E. Jiménez and R. Aguilar 3500* (USJ (3 parts, including fls. in spirit, holotype of *Aristolochia ornithorhyncha*), CR (isotype)); Golfito, Jiménez, Finca Playa Kare Oeste, 8°24'40''N, 83°17'00''W, 20 m, 13.XI.2015, fl, fr, *R. Aguilar 15430* (CR, USJ (fls. in spirit)); Golfito, Jiménez, Conservación Osa, Piro, 110 m, 10.II.2016, fl, *J. E. Jiménez and M. López 3503* (USJ (in spirit)). PANAMA. Province Chiriquí, Distrito Barú, Puerto Armuelles, Quebrada Tuco, 9 mi south of Puerto Armuelles, 0-150 m, 21.II.1973, fr, *R. L. Liesner 157* (MO). Distrito Bugaba, La Estrella, carretera a Santa Risa, orilla del Río Escarrea, 270 m, 22.IV.2012, fl, *I. Martínez et al. 1727* (UCH (2 parts)). Distrito Gualaca, Londres, a orillas del Río Gualaca, 670 m, without specific date (1998, year of determination), fl, *J. Polanco 2792* (PMA). Distrito Boquete, bosque cercano al Río Cochea, cercano al puente sobre el río que divide Boquete de Dolega, 8°36'22.9''N, 82°25'24.8''W, 340 m 19.III.2021, fr, *J. E. Jiménez et al. 5587* (PMA).

Discussion

Aristolochia quiricoana belongs to *Aristolochia* series *Thyrsicae* because of its leafy and thyrsoid synflorescences with paracladia sometimes ramiflorous or cauliflorous, partial florescences in rhipidia (with each flower opposite to a re-

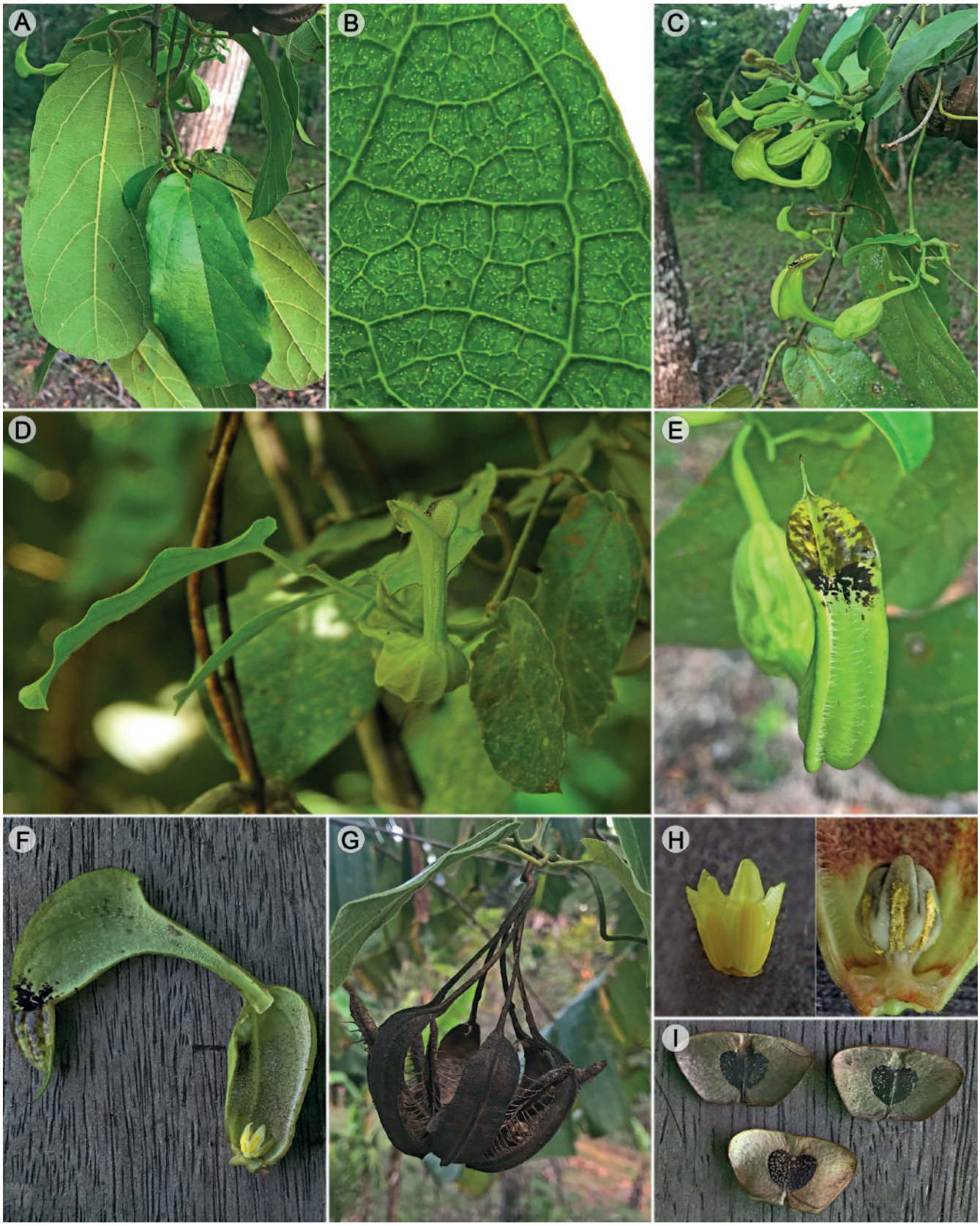

Figure 3: *Aristolochia quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño. A. shoot segment with leaves; B. detail of abaxial leaf surface showing pellucid gland-dots; C. inflorescences and flowers in lateral view; D. branch and flower in frontal view; E. flower limb in frontal view; F. longitudinal section of flower; G. mature fruit; H. gynostemium in female phase (left) and male phase (right); I. seeds. Photographs based on living plants vouchered by *J. E. Jiménez et al. 5482* (USJ).

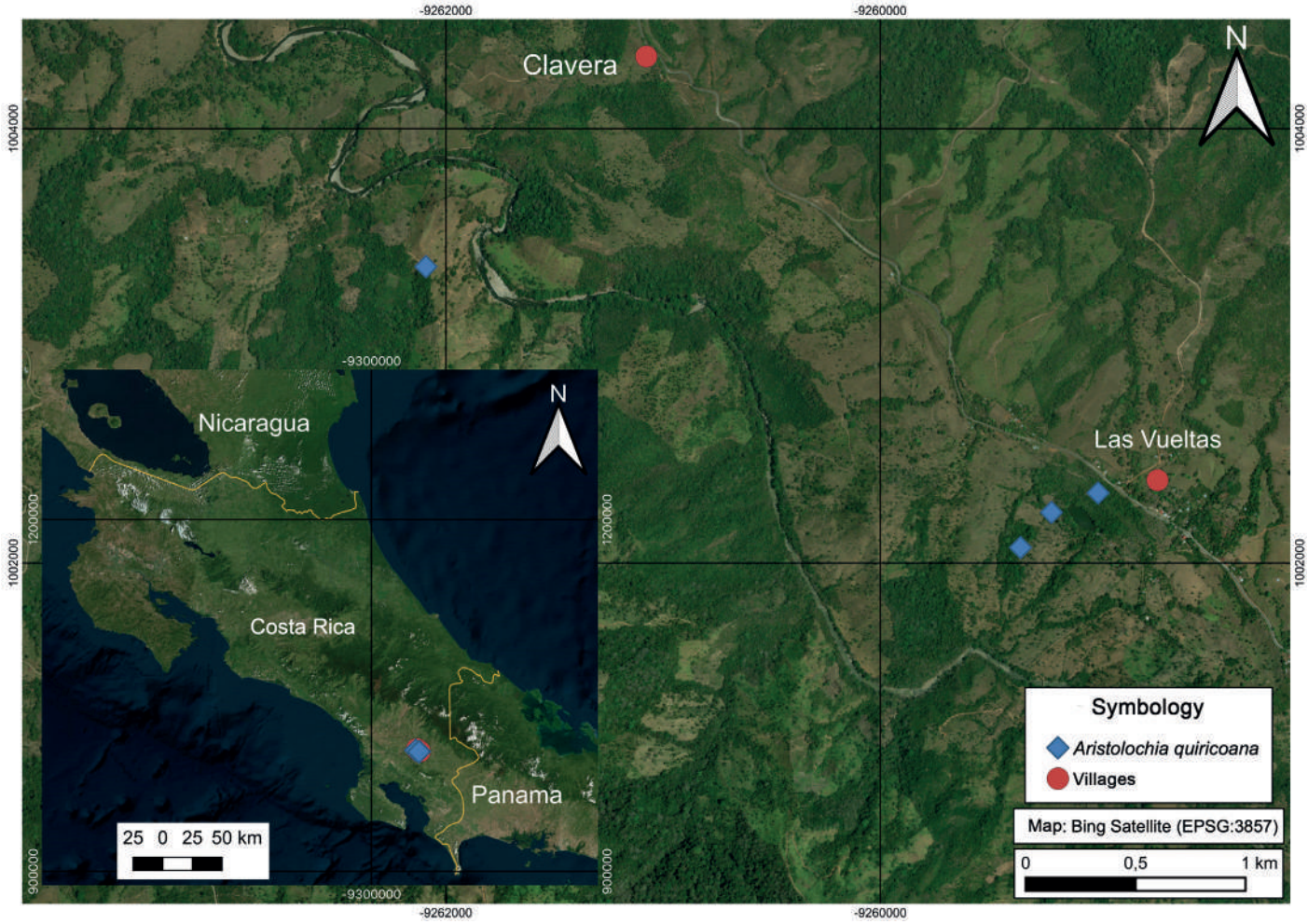

Figure 4: Geographic distributions of *Aristolochia quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño in Costa Rica (based on herbarium specimens). The inset shows the area in Costa Rica where all the collections have been found; the larger map has the same area in higher magnification, showing the various localities of individual collections.

duced bracteole), abscission zones located at the bases of petioles, partial florescences and flower stalks (i.e., pedicels in the sense used here), capsules with cancellate septa and broadly oblong, 2-winged seeds, with the abaxial wing shorter than the adaxial one (González and Pabón-Mora, 2017). The other members of series *Thyrsicae* documented in Costa Rica are *A. constricta* Griseb. (*sensu* Jiménez and Blanco, 2020), *A. longissima* M.A. Blanco, J.E. Jiménez & Aguilar, *A. maxima* Jacq., *A. ornithorhyncha* J.E. Jiménez, M.A. Blanco & Aguilar and *A. tonduzii* O.C. Schmidt (Jiménez, 2016; Jiménez and Blanco, 2020; Jiménez et al., 2021). *Aristolochia quiricoana* represents the 22nd species documented in *Aristolochia* series *Thyrsicae*, as well as the 20th species of the genus known from Costa Rica.

Aristolochia quiricoana was confused with *A. ornithorhyncha* by Jiménez and Blanco (2020), who reported the latter species (as "*Aristolochia* sp. C") as occurring in the Valle de Coto Brus region. That locality was based on the collections *Cedeño and Flores 1348* (USJ) and *Jiménez et al. 4596* (USJ, the latter cited by Jiménez and Blanco (2020) as the voucher for "*Aristolochia* sp. C"), both of which are in fact *A. quiricoana* (the corresponding data for *A. ornithorhyncha* were corrected by Jiménez et al., 2021). Both species have oblong leaf blades with pellucid gland-dots and flowers of similar shape and color. However, *A. quiricoana* has conspicuous, small, semicircular or teardrop-shaped leaf-blade sinuses 0.3-0.7 cm in diameter (*vs*. truncate to subcordate blades with widely open, V-shaped sinuses in *A.*

ornithorhyncha), shorter flower pedicels (2.5-2.7 cm long *vs*. 4.2-6 cm), an oblong, wider (2-2.5 cm) and acuminate perigone limb that is markedly bent backward on its distal third (*vs*. 1.3-1.6 cm wide, lanceolate-attenuate, and lacking a distal backward bend) with a shorter appendix (0.5-0.8 cm long *vs*. 2-2.5 cm), and a different limb internal color pattern (uniformly light green in the proximal half, with an irregular purple blotch in the middle surrounded by purple dots, and yellowish distally with brownish to purplish spots; *vs*. yellowish white proximally, with purple-brown spots, and greenish-yellow medially and distally with light brown spots) (Fig. 5, Table 1; see also Figs. 5 and 6 in Jiménez et al., 2021). *Aristolochia quiricoana* represents the fourth documented species of *Aristolochia* with pellucid gland-dots in the leaves, all of which occur in Central America.

Aristolochia quiricoana is also similar to *A. chapmaniana* from central Panama. Both species have oblong leaf blades with small but well-marked semicircular to drop-shaped sinuses, and the perigone limb markedly bent backward on its distal third (very noticeable when seen sideways), acuminate, and internally light-colored but spotted with purple-brown on the distal, bent portion. *Aristolochia quiricoana* differs from *A. chapmaniana* by its presence of pellucid gland-dots (*vs*. absent), externally light green (*vs*. brownish to reddish) perigone, shorter, ellipsoid utricle (*vs*. oblong), and oblong-acuminate, shorter perigone limb (*vs*. oblanceolate and attenuate, longer) (see Fig. 4 in Jiménez et al., 2021, Table 1).

Our circumscription of *Aristolochia chapmaniana* differs from that of González and Pabón-Mora (2017). Under this name, those authors included plants from Colombia and Ecuador with a leaf shape and floral-limb conformation different than those of plants from the type locality in Panama (e.g., *González 542* (COL) from Medellín, Colombia, illus-

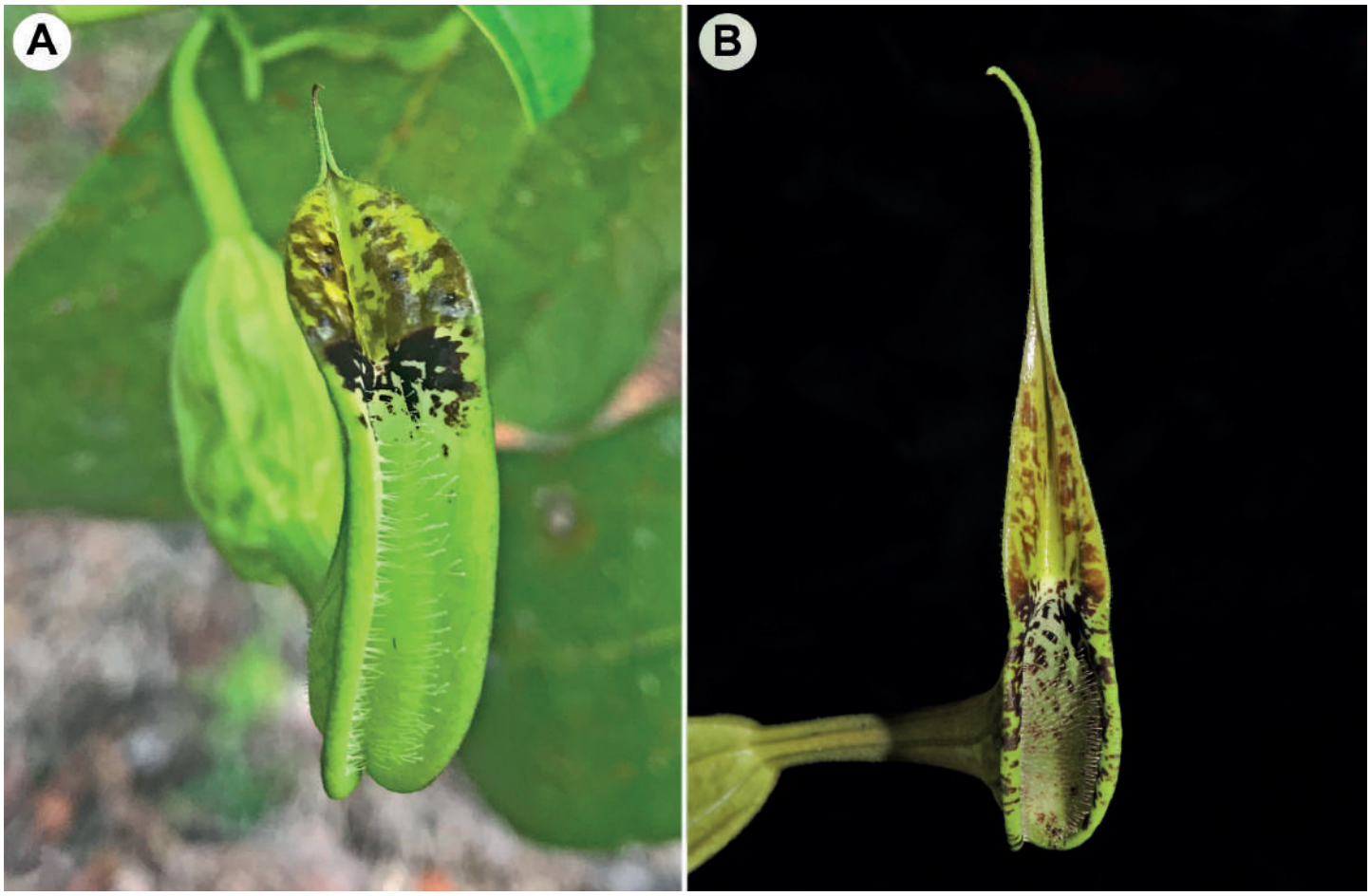

Figure 5: A. flower of *Aristolochia quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño, plant vouchered by *J. E. Jiménez et al. 5482* (USJ); B. flower of *A. ornithorhyncha* J.E. Jiménez, M.A. Blanco & Aguilar, plant vouchered by *R. Aguilar 15430* (USJ).

Table 1: Morphological comparison between *Aristolochia chapmaniana* Standl., *A. ornithorhyncha* J.E. Jiménez, M.A. Blanco & Aguilar and *A. quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño.

	Species		
Character	*A. chapmaniana* Standl.	*A. ornithorhyncha* J.E. Jiménez, M.A. Blanco & Aguilar	*A. quiricoana* J.E. Jiménez, M.A. Blanco & M. Cedeño
Pellucid gland-dots	absent	present	present
Flower pedicel length	3-3.7 cm	4.2-6 cm	2.5-2.7 cm
Utricle shape	oblong, gibbous	ellipsoid, gibbous	ellipsoid, gibbous
Utricle length	4-4.8 cm	4.2-5 cm	3-3.6 cm
Utricle and tube color (in life)	brownish to reddish	greenish yellow	light green
Tube length	3.1-4.8 cm	3.5-4 cm	3.5-4.2 cm
Perigone limb length	6-7.5 cm	5-6 cm	5.8-6.2 cm
Perigone limb width	1-1.6 cm	1.3-1.6 cm	2-2.5 cm
Appendix length	0.7-1.1 cm	2-2.5 cm	0.5-0.8 cm

trated in detail by González, 1990: Fig. 20 as *A. tonduzii*), that in our opinion are more similar to *A. schmidtiana* Hoehne (compare with the original description and illustration of the latter by Hoehne, 1942: 90-91, Tab. 93). In our more restricted circumscription, *A. chapmaniana* is endemic to Panama, and is characterized by short-petiolate, essentially glabrous (when mature), oblong to spathulate, elongate leaves (2.5-5.5 times as long as broad,) with a small but well-defined semi-circular or teardrop-shaped sinus; the floral limb is mostly yellowish internally and slightly but consistently bent backward on its distal third portion, and heavily spotted with dark maroon on the internal face of that portion.

According to our observations made in the field and of herbarium specimens, the differences between species mentioned above and in Table 1 are both consistent and strongly related to the stated geographic distributions, which support our circumscriptions. The specimens studied corresponding to *Aristolochia chapmaniana* and *A. ornithorhyncha* are listed above. See Jiménez et al. (2021) for a discussion of taxonomically important characters in *Aristolochia* that are evident in living flowers but that become distorted or obscured in pressed, dry herbarium specimens, and the consequent need for their careful documentation in living plants.

Author contributions

JEJ and MAB made plant identifications, reviewed herbarium material, and wrote the nomenclatural remarks. JEJ, MCF and MAB wrote the text. JEJ and MCF collected the specimens and took the photographs. All authors contributed to the design and implementation of the research and reviewed all versions of the manuscript.

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