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Revision of *Monstera* (Araceae: Monsteroideae) of Central America

THOMAS B. CROAT[1,7], MARCO CEDEÑO-FONSECA[2,3,4,8*] & ORLANDO O. ORTIZ[2,5,6,9]

[1]*P. A. Schulze Curator, Missouri Botanical Garden, 4344 Shaw Blvd., St. Louis, Missouri 63110, U.S.A.*
[2]*Botanischer Garten und Botanisches Museum Berlin, Freie Universität Berlin, Königin-Luise-Straße 6-8, D-14195 Berlin, Germany.*
[3]*Herbario Luis Fournier Origgi (USJ), Centro de Investigación en Biodiversidad y Ecología Tropical, Universidad de Costa Rica, Apdo.11501−2060, San José, Costa Rica.*
[4]*Jardín Botánico Lankester, Universidad de Costa Rica, Apartado 302-7050 Cartago, Costa Rica.*
[5]*Herbario PMA, Universidad de Panamá, Estafeta Universitaria, Panama City, Republic of Panamá.*
[6]*Coiba Scientific Station (COIBA AIP), Clayton, Panama City, Panama.*
[7]*email: thomas.croat@mobot.org; https://orcid.org/0000-0002-1804-0532*
[8]*email: marcovf.09@gmail.com; https://orcid.org/0000-0003-0119-0427*
[9]*email: ortizopma@gmail.com; https://orcid.org/0000-0002-7805-0046*
**Corresponding author. e-mail: marcovf.09@gmail.com*

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Abstract

Monstera is the taxonomically least understood genus in the Araceae family in Mesoamerica. Identification is further complicated by drastic phenotypic changes from juvenile to adult stages and the precocious flowering of some species. The reliability of traditional taxonomic characters is uncertain, as they have been primarily studied in dry herbarium specimens, with their variability in natural populations and living plants remaining largely unknown. To enhance the taxonomy of *Monstera*, a comprehensive revision of Central America species was conducted. This involved: (1) an exhaustive literature review; (2) examining 4500 specimens from different herbaria, including most type specimens; (3) extensive fieldwork to document plant morphology at different developmental stages through photography and herbarium preparation; and (4) circumscribing species using the gathered data. This study recognizes 52 native species in Central America. Three species are newly described here *M. coclensis*, *M. harrisoneorum*, and *M. ngabensis*, and one is new record for Panama. For each species, detailed morphological descriptions, habitat information, phenology, conservation status, examined specimen lists, taxonomic and nomenclatural comments, and photographs of key morphological traits are provided.

Key words: Araceae, Central America, *Monstera*, Monsteroideae, New species.

Introduction

The first use of the name *Monstera* Adanson (1763: 470) was in 1763 by the French botanist Charles Plummier who illustrated *Monstera adansonii* Schott (1830: 1028), calling it *Arum hederaceum amplis foliis perforates* (Plumier 1693, Madison 1977). The earliest history of and its confusion with *Dracontium* Linnaeus (1753: 967), *Philodendron* Schott (1829: 780), *Pothos* Linnaeus (1753: 968) and *Scindapsus* Schott (1832: 21) was covered in detail by Madison (1977) and it is suggested that one consult that paper for details. The first revision of *Monstera* was that by Schott (1860) who treated 29 species, many of which are currently synonymized. Only 4 species, *M. adansonii*, *M. expilata* Schott (1860: 367), *M. lechleriana* Schott (1860: 366) and *M. tenuis* Koch in Braun & Bouché (1855: 4) are still accepted names.

Engler & Krause (1908) provided the next revision 48 years later and that revision included even fewer taxa with only 27 species. Again, many of these species are currently considered synonyms and only 10 species are still accepted. These are *M. acuminata* Koch (1855: 4), *M. deliciosa* Liebmann (1849: 19), *M. dubia* (Kunth 1825: 217) Engler & Krause (1908: 117), *M. epipremnoides* Engler (1905: 118), *M. gracilis* Engler (1879: 258), *M. obliqua* Miquel (1844: 79), *M. pittieri* Engler (1905: 116), *M. punctulata* (Schott 1860: 393) Schott ex Engl. in Martius (1860: 393), *M. spruceana* (Schott 1859: 40) Engler (1878: 115) and *M. subpinnata* (Schott 1860: 357) Engler (1879: 267). Following Engler & Krause's revision Rusby (1910) published *M. unilatera* Rusby (1910: 494) and *M. boliviana* Rusby (1910: 494). Both names now are synonym of *M. obliqua*.

Krause working alone between the years 1914 and 1932 described five species and one variety from South America: *M. acreana* Krause (1914: 114) (now = *M. dubia*), *M. peckoltii* Krause (1916: 124) (now = *Monstera adansonii* subsp. *klotzschiana* Mayo & Andrade (2013 [2014]: 24)), *M. snethlagei* Krause (1925: 272) (now = *M. obliqua*), *M. killipii* Krause (1932: 614), and *M. falcifolia* var. *latifolia* Krause (1932: 614) (now = *M. obliqua*), and *M. latiloba* Krause (1932: 614) (now = *M. subpinnata*), all of which were synonymized by Madison (1977).

Working in Central America, Bartlett described *M. guatemalensis* Bartlett (1935: 17), but it is considered a nomen nudum. Also, in Central America Lundell (1939) described two species, *M. belizensis* Lundell (1939: 76) (now = *M. acuminata*) and *M. tuberculata* Lundell (1939: 1). Standley and Steyermark described *M. grandifolia* Standley & Steyermark (1947: 212) which is now synonymized with *M. acuminata*. In Mexico, Matuda described three species in *Monstera*, *M. acacoyaguensis* Matuda (1949: 48), *M. chiapensis* Matuda (1949: 48) (now = *M. acuminata*) and *M. roseospadix* Matuda (1949: 48) (now = *Rhodospatha wendlandii* Schott (1864: 52)) and another three species in 1950, *M. siltepecana* Matuda (1950: 97), *M. viridispatha* Matuda (1950: 98) (now = *M. acuminata*) and *M. magnispatha* Matuda (1950: 97) (now = *M. acacoyaguensis*). Matuda (1954) later lowered the latter species to varietal status as *M. magnispatha* var. *acacoyaguensis* (Matuda) Matuda (1954: 172). Matuda also described *M. tacanaensis* Matuda (1972 [1974]: 55) which was synonymized with *M. deliciosa* Liebmann (1849: 20) by Madison (1977) and now is considered an accepted species (Cedeño-Fonseca *et al.* 2020c).

In Trinidad, Simmonds described *M. irritans* Simmonds (1951: 398) which has been synonymized with *M. dubia*. In Central America, Steyermark transferred *Anepsias moritzianus* (Schott 1857: 109–110) Schott (1858: 73) to *Monstera* as *M. moritziana* (Schott) Steyermark (1957: 819), but this species proved to be a species of *Rhodospatha* Poeppig (1845: 91), now *Rhodospatha moritziana* Schott (1857: 109). George S. Bunting, working in Mexico, described *M.*

deliciosa var. *sierrana* Bunting (1965: 228) and from Costa Rica he described *M. standleyana* Bunting (1966: 46). In South America he described *M. henry-pittieri* Bunting (1975: 286) (now = *M. lechleriana* Schott) and *M. steyermarkii* Bunting (1975: 288) (now = *M. spruceana*).

The greatest impact on taxonomy of the genus was made by Madison who did a revision of *Monstera* for his Ph.D. at Harvard University. His revision (Madison 1977) of *Monstera* was the most recent major work published on the genus. Madison conducted fieldwork in both Central and South America and thus the revision has many excellent photos and illustrations. Madison's revision included 22 species and three varieties arranged in four sections: Section *Tornelia* (Gutiérrez ex Schott 1858: 74) Madison (1977: 93) with one species *M. deliciosa*; Section *Monstera* Schott with 13 species; Section *Marcgraviopsis* Madison (1977: 72) with seven species and Section *Echinospadix* Madison (1977: 90) with 1 species (*M. tuberculata*). Madison's 1977 Revision included five new species: *M. luteynii* Madison (1977: 89), *M. membranacea* Madison (1977: 55), *M. minima* Madison (1977: 55), *M. oreophila* Madison (1977: 54) and *M. xanthospatha* Madison (1977: 65) as well as two new combinations: *M. adansonii* var. *klotzschiana* (Schott) Madison (1977: 40) and *M. adansonii* var. *laniata* (Schott 1830: 1028) Madison (1977: 38).

Madison's work suffered from having been completed during the short span of a Ph.D. thesis project so that in some cases Madison over clumped some species, especially *M. obliqua*. and *M. lechleriana*. In addition, many new collections have been made from newly opened areas since 1977. Since the time of Madison's revision (Madison 1977), 40 species have been described, most of which are from Central America.

In 1987 Croat and Grayum made two necessary new combinations, *Rhodospatha costaricensis* Engler & Krause (1908: 95) to *M. costaricensis* (Engl. & K.Krause) Croat & Grayum (1987: 659) and *Tornelia dissecta* Schott (1858: 179) to *M. dissecta* (Schott) Croat & Grayum (1987: 659). In a paper by Grayum (1997) *M. molinae* Grayum (1997: 48) was published and an additional four species coauthored as Croat & Grayum were published: *M. buseyi* Croat & Grayum in Grayum (1997: 38), *M. lentii* Croat & Grayum in Grayum (1997: 46), *M. filamentosa* Croat & Grayum in Grayum (1997: 43) and *M. glaucescens* Croat & Grayum in Grayum (1997: 44).

For the revision of the Araceae of La Planada (Part 2) Croat *et al.* (2010a) published *M. planadensis* Croat (2010a: 88). In the treatment of the Araceae for the Flora of Cabo Corrientes Croat & Mora (2004) published *M. amargalensis* Croat & Mora (2004: 90). Additional studies of *Monstera* in South America yielded *M. kikiae* Zuluaga & M.Cedeño in Zuluaga *et al.* (2021: 135) and *M. momoi* Zuluaga & M.Cedeño in Zuluaga *et al.* (2021: 138) from the Pacific slope of the Andes in Colombia; *M. praetermissa* Gonçalves & Temponi (2004: 72) from eastern Brazil; *M. kessleri* Croat in Croat & Acebey (2005: 91) in Bolivia and *M. barrieri* Croat *et al.* (2005a: 61) in French Guiana. For the Flora of Río Cenepa three species were published: *M. aureopinnata* Croat in Croat *et al.* (2005b: 92), *M. cenepensis* Croat in Croat *et al.* (2005b: 95) and *M. vasquezii* Croat in Croat *et al.* (2005b: 96) from northern Peru in Amazonas state.

From Central America 20 species were published in recent years: *Monstera anomala* Zuluaga & Croat in Zuluaga & Cameron (2018: 6), *M. integrifolia* Zuluaga & Croat in Zuluaga & Cameron (2018: 6), *M. bocatorensis* Croat & M.Cedeño in Cedeño-Fonseca *et al.* (2021b: 266), *M. donosoensis* Croat, M.Cedeño & O.Ortiz in Cedeño-Fonseca *et al.* (2021b: 269), *M. gigas* Croat, M.Cedeño, Zuluaga & O.Ortiz in Cedeño-Fonseca *et al.* (2021b: 272), and *M. titanum* Croat, M.Cedeño & O.Ortiz in Cedeño-Fonseca *et al.* (2021b: 275). *Monstera gentryi* Croat, M.Cedeño & O.Ortiz in Cedeño-Fonseca *et al.* (2021a: 213), *M. mittermeieri* M.Cedeño in Cedeño-Fonseca *et al.* (2021a: 2017), *M. alfaroi* Croat & M.Cedeño in Cedeño-Fonseca *et al.* (2020a: 2), *M. tarrazuensis* Croat & M.Cedeño in Cedeño-Fonseca *et al.* (2020a: 5), *M. wilsoniensis* M.Cedeño & Grayum in Cedeño-Fonseca *et al.* (2020a: 8), *M. juliusii* M.Cedeño & Croat in Cedeño-Fonseca *et al.* (2020b: 186), *M. monteverdensis* M.Cedeño & Croat in Cedeño-Fonseca *et al.* (2020b: 188), *M. croatii* M.Cedeño & A.Hay in Cedeño-Fonseca *et al.* (2020d: 124), *M. gambensis* M.Cedeño & M.A.Blanco in Cedeño-Fonseca *et al* (2020d: 123), *M. alcirana* Croat, M.Cedeño, Zuluaga & O.Ortiz in Cedeño-Fonseca *et al.* (2020g: 251), *M. limitaris* M.Cedeño in Cedeño-Fonseca *et al.* (2018: 37), and *M. guzmanjacobiae* Díaz Jiménez, M.Cedeño, Zuluaga & Aguilar-Rodríguez in Díaz-Jiménez *et al.* (2020: 039). *Monstera florescanoana* Croat *et al.* (2010b: 225) was published from eastern Mexico and *Monstera maderaverde* Grayum & Karney (2012: 209) was described from Honduras.

Finally, following their studies on the *Monstera adansonii* complex in eastern Brazil, Mayo & Andrade (1998) made a new combination, *M. adansonii* Schott subsp. *blanchetii* (Schott 1860: 367) Mayo & Andrade (2013 [2014]: 124), they also proposed new status for *M. adansonii* by elevating *M. adansonii* var. *klotzschiana* (Schott) Madison and *M. adansonii* var. *laniata* (Schott) Madison to subspecific status, as *M. adansonii* subsp. *klotzschiana* (Schott) Mayo & Andrade (2013 [2014]: 24) and *M. adansonii* subsp. *laniata* (Schott) Mayo & Andrade (2013 [2014]: 124).

A revision of the genus *Monstera* for Costa Rica was recently published, which includes 32 widely documented species with photographic details of morphological characteristics, in addition to extensive discussions of nomenclatural issues (Cedeño-Fonseca *et al.* 2022).

Sectional classification of *Monstera*

Madison (1977) proposed the first and only sectional classification, where four sections were included (based mainly on morphological characters of leaf blades, ligules, inflorescences, infructescences, and growth life form). Both section *Tornelia* and section *Monstera* have their earliest climbing phase with exerted leaves with the petioles more than 2/3 as long as the blades, while both section *Marcgraviopsis* and section *Echinospadix* in the earliest climbing phase have leaves tightly appressed to the substrate (shingle plant) and have petioles that are less than ½ as long as the blades. Section *Tornelia* is further distinguished by its very large fruits. Section *Marcgraviopsis* and section *Echinospadix* differ in habit with sect. *Marcgraviopsis* having erect inflorescences and the adult plants have leaves with a short ligule or with the ligule all together lacking while sect. *Echinospadix* has the flowering plants pendent with the leaf having a ligule that is about as long as the petiole.

Phylogeny

The subfamily Monsteroideae includes 12 genera in four tribes: Spathiphylleae, Anadendreae, Heteropsideae, and Monstereae (Mayo *et al.* 1997). Molecular studies by Tam *et al.* (2004) demonstrated strong support for the subfamily but not much support for clades within the subfamily. The classification of Monsteroideae by Cusimano *et al.* (2011) recognizes 12 genera clustered into three main clades: tropical American clade (*Heteropsis* clade) with *Alloschemone* Schott (1858: 99), *Heteropsis* Kunth (1841: 59), *Rhodospatha*, and *Stenospermation* Schott (1858: 70); the tribe Spathiphylleae that includes *Holochlamys* Engler (1883: 265) and *Spathiphyllum* Schott (1832: 22); mostly Paleotropical clade (Rhaphidophora clade) with *Amydrium* Schott (1863: 127), *Anadendrum* Schott (1857: 45), *Epipremnum* Schott (1857: 45), *Monstera*, *Scindapsus*, and *Rhaphidophora* Hasskarl (1842: 11). A recent molecular research paper by Zuluaga *et al.* (2019) showed high support for the monophyly of the three major clades (Spathiphylleae sister to *Heteropsis* and *Rhaphidophora* clades), and for six of the genera within Monsteroideae, the Paleotropical genera *Anadendrum*, *Scindapsus*, as well as the Neotropical *Monstera* in one clade, along with *Rhodospatha*, *Stenospermation*, and *Heteropsis* in another clade.

According to Cusimano *et al.* (2011), Monsteroideae (clade 24) is supported by the following phenotypic synapomorphies: trichoschlereids, parallel-pinnate fine leaf venation, zonate (ring-like aperature) pollen, and undifferentiated, soon deciduous spathes, although these characters have exceptions in one or more genera. Spathiphylleae clade are phenotypically very distinct, being characterized by smaller trichoschlereids in bundles and polyplicate-multiaperturate pollen type (Tarasevich 1988, Hesse & Zetter 2007). The *Heteropsis* clade has the phenotypic synapomorphy of chromosome base number x = 14 while the *Rhaphidophora* clade lacks phenotypic synapomorphies.

Ecology

The genus *Monstera* is unusual for the diverse forms of growth that a single species undergoes. Nearly all species are epiphytic climbers, usually appressed-climbing epiphytes (termed “nomadic vines” by Zotz 2013, Sperotto *et al.* 2020) or sometimes scrambling loosely through their usually arborescent hosts. Typically, seeds are large and do not germinate on trees but rather in the soil in the shady interior of the forest for most species. Seedlings develop a short stem with several petiolate leaves but eventually branch to form a creeping stem which grows in the “up slope” direction (Madison 1977) and scototropically (toward darkness) (Strong & Ray 1975). When the stem begins to climb, a change in the auxin position in the cell causes the plant to grow toward the light, up the slide of the climbing surface. Stems are typically flattened with a dense layer of roots on the side facing the surface of the host tree with leaves produced distichously on the opposite side of the stem. The inner surface of the stem also has little development of chlorophyll and is typically pale green or white. The roots are very effective at entering pores in the bark or even into cracks on rocks or concrete walls. Thus, the stem can remain firmly affixed without the presence of grappling roots so common to *Philodendron* which partially engulf the circumference of the tree to hold on.

Juvenile plants are of two basic types. Those of sections *Marcgraviopsis* and *Echinospadix* produce plants with short, usually heavily sheathed petioles with subrounded blades growing appressed to the tree and mostly obscuring the short petioles. Owing to the low light conditions for the juvenile plants growing low on tree trunks, the leaf blades

are typically matte-subvelvety or velvety, allowing for the capture of a larger proportion of the light that strikes them (Madison 1977). The second type of juvenile blades have conspicuously petiolate leaves. The juvenile blades usually have little resemblance to those of the adult plant but generally take on the other characteristics of the adult plant, namely drying color, texture, and presence or absence of conspicuous cellular inclusion. Since the calcium oxalate crystals taken up by the plant are accumulated in various ways and in various forms, each often indistinguishable without anatomical dissection, we refer to all of them merely as cellular inclusions in this treatment. Often these cellular inclusions form hyphen-shaped structures (Madison 1977). This work refers to these as short pale lineations without designating the crystal type, eg. druse or raphide.

While climbing up the side of its support, *Monstera* juvenile plants soon reach a height at which the plant has enough light for the leaf type to become modified. This process is known as heteroblasty (Zotz *et al.* 2011). The next step in the growth pattern of most *Monstera* species is production of long-petiolate leaves with blades that are somewhat like those of the adult plant in color and texture but smaller in size and usually lacking perforations. Thus, if the adult plant has an oblong-elliptic blade, a similar preadult plants leaf is developed. Initially these preadult leaves are growing with longer internodes but as the stem girth increases the internode length decreases proportionately and thus eventually internodes become very short and very broad (Madison 1977).

Adult plant leaf blade types begin developing at some point in this sequence so that often one can collect juvenile, preadult and adult type leaves from the same stem. Collectors are encouraged to make samples of this series since many of the juvenile and preadult plants of known species are yet unknown and determination of those forms is not easily made without collecting corresponding adult plants.

Floral and pollination biology

While few observations have been made on pollination of *Monstera* (Chouteau *et al.* 2007, 2009, Prieto & Cascante 2017), most species have a syndrome that certainly suggests pollination by beetles (*Cychrocephalus corvinus* (Reitter 1873), Nitidulidae) and one possible for drosophila flies (Prieto & Cascante 2017). The spathes are conduplicate and very broad, almost globular at anthesis. Moreover, the spathe begins to loosen early in the afternoon forming a chamber internally (Prieto & Cascante 2017) and is generally showing a gap between the inner margin and the outer margin of the spathe, space where pollinating insects manage to enter. The development of the spathe from the female anthesis to the male phase can last up to 192 hours (Prieto & Cascante 2017). However, this can vary depending on the size of the spadix. The flowers are protogynous with the stigmatic drops available during the female anthesis, which dries in 1–6 hours before the male phase begins (pollen release) (Madison 1977, Cedeño-Fonseca *et al.* pers. obs.).

The stamens emerge in the stasis before the extension of the broad filament in the same way as in *Anthurium* (Croat 1980, Cedeño-Fonseca *et al.* pers. obs.). Pollen emerges from the ends of the thecae in fine sticky threads reminiscent of *Dieffenbachia* Schott (1829: 803) and *Philodendron* (Prieto & Cascante 2017) (Cedeño-Fonseca *et al.* pers. obs.). Since most pollination is likely to occur on the first night of flowering when stigmas are still receptive, the timing of the appearance of stamens is important since the first visitors can be induced to leave the inflorescence even before stamens emerge, thus preventing the essential cross-pollination.

In most genera with unisexual flowers the pollination syndrome is highly specialized and the pistillate flowers are receptive the first night and the beetles spend about 24 hours in a semi-positive state while copulating and feeding on sterile lipid-rich flowers while they wait the afternoon of the day (Gibernau *et al.* 1999). At this time, the stamens are emerging, and the spathes are reclosing while the approach of darkness generally encourages their departure with deposits of pollen adhering to their carapace (Gibernau *et al.* 1999). The situation in *Monstera*, with its semi-open spathe for more than 24 hours, is more complex, because it keeps the beetles trapped and subsequently opens in the male phase releasing pollen which is removed by the beetles when moving to the apex of the spadix to exit (Prieto & Cascante 2017, Cedeño-Fonseca *et al.* pers. obs.).

Apart from the insects considered pollinators (Nitidulidae and Drosophyllidae), other groups have been found that manage to enter when it is the female phase without the need to pierce the spathe like *Cyclocephala* (Dejean 1821), and staphilinides (Staphyllinidae) eating pollen and nectar from basal sterile flowers and other genera of nitidulides.

Frugivory and herbivory

Cedeño-Fonseca *et al.* (2020f) documented seed dispersal of *Monstera adansonii* by birds such as *Habia rubica* (Vieillot 1817) in Costa Rica, and *Thraupis episcopus* (Linnaeus 1766) and the monkey *Saguinus geoffroyi* (Pucheran 1845) in Panama.

In the case of herbivory, Cedeño-Fonseca & Zuluaga (2020) reported the monkey *Ateles geoffroyi* (Kuhl 1820) eating *M. tenuis* leaves, galls of the Cecidomyiidae in the roots of *M. pittieri*, leaf miner Lepidoptera larvae in *M. limitaris*, Lepidoptera larva (Bombycidae: Apatelodinae) eating leaf in *M. lentii*, and *Atta* (Fabricius 1805) cutting leaves of *M. dubia* in Costa Rica. For Colombia, the *Cactophagus aurofasciatus* (Brême 1844) beetle is reported damaging the developing inflorescence of *M. xanthospatha* to lay its eggs, Lepidoptera larvae in *Monstera* sp. eating the peduncle to enter the rachis of the developing inflorescence, and the *Brachyteles hypoxanthus* (Kuhl 1820) monkey eating leaves of *Monstera* sp. in Brazil (see Cedeño-Fonseca & Zuluaga 2020).

Materials and methods

Field work was carried out between 2015 and 2020 in Costa Rica in different sectors of the Cordillera de Tilarán, Central and Talamanca, on both the Pacific and Caribbean slopes, and the Peninsula de Osa. In Panama, between 2012 and 2020 along the Cordillera de Talamanca in the Pacific and Caribbean slopes, central Panama and the Darien. Between 2015 and 2020 in Mexico around Chiapas and Veracruz. During the fieldwork, herbarium specimens were collected and the plants in their natural state were documented.

Herbarium material was studied from the following herbaria: AGUAT, B, BIGU, CHIP, CR, CSAT, CUVC, B, ENCB, HEM, HLDG, HNMN, ITIC, JAUM, JVR, LAGU, LSCR, MA, MEXU, MHES, MO, NY, PMA, SEL, SCZ, TEFH, UCH, UJUAT, USCG, USJ and XAL, as well as images of specimens accessible on-line at C, COL, EAP, ENCB, MEXU and TEFH.

Type material used to determine the correct names and synonyms applied to the species circumscribed in this treatment have been examined where possible, either on-line by consulting the virtual herbaria of particular institutions, via the JSTOR Global Plants database (https://plants.jstor.org/), or by directly examining type material at CR, MEXU, MO, PMA and USJ.

For the documentation of the plant in its natural state and the herbarium material, we used the methodology of Cedeño-Fonseca *et al.* (2022).

Taxonomy

Monstera Adans., Fam. Pl. 2: 470. 1763. Nom. et typ. cons. (see Nicolson 1968, McVaugh 1969).

Type:—*Monstera adansonii* Schott [based on *Dracontium pertusum* Linnaeus (1753: 968); non *Monstera pertusa* (Roxburgh 1820: 455) Schott (1830: 1028) (*Pothos pertusus* Roxburgh (1820: 455)), i.e. *Rhaphidophora pertusa* (Roxburgh 1820: 455) Schott (1860: 382)].

Tornelia [Gutiérrez ex Schldl., Linnaea 26: 382. 1854 ('1853'), in synon.]; Gutiérrez ex Schott, Gen. Aroid. 74. 1858. TYPE:—*Tornelia fragrans* Gutiérrez ex Schott (1858: 74) (= *Monstera deliciosa* Liebm.).

Serangium Wood ex Salisbury (1866), Gen. Pl.: 5. 1866. TYPE:—*Dracontium pertusum* L. (≡ *Monstera adansonii* Schott).

Slender to massive nomadic vines, appressed-climbing or climbing with pendent stems; growth sympodial in the adult reproductive phase. SEEDLINGS skototropic, terrestrial; **shoots** with foliage leaves or filiform and aphyllous. JUVENILE PLANTS: **stems** cylindrical or dorsoventrally compressed, ascending with adventitious roots; leaves exerted or appressed to the substrate; **petiole** distinct or obscure; **blade** elliptic, ovate, lanceolate or oblanceolate, sometimes fenestrate, sometimes variegated grayish-green around or between the veins, oblique, attenuate, cordate, subcordate or obtuse at base, obtuse or acuminate at apex, margins entire or pinnatilobed. ADULTS: **stems** cylindrical or dorsoventrally compressed, sometimes sulcate; **roots** dimorphic, positively geotropic, growing to penetrate substrate,

appressed to substrate or pendent, occasionally with peridermal tissue; **anchor roots** along stem or only at nodes; **feeder roots** one per node on opposite side to petiole; **prophylls** deciduous, marcescent entire or becoming fibrous, 2-ribbed; **cataphylls** deciduous or marcescent, becoming fibrous, sometimes with a reduced blade at apex. LEAVES distichous; **petiole** basally alate and usually geniculate at apex; **blades** narrowly lanceolate to ovate-cordate, obtuse or long-acuminate at apex, sometimes decurrent along geniculum, entire or conspicuously fenestrate, margins entire, pinnatilobed or pinnatifid by intramarginal dissection, venation pinnate, primary lateral veins simple, bifurcated or trifurcated. INFLORESCENCE terminal, solitary or arranged in groups of up to 13 spadices, developed in ascending (adherent) stems, on pendent stems or in both types; **peduncle** straight or recurved; **spathe** equal to or longer than spadix, sometimes pruinose, without a proximal tube, tearing longitudinally at anthesis in some species, deciduous or marcescent after anthesis; stipe short (up to 2.5 cm long); **spadix** sub-cylindrical, with densely grouped flowers in spirals, white during development and cream at anthesis, with a region of sterile flowers at base sometimes decurrent on peduncle; **flowers** hermaphrodite, achlamydeous, protogynous; androecium of 4 free stamens; filaments laminar; anthers oblong-ellipsoid, thecae with lateral dehiscence; gynoecium with a prismatic ovary, bilocular, with 2 ovules per locule, placentation axile; style cylindrical or tetragonal, usually wider than long, the upper surface quadrangular, trapezoidal, pentagonal or hexagonal; stigma linear or circular, elevated by a cupuliform, columnar or conical stigmaphore. INFRUCTESCENCE with berries grouped in a syncarp ("monsterocarp"); **berries** with the stylar cap deciduous at maturity, 1–4 seeded; **seeds** obovate to ellipsoid, smooth, embryo large, endosperm absent; chromosome number 2n = 60 (24, 48, 56, 58, 70).

With 64 species in the Neotropics and 52 species in Central America (Mexico to Panama).

Key to *Monstera* of Central America

1a. Spathe orange or yellow-orange at anthesis; fruits with the stylar cap orange 2

2a. Petioles shorter than blades; blades yellowish when dry, mostly less than 3 times longer than wide, mostly obtuse to rounded with short apiculum at apex; peduncle longer (up to 38 cm long) ..... *M. alcirana*

2b. Petioles often about as long as blade; blades blackish, reddish, light brown or grayish when dry, mostly 3.3–3.5 times longer than broad, typically acute to acuminate at apex; peduncle shorter (10–17 cm) ..... *M. obliqua*

1b. Spathe of various colors, never orange or yellow-orange; the stylar cap never orange 3

3a. Plants with pendent habit and usually lacking or with poorly-developed anchor roots on flowering branches (inflorescence always on hanging shoots); internodes mostly elongated at stem apex, generally 3 or more times longer than wide 4

4a. Adult plants with leaf blades pinnatilobed 5

5a. Petiolar sheath persistent or semi-persistent, reaching base of the geniculum or base of the leaf blade; spathe tearing longitudinally at base after anthesis before falling, white within, externally yellowish-green and not pruinose; leaf blade, with 2–4 lobes per side, never perforate ..... *M. molinae*

5b. Petiolar sheath deciduous, not reaching the geniculum; spathe not tearing longitudinally at base after anthesis before falling, pale pink internally, green and pruinose externally; leaf blade with 2–6 lobes per side, usually perforated ..... *M. tacanaensis*

4b. Adult plants with leaf blades margins entire 6

6a. Stems tuberculate with scaly epidermis; petiole sheath markedly ligulate and marcescent leaving persistent fibrous remains 7

7a. Leaf blades large (usually 18–59 × 15–37 cm); peduncles longer, usually equal or more than 5 cm long ..... *M. guzmanjacobiae*

7b. Leaf blades smaller (12–20 × 9–13 cm); peduncles shorter, typically up to 5 cm long 8

8a. Petioles more than 7 cm long; petiolar sheath ligulate up to 3 cm; inflorescences erect ..... *M. luteynii*

8b. Petioles less than 4 cm long; petiolar sheath ligulate for 3–6 cm; inflorescences pendent ..... *M. tuberculata*

6b. Stems generally smooth; petiole sheath non-ligulate or with poorly developed ligule (less than 1 cm long) and completely deciduous 9

9a. Leaf blade cuneate to rounded or truncated at base; peduncles shorter, up to 4 cm long ..... *M. pittieri*

9b. Leaf blade cordate, subcordate, rounded, truncate to cordulate at base; peduncles more than 8 cm long 10

10a. Primary lateral veins 15–25 per side; leaf blade generally with perforations .....*M. wilsoniensis*

10b. Primary lateral veins up to 9 per side; leaf blade usually lacking perforations..... 11

11a. Leaf blades 1.5–2.1 times longer than wide, up to 26 cm long; peduncle 2.5–2.6 longer than the spadix; Costa Rica (Tarrazú)..... *M. tarrazuensis*

11b. Leaf blades less 1.0–1.1 times longer than wide, usually 12.8–16.0 cm long; peduncle 1.6–1.8 times longer than the spadix; Honduras (Atlántida) ..... *M. maderaverde*

3b. Plants generally appressed-climbing with well-developed anchor roots on flowering branches (inflorescence typically on ascending shoots); internodes mostly short at stem apex, generally less 3 times longer than wide 12

12a. Adult leaf blade regularly pinnatifid or pinnatilobed (the lobes well differentiated and/or arranged consistently along the midrib).....13

13a. Leaf blades narrow (up to 13 cm wide), usually 2.0–2.6 times longer than wide ..... *M. integrifolia*

13b. Leaf blades wider (more than 13 cm wide), usually less than 2 times longer than wide 14

14a. Petiolar sheath persistent (presence of continuous tissue, whether living or marcescent, along adaxial margins of the petiole) 15

15a. Petiole typically half-sheathed 16

16a. Petioles more than 45 cm long; spadix 5.4–6.4 times longer than wide; Panama (Caribbean slope)..... *M. bocatorensis*

16b. Petioles less than 45 cm long; spadix up to 5 times longer than wide 17

17a. Leaf blades with 6–12 pairs of lobes, mostly less than 5 cm wide; Costa Rica (Pacific slope) ..... *M. croatii*

17b. Leaf blades with 2–7 pairs of lobes, mostly more than 5 cm wide; Costa Rica to Colombia ..... *M. glaucescens*

15b. Petiole fully sheathed, sometimes sheathed up to 3–6 cm before the geniculum 18

18a. Petiole whitish or sparsely speckled with white dots; leaf blade with abundant rounded fenestrations on each side adjacent to the midrib; primary lateral veins emerge from the midrib at an angle of 80–90°; Costa Rica and Panama ..... *M. epipremnoides*

18b. Petiole greenish or strongly speckled with white dots; leaf blade lacking fenestrations or with few rounded fenestrations on each side adjacent to the midrib.....19

19a. Adult leaf blade deeply pinnatifid; lobes mostly less than 5 cm wide; spadix 5.5–9.1 times longer than wide; Belize to South America (widespread)..... *M. pinnatipartita*

19b. Adult leaf blade deeply pinnatilobed; lobes usually more than 5 cm wide 20

20a. Stigmatophore strongly conical; Costa Rica to western Panama, at 1050–1650 m ..... *M. lentii*

20b. Stigmatophore cupuliform; Belize to Guatemala, Nicaragua, Honduras, Costa Rica and Panama from sea level to mostly less that 700 m..... *M. dissecta*

14b. Petiolar sheath deciduous (no tissue along adaxial margins of the petiole; sometimes leaving fibers and/or remains of irregular pieces of tissue) 21

21a. Petiole typically half-sheathed; geniculum winged; blades 1.0–1.1 times as longer than wide; Mexico, Belize and Guatemala.....*M. deliciosa*

21b. Petiole fully sheathed, sometimes sheathed up to 2–3 cm before the geniculum; geniculum smooth or obscure; blades generally more than 1.2 times longer than wide 22

22a. Adult leaf blades lacking fenestrations; spadix 6.5–9.0 times longer than wide and 2.5–3.7 times longer than peduncle 23

23a. Adult leaf blades with 1–6 pairs of lobes, usually more than 3 cm wide ....*M. spruceana*

23b. Adult leaf blades with generally more than 6 pairs of lobes, mostly narrow (up to 3 cm wide)..... .....*M. tenuis*

22b. Adult leaf blades with or without fenestrations; spadix less than 6 times longer than wide and up to 1.6 times longer than peduncle....24

24a. Adult blade with each lobe (incompletely) separated from the next by a row of fenestrations, with the lobes sometimes cross-linked by filaments or very narrow bands of lamina often becoming broken with age 25

25a. Blades with 3–6 pairs of lobes, mostly connected by broader bands of laminar tissue; spathe externally pink, never longitudinally splitting at male anthesis; spadix 1.5–2.0 times longer than wide.....*M. dubia*

25b. Blades with more than 6 pairs of lobes, generally connected by very fine thread-like filaments; spathe externally yellowish green or pinkish, usually longitudinally splitting at male anthesis; spadix 4 or more times longer than wide....26

26a. Petiolar sheath deciduous but leaving persistent fibrous remains; spathe externally pink..... *M. filamentosa*

26b. Petiolar sheath deciduous without leaving fibrous remains; spathe externally yellowish-green . *M. punctulata*

24b. Adult leaf blade with each lobe completely separated from the next by a single incision reaching or approaching the midrib 27

27a. Style not at all cupuliform but rather with narrow sloping shoulders, the stigma protruding well above style; Panama, 100–1600 m ....*M. donosoensis*

27b. Style drying cupuliform with the margins usually as high or higher than the essentially sessile stigma, the stigma not protruding well above style; Costa Rica, 1200–1500 m ..*M. monteverdensis*

12b. Adult leaf blade with entire margins (with or without fenestrations) or irregularly pinnatilobed (lobes originated by tearing of the fenestrations that extend close to the margin) with a few lacerations. 28

28a. Petiole and peduncle surface verrucose due to the presence of numerous and conspicuous brown, black, green or white pustules (lenticel-like structures visible to the naked eye) on the epidermis....29

29a. Petiole sheath deciduous, not undulate; stems and petioles with large black pustules; spathe yellowish-cream externally; Costa Rica (Alajuela, Heredia, Puntarenas, San José) to Panama (Chiriquí), 40–150 m .....*M. buseyi*

29b. Petiole sheath persistent or deciduous, markedly undulate; stems and petioles with large brown, black or white pustules; spathe light green or cream externally 30

30a. Petioles with greenish white (never black) pustules; base of petiole dark green; styles conical; western Panama to south central Costa Rica (Caribbean slope), 100–1200 ..... *M. costaricensis*

30b. Petioles with brown, black and/or white pustules; styles truncate; Costa Rica (Puntarenas, San José; Pacific slope), 1100–1250 m ....*M. alfaroi*

28b. Petiole and peduncle smooth or rough but due to the presence of small elongated scale-like structures on the epidermis (10x magnification), pustules generally absent 31

31a. Adult leaf blade distinctly membranous; mature infructescence with the pulp orange....*M. membranacea*

31b. Adult leaf blade subcoriaceous or coriaceous; mature infructescence with the pulp white 32

32a. Flowers with a distinctly circular stigma 33

33a. Inflorescence robust, peduncle 25–48 cm long; spathe 16–47 cm long; spadix large, 18.0–25.5 cm long, 2.4–6.0 cm diam.; primary lateral veins 20–65 pairs; Panama (endemics) 34

34a. Leaf blades lacking fenestrations; petioles light green, smooth, sheathed up to (0.36–)0.74–0.86 its total length, unsheathed portion subterete ..... *M. gigas*

34b. Leaf blades typically with fenestrations; petiole dark or light green, sheathed to base of the geniculum, unsheathed portion sulcate adaxially ..... *M. titanum*

33b. Inflorescence medium-sized, peduncle up to 35 cm long; spathe up to 25 cm long; spadix less than 20 cm long, 2–3 cm diam.; primary lateral veins up to 25 pairs..... 35

35a. Leaf blades generally narrowly lanceolate, generally more than 2.1 times longer than wide..... 36

36a. Petiole whitish to speckled with white dots; adult leaf blade perforated or not; spadix 4.7–5 times longer than wide, 0.6–0.9 times as long as peduncle; style conical; Costa Rica and Panama .... *M. integrifolia*

36b. Petiole green; adult leaf blade never perforated; spadix 2.1–4.6 times longer than wide, 0.2–0.4 times as long as peduncle; style rounded; Panama (Coclé)..... *M. coclensis* sp. nov.

35b. Leaf blades lanceolate-ovate to broadly lanceolate, ovate, oblong or elliptic, typically less than 2.2 times longer than wide 37

37a. Petiolar sheath deciduous (no tissue along adaxial margins of the petiole; sometimes leaving fibers and/or irregular tissue pieces remains) 38

38a. Leaf blades 1.3–1.7 times longer than petiole; fenestrations usually numerous; peduncle short (up to 12 cm long); spadix 1.1–2 times as long as peduncle; Mexico to Guatemala, El Salvador, Honduras and Nicaragua ..... *M. siltepecana*

38b. Leaf blades 0.7–1.3 times longer than petiole; fenestrations few; peduncle 12–20 cm long; spadix 0.5–0.8 times as long as peduncle; Panama (endemics) 39

39a. Leaf blades small, up to 25.5 × 16.0 cm; primary lateral veins up to 8 pairs; style truncate; Panama (Cerro Jefe) at 980 m ..... *M. harrisoniorum* sp. nov.

39b. Leaf blades large, typically more than 26 × 16 cm; primary lateral veins up to 20 pairs; style strongly conical; Panama (widespread), at elevations of 100–1600 ..... *M. donosoensis*

37b. Petiolar sheath persistent (presence of continuous tissue, whether living or marcescent, along adaxial margins of the petiole)..... 40

40a. Petioles and leaf blades glaucous adaxially (when fresh); fenestrations numerous; peduncle short, up to 6 cm long; spadix 1.6–3.3 times longer than peduncle; Mexico (Veracruz)..... *M. florescanoana*

40b. Petioles and leaf blades green; fenestrations usually absent, peduncle generally more than 9 cm long; spadix 0.6–0.9 times as long as peduncle; Nicaragua to Panama ..... *M. standleyana*

32b. Flowers with a strongly linear stigma 41

41a. Petiolar sheath deciduous (no tissue along adaxial margins of the petiole; sometimes leaving fibers and/or irregular tissue pieces remains)..... 42

42a. Leaf blades generally narrowly lanceolate, 2.1–6.0 times longer than wide; fenestrations absent..... 43

43a. Peduncle more than 12 cm long, 3–8 times longer than petiole; primary lateral veins up to 5 pairs; style truncate; Panama (Comarca Guna Yala) ..... *M. minima*

43b. Peduncle typically less than 15 cm long, 0.2 times as long as petiole; primary lateral veins 4–25 pairs; style prolonged and constricted in the middle; Costa Rica and Panama ..... *M. anomala*

42b. Leaf blades lanceolate-ovate to broadly lanceolate, ovate, oblong or elliptic, typically up to 2 times longer than wide; fenestrations usually present, rarely absent 44

44a. Primary lateral veins up to 7 pairs; Panama (Comarca Ngäbe-Buglé)..... *M. ngabensis* sp. nov.

44b. Primary lateral veins numerous, more than 14 pairs 45

45a. Spathe pink to salmon-pink at anthesis 46

46a. Spathe pale pink internally, not becoming torn at base nor reflexed when open; petioles smooth; Costa Rica (Buenos Aires, Pacific slope in the Cordillera of Talamanca), 2000–2100 m.....*M. mittermeieri*

46b. Spathe dark pink or salmon-pink internally; petioles smooth or warty; Costa Rica to Panama, 800–2300 m .....*M. oreophila*

45b. Spathe of various colors, never pink to salmon-pink 47

47a. Leaf blades 35–45 cm wide, 1.2–1.5 times longer than petiole; Mexico (western Chiapas) to Belize, and Guatemala; elevations range from 0–200 m .....*M. acacoyaguensis*

47b. Leaf blades up to 30 cm wide, 0.9–1.0 times as long as petiole 48

48a. Spadix 3.6–4.8 times longer than wide, 1.0–1.2 times as long as peduncle; Costa Rica and Panama, 1900–2300 m .... *M. tablasensis* M.Cedeño in Cedeño-Fonseca *et al.* (2022: 162)

48b. Spadix 4.8–9.2 times longer than wide, 0.7–0.9 times as long as peduncle; from sea level to 975 m.....49

50a. Petiole dark green, smooth (rarely asperous with white pustules); primary lateral veins bifurcated or trifurcated or not; spathe white externally; widespread..... .....*M. adansonii*

50b. Petiole white-dotted, smooth with few dark pustules in base; primary lateral veins never bifurcated or trifurcated; spathe white-yellowish externally; Costa Rica and Panama (Pacific slope).....*M. limitaris*

41b. Petiolar sheath persistent (presence of continuous tissue, whether living or marcescent, along adaxial margins of the petiole).....51

51a. Petiole usually half-sheathed, sometimes 5–15 cm beyond the middle; leaf blades glaucous abaxially (when fresh); Panama (Caribbean slopes of Bocas del Toro and Veraguas).....*M. bocatorensis*

51b. Petiole fully sheathed, sometimes sheathed up to 2–3 cm before the geniculum; leaf blades never glaucous 52

52a. Spathe pink to salmon-pink at anthesis; Panama (Chiriquí Province, Comarca Ngäbe-Buglé, and Veraguas) at 900–1500 m .....*M. gentryi*

52b. Spathe of various colors, never pink to salmon-pink 53

53a. Petiole asperous; petiolar sheath involute; leaf blade up to 10 cm wide; peduncle 1.0–1.1 times as long as petiole; spadix 0.3–0.4 times as long as peduncle; Costa Rica (Golfito) at 50–100 ... *M. gambensis*

53b. Petiole smooth; petiolar sheath non-involute; leaf blade more than 10 cm wide; peduncle 0.1–0.6 times as long as petiole; spadix 0.7–2.0 times as long as peduncle 54

54a. Peduncle short, up to 12 cm long; spadix 0.9–2.0 times longer than peduncle; Mexico to Guatemala, Belize, Honduras, and Nicaragua..... *M. acuminata*

54b. Peduncle more than 12 cm long; spadix 0.7–1.3 times as long as peduncle.....55

55a. Spadix up to 14 cm long, 0.9–1.3 times as long as peduncle; Costa Rica and Panama at 1650–2010 m..... *M. juliusii*

55b. Spadix more than 14 cm long, 0.7–0.8 times as long as peduncle; Mexico and Belize at 100–1500 m..... *M. egregia* Schott (1864: 53–54)

1. ***Monstera acacoyaguensis*** Matuda, *Madroño* 10: 48. 1949. (Figs. 1, 2)

Type:—MEXICO. Chiapas: in shaded woods or forest, along the Rio Grande, Acacoyagua, near Escuintla, at about 100 m. altitude, 25 May 1948, *Matuda 17853* (holotype MEXU!, isotypes EAP!, F, MEXU!).

Monstera magnispatha Matuda, *Rev. Soc. Mex. Hist. Nat.* 11: 97 (1950). TYPE:—MEXICO, Chiapas, en orilla de arroyo, bosque alto, Esperanza, Escuintla, 160 m., 28 Sept. 1947, *E. Matuda 17015* (lectotype HEM [Matuda Herbarium], designated by Madison (1977), isolectotypes F (1273057, 1273060)!, MEXU!, NY [photo]!).

Nomadic vine, appressed-climbing. SEEDLINGS bearing foliose leaves. JUVENILE PLANTS root climbers; **stems** cylindrical, smooth, light green, internodes 3–7 cm long, 3–6 mm diam.; **petiole** distinct, light-green, smooth, 5–10 cm long, sheathed to the geniculum; **petiole sheath** semi-persistent; **blades** elliptical, subcordate at base, acuminate at apex, thinly coriaceous, 10–15 × 5–10 cm, not appressed to the phorophyte; **fenestrations** present or absent. ADULT PLANTS: root climbers; **stems** cylindrical, smooth, light green or grayish, internodes 1–3 cm long, 1–3 cm diam., as long as wide; **anchor roots** black, **feeder roots** light brown; **petioles** 35–55 cm long, light or dark green, smooth, sheathed to the geniculum; **petiole sheath** semi-persistent; geniculum 2–5 cm long, smooth, flattened or slightly corrugated adaxially and convex abaxially; **blades** 45–85 × 35–45 cm, 1.7–2.5 times longer than wide, slightly decurrent on the geniculum (decurrent part 1.5–2.0 mm wide), lanceolate, elliptical, subcordate to obtuse, acuminate at apex, thinly coriaceous, drying blackish or greenish brown; **midrib** sulcate adaxially, convex abaxially; **primary lateral veins** 15–25 per side, parallel, sunken adaxially, raised abaxially, departing midrib at 75–85°; **secondary veins** inconspicuous and reticulate towards the margin; **collective veins** present; **fenestrations** elongated and ellipsoid, arranged in 1 or 2 series on each side of the midrib; **margins** entire or pinnatilobed (3–5 lobes per side). INFLORESCENCES on ascending stems, arranged in the axils and into deciduous cataphylls, 1–3 simultaneously during the flowering season; **peduncle** smooth, 15–35 cm long, 1.5–2.0 cm diam.; **spathe** acuminate, light-green and pruinose during development, yellowish green externally and white internally at anthesis, coriaceous, deciduous after anthesis, 10–20 × 7–10 cm, up to 10 cm longer than the spadix; **spadix** acute at apex, white during development, yellowish at anthesis, 15–17 cm long, 2–3 cm diam., (6.3)9.0–10.0(11.0) times longer than wide; **basal sterile flowers** 5–6 mm long, with yellowish stigmatic secretion; **fertile flowers** 5–7 mm long; stamens 2–6 mm long, with laminar filaments; anthers 1–3 mm long; ovary quadrangular in longitudinal section, ribbed, 3–4 × 2–3 mm; style hexagonal, 0.5–1.5 × 3.5–4.0 mm; stigmatophore columnar, 0.5–1.5 mm long; stigma linear, with a transparent stigmatic secretion; **berries** with a stylar cap white, cream white or cream during development, pulp white; **seeds** spherical, 4–7 mm diam., black.

Distribution and ecology:—*Monstera acacoyaguensis* ranges from Mexico (western Chiapas) to Belize and Guatemala; elevations range from 0–200 m, in *Tropical moist forest*, *Premontane wet forest*.

Phenology:—Flowering in January and March. Fruiting in March.

Discussion:—The species, a member of sect. *Monstera*, is characterized by its large, non-pinnate, heavily perforated blades with attenuated leaf bases, with elongated and ellipsoid fenestrations arranged in 1 or 2 series on each side of the midrib, petiole sheath semi-persistent, and by the long inflorescence which is one of the longest and narrowest inflorescences of species in Central America. The epidermis of this species is characteristic in drying with a series of raised minute ridges with frequent diagonal cross-veins.

Monstera acacoyaguensis could be confused with *M. adansonii* but differs in having petiole sheath semi-persistent (vs. petiole sheath deciduous, sometimes with fibrous residues), blades 45–85 × 35–45 cm (vs. blades 23–65 × 17–30 cm), peduncle 15–35 cm long (vs. peduncle 12–20 cm long), spathe up to 10 cm longer than the spadix (vs. spathe up to 5 cm longer than the spadix), spadix 15–17 cm long (vs. 10–15 cm long), and spadix 9–10 times longer than wide (vs. spadix 7.0–9.2 times longer than wide).

The type specimen is from western Mexico, but most of the material observed is from the Caribbean slope in Yucatan, Belize, and eastern Guatemala.

Additional specimens examined:—MEXICO. **Chiapas:** Municipio Acacoyagua, ca. de 500 m antes de la desviación a Los Cacaos, 15°21’14”N 092°40’12”W, 114 m, 08 March 2020, *P.D. Jiménez et al. 1463* (HEM!); 150 m, 05 December 1949, *E. Matuda 18716* (EAP); 2 km from Highway 200 on road to El Triunfo, open site along stream, 100 m, 24 Aug 1972, *M.T. Madison 638* (SEL!); **Guerrero:** San Luis Acatlán. Yoloxóchitl. Parje ichi yata kurra Mateo Herrera, a 2.39 km al W en linea recta del centro de Yoloxóchitl, 50 m del camino viejo a San Luis, en la parcela del Sr. Timoteo Morales Isabel, 16°48’35”N 098°42’26”W, 470 m, 19 April 2017, *K. Velasco 40327* (MO!); **Oaxaca:** Concepción Progreso, 15 km al E de Putla. Veg. Bosque mesófilo con Pinus, 9 Jun 1985, *R. Torres C. & A.J. García-Mendoza 6717* (MO!); **Veracruz:** Along road between Catemaco and Montepio, 4.7 km S of Los Tuxtlas

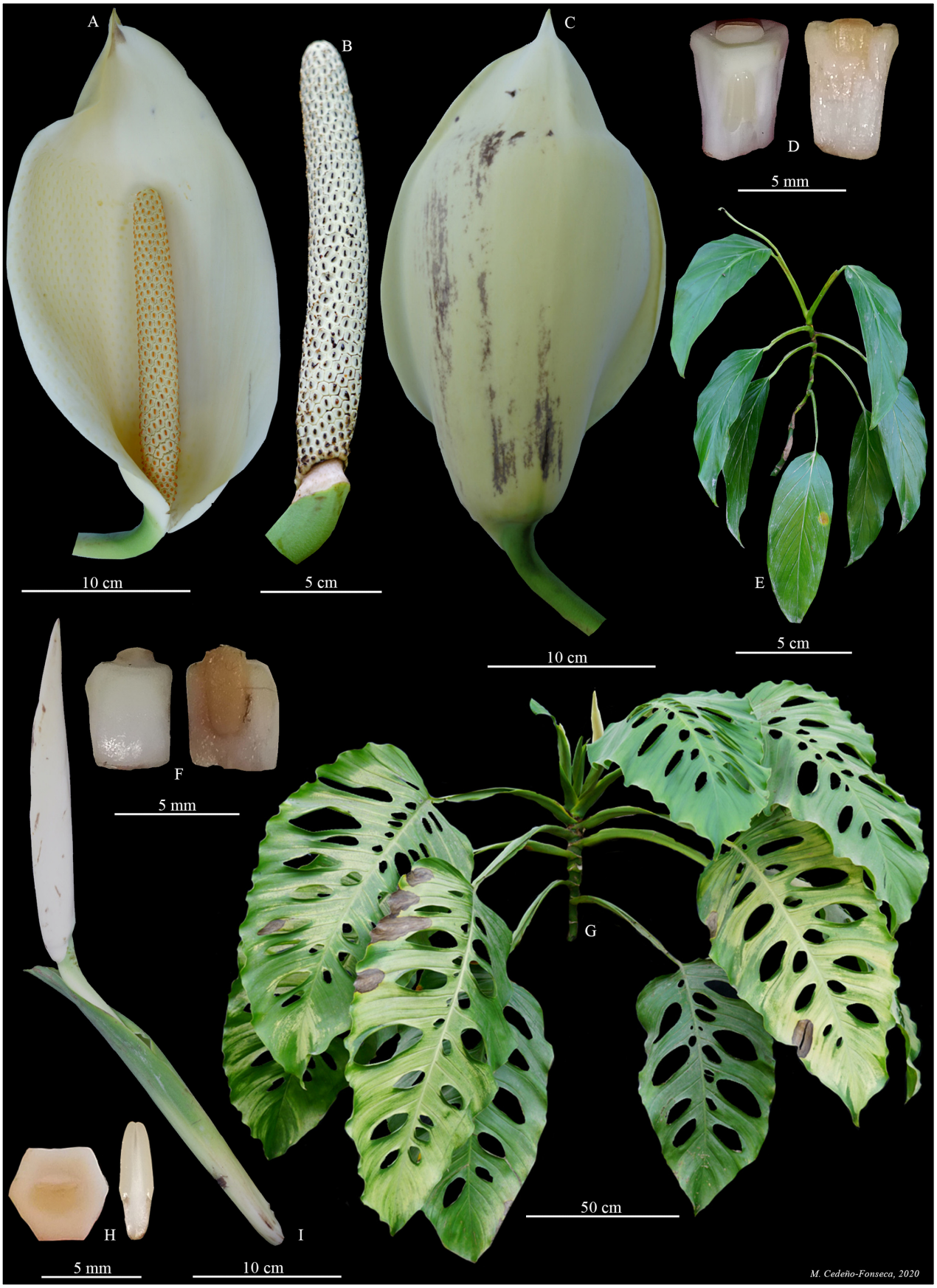

FIGURE 1. *Monstera acacoyaguensis* from Acacoyagua, Mexico. (A) Open inflorescence, frontal view. (B) Immature infructescence. (C) Open inflorescence, back view. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Portion of juvenile plant. (F) Sterile flower; in lateral view (left), and longitudinal section (right). (G) Portion of adult plant. (H) Stylar plate with stigma (left) and one stamen (right). (I) Developing inflorescence. *P. Diaz-Jiménez et al. 1463* (HEM). Photo by M. Cedeño-Fonseca.



FIGURE 2. *Monstera acacoyaguensis*. Adult plant growing in the locality type in Acacoyagua, Mexico. *P. Diaz-Jiménez et al.* 1463 (HEM). Photo by M. Cedeño-Fonseca.

Field Station, 7.4 km beyond end of asphalt highway, 17.5 km N of Catemaco, 18°36'36"N 095°03'36"W, 50 m, 25 Aug 1996, *T.B. Croat 78689* (MO!); San Andrés Tuxtla. Ejido 1º de Mayo, faldas del Volcán San Martín. Selva alta perennifolia, 18°33'N 095°13'W, 920 m, 2 May 2005, *T. Krömer & A. Acebey 2059* (MEXU!, MO!); **Yucatán:** Sotuta. Sotuta, Cenote Xmucuy, el cenote y sus cercanías constituyendo un enclave, 20°33'32"N 088°59'47"W, 20 m, 09 dic 2000, *G. Carnevali & J.L. Muñoz 6288* (CICY!, MO!, SEL!). BELIZE. **Belize:** Gracie Rock. Sibun River, 17°32'22"N 088°36'24"W, 5–130 m, 22 May 1935, *Percy H. Gentle 1649* (MO!); **Cayo:** 30 Miles section, Hummingbird Highway. High ridge, 17°05'N 088°37'W, 3 Mar 1958, *P.H. Gentle 9670* (LL!). GUATEMALA. **Izabal:** Vicinity of Quiriguá, 15°16'13"N 089°02'24"W, 75–225 m, 15 May 1922 – 31 May 1922, *P.C. Standley 24136A* (GH!, US!); Modesto Méndez. Swampy ground near Río Sarstun, 15°53'31"N 089°13'31"W, 10 m, 12 Jun 1970, *W.E. Harmon 2562* (MO!).

2. ***Monstera acuminata*** K.Koch, *Index Seminum* [Berlin] 4. 1855. (Figs. 3, 4)

Type:—Central America, live plant collected by Warszewicz cultivated at Berlin, *K. Koch s.n.* (holotype B).

Monstera karwinskyi Schott, *Oesterr. Bot. Z.* 9: 99 (1859). TYPE:—Mexico: ¨a Colipa usque Papantla ubicumque frequens, scandens super arbores¨, [April 1841], *W.F. Karwinsky [838]* (holotype W destroyed, isotype LE-00000997!, **here designated as lectotype**).

Monstera belizensis Lundell, *Lloydia* 2: 76 (1939). TYPE:—Belize, EI Cayo District, 23 June 1936, *Lundell* 6198 (holotype MICH-1115584!).

Monstera grandifolia Standl. & Steyerm., *Pub. Field Mus. Nat. Hist. Botany* 23: 212 (1947). TYPE:—Guatemala, Peten, low forest between Finca Yalpemech and Chinaja, 28 March 1942, *Steyermark* 45423 (holotype F-1129317–9!, isotype US-1864956!).

Monstera chiapensis Matuda, *Madroño* 10: 48 (1949). SYNTYPES:—Mexico, Chiapas, Finca California, Col. Turquia, Escuintla, 150 m., 29 August 1947, *E. Matuda 17789* HEM [at Matuda Herbarium]; Finca Esperanza, 10 km. NE of Escuintla, 200 m., *Matuda 17786* HEM (at Matuda Herbarium).

Monstera viridispatha Matuda, *Rev. Soc. Mex. Hist. Nat.* 11: 98 (1950). TYPE:—Mexico, Chiapas, Esperanza, Escuintla, 150–250 m., 7 Dec. 1949, *Matuda 18717* (holotype HEM! [at Matuda Herbarium], isotypes NY!, UC-903869!, BH [photo]!).

Nomadic vine, appressed-climbing habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stem** dorsoventrally compressed, smooth, greenish; **internodes** 3–7 cm long, 3–5 mm diam.; **petiole** more or less distinct, greenish, smooth, 7–11 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** obovate, cordate at base, acuminate at apex, coriaceous, 9–12 × 7–9 cm, slightly appressed to the phorophyte; **fenestrations** present or absent. ADULT PLANTS: root climbers; **stems** dark-green, smooth or verrucose, cylindrical or dorsiventrally compressed; **internodes** 1.0–8.5 cm long, 1–3 cm diam., 0.3–2.8 times longer than wide; **anchor roots** brown or black; **feeder roots** corky, dark-brown; **petiole** dark green or greenish, smooth or verrucose at base, sheathed up to half the geniculum, 25–66 cm long; **petiole sheath** persistent; geniculum more or less evident, smooth, 2.0–4.5 cm long; **blades** lanceolate or elliptical, widely truncate to obtuse at base, acuminate at apex, thinly coriaceous, drying blackish or greenish, 35–72 × 15–40 cm, 1.8–2.3 times longer than wide, slightly decurrent on the geniculum (decurrent part 1–2 mm wide); **midrib** sunken adaxially, raised abaxially, **primary lateral veins** 6–15 per side, slightly sunken adaxially, raised abaxially, departing midrib at 35–60°, **secondary veins** inconspicuous, **collective veins** absent; **fenestrations** present or absent, 1–6(9) oblong-elliptical perforations when present, that are located on both blade sides between the midrib and margin; **margins** entire or rarely pinnatilobed. INFLORESCENCES on ascending stems, 1–2 simultaneously at the flowering season, arranged in the leaf axils, rarely in deciduous cataphylls; **peduncle** smooth, 4–13 cm long; 1.5–2.5 cm diam.; **spathe** obtuse, length equal to the spadix, bright-green during development, light-green externally and white internally at anthesis, deciduous in fragments after anthesis; **spadix** white during development, cream at anthesis, 8–12 cm long, 2–3 cm diam., (3.1)4.5–7.0 times longer than wide; **basal sterile flowers** 5–6 mm long, with a yellowish stigmatic secretion; **fertile flowers** 5–7 mm long; stamens 2–7 mm long, with laminar filaments; anthers 1.0–2.5 mm long; ovary quadrangular in longitudinal section, ribbed, 3–4 × 1.5–2.5 mm; style pentagonal or hexagonal, 1.5–2.5 × 1.5–2.5 mm; stigma linear, with a yellowish stigmatic secretion; **berries** with a stylar cap yellow, green during development; **seeds** not seen.

Distribution and ecology:—*Monstera acuminata* ranges from Mexico (Chiapas, Escuintla, Oaxaca, San Luis Potosí, Tabasco, Jalapa, Veracruz) to Guatemala (Escuintla, Izabal, San Marcos, Suchitepequez, Zacapa), Belize (Toledo), Honduras (Comayagua, Copn, Olancho, Santa Barbara, Santa Rita) and Nicaragua (Granada, Río San Juan, Zelaya) at 50–1000(1524) m, in *Tropical moist forest* and *Premontane wet forest* life zones.

Phenology:—Flowering January-March, August-September. Fruiting in January-July, April-August, and November.

Discussion:—The species is a member of sect. *Marcgraviopsis* and is characterized by its appressed-climbing habit, minutely speckled petioles which are sheathed throughout with flaking or fibrous margins, ovate blades which are very asymmetric, unequal and truncate to acute at base and dry dark brown to grayish yellow-brown or blackened, usually with 1–9 perforations on both sides of the blade, 6–12 primary lateral veins as well as 1–2 inflorescences per axil with the peduncle typically shorter than the spadix, a spathe that is 3–5 cm longer than the spadix and a spadix about (3.1)4.5–7.0 times longer than broad and white to pale yellow-cream at anthesis with the fruiting spadix yellowish, pale yellow-green to white.

Monstera acuminata could be confused with *M. spruceana* but differs in having petiole 7–11 cm long (vs. 25–50 cm long), petiole sheath persistent (vs. petiolar sheath disintegrating as fibrous residues), spadix 8–12 × 2–3 cm (vs. spadix 15–25 × 3–6 cm), spadix 4.5–7.0 times longer than wide (vs. spadix 8–9 times longer than wide), and spathe 3–5 cm longer than the spadix (vs. spathe uniform or up to 0.5 cm longer than the spadix). *Monstera acuminata* is distributed from southern Mexico to Nicaragua, while *M. sprucena* is distributed from Costa Rica to Brazil.

Nomenclatural remarks:—In the protologue of *Monstera karwinskyi*, Schott (1859) indicated that the species was described using material from ′Mexico (Colipa)′ and cited ′Karwinsky′ as the collector.

Wilhelm Friedrich von Karwinsky von Karwin (1780–1855) was a German-Austrian naturalist who traveled in Brazil and Mexico. In this last country, Karwinsky made two expeditions. The first was carried out between 1826 and 1831 and was sponsored by the German-American Mining Society of Dusseldorf and the Bavarian government to make

further collections of natural history objects. The second expedition, where he collected the type of *M. karwinskyi*, was carried out between 1841 and 1843 and was supported by five different sponsors in St. Petersburg, mainly to look for wildlife (plants and animals) and minerals. On this second trip to Mexico, Karwinsky met the Danish collector Frederik Liebmann (1813–1856) in Veracruz dunring February 1941, where they agreed to travel and explore together northward through the lowlands (Veracruz to Xicaltepec from February to May, 1841). Both naturalists arrived at Colipa, the type locality of *M. karwinskyi*, where they explored for 27 days (presumably until April 1941). As a result of the entire expedition, Karwinsky collected more than 2000 gatherings (in 6 major sets), which were partly named, and distributed c. 1851 by Ruprecht in St. Petersburg (McVaugh 1980).

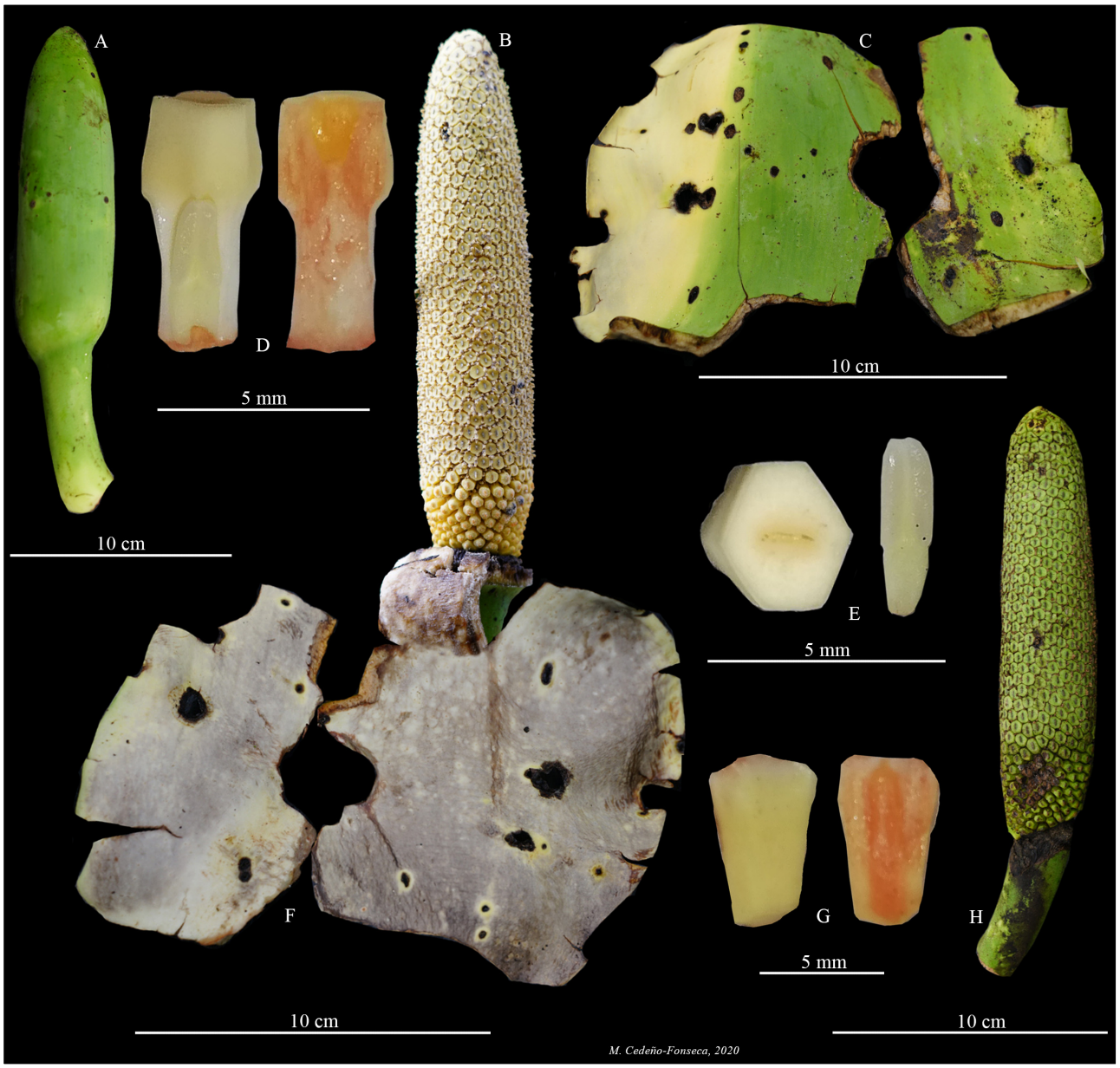

FIGURE 3. *Monstera acuminata* from Tuxtla Gutiérrez, Mexico. (A) Developing inflorescence. (B) Inflorescence in male anthesis with fragments of spathe. (C) Spathe fragments in back view. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Spathe fragments in frontal view. (G) Sterile flower; in lateral view (left), and longitudinal section (right). (H) Developing infructescence. *P. Diaz-Jiménez et al.* 1486 (HEM). Photos by M. Cedeño-Fonseca.

Engler & Krause (1908), in their revision of the Monsteroideae, recognized *M. karwinskyi* and cited three specimens, the presumed holotype from W (*Karwinsky* s.n.) and two other specimens, one from B (*Kerber* s.n.) and another from C (*Liebmann* s.n.). Both the specimen from W and B (photo at F) were destroyed in the second world war. However, we traced two extant specimens which also appear to match the diagnosis made by Schott (1859), one specimen from C (no collector information, barcode C10021452) and another at LE (*Karwinsky 838*, barcode

LE00000997). Both specimens were examined by M. Madison in 1975, where he noted ¨holotype¨ on the specimen from C, however on the specimen from LE he wrote ¨Karwinsky 838 = holotype¨. Subsequently, Madison (1977) in his revision of *Monstera*, cited the specimen from C as ¨type¨ and further alleged that it was collected by Karwinsky; additionally, he designated the specimen from LE (*Karwinsky 838*) as ¨paratype¨.

The Material from C (barcode C10021452) bears handwritings on a few notes about habit, identifications, locality (¨Colipa¨) and date of collection (¨4/41¨), however it does not include collector information. This material bears annotations by two people: the label at the lower right with the information of the locality and identification (as *M. adansonii* Schott) has a handwriting very similar to that of Liebmann; however, the other label (to the lower left) noted a different identification (as *M. karwinskyi*) which corresponds to an annotation by Schott himself. It is possible that this specimen at C was actually originally collected by Liebmann during his trip with Karwinsky in May 1841; in fact, Engler & Krause (1908) cited Liebmann as the collector of this specimen. Considering this information, we believe that the material from C does not contain sufficient evidence to indicate that it represents a duplicate of the original material cited by Schott (1859) which was a collection made by Karwinsky. Additionally, Schott (1859) made no mention of Liebmann in the original protologue of *M. karwinskyi*, so this specimen should be excluded at a potential lectotype.



FIGURE 4. *Monstera acuminata*. Adult plant growing in Acacoyagua, Mexico. Photo by M. Cedeño-Fonseca. (Not collected).

On the other hand, the specimen from LE (barcode LE00000997) seems to represent the only extant original material. This material bears a small handwritten label with an identification (*Caladium pertusum*), also noted ¨a Colipa usque Papantla ubicumque frequens, scandens super arbores¨; additionally, it has a typewritten label with the information on the collector and number (*Karwinsky 838*) and the locality (Iter Mexicanum, 1841, 1842). According to McVaugh (1980), much of the material collected by Karwinsky was not consistently numbered by the collector; however, the material was sorted into systematic order by family and genus, and numbers were arbitrarily assigned, presumably by Ruprecht. Additionally, it is known that Ruprecht, in circa 1851, distributed duplicates to other herbaria outside the former Soviet Union, but mostly without name or other data (McVaugh 1980). Curiously, Schott (1859) included in the same work three new taxa of Araceae (*Anthurium karwinskyi* Schott (1859: 101), *Monstera karwinskyi*

and *Philodendron subincisum* (1859: 99)), where the material examined was collected by Karwinsky in Colipa and Paplanta (during his second exploration done in 1841–1843). This information could support the notion that the original material examined by Schott was one of the duplicates sent by Ruprecht, this would explain why the original protologue of *M. karwinskyi* includes scarce information, as well as explain the fact that the material from LE (*Karwinsky 838*) has a numbering which was omitted in the original protologue in Schott (1859).

Considering the facts layed out above, we concluded that Madison's citation of the specimen at C as (implicitly) the holotype was incorrect and given that the specimen is not demonstrably part of the original material on which the protologue was based, Madison's citation of the "type" is not able to be interpreted as an implicit lectotypification. We therefore propose a corrected typification for *M. karwinskyi*, where we designate the specimen *Karwinsky 838* (bardcode LE00000997) from LE, cited by Madison as a paratype, as the lectotype.

On the other hand, in the case of *Monstera chiapensis*, it was not possible to trace the syntypes cited by Matuda (1949), which are presumably deposited in the HEM Herbarium (at Matuda Herbarium); therefore, it was not possible to perform a proper typification.

Additional specimens examined:—BELIZE. Cultivated at Missouri Botanical Garden. Received from J. *Dwyer s.n.* (MO!); **Cayo:** New Maria Camp. Forest, 16°49'38"N 089°01'W, 550 m, 3 May 1995, *C. Whitefoord 9260* (MO!); Resumadero Camp, at Chiquibul River. On fig tree, 16°37'41"N 089°04'05"W, 507 m, 14 Mar 1999, *G. Reese, et al. 46* (MO!); Forest along highway at mile 28.5 on Hummingbird Highway, south of Belmopan, 17°04'22"N 088°35'58"W, 200–300 ft, 14 June 1973 – 21 June 1973, *T.B. Croat 24558* (MO!); **Stann Creek:** Cockscomb Basin Wildlife Sanctuary, ca. 1 km west of visitors centre, ca. 30 m south of main trail before Wari Loop turnoff, plot 10, 16°46'50"N 088°27'55"W, 100 m, 06 March 2007, *Z.A. Goodwin et al. 490* (E!); **Toledo:** Jalacté, 16°11'18"N 089°10'54"W, 300 m, June 2008, *B. Walshe-Roussel & F. Caal s.n.* (MO!); Southwestern Maya Mountains, Columbia River Forest Reserve. Trail between Union and Gloria Camps. On slightly undulating limestone hills, 16°23'22"N 089°08'10"W, 700–750 m, 13 April 1992, *B.K. Holst 4382* (MO!); Southwestern Maya Mountains, Columbia River Forest Reserve, Union Camp. On undulating limestone hills. Exposed limestone, common on hills and along streams. On dry hills E and N of camp, 16°23'N 089°09'W, 700–750 m, 06 April 1992, *B.K. Holst 4121* (MO!); Columbia River Forest Reserve: along SW base of Little Quartz Ridge, between Camp 1 and Union Camp. Moist, semievergreen forest on limestone soils with gently rolling hills and frequent limestone outcropping. MAP coordinates, 16°23'N 089°07'W, 700–750 m, 22 Feb 1997, *B.K. Holst 5947* (BRH!, CM!, COL!, MO!, NY!); Jimmy Cut, Salamanca, 16°18'N 089°03'W, 40 m, 28 May 1979, *C. Whitefoord 1913* (BM); Southern Maya Mountains, Bladen Nature Reserve, West Snake Creek. Along Snake Creek, 16°27'54"N 089°01'04"W, 580 m, 29 May 1997, *D.L. Holland 15* (BRH!, MO!); Southern Maya Mountains, Bladen Nature Reserve, central Snake Creek Camp, 16°27'35"N 088°58'52"W, 400 m, 28 May 1997, *G. Davidse 36863* (MO!, WU!); Southern Maya Mountains, Bladen Nature Reserve, Ek Xux Valley, stream side vegetation NW of EK Xux archeological site, 16°30'27"N 088°54'25"W, 280 m, 14 May 1996, *G. Davidse 35953* (BRH!, MO!); Southern Maya Mountains, Bladen Nature Reserve, Ek Xux Valley, stream side vegetation NW of EK Xux archeological site, 16°30'27"N 088°54'25"W, 280 m, 14 May 1996, *G. Davidse 35910* (BRH!, MO!); Southern Maya Mountains, Bladen Nature Reserve, streamside forest along river north of "AC Camp", ca. 2 airline km N of upper Bladen Branch, 16°30'15"N 088°55'07"W, 260 m, 11 May 1996, *G. Davidse 35788* (BRH!, MO!); Solomon Camp, vicinity of the junction of Richardson Creek and Bladen Branch, foothills of the Maya Mountains, 16°32'N 088°45'W – 16°33'N 088°46'W, 80–420 m, 05 March 1987 – 12 March 1987, *G. Davidse & A.E. Brant 32195* (MO!); Ca. 40 km SW of Punta Gorda, Dolores Estate. Growing along trail. Primary forest, 15°59'N 089°13'W, 1 Feb 1990, *M.J. Balick et al. 2550* (MO!); Between Condemned Branch Pine Ridge and Mafridyle [Mafredi] Lagoon, 16°09'56"N 088°57'16"W, 9 May 1952, *P.H. Gentle 7687* (LL!); Balsam Hill, Edwards Road, beyond Columbia, 16°16'17"N 088°57'15"W, 10 January 1948, *P.H. Gentle 6360* (LL!); Vic. San Antonio, 16°14'N 088°59'W, 27 Jan 1946, *P.H. Gentle 5499* (LL!); Vicinity of Condemn Branch Hills, 05 March 1945, *P.H. Gentle 5254* (LL!); Swasey Branch, Monkey River, 16°38'N 088°35'W, 9 Mar 1942, *P.H. Gentle 3956* (MO!); 1.5 miles S of Mayan village of San Jose, ca. 5 miles W of Columbia Forest Station, 16°15'N 089°04'W, 12 June 1973, *T.B. Croat 24348* (MO!). EL SALVADOR. **Santa Ana:** m, *E.M Martinez 174* (TEFH!). GUATEMALA. **Alta Verapaz:** 1 km W of Sebol, 15°48'07"N 089°57'09"W, 27 Apr 1964, *E. Contreras 4518* (LL!); Near Río Icvolay, near Hacienda Yaxcabnal, 5 mi NW of Cubilgüitz. Wooded slopes, 15°45'42"N 090°31'21"W, 250 – 300, 5 Mar 1942, *J.A. Steyermark 44670* (F!, MO!); Along road to El Estor (Lago Izabal), 2–4 miles E of Tamahú, 9–11 miles E of Highway CA-14 to Cobán, 15°18'44"N 090°16'34"W, 700–800 m, 18 Jul 1977, *T.B. Croat 41496* (MO!); Along road to El Estor (Lago Izabal), 5 miles W of Tucurú, 12 miles E of Highway CA-14 to Cobán, 15°18'36"N 090°15'10"W, 600 m, 18 July 1977, *T.B. Croat 41513* (MO!); 4 miles up road to Oxec, along road which turns north off Highway 7E (to El Estor), ca. 6 km NE of Panzos, 15°29'03"N 089°39'20"W, 500 m, 20 July 1977, *T.B. Croat 41608* (MO!); **Escuintla:** 6 miles north of Escuintla on road to Alotenango. Roadside near small river,

14°23’05”N 090°49’49”W, 650 m, 27 Jul 1977, *T.B. Croat 42047* (MO!); **Izabal:** Cerro San Gil, 15°37’38”N 088°47’48”W, 400 m, Oct 1996, *C. Lopez s.n.* (MO!); Izabal, Cerro San Gil, 15°37’22”N 088°49’21”W, 300 m, 24 Oct 1996, *C. Lopez 1996* (MO!); Along dirt road which turns E into piña plantations from Highway CA-14, ca. 7 miles S of Puerto Barrios, 15°36’46”N 088°34’01”W, 50 m, 22 Jul 1977, *T.B. Croat 41791A* (MO!); Along dirt road which turns E into piña plantations from Highway CA-14, ca. 7 miles S of Puerto Barrios, 15°36’46”N 088°34’01”W, 50 m, 22 Jul 1977, *T.B. Croat 41814* (MO!, TEX); **Petén:** Tikal National Park, [Tikal], 17°13’30”N 089°36’47”W, 2 Mar 1961, *C.L. Lundell 16834* (LL!); Tikal National Park, [Tikal], 17°13’30”N 089°36’47”W, 2 Mar 1961, *C.L. Lundell 16832* (LL!); Tikal National Park, Tikal, 17°13’30”N 089°36’47”W, 8 Feb 1959, *C.L. Lundell 15409* (LL!); Río Pasion, Ceibal, above Sayaxche, 16°30’48”N 090°03’44”W, 3 Feb 1964, *C.L. Lundell 17642* (LL!); Tikal National Park, on Remate Road, S of Tikal, 17°13’30”N 089°36’47”W, 4 Mar 1961, *C.L. Lundell 16858* (LL!); Lacandon, 17°07’55”N 091°10’27”W, 3 Feb 1962, *E. Contreras 3301* (LL!); Ruins of Ceibal, 16°30’48”N 090°03’44”W, 240 m, 18 June 1971, *W.E. Harmon & J.A. Fuentes 5764* (MO!, UMO); Dolores. Dolores, on Río Mopan trail, about 3–5 km east of village, 16°32’22”N 089°22’44”W, 25 Apr 1961, *E. Contreras 2185* (LL!); San Andres. Parque Laguna del Tigre, 17°44’47”N 090°17’37”W, 110 m, 3 May 1996, *M. Véliz 96.5505* (MO!); Sayaxche. [Río Pasion], Sayaxche, about 3 km SSE of the village, 16°32’06”N 090°09’35”W, February 1964, *C.L. Lundell 18032* (LL!); **Quetzaltenango:** Along Highway CA-2, 4 mi. NW of turnoff to Coloba, 14°41’56”N 091°52’41”W, 400 m, 22 Feb 1976, *T.B. Croat 32781* (MO!); Highway CA2, 3 mi S of turnoff to Colomba, between Coatepeque and Retalhuleu. Coffee plantation, 14°39’30”N 091°46’36”W, 600 m, 22 Jan 1987, *T.B. Croat & D.P. Hannon 63436* (AAU, ENCB, HNMN, MEXU, MO!, SEL!, TEX); **San Marcos:** La Trinidad, ca. 2 km from Finca Armenia above San Rafael, 14°56’02”N 091°53’55”W, 1100–1250 m, 12 July 1977, *T.B. Croat 40844* (MO!); **Suchitepéquez:** Vicinity of Tiquisate. Near Santiago farm. Virgin forest, 14°13’46”N 091°19’50”W, 100 m, 17 Jun 1942, *J.A. Steyermark 47651* (MO!); 1 mi E of Mazatenango, 14°32’13”N 091°28’22”W, 300–500 m, 20 Aug 1977, *T.B. Croat 43756* (MO!); **Zacapa:** Along old road to Finca Agua Fría, 2 miles N from Route CA-9, 41 miles S of turnoff to Petén (near Morales), 15°15’02”N 089°16’24”W, 150 m, 23 Jul 1977, *T.B. Croat 41873* (MO!). HONDURAS. **Atlántida:** Jardin Botanico de Lancetilla, 15°41’59”N 087°28’00”W, 0-500 m, 29 Dec 1993, *C.H. Nelson & R. Andino 17120* (TEFH!); Jardin Botanico de Lancetilla, camino de los Pilis, 15°41’59”N 087°28’00”W, 20 m, 8 enero 1994, *C.H. Nelson et al. 17192* (TEFH!); Campamento Quebrada Grande ca. 10 km south west of La Ceiba. At base of north slope of Pico Bonito, from camp to 2 km south of camp. Río Bonito, forest above, and Cacao Plantation, 15°42’N 086°51’W, 80–140 m, 14 May 1993, *R.L. Liesner 26317* (MO!); Along trail to dam for municipal water supply of Tela, Lancetilla Botanical Gardens, on road ca. 2 mi WSW of Tela and S of main hwy. Printed label for specimens 64586–64646 reads 9/2/1987, but fieldbook states 10/2/1987, 15°44’N 087°27’W, 70–90 m, 10 February 1987, *T.B. Croat & D.P. Hannon 64632A* (MO!); Tela. Lancetilla Valley ca. 10 miles southeast of Tela; in forest preserve along Río Lancetilla, on trail to water reservoir, 15°44’N 087°27’W, 10–150 m, 03 August 1977, *T.B. Croat 42671* (MO!); **Comayagua:** Southern end of Lago Yojoa, 14°46’40”N 087°59’08”W, 610 m, 11 May 1991, *G. Davidse 34344* (MO!); **Copán:** Santa Rita. 13 miles east of Copán along gravel road to La Entrada. disturbed roadsides, 14°52’N 089°04’W, 750 m, 1 Aug 1977, *T.B. Croat 42530* (MO!); Ca. 11 miles east of Copán on gravel road to La Entrada. Disturbed roadsides, 14°52’N 089°05’W, 750 m, 1 Aug 1977, *T.B. Croat 42523* (MO!); **Cortés:** Omoa. Ca. 1 mile northeast of Omoa on road to Puerto Cortes; sea level; pasture with a few trees bearing epiphytes, 15°47’06”N 088°01’26”W, 0 m, 2 Aug 1977, *T.B. Croat 42552* (MO!); **Olancho:** Along Río Olancho, on road between San Francisco de la Paz and Gualaco, 13.6 miles SW of Gualaco, on steep slope ca 0.5 miles E of main road, along gravel road into private property, 15°00’N 086°07’W, 1300 m, 06 February 1987, *T.B. Croat & D.P. Hannon 64298* (MO!); Catacamas. Catacamas. Montanas de Murmuyo [El Murmullo], Sierra de Agalto. Broadleaf forest, 14°52’57”N 085°56’10”W, 1000 m, 25 Feb 1982, *S. Blackmore & G.L. Heath 1948* (MO!); **Santa Bárbara:** Along Hwy. CA14 (National Hwy. 18), between Santa Rosa de Copán and San Pedro Sula, 51.3 mi WSW of junction of main San Pedro Sula–Tegucigalpa hwy. 39.2 mi SWS of frontier of Cortés Dept, 15°18’N 088°25’W, 500 m, 20 Jan 1987, *T.B. Croat & D.P. Hannon 63870* (CR!, MO!, P). MEXICO. Cordoba, La Luz, *E. Kerber s.n.* (MO!); 1841–1843, *F.M. Liebmann s.n (KEW 153)* **Chiapas:** Berriozábal, La Pera, 16°51’43”N 093°18’53”W, 1140 m, 12 March 2020, *P.D. Jiménez et al. 1486* (HEM!); Road to Lacandona Reserva at the Nueva Palestina turnoff, 16°54’36”N 091°12’00”W, 300 m, 11 Oct 1986, *B.E. Hammel et al. 15668* (MO!); Lacondona Reserva; Crucero frontera; Corozal, 16°54’36”N 091°04’48”W, 290 m, 11 Oct 1986, *B.E. Hammel et al. 15674* (MO!); Near ruins of Palenque. Mesophytic woods and roadside, 21 Jul 1971, *D.L. Spellman et al. 161* (MO!); Crucero Corozal, camino Palenque-Boca Lacantum. Veg. Selva alta subperennifolia, 16°45’36”N 091°00’00”W, 180 m, 8 Jan 1986, *E.M. Martínez 15601* (MO!); En reserva El Triunfo, 1900 m, 01 junio 1987, *E.M. Martínez et al. 21501* (MEXU!); Acacoyagua. m, *A. López 55* (HEM!); m, *M. Martínez 918* (HEM!); Angel Albino Corzo. Along slopes of Río Cuxtepec below Finca Cuxtepec, 15°43’48”N 092°57’36”W, 1080 m, 13 Dec 1980, *D.E. Breedlove 48618* (CAS); Ridge, just N

of Finca Cuxtepec, 15°43’42”N 092°56’59”W, 1370 m, 11 January 1982, *D.E. Breedlove & F. Almeda 56970* (MO!); Escuintla. Along road from Escuintla to El Triunfo, ca. 1 mile N of Escuintla, 15°19’12”N 092°38’24”W, 100 m, 21 August 1977, *T.B. Croat 43803* (MO!); Along road between Escuintla and Monte Ovando, 2.8 km NW of Turquia, 15°21’N 092°39’W, 100 m, 13 February 1979, *Thomas B. Croat 47509* (MO!); About 12 miles NE of Escuintla, ca. 2 miles NE of El Triunfo, on gravel road to Permuta, 15°21’36”N 092°31’48”W, 300 m, 21 August 1977, *T.B. Croat 43873* (MO!); About 10 miles NE of Escuintla just above El Triunfo, 15°20’39”N 092°32’09”W, 300 m, 21 Aug 1977, *T.B. Croat 43833* (MO!); Along trail between Finca California (at base of S slope of Monte Ovando and ca. 4 km N of of Ovando Turquia) and summit of Cerro Ovando, 15°22’12”N 092°36’00”W, 450–850 m, 14 February 1979, *T.B. Croat 47574* (MO!); About 12 miles NE of Escuintla, ca. 2 miles NE of El Triunfo, on gravel road to Permuta, 15°21’36”N 092°31’48”W, 300 m, 21 August 1977, *T.B. Croat 43874* (MO!); La Concordia. m, *C.A. Pérez 89* (HEM!); La Trinitaria. m, *A. Shilom Ton 2428* (OAX); 10 km east northeast of Dos Lagos above Santa Elena, 16°06’36”N 091°34’18”W, 1170 m, 19 January 1982, *D.E. Breedlove & F. Almeda 57561* (MO!); Mapastepec. Sierra de Soconusco. New unfinished road to Tuxtla Gutiérrez from Highway 200 (5.5 mi NW of turnoff to Mapastepec), 6.5–8.5 mi up road, 15°39’26”N 093°02’39”W, 350–450 m, 20 January 1987, *T.B. Croat & D.P. Hannon 63338* (MO!); Montecristo de Guerrero. m, *147* m, *R. Reinoso 500* (HEM!); Ocosingo. m, *E.M. Martínez 15601* (MEXU!); 5 km al S de Crucero Corozal. Selva alta perennifolia, 250 m, 21 Apr 1985, *E.M. Martínez 12247* (MO!); Nuevo Guerrero sobre el camino Palenque-Boca Lacantum, 16°59’24”N 091°17’24”W, 340 m, 14 abril 1986, *E.M. Martínez 18140* (MO!); A 1.6 km al SE de San Javier, 16°47’28”N 091°05’43”W, 604 m, 25 abril 2003, *G. Águilar & C. Chancayun 6598* (MEXU!, MO!); A 1.63 km de Frontera Corozal al SE, 16°48’06”N 090°52’33”W, 144 m, 04 junio 2004, *G. Águilar & M. Méndez 10437* (MEXU!, MO!); Al S de Frontera Corozal, 16°47’35”N 090°52’09”W, 132 m, 19 abril 2004, *G. Águilar & M. Méndez 9827* (MEXU!, MO!); A 1.07 km al SO del crucero San Javier, 16°47’25”N 091°04’34”W, 361 m, 09 diciembre 2003, *G. Águilar et al. 8776* (MEXU!, MO!); A 1.25 km al SE de San Javier. Selva alta perennifolia, 16°47’32”N 091°05’48”W, 411 m, 27 febrero 2003, *G. Águilar et al. 5904* (MEXU!, MO!); 5 km SW of Santo Domingo (120 km SE of Palenque on road to Bonampak), 16°59’24”N 091°24’36”W, 600 m, 13 May 1982, *G. Davidse et al. 20400* (MO!); Ocozocoautla de Espinosa. m, *D. Torres-Arguello 58* (CHIP!); 20 mi N of Ocozocouatla along gravel road to Apitpac, near km 31 marker, 16°58’15”N 093°30’10”W, 700 m, 09 July 1977, *T.B. Croat 40655* (MO!); 13 miles north of Ocozocoautla on gravel road to Apitpac, near Km 21 marker, 16°54’N 093°27’W, 900 m, 9 Jul 1977, *T.B. Croat 40631* (MO!); Ostuacán. Two mi S of Chiapas border along highway 195. Disturbed area beside stream, 17°33’03”N 092°59’47”W, 80 m, 3 Jul 1977, *T.B. Croat 40078* (MO!); Palenque. Along gravel road from Palenque to Bonampak, 60 miles SE of Palenque, 17°00’03”N 091°19’11”W, 400 m, 05 July 1977, *T.B. Croat 40196* (MO!); Along gravel road between Palenque and Bonampak, 88–90 miles SE of Palenque, 16°52’30”N 091°12’03”W - 16°51’41”N 091°09’49”W, 350–370 m, 05 July 1977, *T.B. Croat 40253* (MO!); 5 miles SE of Palenque, on road to Chancala, Ocosingo and San Cristóbal de las Casas, 17°28’12”N 091°57’36”W, 200 m, 4 Jul 1977, *T.B. Croat 40138* (MO!); Siltepec. m, *R. Reinoso 582* (HEM!); Tuxtla Gutiérrez. m, *E. Palacios 879* (CHIP!); m, *E. Palacios 2316* (CHIP!); **Oaxaca:** Tuxtepec to Oaxaca; 5 km S of Tuxtepec; on forested hill at paper mill, 18°04’N 096°10’W, 130 m, 26 Sep 1986, *B.E. Hammel & M. Merello 15461* (MO!); Uxpanapa Region, along gravel road between Esmeralda (17 km E of Sarabia) and Río Manea (tributary of Río Verde), 11.5–13.5 mi S of Esmeralda. Roadside vegetation with primary forest elements. Veg. type: ”selva alta perennifolia”, 17°03’36”N 094°45’W, 90–110 m, 19 Jan 1987, *T.B. Croat & D.P. Hannon 63276* (F!, GUAT!, MO!, PMA!); Uxpanapa Region, along gravel road from Esmeralda (17 km E of Sarabia) to Río Verde, 1.1 mi S of Esmeralda. Edge of pasture and in forest on karst limestone formation on steep slopes with cliffs. Veg. type: ”selva alta perennifolia”, 17°09’36”N 094°45’W, 100 m, 18 Jan 1987, *T.B. Croat & D.P. Hannon 63240* (MO!); Uxpanapa region, along gravel road between Esmeralda (17 km E of Sarabia) and Río Verde, 1.1 mi S of Esmeralda; edge of pasture and forest on karst limestone. Veg. type: ”selva alta perennifolia”, 17°10’N 094°45’W, 100 m, 19 Jan 1987, *T.B. Croat & D.P. Hannon 63306* (MO!); Along Rte. 175 between Valle Nacional and Oaxaca, 7–10 km S of bridge over Río San Juan Bautista at Valle Nacional. Steep roadside cliffs, 17°43’33”N 096°19’39”W - 17°43’26”N 096°19’18”W, 597–666 m, 3 Mar 2008, *T.B. Croat & P.D Jiménez 100163* (MO!); Tuxtepec. Mun. San Juan Bautista Valle Nacional. Sierra de Juárez, along Highway 175, between Valle Nacional and Oaxaca, 14 miles SW [above/west] of Valle Nacional, 17°39’36”N 096°19’12”W, 1210 m, 30 June 1977, *T.B. Croat 39784* (MO!); [Mun. San Juan Bautista Valle Nacional]. About 14 miles S of Valle Nacional, along Highway 175 to Oaxaca, 17°39’36”N 096°19’12”W, 1220 m, 22 August 1977, *T.B. Croat 43904* (MO!); **Puebla:** San Miguel Tzinacapan. Vicinity: Partiendo hacia el suroeste de Tzinacapan hacia el poniente rumbo a Masacowatah pero no llegando hasta allá. Justamente por el arroyo de Atekokomol, 20°01’03”N 097°33’01”W, 870 m, 12 October 2015, *J.D. Amith 2673* (MO!); Cuetzalan del Progreso. Taxipchual. Bejando por el lado oriente de un potrero por donde termina la brecha a la cascada y llegando a un arroyo y después volviendo a subir hacia la brecha entre Taxipehual y las cascadas, 20°01’38”N 097°27’19”W, 534 m, 11

October 2015, *J.D. Amith 2667* (MO!); m, *J.L. Contreras 6136* (HUAP!); **Querétaro:** 2 km al suroeste de Neblinas, Río Tancuilin, municipio de Landa. Bosque de Bursera, Cedrela, Higerón y Oshite; ladera de cerro; orilla de arroyo; cañada, 610 m, 12 Sep 1990, *H. Rubio 1959* (MO!); Landa de Matamoros. 2 km al SO de Neblinas, Río Tancuilin, 21°15'00"N 099°03'00"W, 610 m, 12 Sep 1990, *H. Rubio 1959* (IEB!); **San Luis Potosí:** Creek bottom, north of Tamazunchale, 4 July 1935, *O.M. Clark 7407* (MO!); Tamazunchale. Hills above Highway 85, 6 mi NW of Tamazunchale, 21°17'24"N 098°47'24"W, 250 m, 25 June 1977, *T.B. Croat 39269* (MO!); **Tabasco:** Cárdenas. A 2 km del Poblado C-29, 18°03'49"N 093°27'24"W, 14 m, 10 Sep 2008, *P.D Jiménez 613* (MO!); Jalpa de Médez. Km 2 (1.2 miles) de la carretera Jalapa-Tacotalpa. Km 33.9 (21.2 miles) de la desviación de la carretera hacia Lomas Alegres y Castañal, 17°34'12"N 092°36'36"W, 26 m, 16 June 1983, *C.P. Cowan 3929* (MO!); Tacotalpa. 0.2 km abajo (NW) de, y antes de entrar a Tapijulapa. Hasta 0.5 km arriba del camino por el arroyo a pie, 17°28'00"N 092°46'27"W, 43–47 m, 30 mayo 1982, *C.P. Cowan et al. 3533* (MO!); **Veracruz:** Laguna Escondida, 5 km de la Estacion de Biologia de Los Tuxtlas. Orilla de la selva alta perennifolia, primaria, 300 m, 17 Sep 1974, *M. Soto & C.C. Horvitz 27* (F); Along road between Catemaco and Montepio, 15 km E of junction to Tebanca, Coyame and Nanciyaga, 18°29'50"N 095°02'31"W, 133 m, 6 Mar 2008, *T.B. Croat & P.D. Jiménez 100324* (MO!); Along secondary road between Hidalgotitlán and Jaltipan, along Río Coatzacoalcos, vicinity Buena Vista, 4 km S of Buena Vista, 17°49'17"N 096°38'17"W, 150 m, 5 Mar 2008, *T.B. Croat & P.D. Jiménez 100281* (MO!); Alrededores de la Estación de Biologia Tropical "Los Tuxtlas", carr. Catermaco-Montepio, Mpio. de San Andrés Tuxtla, 18°35'N 095°04'W, 120 m, 11 May 2005, *T. Krömer 2172* (MO!); Estación de Biologia Tropical "Los Tuxtlas, Cerro Vigia 5, Lote 67, Mpio. de San Andrés Tuxtla, 18°34'N 095°04'W, 450 m, 12 April 2005, *T. Krömer 1914* (MO!); Catemaco. 19 km E of Catemaco, 18°26'24"N 094°58'12"W, Mar 1965, *L.G. Quintero 2243* (MICH, US); Vicinity of Playa Escondida, 10 km N of Sontecomapan. Selva alta perennifolia. Evergreen tropical forest, some cleared for pastures, on slopes around and above Hotel Playa Escondida and the beach on the Gulf of Mexico, 18°35'24"N 095°03'00"W, 0–150 m, 21 Apr. 1983, *M.H. Nee 26708* (F!, MO!, NY!, XAL!); Coatzacoalcos. April 1895, *C.L. Smith 1069* (US!); Fortín. Near Fortín along walkway from hydroelectric plant to railroad tracks. Open, mostly cleared area, 18°53'24"N 096°59'24"W, 1000–1150 m, 27 June 1977, *T.B. Croat 39468* (MO!); Huatusco. "El Mirador", 21 km E of Huatusco at Km 45 along Highway to Puente National, 19°12'36"N 096°52'12"W, 1200 m, 23 August 1977, *T.B. Croat 43998* (MO!); "El Mirador", 21 km E of Huatusco at Km 45 along Highway to Puente National, 19°12'36"N 096°52'12"W, 1200 m, 23 August 1977, *T.B. Croat 43992* (MO!); "El Mirador", 21 km E of Huatusco at Km 45 along Highway to Puente National, 19°12'36"N 096°52'12"W, 1200 m, 23 August 1977, *T.B. Croat 44012* (MO!); Minatitlán. Minatitlán, 17°58'45"N 094°33'45"W, 14 m, 30 January 1892, *J.G. Smith 240* (MO!); 13.7 km al E de La Laguna sobre terracería a Uxpanapa, luego 6.7 km al N sobre camino nuevo (no completo) a Belisario Domínguez (brecha 93); zona kárstica con selva perennifolia de Dialium, Brosimum, Spondias, Bursera, Robinsonella mirandae, etc, con afloramientos grandes de piedra, 17°19'48"N 094°22'48"W, 130 m, 26 Nov 1981, *T.L. Wendt et al. 3482* (MO!); Papantla. 100 m, Feb 1968, *L. Gutiérrez R. 75* (US!); San Andrés Tuxtla. m, *G.I. Manríquez & et al. 2138* (FEZA); Alrededores de la Estación de Biologia Tropical "Los Tuxtlas", carr. Catemaco-Montepio. Selva alta perennifolia, 18°35'N 095°04'W, 120 m, 11 May 2005, *T. Krömer & A. Acebey 2178* (MO!); Alrededores de la Estación de Biologia Tropical "Los Tuxtlas", 18°35'N 095°04'W, 120 m, 05 noviembre 2005, *T. Krömer & A. Acebey 2178* (MO!); Ejido 1º de Mayo, faldas del Volcán San Martín. Selva alta perennifolia, 18°33'N 095°13'W, 920 m, 2 May 2005, *T. Krömer & A. Acebey 2060* (MO!); Santiago Tuxtla. E of Santiago Tuxtla, 18°27'36"N 095°17'24"W, 25 Jan. 1965, *M. Sousa S. 2156* (MEXU!); Totutla. Km 45 on highway between Conejo (near Puente Nacional) and Huatusco, Hacienda 'El Mirador', slopes of barranca de Santa Maria, 19°12'00"N 096°45'36"W, Sept. 1961, *H.E. Moore & G.S. Bunting 8859* (BH); Zongolica. Wooded area on the north side of airdrome. Campo Experimental de Hule, El Palmar, 19 Nov 1944 – 20 Nov 1944, *J.V. Santos 3635* (MICH). NICARAGUA. **Atlántico Norte:** Cerro Baká, 6.5 km E of Río Coperna; lower mountain slopes and secondary areas, 13°40'N 084°30'W, 200–320 m, 19 Mar 1979, *J.J. Pipoly, III 4932* (MO!); Caño Hormiguero, SE of Cerro La Pimienta No. 1, 13°46'N 084°59'W, 750 m, 10 April 1979, *J.J. Pipoly, III 5084* (MO!); Reserva Bosawas, Municipio de Siuna, sendero rumbo a la cara oeste del cerro Saslaya, 13°42'N 084°56'W, 100–250 m, 9 Abril 1996, *R.M. Rueda et al. 4404* (MO!); Along new road fron Siuna to Matagalpa, ca. 31.4 km beyond Río Ulí (near Waní), ca. 8.9 km beyond Rosa Grande La Balsama and near major highway construction camp, 13°36'N 085°05'W, 100–200 m, 18 March 1978, *W.D. Stevens 7515* (MO!); **Estelí:** Municipio de Esteli, ásentamiento Puertas Azules, 13°16'N 086°16'W, 1300 m, 17 Abril 1999, *R.M. Rueda & W. Velásquez 10928* (MO!); **Granada:** Volcán Mombacho, Hacienda Las Delicias, ca 10 km al SE de Ciudad Granada; bosque húmedo tropical, 11°50'50"N 085°57'50"W, 600–800 m, 24 junio 1984, *D. Soza et al. 104* (MO!); Volcán Mombacho, near Finca Cutirre, 11°49'N 085°56'W, 250–300 m, 01 July 1975, *J.T. Atwood & D.A. Neill AN66* (MO!); Volcán Mombacho, entre las fincas Maria Auxiliadora y el Cacao, 11°51'N 085°56'W, 400–500 m, 24 mayo 1980, *P.P. Moreno 443* (MO!); NE del Volcán Mombacho, en el empalme de los caminos a Santa

Isabel y Cutirre, 11°51'N 085°57'W, 340–360 m, 16 septiembre 1980, *P.P. Moreno 2624* (MO!); Volcán Mombacho, 2 km al SE de la Hacienda Cutirre, El Chipote, 11°48'N 085°54'W, 190–195 m, 11 junio 1982, *P. P. Moreno 16453* (MO!); Volcán Mombacho al Sur de la Hacienda Cutirre, 11°49'N 085°55'W, 300–400 m, 11 junio 1982, *P.P. Moreno 16449* (MO!); Volcán Mombacho, arriba y sureste de la Hacienda Cutirre, 11°49'N 085°56'W, 290–300 m, 29 enero 1981, *P.P. Moreno 6311* (MO!); Municipio de Granada. Reserva Natural Volcán Mombacho, 11°50'27"N 085°58'59"W, 1150–1350 m, 2 Diciembre 2003, *R.M. Rueda & L.D. Paguaga 17621* (HULE); Upper slopes of Volcán Mombacho, along W shore of Lake Nicaragua, ca. 15 km S of Granada, 11°50'N 085°58'W, 1100–1200 m, 19 March 1977, *T.B. Croat 39104* (MO!); **Jinotega:** Along rock road 3.8 miles SE of Yalí, between Condega on Route 1 and Jinotega on Route 3. Roadside and disturbed primary forest on steep slopes, 13°15'N 086°09'W, 1350 m, 6 Aug 1977, *T.B. Croat 42933* (MO!); **Managua:** Ca. 5.4 km NE of El Crucero, ridge of Sierra de Managua near Hda. Palmira, 12°01'N 086°16'W, 800–900 m, 25 August 1977, *W.D. Stevens 3503* (MO!); **Matagalpa:** Ridge along road between La Danta and La Luna, E of Esquipulas, 12°40'N 085°43'W, 960–1000 m, 25 January 1979, *W.D. Stevens 11841* (MO!); **Río San Juan:** Near Caño Chontaleño, 20 km NE of El Castillo, 11°08'N 084°12'W, 200 m, 18 April 1978 – 21 April 1978, *D.A. Neill & P.C. Vincelli 3625* (MO!).

3. ***Monstera adansonii*** Schott, *Wiener Z. Kunst* 4: 1028. 1830. — *Dracontium pertusum* Linnaues, Sp. Pl. 2: 968. 1753. (Figs. 5–7)

Type:—Figs. LVI & LVII, 'Arum hederaceum, amplis foliis perforatis', in R.P.C. Plumier, Description des Plantes de l'Amerique. 1693. (lectotype designated by Madison (1977)).

Monstera friedrichsthalii Schott, *Oest. Bot. Wochen.* 4: 65 (1854). TYPE:—[Nicaragua], [Niquinohomo], *Friedrichsthal* [*1206*] (holotype W, destroyed). **Neotype (designated here)**: Nicaragua. Departamento de Masaya: Laguna de Apoyo, 11°56'N 086°02'W, 100–140 m, 20 sept. 1981, *Pedro P. Moreno 11142* (MO!, two sheets: 3189310 and 3614609).

Monstera seemanii Schott, Oest. Bot. Zeit. 9:40 (1859). TYPE:—[Panama], Insula Taboga, *Seeman 1568* (holotype K, isotype BM!).

Terrestrial or nomadic vine, appressed-climbing or climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** light-green or dark, smooth or slightly rough, cylindrical or flattened; **internodes** 3–5 cm long, 0.5–10.0 mm diam., usually 5 times longer than wide; **petiole** distinct, dark-green, smooth or slightly rough, 10–15 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous or persistent; **blades** ovate-lanceolate, attenuate, cordate or truncate at base, acuminate at apex, subcoriaceous, 10–15 × 5–10 cm, not appressed to the phorophyte; **fenestrations** present or absent. ADULT PLANTS: root climbers; **stem** light-brown, light-green or dark-green, smooth or with small white pustules, sometimes with white dots, cylindrical or slightly flattened; **cataphylls** light green, whitish or yellowish-green, deciduous but leaving dry fragments on the peduncle; **internodes** 1–6 cm long, 1.5–3.5 cm diam.; **anchor roots** dark brown or blackish; **feeder roots** dark brown; **petiole** greenish, sometimes with white dots, smooth or with small white pustules, scarcely verrucose at basebase, 25–70 cm long, sheathed to basebase of the geniculum; **petiole sheath** deciduous, sometimes with fibrous residues; geniculum smooth, flattened or sunken adaxially, convex abaxially, 2–4 cm long; **blades** ovate, lanceolate-ovate or oblong, broadly cuneate to rounded, truncate or rarely cordate at base, acuminate at apex, coriaceous, drying blackish, reddish, yellowish or olive-green, 23–65 × 17–30 cm, 1.3–1.8 times longer than wide, undulate-decurrent on the geniculum (7–11 undulations of 0.5–1.0 mm wide); **midrib** flattened adaxially, convex abaxially, drying black or yellowish green on both surfaces; **primary lateral veins** 15–35 per side, emitting at a very low angle one or two robust secondary veins from near base or to ca. 1/3rd of the way from base of the primary veins, especially in the proximal 2/3rds of the blade, sunken to slightly sunken adaxially, raised abaxially, departing midrib at 45–80° (rarely at 90°), drying black or yellowish; **secondary veins** slightly prominent, reticulate towards the margin or parallel to the lateral nerves, undulate when dry; **collective veins** slightly visible; **fenestrations** present or absent, rounded, ovate or ellipsoid when present, and distributed along the blade near the midrib, sometimes with filaments separating the fenestrations; **margins** entire or pinnatilobed (2–5 lobes per side), due to tearing of the fenestrations that extend to the margin. INFLORESCENCES on ascending and pendent stems, 4–8 simultaneously at the flowering season, arranged in the leaf axils or into cataphylls; **peduncle** smooth or slightly rough, 12–20 cm long; 1.4–1.6 cm diam.; **spathe** short or long acuminate, light green and yellowish green during development, white or yellowish green externally, white internally at anthesis, 13–20 × 5–14 cm, up to 5 cm longer than the spadix, slightly coriaceous or membranous, sometimes with revolute margins, completely open during anthesis or remaining convolute in the lower part, later deciduous or marcescent post-anthesis;



FIGURE 5. *Monstera adansonii*. Adult plant growing in Cerro Azul, Panama. Photo by M. Cedeño-Fonseca. (Not collected).



FIGURE 6. *Monstera adansonii*. Adult plant growing in Buenos Aires, Costa Rica. *M. Cedeño et al. 804* (USJ). Photo by M. Cedeño-Fonseca.

spadix white or yellowish during development, cream-yellowish at anthesis, 10–15 cm long, 1.5–2.0 cm diam., (4.6)7.0–9.2 times longer than wide; **basal sterile flowers** with a yellow stigmatic secretion, 3–5 mm long; **fertile flowers** 4–6 mm long; stamens 1–6 mm long, with laminar filaments; anthers 1–2 mm long; ovary quadrangular or rectangular in longitudinal section, ribbed, 3–4 × 2–3 mm; style compressed, pentagonal or hexagonal, 0.5–2.0 × 2–3 mm; stigmatophore columnar, 0.5–1.0 mm long, absent (i.e. becoming unobservable) in dry specimens; stigma linear or linear-curved, with a transparent stigmatic secretion; **berries** creamy-white, yellowish green during development, pulp whitish; **seeds** dark green, 3–6 mm long.

Distribution and ecology:—*Monstera adansonii* subsp. *laniata* ranges from Nicaragua to Venezuela, Guyana, French Guiana, Suriname, Brazil, Trinidad & Tobago, the Lesser Antilles. In Central America it is very common in *Tropical moist forest*, whereas in Colombia it occurs most often in *Tropical wet forest* from sea level to 975 m.

Phenology:—In Central America the species flowers and fruits throughout the rainy season (April to August), less frequently as early as February and as late as October. Fruiting occurs mostly September to December, less frequently as early as July.

Discussion:—The species is a member of sect. *Monstera* and is characterized by its ovate-elliptic, usually perforate blades, usually less than twice as long as broad, unequal at base with one side truncate to subcordate and the other side cuneate to acute, by primary lateral veins at least on one side arising at an angle of more than 60° and with a peduncle that equals or exceeds the spadix.

It is most easily confused with *M. siltepecana* but that species differs by typically drying darker brown, by having more perforations and by having the secondary lateral veins conspicuously reticulate.

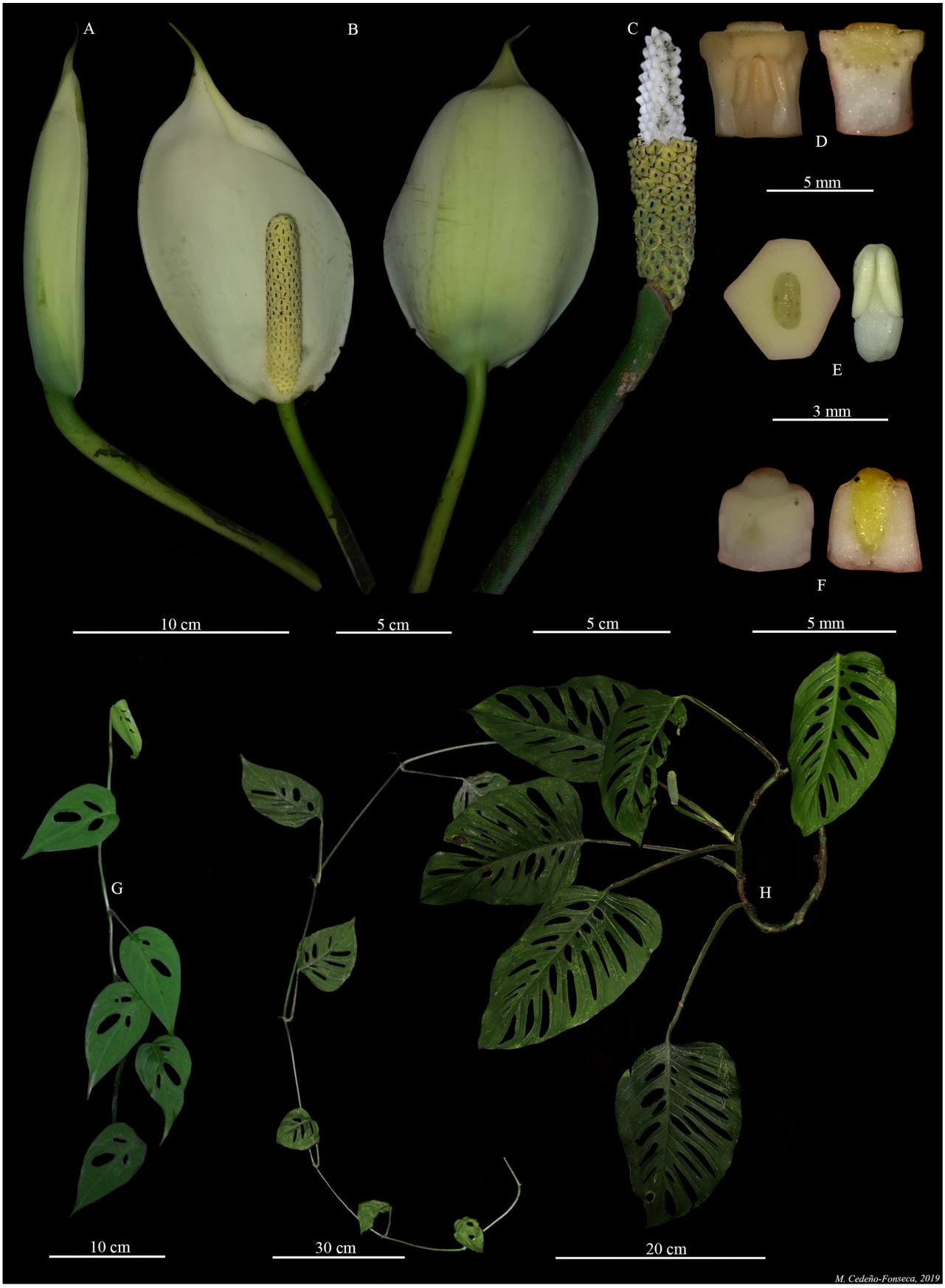

FIGURE 7. *Monstera adansonii* from San Jose, Costa Rica. (A) Developing inflorescence. (B) Open inflorescence, frontal and back views. (C) Mature infructescence, stylar plates detached. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; in lateral view (left), and longitudinal section (right). (G) Portion of juvenile plant. (H) Portion of adult plant. *M. Cedeño et al. 1008* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

Madison (1977) recognized *M. adansonii* as having three varieties with the typical variety being restricted to the West Indies, var. *klotzschiana* (Schott) Madison as being restricted to South America, throughout much of the Amazon basin from southern Venezuela and the Guianas south to Paraná State in Brazil to Amazonian Peru and Bolivia, mostly preferring secondary forest, and the var. *laniata* (Schott) distributed from Nicaragua to Peru, Venezuela, the Guianas, and Brazil. Subsequent to Madison's, studies by Mayo and Andrade (2013) have recognized the three varieties recognized by Madison as distinct subspecies, *M. adansoni*i subsp. *laniata*, *M. adansonii* subsp. *klotzschiana* and *M. adansonii* subsp. *blanchetii*.

For this review *M. adansonii* subsp. *laniata* is the only subspecies present in Central America. In addition, *Monstera seemanii* described from Panama is included under synonyms of this subspecies. Populations of *M. adansonii* considered as the subsp. *laniata* in central Panama and towards the Darien region, have a more closely related morphological similarity to *M. adansonii* subsp. *blanchetii*. However, this complex must be analyzed with more morphological details about the subspecies considered by Mayo & Andrade (2013).

For more details about the taxonomic comments and nomenclatural notes see Cedeño-Fonseca *et al.* (2022).

Nomenclatural remarks:—Schott (1854), in the original protologue of *M. friedrichsthalii*, only included the description and some taxonomic notes, however he did not include information on the locality or collector name. Subsequently, Schott (1860) in his *Prodromus systematis Aroidearum*, added that the plant comes from "Guatemala" and recognizes Friedrichsthal as the original collector. This information is again reiterated in the revision by Engler & Krause (1908), where they cited the holotype specimen as follows: "Guatemala, Niquinomo, Friedrichsthal n. 1206 - Kais. Herb. Wien."

Almost all the Central American herbarium material collected by Emanuel von Friedrichsthal contains labels designating that the specimens were collected in "Guatemala"; nevertheless, historical evidence (Taracena-Arriola & Sellen 2006) and location notes included on the labels suggest that Friedrichsthal actually collected in several countries of Central America, not only in Guatemala. Furthermore, the locality cited by Engler & Krause (1908) indicates that the plant actually comes from Niquinohomo (as "Niquinomo") in Nicaragua.

It is well known that almost all of the original Araceae material housed in W (which was studied by Schott himself) was destroyed during World War II (Riedl & Riedl-Dorn 1988), including the holotype of *M. friedrichsthalii*. Unfortunately, until now, it has been impossible to locate any original material of *M. friedrichsthalii* in the herbaria consulted. In the absence of original material, we propose the specimen *Pedro P. Moreno 11142* (MO, two sheets: 3189310 and 3614609) as the neotype of *M. friedrichsthalii*.

Additional specimens examined:—HONDURAS. **Atlántida:** *Carlos Soto V. 749* (TEFH!); *Cirilo H. Nelson et al. 17472* (TEFH!); Tela. m, *C.H. Nelson & R. Andino 15438* (TEFH!); **Colón:** 1.8 mi strip on the north bank of rio Guaimoreto between old bridge and opening of Laguna Guaimoreto 4.5 mi. NE of Trujillo on old road to Castilla, 15°57'30"N 085°54'30"W, 1 Aug 1980, *J.G. Saunders 519* (MO!); Trujillo. Old Airport road to Castillo, 3 km east of Trujillo, 15°55'N 086°00'W, 50 m, 09 June 1980, *J.G. Saunders 320* (MO!); Capuchin Site West, [1.8 mi. strip on the north bank of río Guaimoreto, between old bridge and opening of Laguna Guaimoreto, 4.5 mi. NE of Trujillo on old road to [Puerto] Castilla], 15°57'30"N 085°54'30"W, 0–20 m, 5 Aug 1980, *J.G. Saunders 524* (MO!); **La Paz:** Guajiquiro. *R.J. Evans 1705* **Olancho:** Along Río Olancho, W of main Tegucigalpa-Catacamas Highway, ca. 1 km up stream from and NW of Puente Boquerón, 8.6 miles SW of Catacamas, 6 miles SW of Santa María del Real, 14°45'N 086°00'W, 400 m, 04 February 1987, *T.B. Croat & D.P. Hannon 64107* (AAU, B, MO, SEL, TEX). COSTA RICA. **Alajuela:** Atenas, Río Grande, Balsa de Atenas, ca 3 km southeast of Atenas on the future site of the Escuela Centroamericana de Ganadería, 400 m, 7 July 1975, (Fr.), *J. Utley & B. Utley 2618* (CR!); San Carlos, La Tigra, 15 km WNW of Quebrada by air, 1 km W of Jabillos, Disturbed primary forest, 175 m, 29 April 1983, (Fl.), *R. Liesner & E. Judziewicz 15172* (CR!, MO!); San Carlos, Cutris, 3 km south of Boca de Arenal in remnant forest patch along río San Carlos on Hacienda Boca Arenal, 100 m, 3 June 1986, (Fr.), *B.E. Hammel 15323* (CR!, MO!); San Ramón, San Isidro, 1–3 km E of San Ramón coffee fincas, pasture, and stream, Near Waterfall, 1000 m, 13 April 1983, (Fl.), *R. Liesner 14251* (CR!, MO!); San Ramón, Santiago, Finca Barranca, Bosque muy húmedo premontano, 900 m, 6 January 1984, (Fl.), *L. Gómez et al. 20762* (CR!, MO!); San Carlos, La Tigra, 15 km WNW of Quebrada by air, 1 km W of Jabillos, Disturbed primary forest, 175 m, 29 April 1983, (Fl., Fr.), *R. Liesner et al. 15139* (CR!, MO!); Upala, Bijagua, Evergreen tropical wet forest formations and pastures on eastern slopes of Volcán Miravalles, West of Bijagua, near the río Zapote, 600 m, 11 February 1982, (Fr.), *W. Burger et al. 11663* (CR!, MO!); San Carlos, Florencia, Directly across the river W of Muelle de San Carlos, 22 km NNE of Quebrada by air, 100 m, 8 April 1983, (Fr.), *R. Liesner 14085* (CR!, MO!); Upala, Aguas Claras, P.N. Rincón de la Vieja, Sector de Ríos Aguas Verdes, 2 km S aguas arriba del puente, falda NE del Volcán Santa María, 600 m, 12 February 1991, (Fl.), *G. Rivera & C. Dennis 1062* (CR!); San Carlos, Fortuna, San Carlos, Fortuna, R. B. Arenal Mundo Aventura, 255 m, 5 March 2004, (Fr.), *A. Rodríguez 8500* (CR!);

San Carlos, Fortuna, San Carlos, Fortuna, R.B. Arenal Mundo Aventura, 255 m, 18 March 2004, (Fr.), *A. Rodríguez 8557* (CR!); San Carlos, Pital, San Carlos, Boca Tapada, Bosque Ancianos, 50 m, 23 May 2004, (Fl.), *D. Solano 1060* (CR!); San Carlos, Pital, Cerros Chaparrón, 100 m, 8 July 2005, (Fr.), *D. Solano 2596* (CR!); Along road between Cañas (Guanacaste) and Upala, 100 m, 25 June 1976, (Infer.), *T.B Croat 36382* (MO!); Along road between Cañas (Guanacaste) and Upala, 100 m, 25 June 1976, (Fl., Fr.), *T.B. Croat 36382* (MO!); Atenas, Banks of Río Cacao, 800 m, 2 January 1983, (Fl., Fr.), *L. Gómez 19565* (MO!); San Carlos, La Fortuna, El Tanque, 9 July 1982, (Fr.), *E. Valerio 61* (USJ!); San Carlos, La Fortuna, El Tanque, 10 July 1982, (Fr.), *E. Valerio 62* (USJ!), San Carlos, La Fortuna, El Tanque, 10 July 1982, (Fr.), *E. Valerio 63* (USJ!); San Carlos, Florencia, San Luis, 280 m, 17 Marzo 2001, (Fr.), C. Trejos 123 (USJ!); Los Chiles; Los Chiles; Río Frio; 40 m, 1 August 1949, (Fr.), *R. Holm & H. Hugh 780* (USJ!); Lago Cote, Bosque Aledaño, 800 m, 23 June 1968, (Fr.), *L.A. Fournier et al. 1448* (USJ!); San Carlos, La Palmera, Extremo este del Tajo de la comunidad, 200 m, 19 February 2000, (Fr.), *A. Pérez 33* (USJ!); Atenas, Concepción, Río Grande, 480 m, 30 May 1981, (Fr.), *E. Valerio s.n* (USJ!); Alajuela, Orotina, Coyolar, 170 m, 1 agosto 1982, (Infer.), *R. Ocampo 3885* (CR!); **Cartago:** Turrialba, Turrialba, CATIE, Confluencia del Rìo Tuis y el Rìo Reventazòn, 580 m, 15 June 1994, (Fr.), *G. Herrera 7180* (CR!); La Unión, San Diego, Z.P. Cerros de La Carpintera, 1800 m, 28 September 2006, (Fr.), *A. Cascante 1586* (CR!); Paraíso, Orori, Bosque primario en las faldas del Alto El Jaular, 1400 m, 20 July 1994, (Fl., Fr.), *K. Taylor 209* (CR!); Turrialba, Ganadería, 10 July 1965, (Infer.), *T.B. Croat 257* (MO!); Turrialba, Pavones, Cruce a La Suiza, En Plantación de Caña, 600 m, 12 December 1999, (Fr.), *M. Blanco 1009* (USJ!); Turrialba, Turrialba, Jardín Botanico del CATIE, 616 m, 26 October 2015, (Fr.), *M. Cedeño 836* (USJ!); Turrialba, Turrialba, Jardín Botanico del CATIE, 616 m, 8 December 1981, (Fr.), *E. Valerio 32* (USJ!); Turrialba, Turrialba, CATIE, 675 m, 2 May 1951, (Fr.), *J. León 3388* (USJ!); Turrialba, 20 July 1984, (Fr.), *C. Helfenberger s.n* (USJ!); **Guanacaste:** Liberia, Liberia, P.N. Rincón de la Vieja, Cordillera de Guanacaste, Sendero de la toma de agua, a 3 km de la estación, 1000 m, 17 September 1990, (Fr.), *G. Rivera 601* (CR!); Nicoya, San Antonio, P.N. Barra Honda, Península de Nicoya, Los Mesones, cerca de los tanques de captación, 350 m, 21 August 1992, (Fr.), *M. Reyes et al. 8* (CR!); Bagaces, Bagaces, 1 km W of Hacienda Palo Verde, 50 m, 10 July 1976, (Infer.), *J. Salomon 2437* (CR!, MO!); Nicoya, San Antonio, R. B. Lomas de Barbudal, Valle del Tempisque, Estación Barra Honda, Sendero de la Flor, 300 m, 1 July 1994, (Fl., Fr.), *U. Chavarría 987* (CR!); Abangares, Sierra, R.B. Monteverde, San Luis valley below comminity, premontane moist forest on Pacific slope, 1000 m, 9 May 1986, (Fr.), *W. Haber & E. Bello 5014* (CR!, MO!); La Cruz, Santa Elena, Along rìo Cuajiniquil, ca. 1 km SE of Rabo de Mico, 30 m, 24 January 2003, (Infer.), *R. Espinoza et al. 11503* (CR!, MO!); Santa Cruz, Santa Cruz, Cuenca del Tempisque, Bosque Nacional Diriá, margen del Río Enmedio de la casona a Río arriba, 300 m, 12 June 1998, (Fr.), *U. Chavarría & J. González 1868* (CR!, MO!); Bagaces, Bagaces, Cuenca del Tempisque, Colecta Lomas Barbudal, Sendero colegio Bagaces, 0 m, 18 July 2000, (Fr.), *G. Vargas & E. Wehncke 2024* (CR!, MO!); Along stream, ca. 11 km n of La Cruz, 0.5 km west of main road, 75 m, 2 February 1978, (Fl.), *R. Liesner 4840* (CR!, MO!); Nandayure, Bejuco, Pacífico Norte, Bejuco, Pilas de Bejuco, Finca de Benigno Mayorga, 40 m, 26 July 1994, (Fr.), *A. Estrada & A. Rodríguez 91* (CR!, MO!); Santa Cruz, Santa Cruz, Bosque Nacional Diría, 126 m, 25 January 2000, (Fr.), *L. Acosta 289* (CR!, MO!); Bagaces, Bagaces, Ojo de Agua, Papayito, Balas de Cañón, 100 m, 22 August 2000, (Infer.), *L. Acosta 2569* (CR!); La Cruz, La Cruz, Cerro El Hacha, Camino a Santa Cecilia, 300 m, 23 March 1992, (Fl.), *R. Espinoza 264* (CR!); Santa Cruz, Santa Cruz, Fila Vista del mar, camino a las torres de comunicación, 300 m, 23 September 1996, (Fr.), *J. Gonzáles 1252* (CR!, MO!); Tilarán, Tronadora, Rio Chiquito, Arenal, Zona Monteverde, 730 m, 3 March 1988, (Fl.), *W. Haber 8256* (CR!); Nicoya, San Antonio, Los Mesones, cerca de los tanques de captación, 300 m, 21 August 1992, (Fl.), *M. Reyes 8* (CR!); Tilarán, Tierras Morenas, Tierras Morenas, Rio Cabuyo, 685 m, 1 August 1994, (Fl.), *G. Rodríguez 298* (CR!); Liberia, Curubandé, P.N. Rincón de la Vieja, sendero hacia el cráter, 1004 m, 1 June 2011, (Fl., Fr.), *L. Vargas 4573* (CR!, MO!); Bagases, Mogote, P.N. Rincón de la Vieja, colecta camino a San Jorge, 3 km, de la casona Sata María, 400 m, 17 February 1991, (Fr.), *G. Rivera 1149* (CR!); Disturbed primary forest and open area along Río Higuerón near agricultural experimentation area near Taboga, 0–100 m, 29 June 1977, (Fl., Fr.), *R. Liesner 2709* (MO!); Tilarán, Tronadora, Monteverde, 3.5 km N Santa Elena on road to San Gerardo, 0.5 km N of junction road and Rio Negro, Lower montane wet forest, 1540 m, 20 August 1988, (Fl.), *W. Haber 8619* (CR!); Along Río Las Flores (identified on Tierras Morenas quadrangle as "Río Flores") 450 m, 25 January 1985, (Fr.), *M.H. Grayum 4913* (MO!); Abangares, Cuenca del Abangares, Zona Protectora Abangares, Sector Ecomuseo hasta Río AguasClaras, 300–500 m, 20 June 1997, (Fr.), *U. Chavarría 1737* (MO!); Finca La Pacifica along Rio Corobici 13 December 1977, (Infer.), *D. Janzen 10890* (MO!); P.N. Rincón de la Vieja, sendero de la toma de agua, a 3 km de la estación 17 September 1990, (Fr.), *G. Rivera 601* (USJ!); Guanacaste, Cañas, Porozal, Disturbed primary forest and open area along Río Higuerón near agricultural experimentation area near Taboga, 50 m, 29 June 1977, (Fr.), *R. Liesner et al. 2717* (CR!, MO!); **Heredia:** Sarapiquí, Puerto Viejo, E.B. La Selva, Finca La Selva, En las parcelas de sucesión, 9 September 1983, (Fr.), *I. Chacón 1339* (CR!); Sarapiquí, La Virgen, E. B. La Selva, E.B. La Selva, Along road leading to the reserve, 100 m, 16 August 1987, (Fr.), *J.F Smith & E. Frost 478*

(CR!); Sarapiquí, Las Horquetas, Along entry road to Finca La Selva, Puerto Viejo de Sarapiquí (from Puerto Viejo-Las Horquetas road), just before La Selva boundary, 5 m, 2 June 1985, (Fr.), *M.H. Grayum 5322* (CR!, MO!); Sarapiquí, Puerto Viejo, Near the junction of the Río Puerto Viejo and the Río Sarapiquí, 100 m, 15 July 1980, (Fr.), *B.E. Hammel 9215* (CR!); Sarapiquí, Las Horquetas, Just n of Las Horquetas along road to Puerto Viejo, 40 m, 19 July 1984, (Fr.), *M.H. Grayum 3563* (CR!); Santo Domingo, Tures, Lote y charral por el Río Tures, ca. 1 km al sur de San Francisco de San Isidro de Heredia, 1250 m, 29 March 2004, (Fr.), *B.E. Hammel 22936* (CR!); Sarapiqui, 2 km south of La Virgen on Puerto Viejo-San José road, 14 June 1981, (Fl., Fr.), *B.E. Hammel 10886* (MO!); La Selva Biological Station. 100 m, 20 June 1984, (Fr.), *B. Jacobs 2441* (MO!); Sarapiqui, La Selva Biological Station 100 m, 8 June 1983, (Fr.), *I. Chacón 898* (MO!); Finca La Selva, 100 m, 4 August 1980, (Fl.), *B.E. Hammel 9436* (MO!); Finca La Selva, 100 m, 23 May 1980, (Fr.), *M.H. Grayum 2848* (MO!); Finca La Selva, 100 m, 19 June 1981, (Fr.), *B.E. Hammel 10890* (MO!); La Selva Biological Station, 100 m, 25 June 1984, (Fl., Fr.), *B. Jacobs 2569* (MO!); Near La Selva Biological Station, 100 m, 4 July 1984, (Fr.), *B. Jacobs 2655* (MO!); Sarapiquí, La Virgen, Reserva Biológica La Tirimbina, En el parqueo del Lodge, 280 m, 1 July 2013, (Fr.), *J. López 327* (USJ!); Heredia, Sarapiquí, Horquetas, Estación Biológica La Selva, 50 m, 3 November 2018, (Fr.), *M. Cedeño & M. Chaves 1495* (USJ!); **Limón:** Pococí, Guacimo, Forested area near Guasimo along river, 22 April 1970, (Fr.), *E. Valerio s.n* (CR!); **Puntarenas:** Corredores, Corredor, Forests on main ridge and NE slopes of Fila de Cal, between San Vito and Ciudad Neilly, 550 m, 13 September 1985, (Fr.), *M. Grayum et al. 6049* (CR!, MO!); Montes de Oro, San Isidro, Interamerican Highway km marker 122; patch of forest west of road, 100 m, 4 August 1985, (Fr.), *B.E. Hammel & J. Trainer 14367* (CR!, MO!); Golfito, Puerto Jiménez, P. N. Corcovado, Estación Sirena, 5 m, 15 June 1990, (Fl.), *N. Obando 61* (CR!); Osa, Palmar, Sitio Arqueológico, Finca 6, Unos 5,5 Km SO en linea recta de Palmar Sur, Camino del portón a los montículos principales, 100 m, 11 October 2011, (Fr.), *A. Quesada et al. 3369* (CR!); Garabito, Tárcoles, P.N. Carara. Along Quebrada Bonita, Carara Reserve, 35 m, 25 July 1985, (Fl., Fr.), *M.H. Grayum et al. 5715* (CR!, MO!); Golfito, Golfito, Along short-cut road to Golfito from Villa Briceño on Interamerican Hwy, W side of Fila Gamba, ca. 6 km from Golfito airport, 80 m, 6 March 1985, (Fr.), *T.B. Croat & M.H. Grayum 59904* (CR!, MO!), Puntarenas, Paquera, Reserva Absoluta Cabo Blanco, Estación Cabo Blanco, Límite de la Reserva, Borde de bosques y potreros, 80 m, 7 November 1991, (Fl., Fr.), *U. Chavarría 320* (CR!); Puntarenas, Guacimal, Monte Verde area, valley of Río San Luis just south of Monte Verde; from 1/2 km below waterfall to base of waterfall, 1050 m, 23 June 1985, (Fr.), *B.E. Hammel & J. Trainer 14016* (CR!, MO!); Puntarenas, Paquera, P.N. Cabo Blanco, Secondary forest, 30 to 50 years old, 10 m, 30 April 1994, (Fr.), *M. Blanco 2257* (CR!); Osa, Sierpe, Valley of Laguna Chocuaco, ca. 9 km W of Rincón de Osa, 200 m, 8 October 1984, (Infer.), *M.H. Grayum et al. 4074* (CR!, MO!); Garabito, Tárcoles, P. N. Carara, Cuenca del Tárcoles, Quebrada Bonita sector, 25 m, 11 May 2009, (Fr.), *L. Vargas et al. 3779* (CR!, MO!); Golfito, Golfito, P.N. Piedras Blancas, 100 m, 6 June 2000, (Fl.), *L. Acosta et al. 1514* (CR!); Garabito, Jacó, 7 m, 5 September 2001, (Fr.),*A. Ruíz et al. 545* (CR!); Puntarenas, Monteverde, Monteverde, 6 km south of Santa Elena on road to highway, Los Cerros, ridge between Río Guacimal and Río Lagarto, 950 m, 19 July 1991, (Fl., Fr.), *W. Haber & W. Zuchowski 10769* (CR!, MO!), 8 km N of Barranca, 1 km N of Miramar turn off. W side of km 123 on the Interamerican Hwy. Quebrada Negros, 25 m, 30 April 1983, (Fl.), *R. Liesner et al. 15133* (CR!, MO!); Puntarenas, Guacimal, R.B. Monteverde, San Luis, Monteverde, Río Guacimal, Bosque húmedo premontano, 700 m, 24 June 1988, (Fl.), *E. Bello et al. 21* (CR!); Puntarenas, Paquera, Península de Nicoya, Curú, Río Curú mouth, Pasture on flats W of ranch headquarters, 0 m, 14 August 1995, (Fr.), *A. Sanders et al. 1755*6 (CR, USJ, MO); Parrita, Parrita, Forest along Río Paquita, 2 m, 13 August 1936, (Infer.), *C. Dodge & V. Goerger 9763* (CR!, MO!); Curu, 5 November 1986, (Fr.), *R. Soto 3149* (CR!); Golfito, Puerto Jiménez. P.N. Corcovado, Sirena, Ollas Trail, 0 m, 28 May 1988, (Fl.), *C. Ketnan et al. 538* (CR!); Golfito, Golfito, Refugio Nacional de Fauna Silvestre Golfito, Cerro Nicuesa, 345 m, 7 April 1994, (Fl.), *G. Rivera & G. Herrera 2268* (CR!); Golfito, Jiménez, Alrededor de la estación, 20 m, 11 September 1998, (Fr.), *R. Aguilar 5530* (CR!, MO!); Puntarenas, Lepanto, Reserva Karen Mongense, Sendero al Mirador viejo; colectado a orillas del sendero; 400 m, 9 May 2003, (Fl., Fr.), *E. Alfaro 4342* (CR!); Puntarenas, Cóbano, Sendero Central, 17 December 1993, (Fl.), *A. Fernández 1320* (CR!); Puntarenas, Lepanto, Jicaral, San Ramón de río Blanco, Cerro Escondido, Bosque alterados remanentes y áreas abiertas, en la cuenca de la Quebrada Pérez, 317 m, 8 May 2003, (Fl., Fr.), *J. Gonzales 3679* (CR!), Puntarenas, Cóbano, Estacion San Miguel, ca. 2 km S. de Malpais, 0 m, 18 January 1996, (Fl.), *B.E. Hammel 20090* (CR!); Buenos Aires, Potrero Grande, Bomba de Cedro, por el Río Cabagra, 200 m, 3 March 2000, (Infer.), *B.E. Hammel 22101* (CR!); Golfito, Jiménez, Rio Piro, Playa Carate, 10 m, 15 September 1990, (Fl., Fr.), *G. Herrera 4298* (CR!, MO!); Golfito, Jiménez, Estacion Sirena, 1 m, 1 September 1990, (Fl.), *J. Quesada 52* (CR!, MO!); Between Palmar Sur and Piedras Blancas, 20 m, 28 February 1976, (Fr.), *T. Croat 32915* (MO!); La Llorona, 0– 200 m, 8 August 1978, (Fr.), *D. Janzen 11043* (MO!); Golfito, Jiménez, Estacion Sirena, Sendero Naranjos, 10 m, 27 July 1994, (Fr.), *R. Aguilar 3522* (CR!); Aguirre, Quepos, Escuela Finca Palma al lado de Rio Naranjo, 10 m, 26 July 1995, (Fl.), *M. Chavarría 929* (CR!, MO!); Golfito, Jiménez, Albergue Cerro de Oro, Rio El Nino, 100 m, 18 March 1995, (Fl., Fr.), *E. Fletes 104* (CR!); Golfito, Jiménez,

Alrededores de la Estacion Sirena, Bosque primario, 10 m, 14 April 1995, (Fr.), *B. Gamboa 152* (CR!, MO!); Golfito, Jiménez, Rio Claro, 5 m, 6 August 1988, (Fr.), *C. Kernan 784* (CR!); Golfito, Jiménez, Quebrada La Ignasia, del puente para el manglar, Finca de Pedro Vaca, 3 m, 20 June 1998, (Fl.), *M. Lobo 224* (CR!); Golfito, Jiménez, Estacion Sirena, Recolectado a orilla del Rio Pavo, 10 m, 16 April 1995, (Fl.), *A. Picado 176* (CR!, MO!); Monte Verde área, valley of Río San Luis just south of Monte Verde, in woods along the river, 1000–1200 m, 18 June 1985, (Fl.), *B.E. Hammel 13935* (MO!); Northeastern slopes of Fila de Cal, 500–620 m, 12 July 1985, (Fl.), *M.H. Grayum 5649* (MO!); Swampy area near Interamerican Highway in vicinity of Piedras Blancas, 28 February 1978, (Infer.), *T.B. Croat 32954* (MO!); Puntarenas, Secondary vegetation on former plantations and pasture, 0–200 m, 1 December 1969, (Fr.), *W. Burger 6657* (MO!); Osa Peninsula, 19 August 1984, (Fr.), *A. Gentry 48693* (MO!); Monteverde, San Luis river valley below community on Pacific slope, 1000 m, 9 May 1986, (Fl.), *W. Haber 5010* (MO!); Canton OSA, along road between Rincón and Boscosa, 50 m, 11 September 1996, (Fr.), *T.B. Croat 79251* (MO!); Buenos Aires, Potrero Grande, Las Vueltas, Centro Turístico Los Chucuacos, 295 m, 25 July 2015, (Fr.), *M. Cedeño 804* (USJ!); Puntarenas, Monteverde, Reserva Biológica San Luis, Bosque secundario cercano a la rivera del Río Guacimal, 673 m, 6 December 2013, (Fr.), *P. Juárez et al. 497* (USJ!); Reserva Biológica Cabo Blanco, 6 August 1993, (Fr.), *R. Soto s.n* (USJ!); Parrita, Plantación vieja de palma africana, 10 m, 20 Enero 2001, (Fr.), *C. Morales 1496* (USJ!); Camino del ICE de Santa Cruz a Vista de Mar, 22 July 1985, (Fr.), *H. Pittier 23671* (MO!); Puntarenas, At Lindora near Monteverde, 29 September 1970, (Fl.), *H. Kennedy 571* (CR!); **San José:** Puriscal, Chires, P.N. La Cangreja, Along Río Negro, E of Santa Rosa, 320 m, 21 July 1988, (Fl.), *M.H. Grayum et al. 8608* (CR!, MO!); Alajuelita, San Antonio, Z.P. Cerros de Escazú, Alrededores de Cerro Rabo de Mico, 2200 m, 22 September 1989, (Infer.), *G. Vargas et al. 765* (CR!); Playa Dominical, Baru, and Tinamastes (along road to San Isidro del General), 250 m, 20 November 1975, (Fr.), *M. Burger 10165* (CR!, MO!); Mora, Colón, Z.P. El Rodeo, Reserva de la Universidad para la Paz, 500 m, 28 January 1994, (Fr.), *A. Cascante et al. 198* (CR!); Región de El General, 850 m, 1 March 1940, (Fr.), *A. Skutch 4824* (CR!); Turrubares, San Juan de Mata, No protegida, Cuenca del Tárcoles, San Luis de Turrubares, finca de Melvin Chavarría, 1200 m, 5 October 2004, (Infer.), *A. Soto 173* (CR!); Pérez Zeledón Río Nuevo, R.F. Los Santos, Savegre Abajo, Márgenes del río División, 550 m, 11 November 1998, (Fr.), *A. Estrada et al. 1899* (CR!); Mora, Colón, Z.P. El Rodeo, Bosque de la Universidad para la Paz, 1020 m, 13 December 2001, (Fr.), *A. Quesada et al. 925* (CR!); Mora, Colón, Z.P. El Rodeo, Finca el Rodeo, camino a la Universidad para la Paz, 500 m, 27 April 1994, (Fl.), *A. Ruíz 440* (CR!); Mora, Tabarcia, Zona Protectora Cerros de Escazú, cuenca del río Negro, 2 km en línea recta al noreste de la plaza de Palmichal en remanentes de bosque a la orilla del río, 1283 m, 19 August 2010, (Fr.), *J. Sánchez & R. Chacón 2166* (CR!); Pérez Zeledón, Daniel Flores, San Isidro de El General, Repunta, Finca de Miguel Quesada, 700 m, 1 August 1993, (Fl.), *R. Aguilar 2077* (CR!); Mora, Colón, Camino a Piedras Negras, sabanas poco antes de llegar al Río Jaris, 500 m, 1 November 2003, (Fr.), *R. Kriebel 4020* (CR!); Turrubares, San Juan de Mata, San Pablo de Turrubares, 100 m, 8 December 2004, (Fr.), *D. Santamaría 331* (CR!); Along Interamerican Highway, 28 February 1976, (Infer.), *T.B. Croat 32942* (MO!); Puriscal, Along main road between Mercedes Sur and Zapotal, 900 m, 1 January 1985, (Fr.), *M.H. Grayum 4688* (MO!); San José, Carmen, Barrio Escalante, 2 November 1984, (Fr.), *E. Valerio 121* (USJ!); Curridabat, Curridabat, Granadilla, 30 August 1980, (Fr.), *E. Valerio s.n* (USJ!); Curridabat, Curridabat, Granadilla, 18 September 1984, (Fr.), *E. Valerio 116* (USJ!); Curridabat, Curridabat. Granadilla. 28 July 1980, (Fr.), *E. Valerio s.n* (USJ!); Mora, Colón, Zona Protectora El Rodeo, Ladera Sur-Oeste de la Fila Diamante, 880 m, 25 October 2011, (Fr.), *L. Ríos 2* (USJ!); Montes de Oca, San Pedro, San Pedro, 17 July 1981, (Fr.), *E. Valerio s.n* (USJ!). PANAMA. **Bocas del Toro:** Rambala and vicinity, 08°55’06”N 082°09’18”W, 50 m, 24 April 1988, *S.A. Thompson 4921* (CM, MO); Chiriquicito to 5 miles S along Río Guarumo, 08°55’N 082°10’W – 09°00’N 082°11’W, 05 June 1967 – 07 June 1967, *W.H. Lewis et al. 2012* (MO!); **Canal Area:** Old Fort San Lorenzo, 09°18’06”N 080°00’05”W, 0-15 m, 06 November 1965, *E.L. Tyson 2217* (IBE, SCZ); Along road to radar station on Semaphor Hill. 1km NW of Summit Garden. Secondary tropical moist forest, 09°04’31”N 079°38’52”W, 100 m, 07 Oct 1973, *M.H. Nee 7291* (MO!); Barro Colorado Island. Fairchild Point [Salud Point], 09°10’20”N 079°50’04”W, 0–5 m, 20 Sep 1968, *T.B. Croat 6225* (MO!); Summit Gardens, 09°03’52”N 079°38’58”W, 75 m, 25 March 1970, *T.B. Croat 9061* (MO!); **Chiriquí:** Jardin Botánico de la UNACHI, 08°23’03”N 082°27’10”W, 24 m, 28 August 2018, *O. Ortiz et al. 3388* (MO!); Vicinity of Puerto Armuelles, 08°17’00”N 082°52’00”W, 0–75 m, 28 July 1940 – 31 July 1940, *R.E. Woodson & R.W. Schery 903* (MO!); Burica Peninsula. Along stream; Quebrada Mellize, 6 miles (10 km) south of Puerto Armuelles, 08°11’N 082°53’W, 0–150 m, 05 March 1973, *R.L. Liesner 503* (MO!); 1 mi W of airport at Puerto Armuelles, 08°15’00”N 082°52’30”W, 0–5 m, 17 Feb 1973, *T.B. Croat 21914* (MO!); **Coclé:** Along El Valle de Antón, roadside near town, 08°37’N 080°07’W, 23 Apr 1977, *J.P. Folsom & J. Kauke 2777* (MO!); El Jordanal, Rio Indio Arriba, 08°40’10”N 080°07’01”W, 570–840 m, 23 Jul 2001 – 25 Jul 2001, *M.B. Jorge 5–130* (PMA!); **Colón:** Along tributary of Quebrada Anchca. 4 km E of Buena Vista, 3 km N of cement plant, 09°18’N 079°39’W, 80 m, 04 November 1973, *M.H. Nee 7787* (MO!); Mosquera, forest, 09°13’30”N 080°05’30”W, 15–50 m, 17 September 1974, *P.J. Maas & S.A. Mori 1749* (MO!); Forest and forest

edge from Portobelo Highway to 40 km up Río Guanche. [Coordinates on original label: 09°30' N 079°40' W], 09°30'N 079°38'W - 09°31'N 079°41'W, 0–50 m, 30 August 1981, *S. Knapp 1023* (MO!); Portobelo. 2–4 km up the Río Guanche from the Portobelo Highway, 09°30'N 079°39'W – 09°30'N 079°40'W, 0–50 m, 03 October 1981, *S. Knapp & R. Chazdon 1407* (MO!); **Darién:** 1–4 miles N of Pucro, 08°00'07"N 077°33'00"W – 08°03'00"N 077°35'00"W, 0–100 m, 22 June 1967, *J.A. Duke 13051* (MO!); Puerto Santa Dorothea (=Puerto Piñas), near Piñas Bay, 07°35'N 078°11'W, 0 m, 21 July 1962, *J.D. Dwyer 2299* (MO!); Area de Manejo Especial de Bahia Piñas, bosque cercano a Aceite, 07°37'41"N 078°11'10"W, 87 m, 30 June 2018, *O. Ortiz et al. 3011* (MO!, PMA!); Area de Manejo Especial de Bahia Piña, b osque cercano a Aceite, 07°37'41"N 078°11'10"W, 87 m, 30 June 2018, *O. Ortiz et al. 3012* (MO!, PMA!); Area de Manejo Especial de Bahia Piñasm bosque seundario circundanate al hotel Tropic Star Lodge, 07°35'11"N 078°12'38"W, 0 m, 30 June 2018, *O. Ortiz et al. 3028* (MO!, PMA!); Vicinity of gold mine at Canal, 07°45'N 077°41'W, 500–600 m, 26 Jul 1976, *T.B. Croat 37604* (MO!); Río Pirre, 07°55'N 077°44'W, 14 Jul 1971, *T.B. Croat & D.M. Porter 15487* (MO!); **Los Santos:** Tonosi. Azuero Peninsula, along trail between Jobero and headwaters of Río Pedregal, 07°20'N 080°35'W, 300–700 m, 28 April 1976, *T.B. Croat 34464* (MO!); Along road between Tonosí and Jobero, 07°20'30"N 080°30'00"W, 50–80 m, 27 April 1976, *T.B. Croat 34455* (MO!); **Panamá:** Sendero ecológico del Centro de Ciencias v Arte. EXPLORA, *J. Vergara 4* (MO!, PMA!); Panamá. Panama City, at Lefevre Park, 08°58'00"N 079°32'00"W, 28 Jun 1940, *H.H. Bartlett & T. Lasser 16337* (MO!); Cerro Jefé, 09°14'02"N 079°22'30"W, 700–1000 m, 12 Apr 1972, *T.C. Plowman & A. Weil 3159* Cerro Jefé, 09°14'02"N 079°22'30"W, 700–1000 m, 12 Apr 1972, *T.C. Plowman & A. Weil 3156* **San Blas:** Moli-ya, tierra firme frente a Isla Playón Chico, camino principal al Sur. [Coordinates on original label: 09º20'N, 078º13'W], 09°19'20"N 078°13'58"W, 0–50 m, 17 septiembre 1987, *H. Herrera 371* (MO!); Coastal rocks between Puerto Obaldía and Puerto Armila, 08°40'N 077°24'W – 08°40'N 077°28'W, 0–300 f, 29 Apr 1980, *W.G. D'Arcy 13683* (MO!); **Veraguas:** Along road from Guabala on Panamerican Hwy. and Soná, between Quebrada de Piedra and Puerto Vidal, ca. 1 km W of Puerto Vidal, 08°03'10"N 081°37'54"W, 37 m, 07 March 2015, *T.B. Croat 106239* (HUA, MO, PMA); Calobre. Colectado hacia Chitra, encalle que va hacia los pozos termales, 08°30'50"N 080°54'17"W, 564 m, 18 May 2017, *E. Campos 940* (MO!, PMA!); Canazas. Ca. 1 km above Cañasas [Cañazas] on road to Los Valles, 08°19'59"N 081°12'43"W, 230 m, 14 July 1976, *T.B. Croat 37048* (MO!); Montijo. Isla de Coiba, cativa entre campamento de Playa Blanca y el Barco Quebrado. 17NMU2513, 07°23'01"N 081°40'07"W – 07°20'16"N 081°41'32"W, 0–50 m, 26 Nov 1994, *A. Espinosa et al. 727MB* (MO!, PMA!); Isla de Coiba, cativa entre campamento de Playa Blanca y el Barco Quebrado. 17NMU2513, 07°23'01"N 081°40'07"W - 07°20'16"N 081°41'32"W, 0–50 m, 26 Nov 1994, *A Espinosa et al. 716MB* (MO!); Isla de Coiba, en cativales de Barco Quebrado, 07°20'16"N 081°41'32"W, 10 m, 26 May 1998, *A. Ibáñez et al. 653AI* (MO!, PMA!); P.N. Coiba. Jicarón. Río más largo de la isla. Orilla del río. 17NMU 1202, 07°15'23"N 081°47'50"W, 5 m, 09 Jul 2004, *A. Ibáñez et al. 3719AI* (MO!); Isla Coiba. Ensanada de Santa Cruz, 07°37'N 081°45'W, 2 May 1995, *C Galdames et al. 2367* (MEXU!, MO!); Isla Coiba. Camino desde Barco Quebrada hasta el Campamento Playa Blanco, 07°20'16"N 081°41'32"W – 07°23'01"N 081°40'07"W, 0–50 m, 03 Sep 1995, *J.E. Aranda et al. 2339* (MO!, PMA!); Cerro Hoya, subiendo por Cobachón, 07°16'20"N 080°39'15"W, 350 m, 21 abril 1997, *J. Deago et al. 475* (MO!, PMA!); Isla de Coiba, entre el campamento de playa Blanca y el de Barco Quebrado, 17NMU2614, 07°22'54"N 081°39'18"W, 28 January 1994, *S. Castroviejo et al. 7253 MV* (MO!); Santa Fe. Vicinity Santa Fé, along road between Santa Fé and Calovebora, 1.7 miles past Alto Piedra School, 1.5 miles beyond Quebrada Cosilla (previously referred to as Río Primero Braso), 08°31'28"N 081°07'50"W, 570 m, 13 July 1994, *T.B. Croat & G.H Zhu 76811A* (MO!); Sona. Isla Canales de Tierra. Playa del Laboratorio. 17NMU 3656, 07°44'53"N 081°34'26"W, 2 m, 29 Jan 2002, *A. Ibáñez & N. López 1493* (MO!, PMA!).

4. ***Monstera alcirana*** Croat, M.Cedeño, Zuluaga & O.Ortiz, *Webbia* 75(2): 251–262. 2020. (Figs. 8, 9)

Type:—PANAMÁ. Coclé: along ridge of Cerro Gaital, N slopes of mountains near La Mesa, N of El Valle; 28 April 1982, 800–900 m, *Knapp & Dressler 4880* (holotype MO!; isotypes K!, PMA!, US!).

Nomadic vine with appressed-climbing habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** smooth, terete, dark-green; **internodes** 1.5–2.5 cm long, 4–6 mm diam.; **petiole** conspicuous, light green, smooth, 4–9 cm long, sheathing to base of the blade; **petiole sheath** slightly persistent or completely deciduous; **blades** oblong-elliptic to lanceolate, attenuate at base, coriaceous, 3–6 × 3–4 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green, smooth, terete or slightly flattened; **internodes** 0.5–3.0 cm long, 5–10 mm diam., usually 3–5 times longer than wide; **anchor roots** black and corky, with black root hairs; **feeder roots** black and corky, with black root hairs; **petiole** light green, smooth, 5–15 cm long, sheathing to base of the geniculum; **petiolar sheath** deciduous; geniculum bulky, 0.5–1.0 cm long; **blades** narrow, lanceolate, oblong-

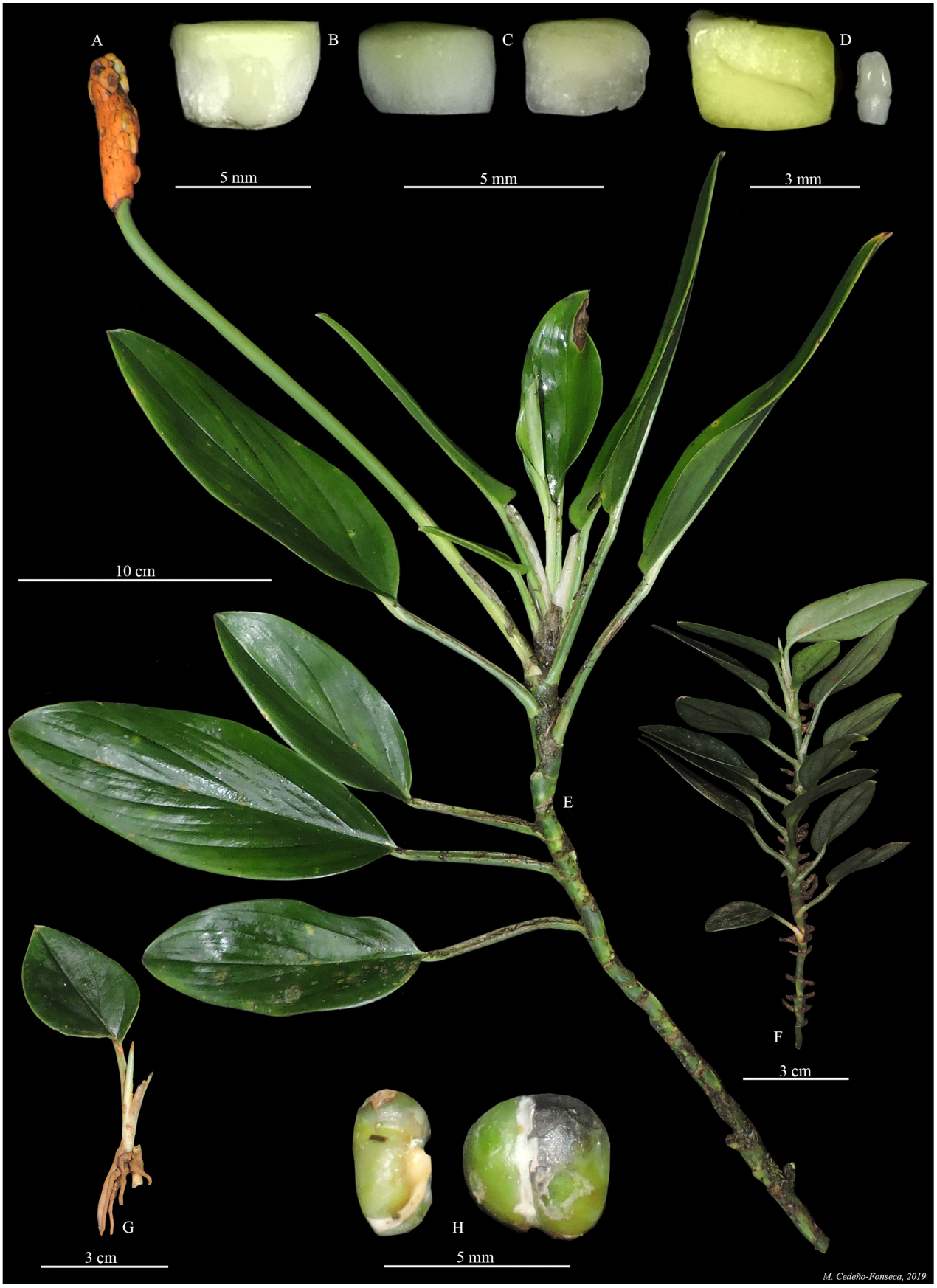

FIGURE 8. *Monstera alcirana* From Cerro Azul, Panama. (A) Infructescence. (B) Fertile flower. (C) Sterile flower; in lateral view (left) and in longitudinal section (right). (D) Stylar plate, top view (left), and individual stamen (right). (E) Adult plant. (F) Juvenile plant. (G) Seedling. (H) Seeds. Image from Cedeño-Fonseca *et al.* (2020g).



FIGURE 9. *Monstera alcirana*. Adult plant growing in Cerro Jefe, Panama. Photo by M. Cedeño-Fonseca. (Not collected).

elliptic or ovate, attenuate at base, obtuse or short-acuminate at apex, thickly coriaceous, drying yellowish, 7.5–25.0 × 3–10 cm, 2.4–3.5 times longer than wide, with base slightly decurrent on the geniculum; **midrib** sunken adaxially, convex abaxially; **primary lateral veins** 4–7 per side, departing from midrib at 35–45°, strongly sunken adaxially, raised abaxially; **secondary veins** inconspicuous; **collective veins** not visible; **fenestrations** absent; **margins** entire. INFLORESCENCES on ascending stems; **peduncle** smooth, 10–38 cm long, 2–4 mm diam.; **spathe** light-green during development, cream on both surfaces at anthesis; **spadix** white during development, cream at anthesis, 3.0–5.2 cm long, 0.7–1.0 cm diam.; **basal sterile flowers** 1.5–3.0 mm long; **fertile flowers** 3–4 mm long; stamens 1.5–4.0 mm long, with laminar filaments; anthers 0.5–1.0 mm long; ovary quadrangular in longitudinal section, ribbed, 1.5–2.5 × 1.5–2.0 mm; style hexagonal, 1–2 × 2.0–2.5 mm; stigma linear; **berries** with orange-green stylar cap, greenish during development; pulp white; **seeds** green or black, spherical, 2–4 mm long.

Distribution and ecology:—*Monstera alcirana* is endemic to Panama in the Provinces of Coclé, Panamá, Colón and San Blas (Guna Yala) Comarca in *Tropical wet forest* and *Premontane rain forest* at 350–1000 m.

Phenology:—The species flowers January-April, and July.

Discussion:—The species is member of sect. *Monstera* and is unusual for the genus in having leaves that are somewhat like *Stenospermation* and indeed the species was long confused with that genus (Gómez 1983).

The other species that can be confused with *M. alcirana* is *M. minima*, but *M. minima* is only known from the type locality in the Comarca Guna Yala (formerly San Blas), Panama, and from Colombia. The key differences are that *M. alcirana* has an orange fruiting spadix (vs. an apparently creamy fruiting spadix), and a thickly coriaceous leaf blade, 7.5–25.0 × 3–10 cm (vs. a thinly coriaceous blade 9–14 × 2.0–4.0 cm), obtuse or short-acuminate at apex (vs. long-acuminate at the apex). *Monstera alcirana* is the fourth diminutive species of *Monstera* in Central America, together with *M. minima*, *M. obliqua*, and the recently published species *M. gambensis* (Cedeño-Fonseca *et al.* 2020b). *Monstera alcirana* differs from the latter species in having a smooth petiole (vs. rough petiole), the petiole sheath deciduous (vs. persistent and involute), and the fruiting spadix orange when ripe (vs. yellow when ripe).

Additional specimens examined:—PANAMA. **Coclé:** La Mesa above El Valle; in forest on both sides of junction with road to Cerro Pilon, ca. 800 m, 21 Jul 1974, *T.B. Croat 25390* (MO!). Along road between Llano Grande and Coclesito (N of Pintada), 4 mi. N of Llano Grande, 600 m, 28 Jan 1980, *T. Antonio 3561* (MO!). 27 km N of Penonome on road to Coclesito in forest reserve at Continental Divide, ca. 300 m, 20 Feb 1978, *B. Hammel 1635* (MO!). Vicinity el Valle de Antón, at forested flat area near Finca Macarenita at La Mesa, 08°36'N, 80°07'W, 800 m, 6 Jul 1994, *T.B. Croat & G.H. Zhu 76665A* (MO!). Parque Nacional General de División Omar Torrijos Herrera, Caño Sucio, camino hacia el Alto Tífe, bosque húmedo con suelos muy rocosos, 8°42'55"N, 80°38'12"W, 243 m, 18 Jul 2013, *O. Ortiz et al. 1416* (MO!, PMA!); **Colón**: East Santa Rita Ridge, 11 January 1968, *M.D. Correa & R.L. Dressler 595* (MO!). Near Agua Clara rainfall station, Santa Rita Ridge, 9°20'N, 79°48'W, 23 Apr 1970, *R.B. Foster 1752* (PMA!). Along ridge of Cerro Gaital, N slopes of mountains near La Mesa, N of El Valle, Premontane rainforest, 08°38'00"N, 80°08'30"W, 800–900 m, 28 Apr 1982, *S. Knapp & R. J. Schmalzel 4880* (MO!). Flotation Molly, 8°51'12"N, 80°38'18"W, 139 m, 21 May 2014, *S. Castillo 402* (PMA!). Distrito de Donoso, área de Concesión Minera Panamá, Pipeline Road, 8°53'46"N, 80°38'50"W, 127 m, 6 May 2013, *O. Ortiz et al. 1310* (MO!, PMA!); **Panamá:** Between 6–12 km north of El Llano on Cartí road, forest and roadside, 09°15'32"N, 078°57'42"W–09°16'32"N, 078°55'49"W, 365 m, 13 Jan 1978, *B.E. Hammel 889* (MO!). Cerro Jefe, ca. 1000 m, *J.D. Dwyer 9480* (MO!). El Llano-Cartí Road, 17.5 km from Inter-American Highway, wet forest, 09°17'45"N, 78°55'59"W, 350 m, 14 Feb 1975, *S.A. Mori et al. 4605* (MO!). Altos de Pacora, northwest of Cerro Jefe, 09°16'30"N, 79°18'50"W, 650–750 m, 8 Nov 1979, *T. Antonio 2502* (MO!). 16–18 km from Interamerican Highway on the El Llano-Cartí Road, 09°17'50"N, 78°56'03"W, 400 m, 28 Mar 1974, *E. L. Tyson & M. H. Nee 7342* (MO!). 8.2 miles from the Pan-American Highway on the El Lano-Cartí Road, 09°14'N, 79°00"W, 6 Jul 1982, *S. Knapp 5917* (MO!). Beyond Goofy Lake along road to Cerro Jefe, 9°14'N, 79°21'W, 4 Jan 1968, *M.D. Correa et al. 567* (MO!, PMA!). Campo Tres, 3 miles NE of Altos de Pacora, 500–800 m, 10 Mar 1973, *R.L. Liesner 523* (MO!, PMA!). Road to Cartí (San Blas), 15.5 kn north of El Llano, 09°21'30"N, 78°58'00"W, ca. 400 m, 13 Feb 1973, *P. Busey 366* (MO!). La Eneida, región of Cerro Jefe, 9°14'N, 79°21'W, 650 m, 15 Jan 1973, *R.L. Dressler 4253* (PMA!). El Llano-Cartí Rd. km. 17.4, Tropical wet forest, 9°19'N, 78°55'W, 350 m, 1 Jul 1985, *G. de Nevers 5922* (MO!, PMA!). Altos de Cerro Azul, sendero el Cantar, 500 m, 16 Sept 2015, *O. Ortiz et al. 2515* (MO!, PMA!); **Veraguas**: Santa Fe, Río Piedra, bosque secundario maduro, camino cerca del río, 8°44'06"N, 80°46'21"W, 370 m, 16 Dec 2013, *A. Morris & L. Martínez 2062* (PMA!). Santa Fe, Parque Nacional Santa Fe, área del Río Veraguas, bosque achaparrado, trocha sobre filo de un cerro, dosel con una altura aproximada de 25 m, con presencia de *Colpothrinax*, 8°41'21"N, 80°50'09"W, 539 m, 8 Feb 2014, *L. Martínez et al. 1672* (PMA!).

5. ***Monstera alfaroi*** Croat & M.Cedeño, *Nordic Journal of Botany* 38(12): 1–13. 2020. (Figs. 10, 11)

Type:—COSTA RICA. San José: Cantón Tarrazú, distrito San Lorenzo, Camino de Tarrazú hacia Quepos, 1386 m, 22 October 2019, (fl.), *M. Cedeño 1702* (holotype USJ!, isotypes MO!, PMA!).

Robust nomadic vine with appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; appressed-climbing; stem dark green, cylindrical or dorsally flattened, with whitish-green pustules making a rough-warty surface; internodes 1–15 cm long, 5–10 mm diam.; **petioles** partly concealed by the leaf blades or not at all, light green, warty, 3–16 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous; **blades** not appressed to the phorophyte, ovate-lanceolate, acuminate at the apex, coriaceous, 9–20 × 8–13 cm, **fenestrations** absent. ADULT PLANTS: root climbers; **stem** with black and dark green pustules, cylindrical; **internodes** 1–2 cm long, 2–3 cm diam., 0.5–0.6 times as long as wide; **anchor roots** blackish; **feeder roots** blackish; **petiole** brown or rarely light green at base, with brown black and white pustules, 40–70 cm long, sheathed along their entire length; **petiole sheath** undulate, persistent or deciduous; geniculum warty throughout, flattened adaxially and transversally convex abaxially, 2.0–2.5 cm long; **blades** narrowly ovate, rounded or asymmetric at base, shortly acuminate at the apex, subcoriaceous, with entire margins and few fenestrations, 60–90 × 30–45 cm, drying dark brown and weakly lustrous, not decurrent on the geniculum; **midrib** concave adaxially, convex abaxially, drying black or yellowish; **primary lateral veins** 8–13 per side, diverging at 50–70°, impressed adaxially, prominent abaxially; **secondary veins** parallel to the primary lateral veins; **collecting veins** poorly visible; **fenestrations** present (weakly perforated near the midrib); **margins** entire. INFLORESCENCES produced on ascending stems; **peduncle** with green or brown pustules, 20–35 cm long; **spathe** obtuse or acuminate, light green in developing inflorescences, internally white and externally light green at anthesis, 13–20 × 8–14 cm; **spadix** white during development, white or yellowish white at anthesis, 10–15 cm long, 1.2–2.5 cm diam.; **basal sterile flowers** 4–5 mm long; **fertile flowers** 5–7 mm long; stamens 2–7 mm long, with laminar filaments; anthers 2.0–2.5 mm long; ovary quadrangular in longitudinal section, ribbed; style hexagonal, 1.2–2.5 mm long, truncate; stigma linear; **berries** with the stylar cap after anthesis white, white-cream when ripe; pulp white; **seeds** black, 3–6 mm long.

Distribution and ecology:—*Monstera alfaroi* is endemic to Costa Rica. It is distributed in the Pacífic Central, Tarrazú, and south in the Fila Chonta and Fila Costeña, at 1100–1250 m. It occurs in *Lower montane rain forest* life zone.

Phenology:—Flowering has been recorded in February, October and November, and fruiting in January.

Discussion:—This species is a member of sect. *Monstera*. It differs from other Costa Rican species in having light brown petioles with black or white warts throughout their length, and the sheath wavy and warty, then promptly deciduous, as well as leaf blades that are coriaceous and scarcely fenestrated, and inflorescences with the peduncle warty and the spathe light green externally. It is most closely related to *Monstera buseyi*, with which it shares tuberculate petioles. Most collections of *Monstera buseyi* differ from *M. alfaroi* in having narrowly ovate-elliptic leaf blades 2.0–2.5 times longer than wide which dry medium grayish yellow-brown above and much paler (yellowish green) and often matte below, although some collections have blades only 1.7 times longer than wide which dry dark brown. Also, *Monstera buseyi* has flowering spadices only 6–9 cm long and ca. 1 cm diam., versus more than 18 cm long and 2 cm diam. in *M. alfaroi*. Finally, *Monstera buseyi* has peduncles drying matte and smooth or only weakly puberulent-scurfy, whereas those of *M. alfaroi* dry grossly ridged and pitted and covered by conspicuous tubercles.

Monstera alfaroi can also be confused with *M. costaricensis*, but the latter has petioles with white pustules and markedly wavy and persistent wings, and flowers with markedly conical styles. *Monstera alfaroi* is restricted to the Pacific slope of the Cordillera de Talamanca, while *M. costaricensis* occurs only in the Caribbean lowlands (below 600 m elevation) of Costa Rica.

Additional specimens examined:—COSTA RICA. **Puntarenas:** Buenos Aires, Changuena, Boques en Fila Anguciana. Finca Bonillas, 1480 m, 25 abril 2020, *M. Cedeño et al. 1719* (USJ!); Buenos Aires, Potrero Grande, La Lucha, Punto, 1400–1500 m, 20 February 2018, (Fl.), *D. Santamaría et al. 7036* (MO!); Parrita, Parrita, Fila Chonta, 1295 m, 27 November 2003, (Fl.), *A. Quesada 1264* (CR!); Parrita; Fila Chonta, camino de San Marcos de Tarrazú a Cerro Cura, La Virgen y Fila Chonta, 1400 m, 31 January 1996, (Fr.), *B.E. Hammel & J. Morales 21189* (INB, MO); **San José:** Tarrazú, San Lorenzo, Nápoles, Estribaciones al Oeste de Cerro Toro, 1200 m, 30 November 1995, (Fl.), *G. Herrera et al. 8785* (CR!); San José, Pérez Zeledón, Fila Costeña, 1100 m, 15 February 1996, (Infer.), *B.E. Hammel et al.* 20161 (INB, MO); Cantón de Pérez Zeledón, Cordillera de Talamanca, Las Nubes, Estación Santa Elena, 1240 m, 15 de febrero de 1996, *E. Alfaro 508* (MO!).

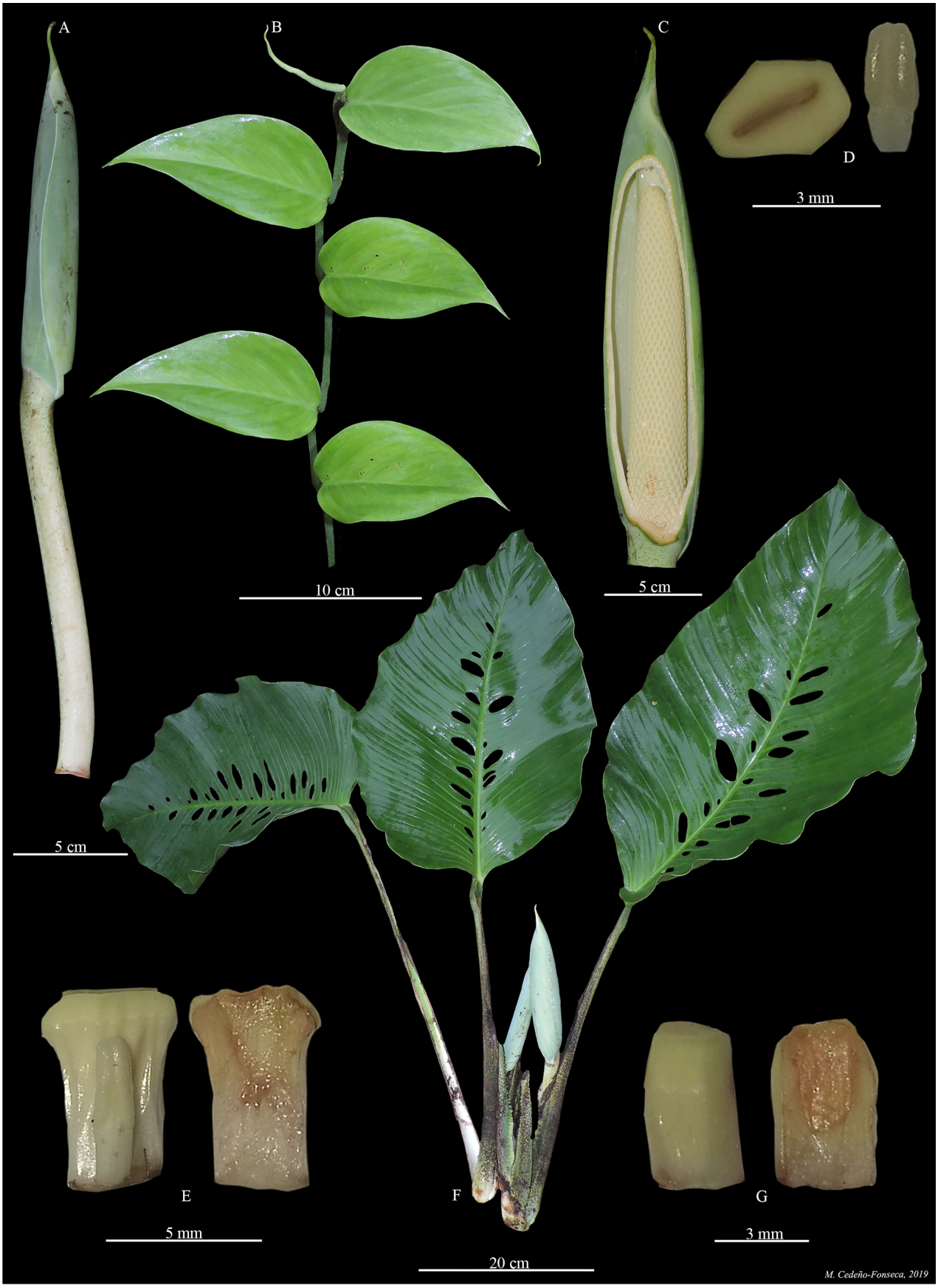

FIGURE 10. *Monstera alfaroi* from Tarrazú, Costa Rica. (A) Developing inflorescence. (B) Portion of juvenile plant. (C) Longitudinal cut of the spathe at female anthesis. (D) Stylar plate with stigma (left) and one stamen (right). (E) Fertile flower; in lateral view (left), and longitudinal section (right). (F) Portion of adult plant. (G) Sterile flower; in lateral view (left), and longitudinal section (right). *M. Cedeño 1702* (USJ). Image from Cedeño-Fonseca *et al.* (2020a).



FIGURE 11. *Monstera alfaroi*. Adult plant growing in the locality type in Tarrazú, Costa Rica. *M. Cedeño 1702* (USJ). Photo by M. Cedeño-Fonseca.

6. ***Monstera anomala*** Zuluaga & Croat, *Phytotaxa* 334: 2–6, f. 1A–F, 2A–D. 2018. (Figs. 12, 13)

Type:—PANAMA. Veraguas: Distrito Santa Fe, corregimiento El Pantano, Parque Nacional Santa Fe, trail between alto Los Gonzales to alto El Viro, 800–1000 m. 16 Jan 2013, *A. Zuluaga, A. Doucette, E. Brantner & E. González 888* (holotype WIS, isotypes PMA!, MO!).

Robust nomadic vine, appressed-climbing. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** light-green, smooth to slightly rough, flattened; **internodes** 3–5 cm long, 3–8 mm diam.; **petiole** distinct, dark-green, smooth, 5–7 mm long, sheathed to base of the geniculum; **petiole sheath** deciduous; **blades** ovate, cordate at base, obtuse to short acuminate, coriaceous, 6–9 × 6–8 cm, completely appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** light green to grayish, slightly rough, cylindrical or slightly flattened, sulcate laterally; **internodes** 1.0–3.5 cm long, 1–3 cm diam., as long as wide; **anchor roots** black; **feeder roots** light brown, corky; **petiole** light-green, smooth, sometimes verrucose at base, 15–50 cm long, sheathed up to the middle of the

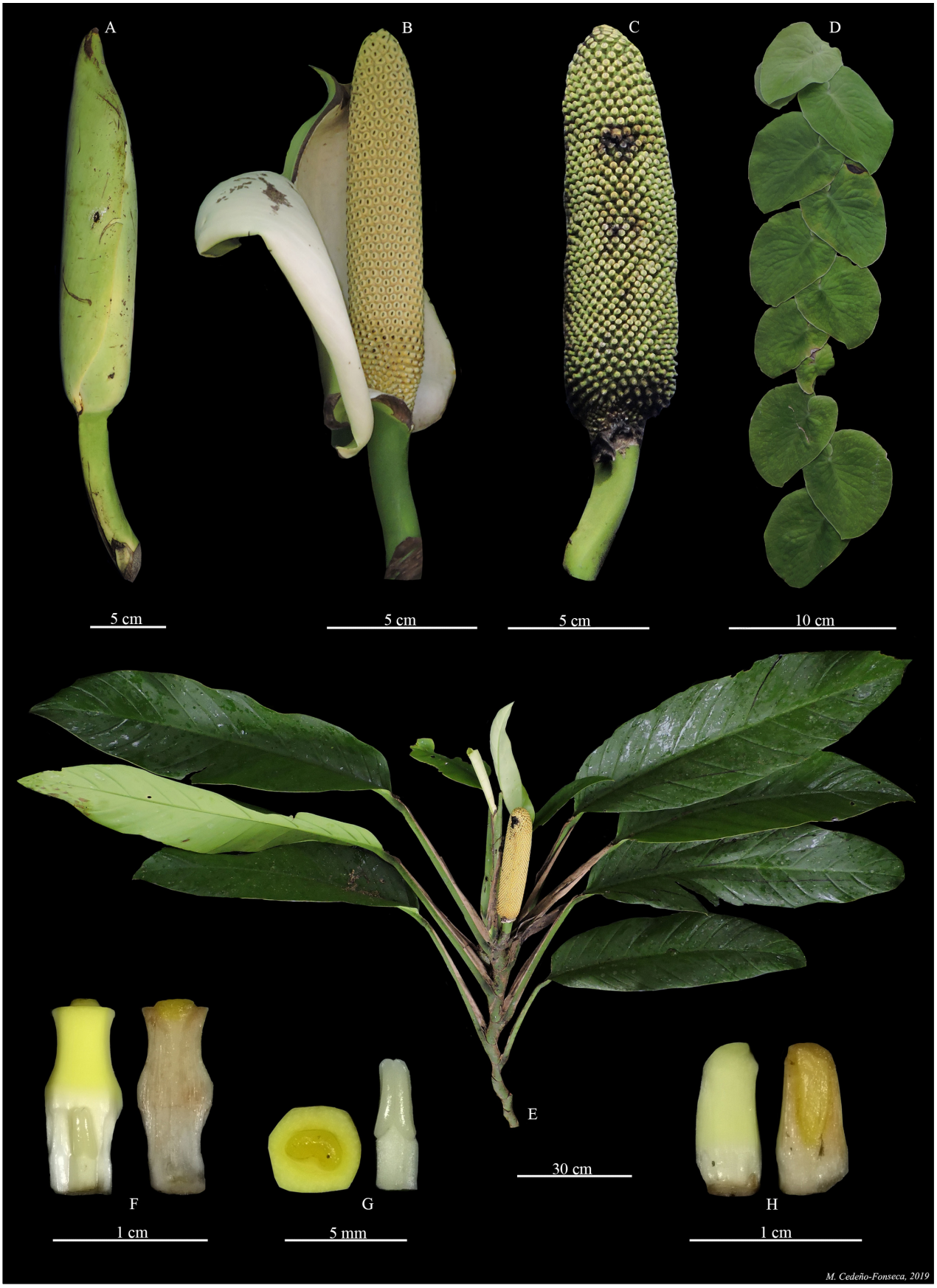

FIGURE 12. *Monstera anomala* from Costa Rica. (A) Developing inflorescence. (B) Open inflorescence, frontal view, with tearing spathe. (C) Immature infructescence. (D) Portion of juvenile plant. (E) Portion of adult plant. (F) Fertile flower; in lateral view (left) and longitudinal section (right). (G) Stylar plate with stigma (left) and one stamen (right). (H) Sterile flower; in lateral view (left) and longitudinal section (right). Golfito, Costa Rica. (Not collected). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 13. *Monstera anomala*. Adult plant growing 20 m above the ground in a tree in Turrialba, Costa Rica. Photo by M. Cedeño-Fonseca. (Not collected).

geniculum; **petiole sheath** deciduous, with fibrous remains; geniculum smooth or pustular, slightly flattened or ribbed adaxially, 2.0–4.5 cm long; **blades** narrowly lanceolate or lanceolate, oblique, broadly-cuneate to attenuate at base, acuminate at apex, subcoriaceous to thinly coriaceous, drying gray, brown, yellowish-green or olive-green, 25–55 × 10–25 cm, 2.1–4.2 times longer than wide, slightly decurrent on the geniculum (decurrent part 2–3 mm wide); **midrib** sunken adaxially, convex abaxially, drying yellowish or blackish on both surfaces; **primary lateral veins** 4–25 per side, obscure adaxially, prominent abaxially, departing midrib at 35–50°, drying yellowish or blackish; **secondary veins** prominent and reticulate towards the margin; **collective veins** slightly visible; **fenestrations** absent; **margins** entire. INFLORESCENCES on ascending stems, 1–2 simultaneously at the flowering season, arranged in the leaf axils; **peduncle** smooth or slightly verrucose, 3–11 cm long, 0.6–1.4 cm diam.; **spathe** obtuse or mucronate, light-green during development, light-green externally and white internally at anthesis, coriaceous, deciduous after anthesis, 10–20 × 7–10 cm, as long as the spadix; **spadix** green-yellow during development, creamy-yellowish at anthesis, 10–24 cm long, 2–4 cm diam., 1.7–2.8 times longer than the peduncle; **basal sterile flowers** with a transparent stigmatic secretion, 4–6 mm long; **fertile flowers** 1.0–2.2 cm long; stamens 3–6 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary quadrangular in longitudinal section, 6–10 × 2.5–5.0 mm; style thin and elongated at the medial part, distal region pentagonal, 4–6 × 1.5–2.5 mm; stigma linear, with a yellowish stigmatic secretion; **berries** with a yellow stylar cap, greenish during development; pulp white; **seeds** black, spherical, 4–6 mm long.

Distribution and ecology:—*Monstera anomala* occurs in Costa Rica and western Panama, at 100–1200 m in *Premontane rain forest* and *Montane rain forest* life zones.

Phenology:—Flowering has been recorded in February, March but primarily August-November. Fruiting in May, July and again in September-December.

Discussion:—The species is a member of sect. *Marcgraviopsis* and is characterized by its high-climbing hemiepiphytic habit, internodes slightly longer than wide, petioles sheathed to the geniculum with a marcescent sheath and turning light brown, mostly entire, non-perforated elliptic to oblong, mostly weakly acuminate blades which are slightly bicolorous with 10–15 primary lateral veins per side as well as by the solitary, erect inflorescence with the peduncle much shorter than the white spadix but especially by the constricted stylar region.

Monstera anomala is easy to distinguish from other species in the genus with shingled leaves and with its flowers with a long and constricted stylar region, 4–6 mm long, which is narrower than the ovary. It is most similar to *M. acuminata* but adult plants are more robust, with coriaceous entire leaves, that lack perforations, and with primary and secondary veins inconspicuous on the upper surface. *M. acuminata*, a widespread species from Mexico to Nicaragua, differs by having proportionately wider leaves with more prominent secondary lateral veins on the lower surface and a broad style that is as wide as the ovary. *Monstera anomala* is also similar to *M. spruceana* and was confused with that species (Grayum, 2003). *Monstera spruceana* differs by being a typically more robust plant with deeply pinnate lobed leaves, as well as often drying more blackened and by having the typical *Monstera* stigma which is only weakly raised and oblong, extending most of the way across the apex of the style.

Additional specimens examined:—COSTA RICA. **Cartago:** Turrialba, Chirripó, Along Quebrada Platanillo near confluence of Quebrada Siripi, Platanillo de Chirripó, 1135 m, 2 March 1990, (Infer.), *M.H. Grayum & R. Hodel 9727* (CR!); **Heredia:** Sarapiquí, La Virgen, E.B. La Selva, Finca La Selva, Puerto Viejo de Sarapiquí, Ridge near and of Pasos Perdidos, 120 m, 3 June 1985, (Infer.), *M.H. Grayum et al. 5356* (CR!); **Limón:** Talamanca, Bribri, R.V.S.M. Manzanillo, 20 m, 3 March 2018, (Fl.), *M. Cedeño 1333* (USJ!); Talamanca, Telire, Alto Urén, subiendo a Cerro Chum, siguiendo un antiguo camino de Quebrada Chaho a Alto Lari, 800 m, 24 July 1989, (Fr.), *G. Herrera 3330* (CR!); Talamanca, Cahuita, Along road between Puerto Viejo de Talamanca and Manzanillo, stretch from Quebrada Ernesto to Manzanillo, 5 m, 3 November 1984, (Fr.), *M.H. Grayum & P. Sleeper 4352* (CR!, MO!); Pococí, Colorado, Hills 3 1/2 airline km S of Islas Buena Vista in the Rìo Colorado, 16 airline km SW of Barra del Colorado, Premontane wet forest on low hills, 110 m, 15 September 1986, (Fl.), *G. Davidse & G. Herrera 31269* (CR!); Limón, Río Blanco, Las Brisas de Veragua, Propiedad de Veragua Rainforest, Sendero que va del serpentario hacia el Río Victoría, 356 m, 26 May 2011, (Fr.), *A. Cascante et al. 2299* (CR!); Pococí, Colorado, R.N.V.S. Barra del Colorado, Forests and pastures between Río Chirripocito and pastures between Río Chirripocito and Río Sardina (”Sardinal” on Chirripó Atlántico quadrangle), 12 m, 21 April 1990, (Infer.), *M.H. Grayum 9809* (CR!); Pococí, Rita, Cuenca Tortuguero-Sierpe, 40 m, 5 February 1988, (Infer.), *M.H. Grayum 11165* (CR!); Limón, Valle de la Estrella, Cuenca del Estrella, Hitoy Cerere, Sendero a los alrededores de la Estación, 90 m, 19 June 1997, (Fr.), *A. Rodríguez & A. Soto 2320* (CR!); **Puntarenas:** Golfito, Golfito, R.N.V.S. Golfito, Cabecerass de la quebrada Cañaza, 150 m, 3 March 1994, (Fr.), *G. Herrera & G. Rivera 7004* (CR!); Osa, Sierpe, Boca Ganado, Estribaciones de Fila Ganado, 350 m, 24 November 1993, (Fr.), *G. Herrera et al. 6684* (CR!); Osa, Sierpe, Along road between Rincón de Osa and Rancho Quemado and Rancho Quemado, ca. 10 km W of Rincón-Pto. Jimenez Road, 175 m, 3 March 1985, (Infer.), *T.B. Croat & M.H. Grayum 59783* (CR!); Osa, Sierpe, Along road between Rincón de Osa and Rancho Quemado, ca. 10 km W of Rincón-Pto. Jiménez Road, 180 m, 3 March 1985, (Infer.), *T.B. Croat 59755* (CR!, MO!); Golfito, Golfito, Cuenca del Coto Colorado, 60 m, 10 September 1996, (Infer.), *T.B. Croat 67585* (CR!); Osa, Sierpe, Cuenca Térraba-Sierpe, 10 m, 13 November 2002, (Infer.), *T.B. Croat 79200* (CR!); Osa, Bahía Ballena, Ballena, 200 m, 22 January 1997, (Fr.), *J. Gonzáles 2324* (CR!); Rincón de Osa; along ridge between Quebrada Aparicio and Quebrada Aguabuena, 200–400 m, 7 October 1984, (Fl.), *M.H. Grayum 4015* (MO!); **San José:** Pérez Zeledón, Río Nuevo, Savegre Abajo de Río Nuevo, Cerro El Zoncho, 900 m, 11 February 1999, (Fl.), *A. Estrada et al. 2043* (CR!).

7. ***Monstera bocatorensis*** Croat & M. Cedeño, *Webbia* 76(2): 266–269. 2021. (Figs. 14, 15)

Type:—Panama. Bocas del Toro. Along road between Chiriquí Grande and Fortuna, 7.7 mi W of Chiriquí Grande, 1.5 mi W of Punta Peña, disturbed primary forest, 80 m, 9 Mar. 1985, *T.B. Croat & M.H. Grayum 60088* (holotype MO-3123561!, isotypes B!, COL!, K!, PMA!, NY!, US!).

Robust nomadic vine, appressed-climbing. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** completely terrestrial or ascending, dark green, smooth and glaucous, cylindrical; **internodes** 0.5–4.0 cm long,



FIGURE 14. *Monstera bocatorensis* from Santa Fe, Panama. (A) Front view of open inflorescence. (B) Developing inflorescence. (C) Front view of open inflorescence with peduncle and persistent cataphyll. (D) Back view of open inflorescence. (E) Juvenile plant. (F) Adult plant. (G) View of spadix at female anthesis, showing flowers with stigmatophore lateral-flattened. Image from Cedeño-Fonseca *et al.* (2020b).



FIGURE 15. *Monstera bocatorensis* from Santa Fe, Panama. (A) Adult plant, leaf-blades with 4–6 lobes per side. (B) Adult plant, one leaf-blade entire and one with 2 or 3 lobes per side. (C) Adult plant, leaf-blade with 2 or 3 lobes per side. (D) Spathe, marcescent after male anthesis and enclosing the spadix. Image from Cedeño-Fonseca *et al.* (2020b).

0.5–1.0 cm diam.; **petiole** dark or light green, smooth and glaucous at base, 8–20 cm long, sheathed for 3–7 cm, or up to the middle; **petiole sheath** persistent and involute; **unsheathed portion** terete; **leaf blades** ovate to elliptic-ovate, attenuate at base, acuminate at apex, thinly coriaceous, 10–25 × 6–10 cm, not appressed to the phorophyte; **fenestrations** absent or present (usually one fenestrated side which breaks at the margin). ADULT PLANTS: root climbers; **stems** dark green or shiny beige, cylindrical and slightly flattened; **internodes** 1.0–2.5 cm long, 1.5–3.0 cm diam., 0.4–0.8 times as long as wide; **cataphylls** with a very small blade at the apex, persistent, light green to pruinose; **anchor roots** light brown, with root trichomes; **feeder roots** light brown, with root trichomes; **petiole** light green or dark green, smooth and glaucous throughout, 46–90 cm long, sheathed up to the middle or 5–15 cm beyond the middle; **petiole sheath** persistent and involute; **unsheathed portion** terete and slightly ribbed near the geniculum; geniculum sunken adaxially and convex abaxially, 2.0–3.5 cm long; **leaf-blades** ovate to oblong-ovate, rounded at base, short-acuminate at apex, subcoriaceous, (31)48–58 × (13)20–32 cm, 1.7–2.0(2.6) times longer than wide, not decurrent on

the geniculum; **midrib** ribbed adaxially, convex abaxially; **primary lateral veins** 14–20 per side, departing midrib at 60–90°, strongly sunken adaxially, prominent abaxially; **secondary veins** completely parallel; **collective veins** scarcely visible on the margins of each lobe; **perforations** absent; **margins** deeply pinnatifid or rarely entire, generally with 2–6 lobes per side, 3–20 cm wide, with 3–10 veins per lobe. INFLORESCENCES on ascending stems, 1 or 2 simultaneously in flowering season; **peduncle** smooth, light green or dark green, 27–45 cm long, 1 cm diam., entirely covered by cataphylls; **spathe** acuminate, membranous, completely open, with margins overlapping at base, light green during development, creamy or white externally and white with longitudinal greenish or white veins internally at anthesis, 12–17 × 5–9 cm, up to 6 cm longer than the spadix; **spadix** white during development and at anthesis, 11–12 cm long, 1.7–2.2 cm diam.; **basal sterile flowers** 3–5 mm long, globose and with a very prominent stigmatophore and an orange stigmatic secretion; **fertile flowers** 5–6 mm long; stamens 1.5–5.0 mm long, with laminar filaments; anthers 1–2 mm long; ovary quadrangular in longitudinal section, 1.5–2.5 × 1.5–2.0 mm; style quadrangular, cylindrical, or hexagonal, 0.5–1.0 × 2–3 mm; stigmatophore columnar, slightly ribbed on style, 0.5–1.0 mm long; stigma linear with a transparent stigmatic secretion; **berries** with green stylar cap during development, unknown when ripe; pulp unknown; **seeds** unknown.

Distribution and ecology:—*Monstera bocatorensis* is endemic to Panama, where it is known only from the western slopes of the mountains east of Fortuna Dam below the Continental Divide in Bocas del Toro Province, from sea level to 1100 m in *Tropical wet forest* and *Premontane wet forest* life zones.

Phenology:—Flowering in September. Fruiting in March, June, September and October.

Discussion:—The species is a member of sect. *Monstera* and is characterized by its ovate, yellowish-drying leaf-blades that are never perforate, frequently pinnatifid with two or three very unequal pinnae, or rarely entire. Other characteristic features are the short petiole sheaths that extend only to the middle or ¾ of its length, as well as the glaucous petioles and blades.

This species is similar to *M. glaucescens* but differs from that species by its leaf-blades drying light yellow-brown on the lower surface and by having the pinnae markedly unequal. In contrast, the leaves of *M. glaucescens* have blades that dry dark brown and have much narrower pinnae, with more long-tapered and more prominently falcate pointed lobes. Another species with which it could be confused is *Monstera croatii* but that species differs by its deeply pinnatifid and bluish green leaf blades, with bifid lobes, a persistent sheathing mucronate cataphyll, and spathe with two longitudinal keels.

Additional specimens examined:—PANAMA. **Bocas del Toro:** La Fortuna area to increase Chiriquí Grande and the oil pipeline; along dirt road 10 mi from continental divide, just past 2nd large bridge; 1 mi north from highway, 08°46’N 082°11’W, 130 m, 05 March 1986, *B.E. Hammel et al. 14599* (MO!); Vicinity of Chiriquí Grande, near town of Rembala [Rambala], on trail west of road. [Coordinates on orginal label: 08º45’N 82º15’W], 08°56’16”N 082°12’19”W, 250 m, 30 June 1987, *G. McPherson 11150* (MO!); Laguna de Chiriqui, rincon SE. Nuri: campamento cerca poblacion Guaymi. 15 km W de Puntas Cricamola, entrando Ensenada de Catavela, y subiendo Quebrada Nuri, 08°55’N 081°49’W, 10–25 m, 19 Mar 1993, *R.B. Foster et al. 14604* (PMA!); Along road between Chiriquí Grande and Fortuna, 7.7 miles W of Chiriquí Grande, 1.5 miles W of Punta Peña, 08°53’36”N 082°11’12”W, 80 m, 09 March 1985, *T.B. Croat & M.H. Grayum 60088* (MO!).

8. ***Monstera buseyi*** Croat & Grayum, *Phytologia* 82: 38. 1997. (Figs. 16, 17)

Type:—COSTA RICA. Heredia: between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva. 8 April 1986. *M.H. Grayum 6877* (holotype MO!, isotypes B!, CR!).

Robust nomadic vine, appressed-climbing. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; stems rough-pustular at apex (with black pustules), green, cylindrical or slightly flattened; **internodes** 2–4 cm long, 1.0–1.5 cm diam.; **petiole** distinct, light-green, rough-pustular with black pustules at base, 12–15 cm long, sheathed to base of the geniculum; **petiole sheath** semi-persistent; **blades** lanceolate, truncate at base, acuminate at apex, thinly coriaceous, 7–14 × 6–9 cm, not appressed to the phorophyte; **fenestrations** absent or present. ADULT PLANTS: root climbers; **stems** green, brown or gray, rough-pustular on leafy parts (with black pustules), cylindrical or slightly flattened; **internodes** 2–5(20) cm long, 1.0–3.0 cm diam., 1.6–2.0 times longer than wide; **cataphylls** deciduous or marcescent, light-green with a very reduced blade, black-pustular at base; **anchor roots** black; **feeder roots** gray and corky; **petioles** light-green, covered with black pustules along their entire length, rough-verrucose mainly at base, white-cream to pale pinkish internally, 20–75 cm long, sheathed 7–10 cm before base of the geniculum; **petiole sheath** semi-persistent; geniculum rough-verrucose, slightly ribbed adaxially and convex abaxially, 3–4 cm long; **unsheathed**

portion flattened adaxially and convex abaxially; **blades** ovate to lanceolate-ovate or elliptic, broadly cuneate to truncate at base, acuminate at apex, thinly coriaceous to subcoriaceous, drying gray, blackish or olive-green (scarcely yellowish-green), 27–75 × 11–33 cm, (1.5)1.7–2.2 times longer than wide, decurrent-undulate over the geniculum (4–8 undulations of 1–4 mm wide), **midrib** slightly ribbed adaxially, convex abaxially, drying black or yellowish on both surfaces, **primary lateral veins** 35–65 per side, bifurcated or trifurcated, strongly sunken adaxially, prominent abaxially, departing midrib at 85–90°, drying black or yellowish; **secondary veins** prominent and reticulate; **collective veins** visible in blades with entire margins; **fenestrations** absent or present, arranged in a single series along the midrib when present; **margins** entire or pinnatilobed with 2–5 lobes per side. INFLORESCENCES on ascending stems, 1–3 simultaneously at flowering season, arranged in the leaf axils or into cataphylls; **peduncle** smooth or scarcely pustular, 17–30 cm long, 1–2 cm diam.; **spathe** short or long acuminate, light green to pruinose during development, white internally and cream-yellowish externally at anthesis, 7–22 × 10–13 cm, equal to or 4 cm longer than the spadix; **spadix** white during development, cream-white at anthesis, 6–20 cm long, 1.5–2.0 cm diam., (5)6–8(9) times longer than wide; **basal sterile flowers** 3–5 mm long; **fertile flowers** 5–7 mm long; stamens 1.2–7.0 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary sub-conical in longitudinal section, 3.5–5.0 × 2.0–2.5 mm; style pentagonal or hexagonal, 1.2–2.0 × 4–5 mm; stigma linear, sunken on the top surface of the style; **berries** with a cream stylar cap, light-green during development; pulp white; **seeds** black, spherical, 5–7 mm long.

Distribution and ecology:—*Monstera buseyi* ranges from Costa Rica (Alejuela, Heredia, Puntarenas, San José) to Panama, (Chirquí) at 40–1450 m in *Tropical wet forest* life zones.

Phenology:—Flowering has been recorded in January-July, November to December. Fruiting in March, June to November.

Discussion:—The species is a member of a sect. *Monstera* and is characterized by short internodes, pustular, obscurely whitish-speckled, brownish-roughened to sometimes weakly verrucose, U-shaped petioles, sheathed to geniculum, with the sheath deciduous or somewhat persistent, blades broadly cuneate to rounded, truncate or subcordate at base and marginally entire to pinnately 4–5 lobed or with 1–2 large perforations or sinuses as well as by peduncle being longer than the spathe, the latter greenish white outside, pale yellowish to white within and with the spadix usually 6–8 times longer than wide and mature white berries.

Monstera buseyi is closely related to *M. alfaroi* and both have tuberculate petioles. Most collections of *M. buseyi* have narrowly ovate-elliptic blades 2.0–2.5 times longer than broad which dry medium grayish yellow-brown above and much paler, yellowish green and often matte below (less frequently dark brown above and dark gray-brown and semiglossy below with the blades only 1.7 times longer than wide) with the flowering spadices 6–9 cm long, to ca. 1 cm diam. and with the infructescences to 12 cm long. In addition, the blades of *M. buseyi* have leaf blades with the primary lateral veins usually branching once or twice near the midrib then with the branches extending closely parallel along the primary lateral vein to the margin. In contrast *M. alfaroi*, known from the Cordillera de Talamanca and in the Fila Tinamaste, have more broadly ovate blades only 1.6 times longer than wide, drying blackened, with the lower surfaces drying semiglossy and with much larger inflorescences, ranging from 17 cm long post-anthesis to 22 cm long in early fruit.

Additional specimens examined:—COSTA RICA. **Alajuela:** San Ramón, Ángeles, R.F. San Ramón, Ca. 10 km west of Lagitos; in forest on ridge and secondary woods along Río San Lorencito, 950 m, 30 May 1986, (Fr.), *B.E. Hammel et al. 15257* (CR!); San Ramón, Ángeles, R.B. Alberto Manuel Brenes. Sendero Volcán Muerto, 800 m, 30 April 1994, (Fr.), *V. Nilsson 456* (CR!); San Ramón, Ángeles, R.B. Alberto Manuel Brenes, Sendero La Cascada, 800 m, 29 April 1994, (Fr.), *V. Nilsson 452* (CR!); San Carlos, La Tigra, Reserva San Lorenzo de UCR, headwaters of the Río San Lorenzo below the Fila Volcan Muerte, 1000 m, 14 July 1983, (Fr.), *K. Barringer & G. Herrera 3830* (CR!); R.F. San Ramón, Bajos de Jamaical, Bosque tropical lluvioso, 850 m, 10 May 1985, (Fr.), *I. Chacon 1809* (CR!); San Ramón, Peñas Blancas, Rio Penas Blancas, Finca de Tomas Guindon, 900 m, 10 March 1989, (Infer.), *E. Bello 761* (CR!); San Ramón; Angeles; Along road between San Ramon and Bajo Rodriguez; 12 km NW of Los Angeles; 16 km NW of San Ramon; 1050 m, 3 September 1996, (Fr.), *T.B. Croat 78879* (CR!, MO!); Alajuela, Sarapiquí, SW of Cariblanco, canyon of Rio Cariblanco and W slope and summit of ridge Rio Cariblanco and Quebrada Quicuyal, 840 m, 22 January 1986, (Fr.), *M.H. Grayum 6185* (CR!, MO!); San Ramón, Angeles, Valley of Rio Peñas Blancas, 850 m, 29 February 1992, (Infer.), *M.H. Grayum 10200* (CR!); San Ramón, Peñas Blancas, Poco Sol, 13 km South Fortuna, 700 m, 20 August 1989, (Fr.), *W. Haber 9345* (CR!); Upala, Aguas Claras, Quebrada Provision, 2 Km aguas abajo del sendero hacia Colonia Blanca, 820 m, 19 January 1991, (Fr.), *G. Rivera 996* (CR!); Upala, Aguas Claras, Los Zanjos, Quebrada Rancho Grande, falda SE del Volcan Santa Maria, 900 m, 1 March 1991, (Infer.), *G. Rivera 1126* (CR!); Upala, Aguas Claras, Colonia Blanca, Quebrada Leiva, 4 km aguas arriba del límite este del parque, 1000 m, 14 April 1991, (Fr.), *G. Rivera 1252* (CR!, MO!); San Ramón, Peñas Blancas, Fortuna, El bosque (San Martín, El

Burrito), Reserva Biológica Dendrobates, Alrededores de Quebrada Piedrita, 150 m, 12 May 2007, (Fr.), *A. Rodríguez 11116* (CR!); Cordillera de Tilarán, Along road between San Ramón and Bajo Rodríguez, 1100 m, 26 September 1987, (Infer.), *T.B. Croat 68068* (MO!); Monteverde Reserve, 900–1150 m, 29 October 1986, (Fr.), *W. Haber 6158* (MO!); Finca Los Ensayos, 850 m, 15 August 1977, (Infer.), *T.B. Croat 43582* (MO!); San Ramón, Reserva Biológica Alberto Manuel Brenes, 850 m, 21 Noviembre 1998, (Fl.), *L. Gómez & V. Mora 13154* (USJ!); San Ramón, Peñas Blancas, Refugio Aleman, 1005 m, 3 December 2017, (Fl.), *M. Cedeño et al. 1051* (USJ!); Guatuso, Cote, Cordillera de Tilarán, 5 km al norte del Lago Arenal, Alrededores del lago Coter, 900 m, 14 October 1994, (Fr.), A. *Cascante et al. 356* (CR!); **Guanacaste:** Liberia, Liberia, P.N. Rincón de la Vieja, Puesto Santa María, del mirador por la fila hasta el sesteo de la danta, de donde se baja hasta el canal, 950 m, 5 March 1988, (Fl.), *G. Herrera 1602* (CR!); Tilarán, Quebrada Grande, Río Chiquito, Arenal, Zona de Monteverde, 730 m, 3 March 1988, (Fl.), *W. Haber & E. Bello 8256* (CR!); P.N. Guanacaste, Estación Pitilla, 700 m, 7 November 1990, (Fr.), *C. Moraga 146* (CR!); Liberia, Mayorga, Estación Cacao, Cerro Cacao, Sendero Arenales, 1100 m, 9 February 1995, (Fl.), *F. Alfaro 40* (CR!); Liberia, Mayorga, Estacion Cacao, 1100 m, 28 October 1990, (Fl.), *C. Chávez 315* (CR!); Liberia, Mayorga, Estacion Cacao, 1100 m, 21 November 1990, (Fl.), *R. Espinoza 17* (CR!); Liberia, Mayorga, Estación Cacao, 11 m, 23 November 1990, (Fr.), *R. Espinoza 53* (CR!); Liberia, Mayorga, Estacion Cacao, 1100 m, 3 June 1990, (Fr.), *M. Zumbado 46* (CR!); **Heredia:** Sarapiquí, La Virgen, Area between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, Mostly primary forest, 495 m, 8 April 1986, (Infer.), *M.H. Grayum 6877* (CR!); Colonia Virgen del Socorro, Cariblanco, 1000 m, 3 June 1983, (Infer.), *C. Chacón & B. Ocampo 68* (CR!); **Limón:** Pococí, Colorado, P.N. Guanacaste, Estación Cacao, Bosque primario y secundario, Orilla Quebrada, bosque primario, 1100 m, 3 June 1990, (Fr.), *U. Chavarría 25* (CR!); **Puntarenas:** Osa, Sierpe, about 5 km west of Rincón de Osa, 50 m, 9 January 1970, (Infer.), *W. Burger & R. Liesner 7327* (CR!); Osa, Sierpe, Forested area near the airfield about 4 miles west of Rincón de Osa, 30 m, 4 June 1968, (Fr.), *W. Burger & R. Stolze 5430* (CR!); Golfito, Golfito, R.N.V.S. Golfito, Cabeceras de la quebrada Cañaza, 150 m, 3 March 1994, (Fl.), *G. Herrera & G. Rivera 7005* (CR!); Golfito, Jiménez, Sirena, Los Patos Forest, 1 m, 26 May 1989, (Infer.), *C. Kernan 1118* (CR!); Osa, Sierpe, Along road between Rincón de Osa and Rancho Quemado, (Valley of Rìo Chocuaco). Ca. 6 km W of main Rincòn-Pto Jiménez road, 40 m, 2 March 1985, (Fr.), *T.B. Croat & M.H. Grayum 59744* (CR!, MO!); Osa, Sierpe, Rancho Quemado, parte plana, 300 m, 16 December 1991, (Infer.), *R. Aguilar 757* (CR!); Osa, Sierpe, Vicinity of Boscosa, at Quebrada Aguabuena, 100 m, 11 September 1996, (Infer.), *T.B. Croat 79233* (MO!); Garabito, Tárcoles, Along N Fork (known locally as 'Quebrada Mona') of Quebrada Bonita, 35 m, 11 June 1986, (Fr.), *M.H. Grayum 7594* (CR!, MO!); Golfito, Golfito, Along steep carril ascending W slope of Fila Gamba, ca. 0.5 km NE of jct. of Quebrada Gamba and Q. Rancho, 100 m, 30 January 1992, (Fr.), *M.H. Grayum 10079* (CR!, MO!); Osa, Sierpe, El Campo, Subiendo por la fila entre Aguabuena y Baneguitas, cuenca superior de Quebrada Banegas, 100 m, 14 January 1991, (Infer.), *G. Herrera 4823* (CR!); Osa, Sierpe, Agua Buena, en ladera boscosa al norte de BOSCOSA, subiendo hacia la Fila Casa Loma, 15 m, 25 August 1990, (Fr.), *C. Morales 96* (CR!); Osa, Sierpe, Osa, Rancho Quemado, 200 m, 31 December 2004, (Fl.), *D. Santamaría 442* (CR!); Osa, Puerto Jiménez, Camino a la toma de agua, Rancho Quemado, Rincón, Bosque Primario, 200 m, 20 June 1905, (Fl.), *F. Quesada 265* (CR!); Along Quebrada Bonita, 35–80 m, 25 July 1985, (Fr.), *M.H. Grayum 5722* (MO!); Osa, Slopes above Airport, Disturbed primary forest, Rincon de Osa, 20–300 m, 11 February 1974, (Fr.), *R. Liesner 2052* (MO!); Osa, Rincón de Osa, Streams and slopes adjacent to airfield, 20–200 m, 6 February 1974, (Infer.), *R. Liesner 1746* (MO!); Hills above Palmar Norte, 100–200 m, 20 May 1976, (Fr.), *T. Croat 35125* (MO!); **San José:** Vazquez de Coronado, Dulce Nombre de Jesús, P.N. Braulio Carrillo, Between Bajo de La Hondura and Alto La Palma, 1450 m, 19 July 1983, (Fr.), *K. Barringer et al. 4003* (CR!); Perez Zeledón, Barú, Tinamaste, Finca de los Suizos, 650 m, 14 April 1999, (Fr.), *A. Estrada 2140* (CR!); Perez Zeledón, Barú, Tinamaste, Faldas de Fila Tinamaste, Finca de los Suizos, 650 m, 19 August 1998, (Fr.), *O. Valverde et al. 1090* (CR!); Turrubares, San Juan de Mata, Ca. 3 km NE of Bijagual de Turrubares, Western part of Montanas Jamaica, 500 m, 7 August 1985, (Fr.), *M.H. Grayum 5840* (CR!); Aserrí, Legua, Quebrada Lajas, ca. 2.5 km al noroeste de Altos el Aguacate, 850 m, 24 September 2003, (Fr.), *R. Kriebel 3962* (CR!); Puriscal, Chires, San Martin de Puriscal, bosque primario remanente en la Fila Vara Blanca, cabecera de Rio Negro, limite NW Cangreja, 800 m, 21 April 1995, (Fr.), *J. Morales 3905* (CR!); Puriscal, Chires, San Martin de Puriscal, bosque primario remanente en la Fila Vara Blanca, cabecera de Rio Negro, limite NW Cangreja, 29 December 1985, (Fl.), *J. Morales 3713* (CR!); Turrubares, San Luis, San Luis de Turrubares, finca de Melvin Chavarría, 1200 m, 5 October 2004, (Fr.), *A. Soto 173* (CR!). PANAMA. **Bocas del Toro:** 1.2 mi S of Punta Peña, 08°54'00"N 082°11'06"W, 100 m, 24 April 1988, *Sue A. Thompson 4919* (CM); Gualaca-Chiriquí Grande, 1 km N of Rambala, 2.1 N of Punta Peña, 08°56'N 082°11'W, 110 m, 29 March 1993, *Thomas B. Croat 74943* (MO!); **Chiriquí:** Burica Peninsula. San Bartolo Limité, 20 km west of Puerto Armuelles, 08°17'48"N 082°30'00"W, 400–600 m, 22 February 1973, *Phil Busey 542* (MO!).

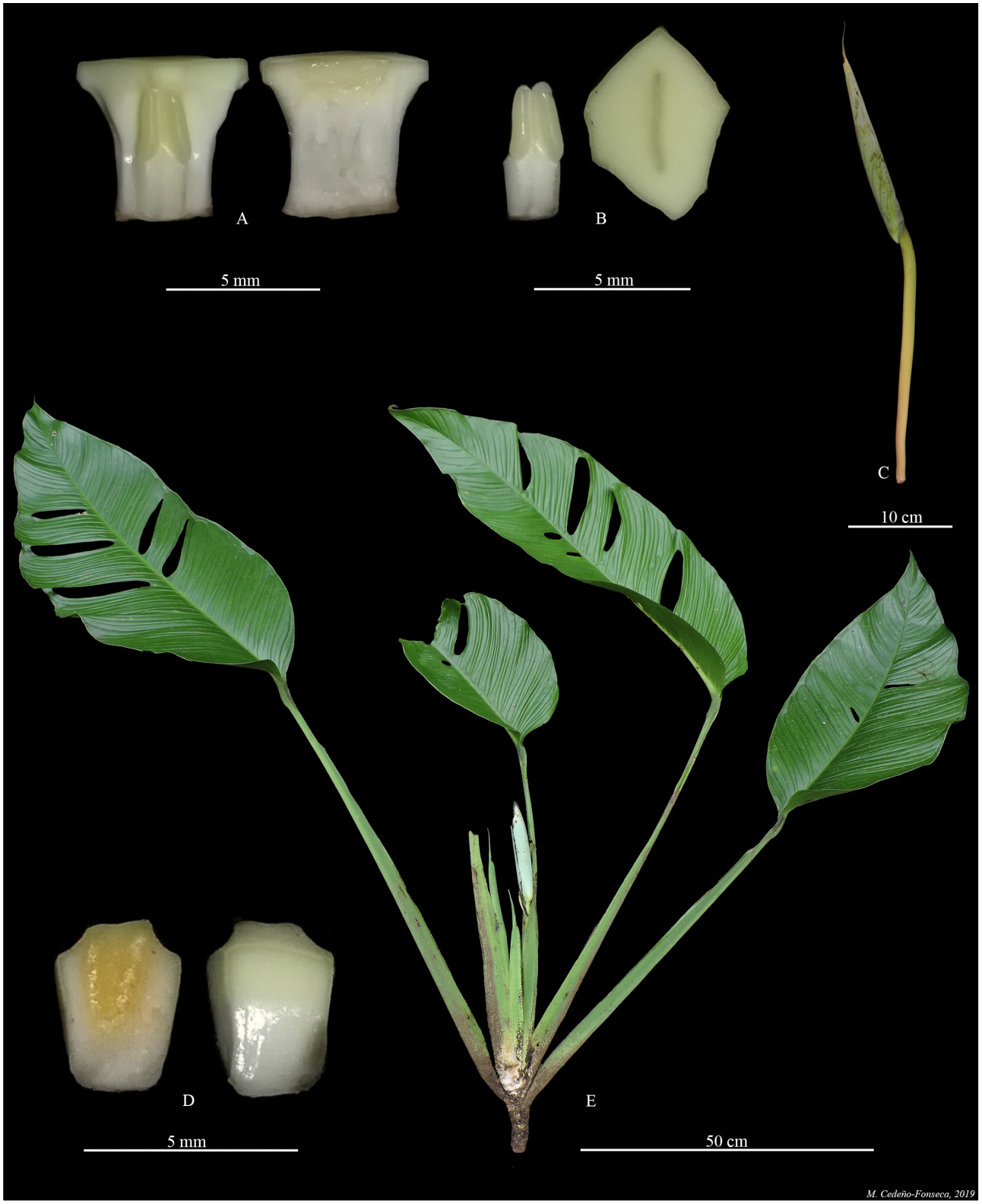

FIGURE 16. *Monstera buseyi* from Tilarán, Costa Rica. (A) Fertile flower; lateral view (left) and longitudinal section (right). (B) One stamen (left) and stylar plate with stigma (right). (C) Developing inflorescence. (D) Sterile flower; longitudinal section (left) and lateral view (right). (E) Portion of adult plant. *M. Cedeño et al. 1052* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 17. *Monstera buseyi* from Tilarán, Costa Rica. (A) Stem; (*i*) segment with short internodes, <1 cm long; (*ii*) feeder root. (B) Petioles with black warts at base (arrow). (C) Base of the blade decurrent onto the geniculum and undulate (arrow). (D) Branched primary lateral veins (arrow). *M. Cedeño et al. 1052* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

9. ***Monstera coclensis*** Croat, ***sp. nov.***

The species is characterized by its petioles sheathed to the geniculum, a persistent sheath, entire, narrowly ovate-elliptic, non-perforate, dark brown-drying blades with the spadix more than twice as long as the spathe.

Type:—PANAMA. Coclé: Above El Potroso sawmill at Continental Divide, N. of El Copé, 1200–1300 m, *Sytsma & Andersson 4529* (holotype MO-2908952!, isotype PMA!).

Nomadic vine, appressed-climbing habit. SEEDLINGS: unknown. JUVENILE PLANTS: root climbers; **stems** dark green, minutely spotted, with yellow-brown deciduous epidermis, drying surface dark brown, matte, longitudinally striated; **internodes** 1–3(10) cm long, 0.6–1.5 cm diam., 1.6–2.0 times longer than wide; **blades** dark green, minutely stained yellow-brown, drying dark brown, matte, longitudinally striated, cordate or rounded at base, faintly glaucous adaxially. ADULT PLANTS: root climbers; **stems** drying dark brown, matte, ribbed; **internodes** with a ripped yellow-brown epidermis, shorter than wide, 1.5 cm diam.; **petiole** pale green, sometimes with pale dots, dark brown when dry, matte, 21–30 cm long, prominently sheathed to base of the geniculum or 1 cm above the geniculum; **petiole sheath** persistent; geniculum markedly sulcate; **blades** narrowly ovate-elliptic, equilateral, one side 1–2 cm wide, rounded to obtuse at base, coriaceous, short acuminate, drying dark-green to brown, matte or faintly glossy, (18)32–34 × (6)9–13 cm, (2.1)2.3–2.9 times longer than wide; **midrib** ribbed adaxially, convex abaxially, drying light-brown or reddish-brown on both surfaces; **primary lateral veins** 7–10 per side, strongly sunken adaxially, prominent abaxially, departing midrib at 30–45°, drying narrowly convex and concolorous adaxially, narrowly rounded and slightly paler abaxially, **secondary veins** parallel and prominent, reticulate at the margin; **collective veins** slightly visible; **fenestrations** apparently absent; **margins** entire. INFLORESCENCES on ascending stems; **peduncle** smooth, pale green or brown, drying dark, matte to faintly glossy, 13–21 cm long, 5–10 mm diam.; **spathe** acuminate, white or greenish externally and white or creamy internally at anthesis, completely open in the apical and basal part, drying dark brownish-purple, 11–26 × 8.2–15.0 cm, up to 4 cm longer than the spadix; **spadix** white or creamy (both during development and a anthesis), 3.7–9.5 cm long, 1.8–2.2 cm diam., 2.1–4.6 times longer than wide; **basal sterile flowers** 3–4 mm long; **fertile flowers** 4–6 mm long; ovary rectangular in longitudinal section, ribbed, 3–4 × 1.5–2.5 mm; style rounded to irregularly angular, more or less truncate to markedly sunken at the medial part with raised margins and moderately irregular-lumpy, densely papillose, 3–5 × 1.5–2 mm; stigma yellow-orange, moderately raised, margins slightly paler, narrow and erect; **berries** unknown; **seeds** unknown.

Distribution and ecology:—*Monstera coclensis* is endemic to the Panama from the El Copé region of Coclé region of Coclé Province, in *Premontane wet forest* at 1200–1300 m.

Phenology:—Flowering in January and May.

Etymology:—The species named for the Province of Coclé where it was first collected.

Discussion:—The species is a member of sect. *Monstera*, it is probably most easily confused with the morphotype of *M. epipremnoides* from southwestern Costa Rica. That species differs in having more ovate blades, ca 2.1 times longer than broad, a broader petiole sheath, the stigmas subrounded and barely more than 1 mm long and especially by having the spathe only slightly longer than the spadix at anthesis (vs. over 2.5 times longer than wide in *M. coclensis*).

Additional specimens examined (paratypes):—PANAMA. **Coclé:** Above El Potroso sawmill at Continental Divide, N of El Cope. Low cloud forest, 08°40’36”N 080°36’36”W, 1200–1300 m, 13 May 1981, *K.J. Sytsma & L. Andersson 4585* (MO!); Above El Potroso sawmill at Continental Divide, N of El Cope. Low cloud forest, 08°40’36”N 080°36’36”W, 1200–1300 m, 13 May 1981, *K.J. Sytsma & L. Andersson 4529* (MO!); Vicinity of La Mesa, N of El Valle de Antón, along N slope of Cerro Gaital, 08°37’N 080°08’W, 850–950 m, 14 July 1987, *Thomas B. Croat 67294* (MO!).

10. ***Monstera costaricensis*** (Engl. & K.Krause) Croat & Grayum, *Ann. Missouri Bot. Gard.* 74: 659. 1987. ≡ *Rhodospatha costaricensis* Engl. & K.Krause in Engl., *Pflanzenr.* IV.23B (Heft 37): 95. 1908. (Figs. 18, 19)

Type:—COSTA RICA. [Limón:] Ferme de Boston, Atlantic watershed, 30 m elev., [10°01’ N, 83°15’30”W], August 1901, *A. Tonduz 14628* (holotype B!, photo F!).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** dark green with greenish-white pustules which form a rough-verrucose surface, cylindrical or dorsally



FIGURE 18. *Monstera costaricensis* from Sarapiquí, Costa Rica. (A) Adult plant. (B) Developing infructescence with warty persistent peduncle and cataphylls, with wavy margin (arrow). (C) Persistent warty cataphylls with a wavy margin (left arrow); warty prophyll with a wavy margin (right arrow); warts on both surfaces are white or greenish. (D) Infructescence with pyramidal and conical styles (arrow). *M. Cedeño et al. 1497* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

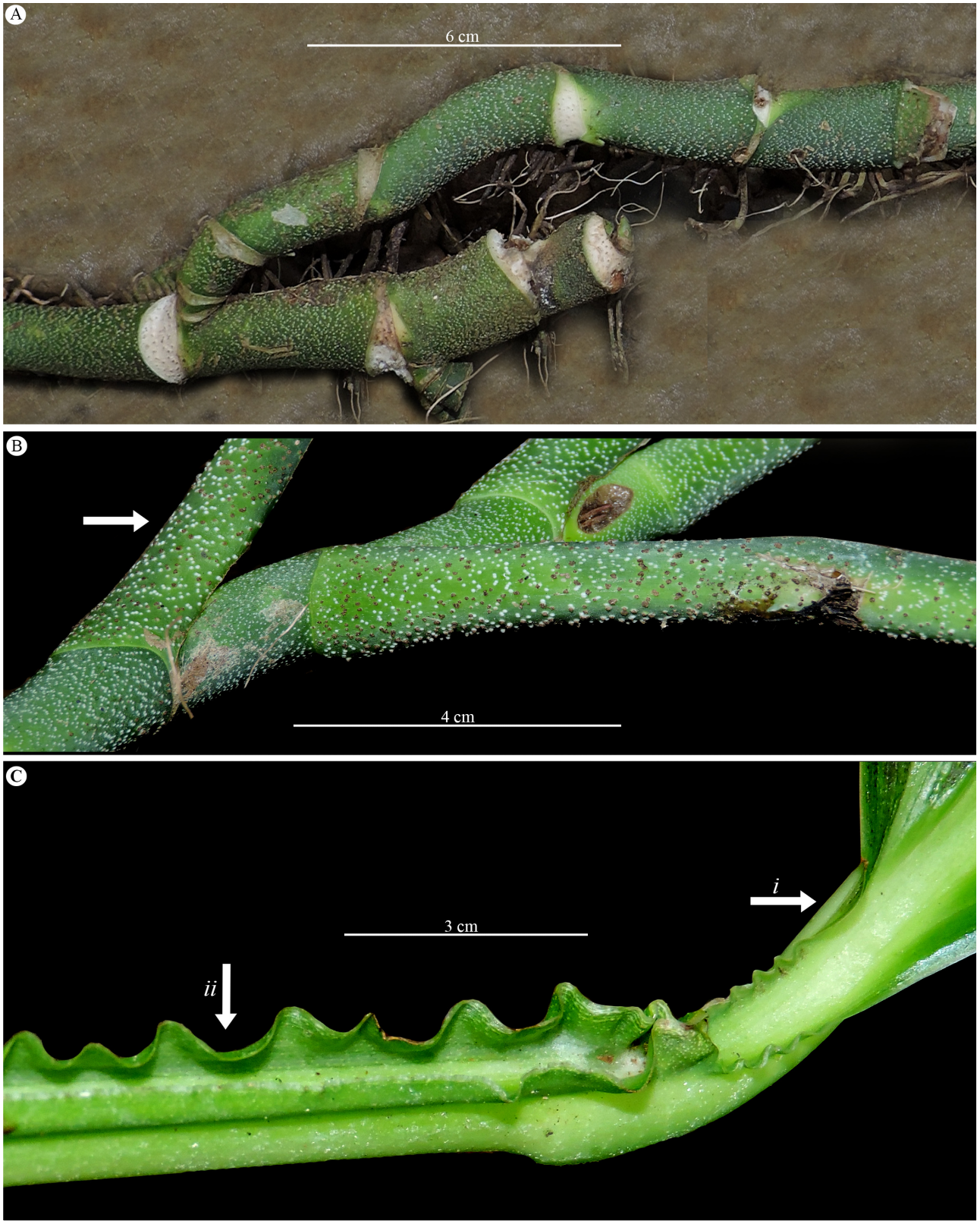

FIGURE 19. *Monstera costaricensis* from Manzanillo, Costa Rica. (A) Stem segment with short and long internodes, covered by white warts; leaves removed from base. (B) Stem segment and petioles with white warts (arrow). (C) Base of the blade decurrent onto the geniculum and slightly wavy (arrow *i*); petiole sheath markedly wavy (arrow *ii*). *M. Cedeño et al. 1102* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

flattened; **internodes** 3–13 cm long, 3–10 mm diam.; **petiole** distinct, light-green, rough, 5–13 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous; **blades** lanceolate, truncate or attenuate at base, acuminate at apex, thinly coriaceous, 8–18 × 4–9 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green with greenish-white pustules which form a rough-verrucose surface, dorsally flattened; **internodes** 2–3 cm long, 2.0–3.5 cm diam., 0.8–1.0 times as long as wide; **cataphylls** with thick-undulate margins, dark green with green or white pustules, marcescent; **anchor roots** grayish; **feeder roots** black; **petiole** dark green with greenish-white pustules along their entire length, rough-verrucose, 30–70 cm long, sheathed to base of the geniculum; **petiole sheath** persistent throughout or from the medial part towards the geniculum, markedly undulate; geniculum rough-verrucose, flattened adaxially, convex abaxially, 2.0–3.5 cm long; **blades** narrowly ovate to lanceolate-ovate, broadly cuneate to truncate at base, spiral-acuminate at apex, thin coriaceous to coriaceous, drying grayish, blackish or greenish, 40–75 × 15–35 cm, 2.0–2.7 times longer than wide, slightly decurrent-undulate up to medial part of the geniculum (4–6 undulations of 2–3 mm wide); **midrib** slightly ribbed adaxially, convex abaxially, drying black on both surfaces; **primary lateral veins** 30–55 per side, bifurcated, strongly sunken adaxially, prominent abaxially, departing midrib at 45–65°, drying black or yellowish, **secondary veins** slightly prominent and reticulate; **collective veins** prominent; **fenestrations** absent or present, arranged near midrib; **margins** entire (slightly undulate) pinnatilobed due to tearing of the perforations that extend to the margin, with 2 lobes per side. INFLORESCENCES on ascending stems, 1–3 simultaneously at flowering season, arranged in the leaf axils or into cataphylls; **peduncle** rough-verrucose, 10–17 cm long, 1.0–1.5 cm diam.; **spathe** obtuse or mucronate, light green during development, white internally and cream externally at anthesis, 9–15 × 8–13 cm, equal or 2 cm longer than the spadix; **spadix** cream during development, green to yellowish at anthesis, 8–14 cm long, 1.2–2.5 cm diam., (4.1)6–7(10.6) times longer than wide; **basal sterile flowers** 3–5 mm long; **fertile flowers** 4–7 mm long; stamens 3–7 mm long, with laminar filaments; anthers 2.0–2.5 mm long; ovary quadrangular in longitudinal section, ribbed; style hexagonal, thickly conical, 1.2–2.5 mm long; stigma linear; **berries** with a yellow stylar cap during development, mature stylar cap cream; pulp white; **seeds** ovoid.

Distribution and ecology:—*Monstera costaricensis* ranges from Nicaragua to Panama, at 0–1047 m in *Tropical wet forest* life zones.

Phenology:—Flowering January, March-May, August, October, and fruiting in April and May.

Discussion:—The species is a member of sect. *Monstera* and is characterized by its dark green, matte, densely and finely tuberculate internodes; minutely and abundantly whitish-dotted and tuberculate-roughened petioles, sheath revolute along the margin, extending to base of the blade and conspicuously undulate along its length onto the geniculum and to base of the blade, narrowly ovate to lanceolate-ovate, never pinnately lobed leaf blades that are 2.0–2.7 times longer than broad with the margins entire and with most larger leaves with 1–3 holes, as well as by an inflorescence with the peduncle longer than the spathe with minute whitish dots or tubercles.

Monstera costaricensis is most similar to *M. buseyi* which differs by its more or less asperous-verruculose petioles and reddish-brown drying blades with 4 or 5 pairs of lateral lobes and 15 to 50 primary lateral veins per side and with *M. alfaroii* which is distinguished by its tuberculous petiole, a persistent and thickly wavy sheath, and a conical style.

Additional specimens examined:—NICARAGUA. **Atlántico Sur:** Isla del Maíz Grande, 12°10’N 083°03’W, 40 m, 20 agosto 1982, *Esteban M. Martínez S. & Russ Riviere 1659* (MO!). COSTA RICA. Ferme de Boston, Versant Atlantique, 30 m, Aug 1901, *Adolphe Tonduz 14628* (F!, MO!, NY!); **Heredia:** Sarapiquí, Las Horquetas, E.B. La Selva, Original forest near the Río Puerto Viejo, about 2 km upstream from the confluence with the Río Sarapiquí, Formerly Finca La Selva ”of Holdridge”, 100 m, 14 June 1968, (Fr.), *W. Burger & R. Stolze 5780* (CR!); Heredia, Sarapiquí, Horquetas, Estación Biológica La Selva, 50 m, 3 November 2018, (Fl., Fr.), *M. Cedeño & M. Chaves 1497* (USJ!); Heredia, Sarapiquí, Horquetas, Estación Biológica La Selva, 50 m, 3 November 2018, (Fl., Fr.), *M. Cedeño & M. Chaves 1494* (USJ!); Heredia, Sarapiquí, Horquetas, Estación Biológica La Selva, 50 m, 18 November 2018, (Fr.), *M. Cedeño & M. Chaves 1496* (USJ!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°24’36”N 084°00’36”W, 100 m, 30 August 1980, *B.E. Hammel 9649* (DUKE!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25’53”N 084°00’13”W, 100 m, 4 August 1980, *B.E. Hammel 9431* (DUKE!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°24’00”N 083°59’24”W, 100 m, 14 November 1980, *B.E. Hammel 10468A* (DUKE!); La Selva Biological Station, 10°25’53”N 084°00’13”W, 100 m, 22 May 1980, *B.E. Hammel 8749* (DUKE!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°24’36”N 084°00’00”W, 100 m, 13 July 1982, *B.E. Hammel & J. Trainer 13177* (DUKE!); La Selva Biological Station, 10°25’53”N 084°00’13”W, 100 m, 6 June 1985, *Brian Jacobs 3278* (DUKE!); La Selva Biological Station, 10°25’53”N 084°00’13”W, 100 m, 26 February 1981, *J.P. Folsom 9126* (DUKE!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25’53”N 084°00’13”W, 100 m,

22 May 1980, *M.H. Grayum 2845* (DUKE!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N 084°00'13"W, 100 m, 18 May 1980, *M.H. Grayum 2826* (DUKE!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N 084°00'13"W, 100 m, 11 August 1979, *M.H. Grayum 2299* (DUKE!); Just N of Las Horquetas along road to Puerto Viejo, 10°22'N 083°58'W, 40 m, 19 July 1984, *M.H. Grayum et al. 3563* (MO!); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N 084°00'13"W, 100 m, 27 October 1982, *T. McDowell 612* (DUKE!); Sarapiqui. La Selva Biological Station, 10°25'53"N 084°00'13"W, 100 m, 24 Marzo 1983, *I. Chacón G. 552* (MO!); Near Puerto Viejo along road near the Río Sucio, 10°27'36"N 083°59'24"W, 20 m, 27 May 1976, *T.B. Croat 35701* (MO!); **Limón**. Río Tercero, 600 m, 2 May 1985, (Fr.), *J. Berrocal 77* (CR!); Pococí, Colorado, R.N.V.S. Barra del Colorado, Forests and pastures between Río Chirripocito and pastures between Río Chirripocito and Río Sardina ("Sardinal" on Chirripó Atlántico quadrangle), 12 m, 20 April 1990, (Fr.), *M.H. Grayum 9779* (CR!, MO!); Pococí, Roxana, Mata de Limón, (incorrectly identified on Agua Fría quadrangle as Milloncito") ca. 16. 5 km (as the crow flies) NE of Cariari, 21 m, 19 March 1988, (Fl.), *M.H. Grayum & R. Robles 8523* (CR!, MO!); Talamanca, Cahuita, Forest between Punta Manzanillo and Punta Mona, E of Manzanillo de Talamanca, 10 m, 2 May 1985, (Fr.), *M.H. Grayum & G. Schatz 5247* (CR!, MO!); Talamanca, Sixaola, Finca Asacode, Sendero La Chonta, 5 m, 2 March 1999, (Fl.), *U. Chavarría 1908* (CR!); Talamanca, Sixaola, Low-lying coastal swamps and forests, Gandoca (slightly to N of trail from Mata de Limón), 1 m, 27 January 1987, (Fr.), *M.H. Grayum 8022* (CR!, MO!); Talamanca, Cahuita, Bosques de Manzanillo, 50 m, 9 January 2017, (Infer.), *M. Cedeño et al. 1102* (USJ!); Pococí, Colorado, Lomas de Sierpe, 5 km Noreste de La Aurora, Guápiles, Cerca del Río Sierpe, 30 m, 8 December 1988, (Infer.), *R. Robles 2239* (CR!, MO!); Along road between Limón and Shiroles, along Río Sixaola, 0.9 mi SW of Bambu, 6.5 mi SW of Bribri. Along stream on steep slope, 09°33'00"N 082°53'24"W, 50 m, 12 August 1977, *T.B. Croat 43302* (MO!); Limón. Near Liverpool, 09°59'N 083°08'W, 30 m, 05 Oct 1972, *Michael T. Madison 753* (SEL!). PANAMA. **Bocas del Toro:** Bosque Protector Palo Seco. Finca Willie Mazu, 08°46'43"N 082°12'32"W, 1047 m, 25 August 2018, *O. Orlando et al. 3367* (MO!)

11. ***Monstera croatii*** M.Cedeño & A.Hay, *Webbia* 75(1): 124. 2020. (Figs. 20, 21)

Type:—COSTA RICA. Puntarenas Province, Golfito Cantón, Golfito, camino hacia las antenas, 389 m, 4 February 2019 (fr.), *M. Cedeño & A. Hay 1624* (holotype USJ! [2 sheets]).

Nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; terrestrial or with ascending stem; stems dark or light green, smooth, cylindrical; internodes 1.0–2.4 mm long, 0.5–10.0 mm diam.; cataphylls light green-pruinose, mucronate, persistent; petiole distinct, dark or light green, smooth, 8–10 cm long, sheathed 3–6 cm long; petiole sheath persistent; **unsheathed portion** slightly terete or slightly ribbed; **blades** lanceolate, attenuate at base, acuminate, thinly coriaceous, 10–20 × 4–10 cm, not appressed to the phorophyte; **fenestrations** present or absent, generally one fenestrated side which breaks at the margin (when present). ADULT PLANTS: root climbers; **stems** dark green or bright beige, cylindrical, **internodes** 1.0–1.5 cm long, 1.5–2.0 cm diam., 0.7–1.0 times as long as wide; **anchor** and **feeder roots** light brown; **petioles** light green, smooth and glaucous throughout, 35–45 cm long, sheathed for 20–28 cm; **petiole sheath** persistent and involute; **unsheathed portion** terete and slightly ribbed near geniculum; geniculum nearly terete, sulcate adaxially, 2.0–2.5 cm long; **blades** oblong-ovate, rounded or asymmetrical at base, short acuminate at apex, subcoriaceous, 30–45 × 25–33 cm, not decurrent on the geniculum; **midrib** ribbed adaxially, convex abaxially; **primary lateral veins** 8–13 per side, departing midrib at 75–90°, sunken adaxially, prominent abaxially; **secondary veins** parallel; **collective veins** scarcely visible on the margins of each lobe; **fenestrations** absent; **margins** deeply pinnatifid, 6–12 lobes per side with 1–2 veins per lobe, 0.5–2.5 cm wide. INFLORESCENCES on ascending stems, 1 or 2 simultaneously at flowering time into cataphylls that cover the middle of the peduncle; **peduncle** smooth, 20–25 cm long; **spathe** long acuminate, 2-ribbed, light green

during development, cream externally and white internally at anthesis, 9–14 × 3–5 cm, up to 5 cm longer than the spadix; **spadix** white in pre-anthesis and anthesis, 6–8 × 2.5–3.0 cm in early fruit, the basal zone of basal sterile flowers slender, very conspicuous; **basal sterile flowers** 3–5 mm long, globose and with a very prominent stigmatophore; **fertile flowers** 5–6 mm long; stamens 2–5 mm long, with laminar filaments; anthers 1–2 mm long; ovary quadrangular in longitudinal section, 1.5–3.0 × 1.5–2.0 mm; style quadrangular from above, cylindrical, or hexagonal, 0.5–1.0 × 2–3 mm; stigma linear; **berries** with green stylar cap during development, ripe berries unknown; **seeds** unknown.

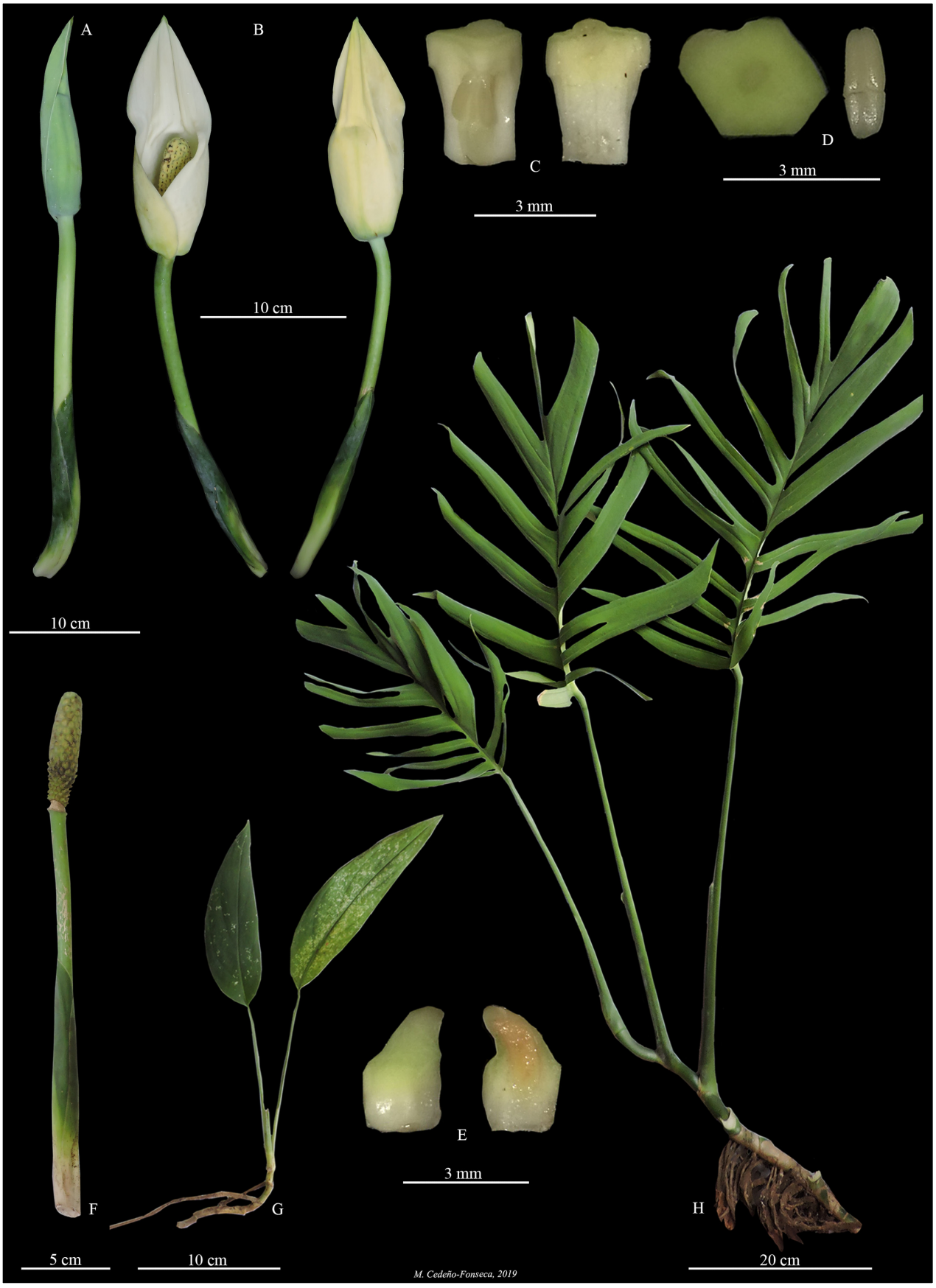

FIGURE 20. *Monstera croatii* from Golfito Costa Rica. (A) Developing inflorescence. (B) Front and back views of open inflorescence. (C) Fertile flower; in lateral view (left) and in longitudinal section (right). (D) Stylar plate with stigma (left) and one stamen (right). (E) Sterile flower; in lateral view (left) and in longitudinal section (right). (F) Infructescence. (G) Juvenile plant. H. Adult plant. *M. Cedeño et al. 1624* (USJ). Image from Cedeño-Fonseca *et al.* (2020d).



FIGURE 21. *Monstera croatii* from Golfito, Costa Rica. (A) Hemi-epiphytic habit, ascending to only 1.5 m above the ground, showing the glaucous leaf color especially on the youngest leaves. (B) Terrestrial habit, with the same morphology as that of reproductive individuals. (C) Young infructescence with the green stylar layer, conspicuous basal sterile zone, and persistent subtending cataphylls. (D) Base of the glaucous/pruinose petiole and persistent involute petiole sheath (arrow). (E) Part of the petiole completely terete beyond the sheath. (F) Leaf with two primary veins per lobe, sometimes bifid into lobules that divide up to 4 cm away from the costa (arrow). *M. Cedeño et al. 1624* (USJ). Image from Cedeño-Fonseca *et al.* (2020d).

Distribution and ecology:—*Monstera croatii* is endemic to Costa Rica, where it is known only from the south on the Pacific side in the region of Golfito and the Parque Nacional Corcovado (both in the Cantón of Golfito) at ca. 300–600 m. It lives in *Tropical wet forest* and *Premontane wet forest transition* life zone; in primary and secondary forest, and in open areas.

Phenology:—The flowering has been recorded in February, and fruiting in October and November.

Discussion:—The species is a member of sect. *Monstera* and is characterized by its long-petiolate, nearly fully sheathed petioles, deeply pinnately lobed, yellowish green-drying blades and narrow pinnae with short pale lineations on both surfaces.

Monstera croatii is differentiated from all other Costa Rican species of *Monstera* by having pruinose/glaucous stems and petioles, the petioles sheathing for about half their length, with the sheath wings involute and persistent and the free (distal) part terete or only weakly channeled. It is further differentiated by the deeply pinnatifid and bluish green leaf blades, sometimes with bifid lobes, and the pruinose peduncles with a persistent sheathing mucronate cataphyll. A unique characteristic of this species is its terrestrial habit, reaching the adult plants vegetative stage in this state and climbing only to very limited height before flowering. Fertile terrestrial individuals were not found, but one plant was observed fertile after climbing only 50 cm above ground level with the same stem and leaf morphology as terrestrial examples.

Monstera croatii has basal sterile flowers with the ovary spherical, as is also the case in *M. glaucescens*, which too has glaucous stems and briefly sheathed petioles, but that species (known only from the Caribbean side of Costa Rica) has the leaves pinnately lobed (never deeply pinnatifid), the petiolar sheath persistent but not with involute margins, and the non-sheathing part of the petiole channeled (never terete). *Monstera croatii* can also be confused with *Monstera pinnatipartita* Schott (1857: 197), but that species has the petioles green or speckled (never glaucous), never develops to the adult plants vegetative form on the ground, is fertile only after significantly ascending its phorophyte, and has acuminate and marcescent (not mucronate and persistent) cataphylls.

Additional specimens examined:—COSTA RICA. Puntarenas, Golfito, Golfito, camino hacia las antenas, 8°38’55.1’’N, 83°9’30.8’’W, 389 m, 4 February 2019 (fr.), *M. Cedeño & A. Hay 1625* (USJ!). Puntarenas, Golfito, Golfito, camino a las torres del I.C.E., aprox. 2 km antes de llegar, 8°39’25’’N, 83°9’25’’W, 389 m, 29 January 1992 (fr.), *Á. Fernández 205* (CR!, MO!). Puntarenas, Golfito, Parque Nacional Corcovado, Estación Agujas, Cerro Rincón, 8°31’34.467’’N, 83°28’3.9’’W, 600 m, 11 November 1999 (fl.), *E. Mora 725* (CR!).

12. ***Monstera deliciosa*** Liebm., *Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn* 1: 19–20. 1849. (Figs. 22, 23)

Type:—MEXICO. Oaxaca, Western Cordillera, 5000–7000 ft. [1524–2134 m], Dec. 1842, F.M. *Liebmann s.n.* (holotype C-LNR-1279!, F [photo]).

Philodendron pertusum Kunth & C.D.Bouché in Kunth, Index Seminum (Berlin) 1848: 11 (Kunth 1848) ≡ *Monstera lennea* K.Koch, Bot. Zeit. 10: 277. 1852 (Koch 1852). [Non *Monstera pertusa* (Roxb.) Schott (1830), i.e. *Rhaphidophora pertusa* (Roxb.) Schott]. TYPE:—cult. Berlin? Potsdam? from plant collected in Guatemala by J. Warszewicz, *K.S. Kunth s.n.* (?holotype B?, destroyed). — GUATEMALA: Dept. Huehuetenango: Paso del Boquerón, along Río Trapichillo, below La Libertad, 21 Aug 1942, *J.A. Steyermark 51186* (neotype, US-01322542!, lectotype, designated by Cedeño-Fonseca *et al.* 2022).

Philodendron anatomicum [Kunth & C.D.Bouché in Kunth, Index Seminum (Berlin) 1848: 11. 1848 (‘*P. anatomica* Hortul.’ in synon.)]; J.H.Morsch, Verh. Vereins Beförd. Gartenbaues Konigl. Preuss. Staaten 19: 332. 1849 (Morsch 1849). TYPE:—GUATEMALA: Dept. Huehuetenango: Paso del Boquerón, along Río Trapichillo, below La Libertad, 21 Aug 1942, *J.A. Steyermark 51186* (neotype US-01322542!, designated by Cedeño-Fonseca *et al.* 2022).

Tornelia fragrans [Gutiérrez ex Schldl., Linnaea 26: 382. 1854 (‘1853’) (Schlechtendal 1854), in synon.]; Gutiérrez ex Schott, Gen. Aroid. t. 74. 1858 (Schott 1858). TYPE:—MEXICO. *Gutiérrez s.n.?* [or "clonotype" of *Philodendron pertusum* Kunth & C.D. Bouché?] (holotype W destroyed, see Riedl & Riedl-Dorn 1988). — Schott, Gen. Aroid. 1858: t. 74 (lectotype, designated by Cedeño-Fonseca *et al.* (2020c)).

Monstera borsigiana K.Koch, Wochenschr. Vereines Beförd. Gartenbaues Königl. Preuss. Staaten 5: 275. 1862. ≡ *Monstera deliciosa* Liebm. var. *borsigian*a (K.Koch) Engl. & K.Krause, Pflanzenr. IV. 23B (Heft 37): 111. 1908. TYPE:—Cult. hort. Borsig, Moabit, Berlin, 1862, *K. Koch s.n.* (?holotype, B destroyed); — MEXICO. [Veracruz]: Valle de Cordoba, 20 Jan. 1865 or 1866, *E. Bourgeau*

1904 (neotype G! 4 sheets G00413452 and G00413452a–c, isoneotypes L-L.1421839!, MPU! 2 sheets MPU014356 & MPU014357, US-01322541!, designated by Cedeño-Fonseca *et al.* (2022)).

Robust to massive herb, terrestrial or nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** brown to grayish, smooth or warty, cylindrical; **internodes** 7–12 cm long, 1–2 cm diam.; **petiole** distinct, dark green, smooth, 14–17 cm long, sheathed up to half their length; **petiole sheath** semi-deciduous; **blades** ovate to lanceolate, cordate at base, acuminate, coriaceous, 15–23 × 14–20 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** beige or whitish, smooth, cylindrical, **internodes** 1–9 cm in long, 3.0–5.5 cm diam., 0.3–1.6 times as long as wide; **anchor roots** whitish; **feeder roots** dark brown; **petiole** light green, warty or smooth, 40–110 cm long, sheathed up to half their length; **petiole sheath** deciduous; **unsheathed portion** flattened and winged adaxially, convex abaxially; geniculum warty, flattened adaxially and convex abaxially, 2–5 cm long; **blades** ovate to lanceolate, cordate to subcordate at base, acuminate, coriaceous, drying grayish or yellowish, 40–75(112) × 40–55(88) cm, 1.0–1.1 times longer than wide, decurrent-undulate over the geniculum, with 4–6 undulations of 5–7 mm wide; **midrib** flattened adaxially, convex abaxially, drying yellowish or blackish on both surfaces; **primary lateral veins** 6–11 per side, prominent on both surfaces, departing midrib at 85–90°, drying yellowish, black or dark brown; **secondary veins** slightly prominent and reticulate; **collective veins** not visible; **fenestrations** round or ovoid, numerous, extending along the blade and near the midrib; **margins** pinnatilobed, 4–10 lobes per side, sometimes with a vein that runs along the margin which reaches the middle of the blade, occasionally marginal fenestrations can break the margin and cause a bifid lobe. INFLORESCENCES on ascending stems, 2–5 simultaneously at flowering time, arranged in the leaf axils or into cataphylls; **peduncle** 12–25 cm long, 2.5–3.0 cm diam., tuberculate; **spathe** short acuminate, bluish-green during development, yellowish externally and cream internally with revolute margins and closed (at apex) at anthesis, deciduous after anthesis, 12–23 × 7–13 cm, up to 5 cm longer than the spadix; **spadix** creamy-yellowish (both during development and at anthesis), 10–20 cm long, 2.5–3.0 cm diam., 3.4–5.8 times longer than wide; **basal sterile flowers** with a yellow stigmatic secretion, 5–8 mm long; **fertile flowers** 7–10 mm long; stamens 1.2–9.5 mm long, with laminar filaments; anthers 2.0–2.7 mm long; ovary quadrangular in longitudinal section, ribbed, 5–8 × 5–7 mm; style compressed and hexagonal, 2.5–3.0 × 4–7 mm; stigmatophore slightly cupuliform, 0.3–0.4 mm long; stigma circular and sunken, with transparent secretion; **berries** with a light green stylar cap during development, mature stylar cap yellowish; pulp white; **seeds** dark green, 5–10 mm long.

Distribution and ecology:—*Monstera deliciosa* is known in Southern Mexico (Chiapas, Oaxaca, Tabasco, and Veracruz) and Guatemala, at elevations of 90–2750 m, in *Premontane rain forest*, *Tropical moist forest* and *Tropical wet forest* life zones.

Phenology:—Flowering March, April, and May. Fruit is present all year.

Discussion:—The species is a member of sect. *Tornelia* and is distinguished by its smooth stem with short internodes, petioles shorter than the blades, ovate cordate, moderately coriaceous leaves with conspicuous secondary veins, peduncles about as long as spadix and the spadix which becomes blackish to bluish green.

Monstera deliciosa was considered a widely distributed species in Central America. However, through fieldwork in Costa Rica and Panama this species is found only in cultivated form. The natural populations that were considered for Costa Rica and Panama with hanging habit and not robust plants have been considered as *Monstera tacanaensis* Matuda. This species was established as a synonym by Madison in 1997, but Cedeño-Fonseca *et al.* (2020c) have considered that these individuals belong to a different species and are not part of the *M. deliciosa* variation. To corroborate this, Cedeño-Fonseca *et al.* (2020c) carried out fieldwork in the type locality of *M. tacanaensis* in the Volcán Tacaná region

Mexico and Guatemala are the only regions where *M. deliciosa* has been collected naturally. The other collections in Central Amerca indicate that they are collections of cultivated plants. *Monstera deliciosa* is a species that is distributed in different habits in Mexico, dry forests, humid forests and cloud forests, possibly being the species with the greatest diversity of growth habitats.

For more details about the taxonomic comments and nomenclatural note see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—MEXICO. **Chiapas:** Pueblo Nuevo Solistahuacan, Bochil-Pichucalco, Along Highway 195 between Bochil and Pichucalco, 8 mi NW of Pueblo Nuevo Solistahuacán, 17°12’36”N, 092°57’36”W, 1900–1950 m, 25 Jan. 1979, *T.B. Croat 46358* (MO!); *T. Croat 46425* (ENCB!, MO!); **Oaxaca:** Oaxaca-Juxtepec, below Cerro Pinon Vista Hermosa, 4000 ft [ca. 1220 m], 8 Feb. 1968, *MacDougall 3945* (F); Mpio. Sta. Maria Chimalapa, Cerro El Crestón, pico más alto (1380 m) de la parte O de la Sta. María de Tres Picos, ca. 23.5 km en línea recta al NE de Sta. María; 17°03’00”N, 094°31’48”W, 1250–1380 m, 4 May 1988, *T. Wendt & H. Hernández 5944*

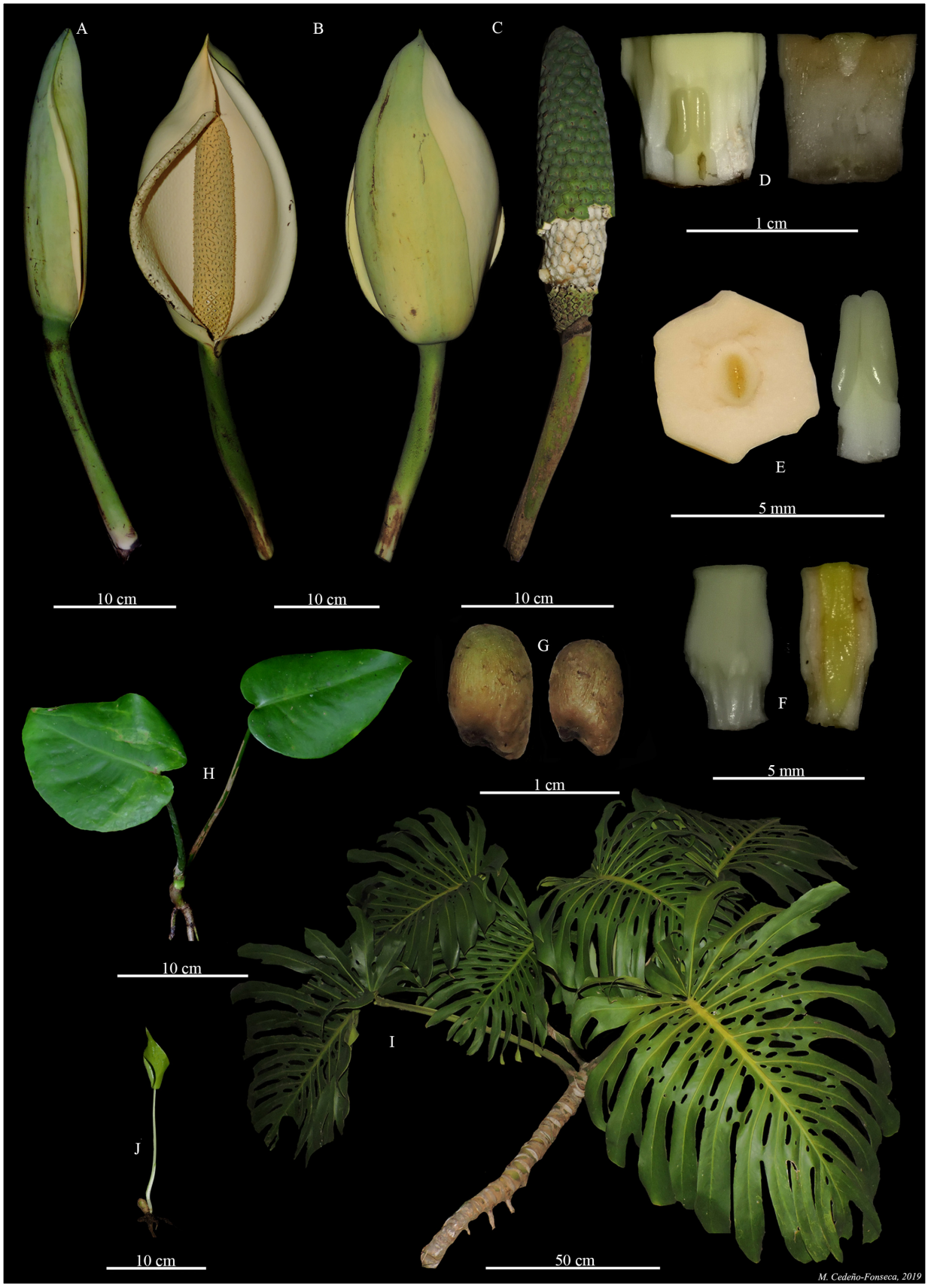

FIGURE 22. *Monstera deliciosa* from Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, some stylar plates detached. (D) Fertile flower; in lateral view (left) and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left) and longitudinal section (right). (G) Seeds. (H) Juvenile plant. (I) Habit of adult plant. (J) Seedling. Lankester Botanical Garden (not collected). Image from Cedeño-Fonseca *et al.* (2020c).



FIGURE 23. *Monstera deliciosa*. Adult plant growing in natural stage in Veracruz, Mexico. Photo by M. Cedeño-Fonseca. (Not collected).

(CHAPA, MO); Mcpio. San José Tenango, Zona boscosa al SW de San Martín Caballero, 18°05’57”N, 096°38’35”W, 1645 m, 19 Jan. 2002, *X. Estrada et al. 761* (MEXU, MO, TEX, XAL); Mpio. Sta. María Chimalapa, Afloramiento de roca en la cresta S. del cañón del Río del Corte ca 4 km al N de Sta. María cerca de la vereda al Paso de la Cueva; 16°56’N 094°40’30’’W, 320 m, 26 Jul. 1984, *H. Hernández 253* (MO!); Esmeralda, Esmeralda-Río Verde, Uxpanapa Region, along gravel road between Esmeralda (ca. 17 km E of Sarabia) and Río Verde, 1.1 mi. S of Esmeralda, 17°09’36’’N 09°4’45’’W, 100 m, 19 Jan. 1987, *T.B. Croat & P. Hannon 63305* (MO!); Huatla de Jimenez, Teotitlan del Camino - Chilchotla, [Mun. Santa María Chilchotla]. Along road between Teotilán del Camino and Chilchotla, 2.2 mi beyond turn-off to Huatla de Jiménez, 18°10’12”N, 096°50’24”W, 1270 m, 23 Feb. 1979, *T.B. Croat 48327* (MO!); Mun. Santa María Chilchotla, Along road from Teotitlán del Camino to Chilchotla, 3.8 mi past turn-off to Huatla de Jiménez, 18°11’24”N, 096°50’24”W, 1265 m, 23 Feb. 1979, *T.B. Croat 48375* (MO!); La Esperanza, Tuxtepec-Oaxaca, [Mun. San Juan Bautista Valle Nacional]. Río Corte, Sarabia-Uxpanapa, Along road from Sarabia (on Hwy. 185) to Uxpanapa, between Río Corte and 5 km W of Río Corte, 17.06N 094.55.48W, 200–225 m, 20 Feb. 1987, *T.B. Croat & P. Hannon 65395* (MO!). Valle Nacional, [Mun. San Juan Bautista Valle Nacional], About 14 miles S of Valle Nacional, along Highway 175 to Oaxaca, 17°39’36”N, 096°19’12”W, 1220 m, 22 Aug. 1977, *T.B. Croat 43912* (MO!); Ixtlan, Municipio de Comaltepec, La Esperanza, 17°36’36”N, 096°21’00”W, 1600 m, 10 Oct. 1988, *R. López et al. 381* (MO!); Municipio de Comaltepec, Oaxaca-Tuxtepec, Cerro Redondo, above town of La Esperanza (on the Oaxaca-Tuxtepec road, Highway 175), Caribbean slope, Off of path leading to power lines, 17°37’12”N, 096°21’36”W, 1750 m, 25 Oct. 1991, *B. Boyle & A. Boyle 597* (MO!); Mixe, Municipio de Totontepec: Tepitongo, 17°18’00”N, 096°01’48”W, 1700 m, 8 Aug. 1987, *E. López & G. Martín 78* (MO!); Municpio de Totontepec, Totontepec,

17°15’00”N, 096°01’48”W, 1900 m, 2 Aug. 1987, *J. Reyes & G. Martín 802* (MO!); Pluma Hidalgo, Camino de San Pedro Cafetitlan al Cementerio, 1020 m, 6 Apr. 1989 (fl., fr.), *Acosta 1195* (ENCB!); **Veracruz:** Orizaba, Sierra San Cristobal, between Ciudad Mendoza and Orizaba, along highway 150D (auto pista), ca. 3 km SW of Orizaba, S of auto pista ca. 0.5 km, 18°49’48”N, 097°08’24”W, 1260–1400 m, 27 Jun. 1977, *T.B. Croat 39528* (MO!); Catemaco, Tebanca, camino Tebanca-Bastonal, 18°24’N, 94°55’W, 700 m, 18 Jul. 1980 (sterile), *F. Ramírez 1103* (XAL!); Catemaco, Ladera S Cerro Jegal, al N del Rancho Los Naranjos, entrada por la carretera Catemaco-Dos Amates, 21 May 1985 (fl.), *J.I. Calzada 11547* (XAL!); Caetzal, Ladera de Cerro al E de Coetzala, 18°46’50’’N, 96°54’52’’W, 650 m, 31 Oct. 2001 (fr.), *A. Rincón & C. Durán 2805* (XAL!); Coatepec, 1 km sobre el camino Coatepec-Teocelo, finca La Cruz, 19°26’13’’N, 96°57’5’’W, 1170 m, 5 May 1991 (fl.), *A. Espejo et al. 4433* (XAL!); Cerro de Chicanhuaxtla-Cuauhtlapan, 22 Jan. 1968 (sterile), *M. Rosas 1066* (XAL!); Los Reyes, Colonia Bugambilia-Congocotepec (terrenos particulares), carretera Orizaba-Zongolica (km 32), 18°41’20’’N, 97°1’18’’W, 1700 m, 9 Apr. 2000 (sterile), *A. Rincón & C. Durán 1414* (XAL!); Veracruz, Vivero Los Tanques, 19°32’N, 96°49’W, 8 Apr. 1994 (sterile), *P. Zamora 3810* (XAL!); Xalapa, Viveros oficiales del H. Ayuntamiento, 19 Nov. 1988 (fr.), *C. Tovar 13* (XAL!); Las Minas, Las Minas hacia Molinillos, 19°42’N, 97°08’W, 130 m, 25 May 1989 (fr.), *C. Durán et al. 819* (XAL!); Huilopan, Cerro de San Cristobal, 18°48’N, 95°05’W, 1300 m, 22 Apr. 1982 (fl., fr.), *J.I. Calzada 8559* (ENCB, XAL!); Zongolica, Reserva Biológica La Quinta, Amatitla, 18°38’N, 96°59’W, 1450 m, Apr. 2008, *T. Kromer THO3049* (SEL!); Catemaco, San Andrés Tuxtla, Estación Biológica Los Tuxtlas, 18°34’N, 95°07’W, 640 m, 12 May 2005, *T. Kromer et al. 2180* (SEL!); 7 km N of Catemaco, 18°28’12”N, 095°06’00”W, 1973, *R. Cedillo & J.I. Calzada 136* (BR, XAL); San Andrés, camino al ejido Ruíz Cortínez, 18°29’42”N, 095°10’11”W, 797 m, 06 Mar. 2020, *P. Díaz-Jiménez et al. 1455* (HEM!); Cordoba, Cordoba-Veracruz, Hillside above San José de Gracia, 1 mile S of highway between Córdoba and Veracruz, 18°51’36”N, 096°53’24”W, 750 m, 28 Jun. 1977, *T.B. Croat 39615* (MO!); Hidalgotitlan, 1.7 km W of La Laguna, luego 0.7 km al N, 17°16’12”N, 094°31’12”W, 130 m, 28 Nov. 1981, *T. Wendt & A. Villalobos 3515* (MO!); San Andrés Tuxtla, Laguna Encantada near San Andrés Tuxtla, 18°27’00”N, 095°10’48”W, 10 Apr. 1952, *H.E. Moore 6231* (BH, MEXU, MO); Sayula, Sayula de Aleman, Along road under construction, 1 mile W of Sayula de Alemán; ca. 6 mi S of Acayucan, 17°52’12”N, 094°57’36”W, 90 m, 3 Jul. 1977, *T.B. Croat 40022* (MO!); Soteapan, 7 km NW of Pajapan, N side of Volcán San Martín Pajapan, 18°18’36”N, 094°42’36”W, 830–980 m, 15 Jul. 1982, *M. Nee et al. 25042* (F!, MO!, XAL!); N side of Volcán San Martín Pajapan, 7 km NW of Pajapan, 18.18.45N 094.43W, 830–980 m, 15 Jul. 1982, *M. Nee et al. 25043* (MO!); Totutla, Km 45 on highway between Conejos (near Puente Nacional) and Huatusco, Hacienda ‘El Mirador’, slopes of barranca de Santa María, 19°12’00”N, 096°45’36”W, 21 Sep. 1961, *H.E. Moore & G. Bunting 8860* (BH); **Tabasco:** Municipio Huimanguillo, Cerro de las Flores (Cerro el microondas), Villa de Guadalupe, 17°22’26”N 093°37’51”W, 556 m, 28 Apr. 2009, *P. Díaz-Jiménez et al. 762* (UJAT!). GUATEMALA. **Guatemala:** 7 miles E of Guatemala City, 1840 m, 26 Apr. 1970 (fr.), *W.E. Harmon & J.A. Fuentes 2267* (ENCB!); **Alta Verapaz:** Sebol, 3 km NNW of Sebol off road to Petén, 15°49’44”N, 089°57’25”W, 14 Apr. 1964, *E. Contreras 4304* (LL!); **Huehuetenango:** Jutal, Above Democracia on trail towards Jutal, 1000 m, 23 Aug. 1942, *J.A. Steyermark 51060a* (MO!); **Sacatepéquez:** San Miguel Duenas, 1470 m, 19 Sep. 1992, *M. Veliz 92.2503* (MO!); **San Marcos:** 1 mile above Africa, ca. 3.3 miles above Finca Armenia above San Rafael, 1600 m, 13 Jul. 1977, *T.B. Croat 40927* (MO!).

13. ***Monstera dissecta*** [(Schott) N.E.Br. ex Donn.Sm., Enum. Pl. Guatem. 5: 88. 1899, comb. inval.]; (Schott) Croat & Grayum, *Ann. Missouri Bot. Gard.* 74(3): 659. 1987. ≡ *Tornelia dissecta* Schott (‘*Fornelia dissecta*’), *Oesterr. Bot. Z.* 8: 179. 1858. (Figs. 24, 25)

Type:—Costa Rica. [Cartago:] Vulcan de Turialba [sic], 24 March 1857 (‘1856’), *H.A. Wendland 500* (holotype GOET!; ?isotypes W, destroyed [fragm.], K *fide* Engler & Krause (1908: 111, n.v.)).

Monstera longipedunculata Matuda, Bol. Soc. Bot. México 14: 22. 1952. Type:—BELIZE. Middlesex: Stann Creek, 25 May 1939, *P.H. Gentle 2796A* (holotype MICH-1115585!).

Robust herb, terrestrial or nomadic vine, appressed-climbing or pendent habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** light brown to beige, smooth, cylindrical; **internodes** 3–4 cm long, 5–10 mm diam.; **petiole** distinct, light green, smooth, 7–10 cm long, sheathed to base of the geniculum or blade; **petiole sheath** persistent; **blades** ovate to lanceolate, attenuate to subcordate at base, acuminate, subcoriaceous, 15–23 × 14–20 cm, not appressed to the phorophyte; **fenestrations** absent or present, only on one margin of the blade; margins entire or lobed (due to tearing of the perforations that extend to the margin). ADULT PLANTS: root climbers; **stems**

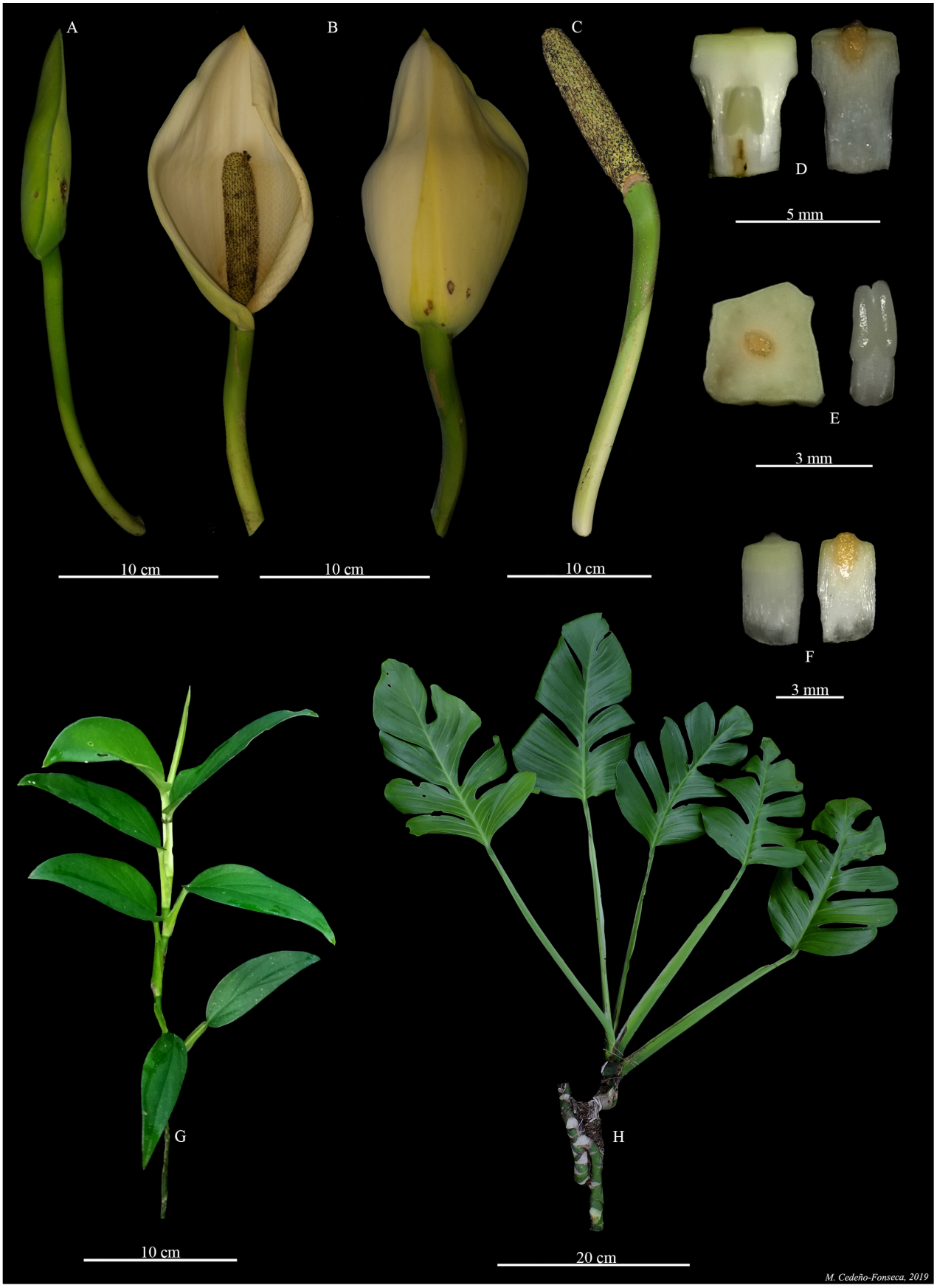

FIGURE 24. *Monstera dissecta* from Sarapiquí, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe frontal and back views. (C) Immature infructescence. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), longitudinal section (right). (G) Juvenile plant. (H) Adult plant. *M. Cedeño et al. 1001* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 25. *Monstera dissecta*. Adult plant growing 20 m above the ground in a tree in San Carlos, Costa Rica. Photo by M. Cedeño-Fonseca. (Not collected).

beige to light brown, smooth, cylindrical; **internodes** 1–3 cm long, 0.8–3.0 cm diam., 1.0–1.2 times longer than wide; **cataphylls** light-green, deciduous; **anchor roots** light brown; **feeder roots** corky, dark brown; **petiole** light green, smooth, 15–55 cm long, fully sheathed or up to 5 cm before of the geniculum; **petiole sheath** persistent, horizontally open or revolute, fused at apex; geniculum smooth, sunken adaxially, convex abaxially, 1–3 cm long; **blades** ovate to elliptic or oblong, cuneate to rounded or truncate at base, subcoriaceous to coriaceous, obtuse to short-acuminate at apex, drying bright reddish, brownish or greenish, 23–58 × 14–35 cm, (1.3)1.7–1.9(2.0) times longer than wide, decurrent on the geniculum, decurrent portion 3–5 mm wide; **midrib** ribbed adaxially, convex abaxially, drying brownish on both surfaces; **primary lateral veins** 4–20 per side, sunken adaxially, prominent abaxially, departing midrib at 50–65°, drying brownish or reddish; **secondary veins** parallel and prominent, reticulate towards margins; **collective veins** visible towards lobes; **fenestrations** absent or present; **margins** entire, pinnatilobed or scarcely pinnatifid, 2–6 lobed per side. INFLORESCENCES on ascending and pendent stems, 1–5 simultaneously at flowering time, arranged in the leaf axils or into cataphylls; **peduncle** smooth, 12–24 cm long; **spathe** acuminate, light green during development, yellowish externally and cream internally at anthesis, with revolute margins and completely open at apex, deciduous after anthesis, scarcely marcescent, 16–24 × 12–15 cm, up to 10 cm longer than spadix; **spadix** creamy-yellowish (both during development and at anthesis), 6–15 cm long, 1.5–3.6 cm diam., 2.0–5.7 times longer than wide; **basal sterile flowers** 5–7 mm long, with an orange stigmatic secretion; **fertile flowers** 4–7 mm long; stamens 1.0–6.5 mm long, with laminar filaments; anthers 1.3–2.7 mm long; ovary rectangular in longitudinal section, ribbed, 3–4 × 2–3 mm; style hexagonal, 2–3 × 4–5 mm; stigmatophore cupuliform, 0.4–1.0 mm long; stigma circular, with a yellowish

stigmatic secretion; **berries** with a light-green stylar cap during development, mature stylar cap creamy-yellowish; pulp white; **seeds** black with brown dots, 4–7 mm long.

Distribution and ecology:—*Monstera dissecta* ranges from Belize to Guatemala, Nicaragua, Honduras, Costa Rica and Panama from sea level to mostly less that 700 (1150) m, in *Tropical wet forest*, *Premontane wet* and *Lower montane rain forest* life zones.

Phenology:—Flowering September to November. Fruiting occurs mostly February, June, July, and September to November.

Discussion:—The species is a member of sect. *Monstera*. It differs from the other species in its persistent and revolute petiolar sheath, its hardly perforated but often pinnatilobed leaf blade, with a decurrent base, its externally yellowish spathe, and the stigma slightly raised by a cupuliform stigmatophore, with yellowish secretion. It is similar to *M. limitaris* and *M. monteverdensis* but differs from the latter which has a deciduous petiolar sheath, and pinnatilobed, never-fenestrate leaves, and a light green and externally pruinose spathe. It differs from *M. limitaris* which has petioles with brown-dark warts on the base, leaves with pinnatilobed margins, and undulating base decurrent on the geniculum and fenestrations on each side next to the midrib, and the stigma raised by a columnar stigmatophore and with transparent secretion.

Monstera dissecta is highly variable in vegetative morphology and growth form; adult and reproductive plants can have entire and pinnatilobed leaf blades in ascending stems or have completely entire leaves in ascending and hanging stems.

Monstera dissecta material collected in Costa Rica had been determined by Madison (1977) as "*M. dilacerata* (K.Koch & Sello) K.Koch", apparently based on misinterpretation of photos of the lost type, which had been made from a sterile cultivated plant of uncertain geographical origin (Croat & Grayum, 1987; Grayum, 1997). Grayum (1997) and then Boyce (1998) concluded that the name *M. dilacerata* is in fact a synonym of *Epipremnum pinnatum* (Linnaeus (1763: 1374)) Engler in Engler & Krause (1908: 60), an Asian species (see Grayum & Cedeño-Fonseca 2018 for its neotypification). Grayum (1997) further determined that all Costa Rican material previously identified as *M. dilacerata* represented not only *M. dissecta*, but also *M. glaucescens*, *M. lentii* and *M. pinnatipartita*.

For more details about the taxonomic comments and nomenclatural notes see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—BELIZE. **Stann Creek:** Jaguar Preserve, 10 km W of Maya Center, off Southern Highway, 16°45'N 088°35'W, 400 m, 25 May 1990, *M.J. Balick 2718* (MO!); **Toledo:** In high ridge, on hill slope, Balsam Hill, Edwards Road beyond Columbia, 16°20'N 088°10'W, 6 Jan 1948, *P.H. Gentle 6358* (LL!). GUATEMALA. **Alta Verapaz:** Between Hacienda Yaxcabnal along Río Icvolay and Río Apia, 6–8 miles northwest of Cubilgüitz, 15°42'28"N 090°27'54"W, 210–250 m, 13 Mar 1942, *J.A. Steyermark 45022* (MO!); **Izabal:** Livingston. Chocón Machacas, 15°40'35"N 088°58'06"W, 30 enero 2003, *Anonymous 3078* (MO, USCG); **Petén:** Dolores. Km 78, Santo Toribio Road. In high forest on top of hill, 16°31'45"N 089°27'15"W, 20 Apr 1961, *E. Contreras 2146* (LL!). HONDURAS. **Atlántida:** Proyecto de Punta Sal, 25 km NO de Tela, nivel del mar, bosque húmedo tropical. Cerro de Punta Sal, asociación de Orbignya y Sabal, 15°05'N 087°05'W, 170 m, 16 Abril 1993, *C.H. Nelson & R. Andino U. 15678* (MO, TEFH); Jardin Botanico de Lancetilla, camino entre el arborétum y Nuevo San Francisco, 15°41'59"N 087°28'00"W, 20–500 m, 18 enero 1994, *C.H. Nelson et al. 17337* (TEFH!); Along trail to dam for municipal water supply of Tela, Lancetilla Botanical Gardens, on road ca. 2 mi WSW of Tela and S of main hwy. Printed label for specimens 64586–64646 reads 9/2/1987, but fieldbook states 10/2/1987, 15°44'N 087°27'W, 70–90 m, 10 February 1987, *T.B. Croat & D.P. Hannon 64632* (MO!); Esparta. Valley of the Río León, vicinity of Las Lomas, between San José de Texíguat and Suyapa de León (Matarras), 15°33'N 087°26'W, 80 m, 16 May 1991, *G. Davidse et al. 34439* (MO!); Tela. Lancetilla Valley, near Tela, 15°42'40"N 087°27'28"W, 20–600 m, 06 December 1927 – 20 March 1928, *P.C. Standley 54465* (US!); Lancetilla Valley ca. 10 miles southeast of Tela; in forest preserve along Río Lancetilla, on trail to water reservoir, 15°44'N 087°27'W, 10–150 m, 03 August 1977, *T.B. Croat 42626* (MO!); **Cortés:** Nacimiento del Rio Lindo, 600 m, April 1951, *L.O. Williams & A. Molina 18267* (EAP); Omoa. 5 km west of Puerto Cortés on road to Omoa. Roadside through low-lying farm land, with patches of forest, 15°47'56"N 087°57'13"W, 10 m, 20 May 1987, *S. Blackmore & M. Chorley 3994* (BM, MO); 2–3 miles southwest of Omoa on road from Puerto Cortes to Guatamalan border; sea level; pastures with few trees, 15°45'09"N 088°04'00"W, 0 m, 2 Aug 1977, *T.B. Croat 42557* (MO!); Santa Cruz de Yojoa. North of Lago de Yojoa, along gravel road (old Hwy 1) ca. 2–6 miles from junction with new Hwy 1, southwest of Santa Cruz de Yojoa. Disturbed area along road near lake, 14°55'25"N 087°58'39"W, 600 m, 04 August 1977, *T.B. Croat 42742* (MO!, US!); **Olancho:** Dulce Nombre de Culmí. Between El Jocomico and Cerro El Mulato. River valley jungle with Mahogany, 15°13'56"N 085°22'33"W, 500 m, 5 Feb 1982, *S. Blackmore & G.L.A. Heath 1688* (BM, MO). NICARAGUA. **Atlántico Norte:** Cerro La Pimienta, E range, summits of two peaks, northernmost and central; cloud forest and elfin forest, 13°44'00"N 084°59'45"W, 900–1160 m, 17 Apr 1979, *J.J.*

Pipoly III 5249 (MO!); Colonia Kururia, 14°41'N 084°04'W, 25–50 m, 03 March 1979, *J.J. Pipoly III 3963* (MO!); Reserva Bosawas, Municipio de Bonanza, Cerro Cola Blanca, 14°06'N 084°31'W, 700–880 m, 2 Junio 1997, *R.M. Rueda & I. Coronado 6517* (HULE); Ibo Tingni, drainage of Caño Sung Sung, N of road between Puerto Cabezas and Río Wawa; gallery forest and adjacent savanna, 14°10'N 083°30'W, 5–10 m, 6 October 1978, *W.D. Stevens 10668-B* (MO!); Along road to Panua (entrance ca. 7.6 km NW of Santa Marta), ca. 1.6 km NW of Panua and 5.7 km from main road; low "island" of broadleaf forest in pine savanna, 14°18'N 083°41'W, 20 m, 20 Apr. 1978, *W. D. Stevens 7766* (MO!); **Atlántico Sur:** Municipio de Kukra Hill, Río Kama, comunidad de San Brown, Reserva privada Los Chávez, 12°08'12"N 083°55'56"W, 0–10 m, 21 April 2004, *A. Grijalva 7496* (HNMN); Finca Santa Rosa, 2.5 km ENE of Rama; pastures and old fields, 12°11'N 084°12'W, 50 – 75 m, 5 Apr 1966, *G.R. Proctor et al. 27335* (F!, NY!); Kurinwacito, 13°08'N 084°55'W, 80–100 m, 18 marzo 1984 – 22 marzo 1984, *P.P. Moreno 23691* (MO!); Caño Montecristo, del Campamento Germán Pomares hacia arriba hasta Las Benitas, 11°36'N 083°51'W, 10 m, 6 febrero 1982, *P.P. Moreno & J.C. Sandino 14922* (MO!); Punta Gorda, 11°30'55"N 083°46'30"W, 0–2 m, 12 febrero 1982, *P.P. Moreno & J.C. Sandino 15198* (MO!); Along new road from Río Blanco to Río Copalar, ca. 29 km E of Río Blanco, at ford of small stream, 12°52'30"N 085°02'30"W, 200–400 m, 14 February 1979, *W.D. Stevens 12194* (IBE, MO); Monkey Point; beach and bluff near village, 11°36'00"N 083°40'00"W, 0–20 m, 7 April 1981, *W.D. Stevens 19990* (MO!); **Boaco:** NE de Mombachito, 12°25'N 085°32'W, 600–700 m, 11 mayo 1982, *J.C. Sandino 2819* (MO!); Cerro Mombachito, 8.5 km noroeste de Camoapa, 12°24'N 085°33'W, 900–1020 m, 24 enero 1980, *M. Araquistain & P.P. Moreno 1004* (MO!); Quebrada Río Grande, al NE de Cerro Mombachito, 12°25'N 085°32'W, 600–700 m, 30 sept. 1980, *P.P. Moreno 3251* (MO!); Upper SW slope of Cerro Mombachito, S of road between Boaco and Camoapa, 12°24'N 085°33'W, 900–1000 m, 3 October 1979, *W.D. Stevens et al. 14586* (MO!); **Jinotega:** Cordillera Isabelia, near Río Bote, Comarca de Bocaycito, 117 km from Matagalpa; lower montane rain forest [Seymour series (#)], 13°17'N 085°36'W, 1200 m, 6 May 1976, *D.A. Neill 278 (7149)* (MO!); **Río San Juan:** La Lupe, ca. 25 km ENE of Boca de Sabalo; primary forest lightly logged with silvicultural treatment, clay soils, hilly, 11°08'N 084°21'W, 80–120 m, 28 June 1997 – 2 July 1997, *J. Salick & E. Stijfhoorn 8266* (MO!); 2 km al NW de Sábalos, 11°02'N 084°29'W, 70 m, 23 febrero 1984, *P.P. Moreno 23299* (MO!); Municipio de San Carlos, Reserva Esperanza Verde, 11°05'N 084°44'W, 50 m, 1 Junio 2002, *R.M. Rueda et al. 17268* (HULE!, MO!, US!); **Rivas:** Isla Ometepe, Volcán Maderas, N slope, Finca Argentina, 11°27'N 085°31'W, 600 m, 23 February 1978, *D.A. Neill & P.C. Vincelli 3222* (MO!); Isla Ometepe, Volcán Maderas, N slope; cloud forest, 11°27'N 085°31'W, 800–1000 m, 24 February 1978, *D.A. Neill & P.C. Vincelli 3254* (HNMN!, MO!). COSTA RICA. **Alajuela:** Along road between Cañas (Guanacaste) and Upala, 100 m, 25 June 1976, (Fl., Fr.), *T.B. Croat 36403* (MO!); San Carlos, Florencia, San Luis de Florencia, A unos 100 m al oeste de la plaza de deportes de San Luis, 280 m, 16 February 2011, (Fl.), *C. Trejos 25* (CR!); San Carlos, Florencia, 9 km north of Ciudad Quesada on road to La Florencia, in patch of forest along Río Peje on property of Jose Corrales, 300 m, 3 June 1986, (Fr.), *B.E. Hammel & G. Nevers 15310* (CR!, MO!); Lower W-SW slopes of Volcan Arenal, Pre-montane wet forest, 17 September 1988, (Fl.), *V. Funk* 10474 (CR!); San Carlos, Florencia, 22 km NE of Quesada by air, 4 km W of Muelle de San Carlos, Disturbed, seasonally dry primary forest, 9 April 1983, (Fr.), *R. Liesner* 14106 (CR!, MO!); San Carlos, Pital, San Carlos, Pital, ca. 8 km NE de Boca Tapada, ruta a Río San Juan, alrededores de Laguna Canacas, 50 m, 27 February 2004, (Fr.), *A. Rodríguez* (CR!); Along road between Cañas (Guanacaste) and Upala, 100 m, 25 June 1976, (Fr.), *T.B. Croat 36404* (MO!); Los Chiles, Refugio Nacional de Vida Silvestre Caño Negro, 30 m, 8 July 1987, (Fr.), *N. Zamora 1354* (MO!); San Ramón, Peñas Blancas, Reserva Biológica Soltis Center, Sendero a la Catarata, 500 m, 29 Agosto 2016, (Fr.), *M. Cedeño et al. 929* (USJ!); Upala, Aguas Claras, Sendero Cabinas Bromelia, 490 m, 15 Diciembre 2016, (Fl.), *M. Cedeño et al. 976* (USJ!); San Carlos, Monterrey, Río La Muerte, 110 m, 24 Febrero 2017, (Fl.), *M. Cedeño et al. 1001* (USJ!). **Cartago:** Turrialba, Pavones, Javillo de Turrialba, 750 m, 30 November 1994, (Fr.), *V. Nilson et al. 610* (CR!); Turrialba, CATIE, 525–600 m, 9 May 1983, (Fr.), *R. Liesner 15258* (MO!); Turrialba, Forested slope leading down to the Río Reventazón behind main building of CATIE, 560–600 m, 30 July 1985, (Fr.), *M.H. Grayum 5739* (MO!). **Guanacaste:** Liberia, Mayorga, Estacion Cacao, Cerro Cacao, Bosque primario, 1060 m, 8 February 1995, (Fr.), *A. Rodríguez 40* (CR!); Tilarán, Río Piedra, Arenal de Tilarán, 600 m, 7 December 1983, (Fr.), *E. Valerio 69* (USJ!); Tilaran, Arenal, Santuario de la Divina Misericordia, 650 m, 11 April 2016, (Fr.), *M. Cedeño et al. 872* (USJ!). **Heredia:** Sarapiquí, Las Horquetas, Along main road ca. 1 km SE of Las Horquetas (Buenos Aires) de Sarapiquí, 70 m, 2 June 1985, (Fl.), *M.H. Grayum & B. Jacobs 5319* (CR!, MO!); Sarapiquí, Las Horquetas, Reserva Rara Avis, Sector Catarata, 700 m, 16 June 1995, (Fl.), *S. Marten 878* (CR!); Sarapiquí, Horquetas (Buenos Aires), Finca CECAFOR, Sarapiquí, 80 m, 19 October 2006, (Fr.), *D. Beatríz 28* (CR!); Sarapiquí, La Virgen, Bosques remanentes siguiendo el sendero del Río Peje, 100 m, 12 July 2003, (Fr.), *J. Gonzales 3966* (CR!); Sarapiquí, Horquetas (Buenos Aires), Puerto Viejo a Rio Corinto, potreros, 100 m, 2 September 1993, (Fl.), *B.E. Hammel 18993* (CR!); Finca La Selva, 100 m, 17 July 1982, (Fr.), *B.E. Hammel 13217* (MO!); La Selva

Biological Station, 100 m, 20 March 1980, (Fr.), *B.E. Hammel 8189* (MO!); Finca La Selva, 100 m, 2 August 1979, (Fr.), *M.H. Grayum 2179* (MO!); Finca La Selva, 100 m, 12 August 1980, (Fr.), *B.E. Hammel 9524* (MO!); Estación Biológica La Selva At confluence of Río Sarapiquí and Río Puerto Viejo, 50–80 m, 3 May 1987, (Fr.), *M.H. Grayum 8297* (MO!); Finca La Selva, 100 m, 22 May 1980, (Fr.), *M.H. Grayum 2844* (MO!); Finca La Selva, 100 m, 13 July 1982, (Fr.), *B.E. Hammel 13159* (MO!); Sarapiquí, La Virgen, Estación Biológica La Tirimbina, Sendero la Ceiba, 197 m, 19 Febrero 2016, (Fr.), *M. Cedeño et al. 1053* (USJ!). **Limón:** Pococí, Roxana, Along road between Mata de Limón, (incorrectly identified on Agua Fría quadrangle as "Milloncito") and Millón, 25 m, 7 November 1987, (Fl.), *M.H. Grayum & B.E. Hammel 8406* (CR!, MO!); Talamanca, Cahuita, P.N. Cahuita, Sector Puerto Vargas, Sendero Las Baulas, 1 m, 24 August 2011, (Fl.), *A. Estrada et al. 5084* (CR!); Pococí, Colorado, North shore of the mouth of the Río Colorado at Barra del Colorado, between the village and the Caribbean Sea, Low-land, tropical wet forest just behind the river white, 3 m, 12 September 1986, (Fr.), *G. Davidse & G. Herrera 30955* (CR!, MO!); Pococí, Colorado, P.N. Tortuguero, Llanura de Tortuguero, Estaciòn Cuatro Esquinas, 2 m, 18 October 1989, (Fr.), *J. Solano 17* (CR!); Limón, Valle la Estrella, Along road leading south from Finca Concepción, Valle La Estrella, to Hitoy Cerere reserve (to E of Río Cerere), 100 m, 31 July 1985, (Fr.), *M.H. Grayum 5761* (CR!, MO!); Siquirres, Pacuarito, Banana and cacao plantations on level areas between Siquirres and the Río Pacuare, and remnant forest on steep hills south of the railroad bridge over the río Pacuare, 80 m, 20 December 1969, (Fr.), *W. Burger & R. Liesner 6936* (CR!); Limón to Moin road, 3 m, 21 February 1984, (Infer.), *Khan et al. 1200* (CR!, MO!); Talamanca, Sixaola, R.V.S. Gandoca-Manzanillo, Sendero entre Gandoca y Manzanillo, Aprox. 1,2 Km de la entrada al sendero por el sector de Gandoca, 1 m, 11 April 2012, (Fr.), *A. Estrada et al. 5344* (CR!); Limón, Valle la Estrella, Sea shore vegetation swamp forest cacao plantations and secondary growth along the Caribbean Coast between the río Bananito and Cahuita, 5 m, 9 February 1977, (Fr.), *W. Burger et al. 10500* (CR!, MO!); Limón, Matama, Limón, Valle de la Estrella, Fila Matama, Cerca de 11 km SW del pueblo de Aguas Zarcas, Punto 51, Bosque maduro dominado por *Tetragastris panamensis*, *Calatola costaricensis*, *Quaribaea*, *Sloanea* y *Billia rosea*, 800 m, 1 November 2007, (Fr.), *D. Solano 4892* (CR!); Pococí, Colorado, Tortuguero, Sendero al pie del Cerro Tortuguero, entrando por Caño Palma, 4 m, 1 September 1995, (Fl.), *A. Cascante & A. Ruiz 673* (CR!); Limón, Valle la Estrella, Reserva y alrededores del Hotel Colón Caribe, Borde de Estero Negro, 5 m, 25 August 2011, (Fr.), *S. Lobo et al. 3008* (CR!); Pococí, Colorado, Cerro Coronel, E of Laguna Danto, Tall evergreen forest on gentle to moderately steep slopes, 75 m, 16 January 1986, (Fr.), *W. Stevens 23667* (CR!, MO!); Pococí, Toro amarillo, 30 August 1936, (Fr.), *F. Solís 429* (CR!); Pococí, Roxana, P.N. Tortuguero, Estación Agua Fría, ca. 8 km al Sureste siguiendo el Sendero Los Raudales, hasta llegar a las primeras Lomas de Sierpe, Bosque primario, 55 m, 27 February 1988, (Fr.), *R. Robles & L. Flores 1637* (CR!); Talamanca, Sixaola, Patch of slightly disturbed primary forest on level tract behind Naisa house, Ganddoca, 3 m, 4 May 1985, (Fl.), *M.H. Grayum & G. Schatz 5281* (CR!, MO!); Talamanca, Sixaola, Colecta en sendero; a orilla de la costa de Manzanillo hacia Gandoca, 10 m, 4 October 2000, (Fr.), *L. Acosta 2850* (CR!); Limón, Valle La Estrella, Hitoy Cerere, Senderos en los alrededores de la estacion, 90 m, 19 June 1997, (Fr.), *A. Rodríguez 2320* (CR!); Pococí, Guapiles, Finca Bosque Lluvioso, Sendero Los Helechos, Bosques secundarios, 300 m, 8 January 2008, (Fr.), *L. Vargas 2910* (CR!); Bahia de Portete Parque Nacional, 10 m, 7 January 1984, (Fr.), *S. Thompson 1172* (MO!); Low areas mostly in or near cacao groves, 10 m, 4 November 1984, (Fr.), *M.H. Grayum 4370* (MO!); Refugio Gandoca-Manzanillo Along Río Gandoca from mouth ("Gandoca Bar") to ca. 2 km upstream, Mainly Rhiz- ophora toward mouth; Raphia, 5 m, 29 January 1987, (Fr.), *M.H. Grayum 8063* (MO!); Cahuita, Abundante en el bosque y en árboles aislados, 1 May 1985, (Fr.), *E. Valerio 127* (USJ!); Talamanca, Cahuita, R.V.S.M. Manzanillo, 18 m, 4 October 2017, (Fl.), *M. Cedeño et al. 1070* (USJ!); Estación Carrillo de 700 a 450 m, de la Fila al Cañón del Río Sucio, Bosque muy húmedo tropical-transición a premontano, 12 November 1983, (Fr.), *I. Chacón & G. Herrera 1737* (CR!, MO!); Parque Tortuguero, Estación Cuatro Esquinas, 600 m al Este de la casa-estación, Sendero a la playa, Bosque secundario, 2 m, 3 December 1987, (Fl.), *R. Robles 1444* (CR!, MO!); Barra del Colorado, S side, between town and ocean beach; beach and fresh to blackish swamp, 1 m, 26 January 1986, (Fl.), *W. Stevens 24090* (CR!, MO!); Barra del Colorado, N side, between town and ocean beach, Swamp forest, 1 m, 26 January 1986, (Fr.), *W. Stevens 24149* (CR!, MO!). **San José:** Hacienda Chirripó, 200 m, 1 February 1900, (Fr.), *H. Pittier 16041* (MO!); 02 Octubre 1899, (Fr.), *A. Tonduz 13320* (MO!); Perez Zeledon, Cordillera de Talamanca, 1150 m, 14 February 1996, (Fr.), *E. Alfaro 475* (MO!). PANAMA. **Bocas del Toro:** North coast of Escudo de Veraguas Island, 09°05'N 081°33'W - 09°06'N 081°35'W, 5 m, 08 August 1987, *G. McPherson 11411* (MO!); Chiriquí Lagoon, on Cayo Agua, 09°08'59"N 082°01'59"W, 5 m, 11 August 1987, *G. McPherson 11478* (MO!); Water Valley, vicinity of Chiriquí Lagoon, 09°14'42"N 082°23'00"W, 24 Sep 1941, *H. von Wedel 2755* (MO!); Columbus Island [Isla Colón], vicinity of Chiriquí Lagoon, 09°24'N 082°17'W, 30 Aug 1941, *H. von Wedel 2609* (MO!); Water Valley, vicinity of Chiriquí Lagoon, 09°14'42"N 082°23'00"W, 0 – 120 m, 2 Oct 1940, *H. von Wedel 984* (MO!); Wet wooded margin of Garey Creek southeast of Almirante across bay, 09°12'00"N 082°20'36"W, 22 Aug 1964, *S.T.*

McDaniel 5165 (IBE, MO); Changuinola. About 1 mile S of Changuinola on the Changuinola River. Forest edge of banana grove, 09°24’06”N 082°30’00”W, 19 Apr 1969, *R.L. Lazor & E.L. Tyson 2658* (MO!); **Colón:** Westernmost part of province, site of proposed copper mine (INMET). Along proposed road to coast. Collected with Jean-Yves Serein, 08°58’28”N 080°42’23”W, 130 m, 09 April 2009, *G. McPherson 20793* (MO!); **Panamá:** Panamá. Slopes of Cerro Jefe between Cerro Azul and La Eneida about 15 miles northeast of Panama city, 09°12’50”N 079°23’05”W, 800–900 m, 30 Dec 1971, *R.L. Wilbur et al. 15566* (DUKE!).

14. ***Monstera donosoensis*** Croat, M.Cedeño & O.Ortíz, *Webbia* 76(2): 269–272. 2021. (Figs. 26, 27)

Type:—Panama. Colón: Donoso District. Minera Panamá copper-mining concession, slopes and ridges in drainage of Quebrada Brazo, 243 m, 30 Aug 2014, *M.Grayum, G.McPherson, C.Ramos, I.Vergara-Pérez & L.Rojas 13242* (holotype PMA!, isotype MO-6636330!).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** light green or beige, sometimes white-dotted, smooth, cylindrical; **internodes** 2–5 cm long, 0.5–1.0 cm diam.; **petiole** distinct, light green, smooth, 8–15 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous or slightly persistent; **leaf-blades** ovate to lanceolate, attenuate or cuneate at base, acuminate, subcoriaceous to coriaceous, 10–25 × 9–15 cm, not appressed to the phorophyte; **fenestrations** absent or present, only on one side of the lamina. ADULT PLANTS: root climbers; **stems** beige to light brown, smooth, cylindrical; **internodes** 1–4 cm long, 1–5 cm diam., 0.8–1.0 as long as wide; **anchor roots** light brown or beige; **feeder roots** corky, dark brown; **petiole** dark green, scarcely white-dotted, smooth, 22.0–41.5 cm long, fully sheathed, or for up to 15 cm; **petiole sheath** deciduous or slightly persistent, horizontally open; geniculum smooth, sunken adaxially, convex abaxially, 0.5–3.0 cm long; **blades** ovate to elliptic, rounded or truncate at base, subcoriaceous to coriaceous, obtuse to short-acuminate at apex, drying glossy, beige or brownish, 26.5–47.0 × 16.3–25.0 cm, 1.62–1.88 times longer than wide, decurrent on the geniculum, decurrent portion 1–2 mm wide; **midrib** ribbed adaxially, convex abaxially, drying light or reddish brown on both surfaces, **primary lateral veins** 6–20 per side, strongly sunken adaxially, prominent abaxially, departing the midrib at 50–60°, drying brownish or reddish, **secondary veins** prominent and parallel, reticulate toward the margin; **collective veins** slightly visible toward lobes; **fenestrations** absent or present; margins entire, pinnatilobed or scarcely pinnatifid, with 2–8 lobes per side. INFLORESCENCES on ascending stems; **peduncle** smooth, 11.5–19.0 cm long; **spathe** obtuse to short-acuminate, light green during development, yellowish or cream externally and white or creamy internally at anthesis, completely open, marcescent after anthesis, 10–20 × 6–10 cm, up to 2 cm longer than the spadix; spadix white or cream (both during development and at anthesis), 9.0–10.5 cm long, 1.8–2.5 cm diam., 4.1–4.2× longer than wide; **basal sterile flowers** 4–6 mm long, with an orange stigmatic secretion; **fertile flowers** 5–9 mm long; stamens 2.0–6.5 mm long, with laminar filaments; anthers 1.3–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 3–4 × 1.5–2.5 mm; style hexagonal and strongly conical, distally cylindrical, 2–5 × 2–3 mm; stigma circular, with an orange stigmatic secretion; **berries** with a light or dark green stylar cap during development, mature stylar cap cream-yellowish; pulp unknown; **seeds** unknown.

Distribution and ecology:—*Monstera donosoensis* is endemic to Panama, knowm from Coclé, Colón, Veraguas, Guna Yale, Panamá Oeste and Panamá, at elevations of 100–1600 m, in *Premontane rainforest* life zones.

Phenology:—Flowering in September to November. Fruiting occurs mostly February, September to November.

Discussion:—The species is a member of sect. *Monstera* and is characterized by its thick stems with moderately short internodes, long, nearly fully sheathed petioles, with the sheath deciduous or slightly persistent, and moderately coriaceous, dark brown-drying, usually sparsely perforate, ovate-elliptic, and weakly acuminate leaf blades, inequilaterally subrounded to acute at base, with the primary lateral veins heavily aggregated near base and the perforations (when present) large and few, mostly beginning near the midrib, as well as by its long-pedunculate inflorescences with the spathe greenish, cream-colored within, and the spadix about 2/3 as long as the spathe, and especially by its flowers with a protruding, hexagonal, strongly conical and distally cylindrical style.

Monstera donosoensis is similar to *M. dissecta* (Schott) Croat & Grayum (1987), but differs in having petioles speckled with white dots, with the sheath deciduous or slightly persistent, coriaceous leaf blades, and flowers with a hexagonal, strongly conical, and distally cylindrical style. *Monstera donosoensis* has similar characteristics to the South American *M. adansonii* Schott subsp. *klotzschiana* (Schott) Mayo & Andrade (2013), but the latter differs in having dark green, less frequently mottled petioles with the sheath persistent and slightly coriaceous leaf-blades.

Additional specimens examined:—PANAMA. **Coclé:** Road to Coclesito. Logging camp 12 miles from Llano Grande, 200 m, *W. Churchill et al. 3984* (MO!); Along road past Furlong’s Finca, due N of Cerro Pilón, 880 m, *T.B. Croat 37573* (MO!); On Atlantic slope near the Continental Divide along lumbering road N of El Cope, 9.4 km above

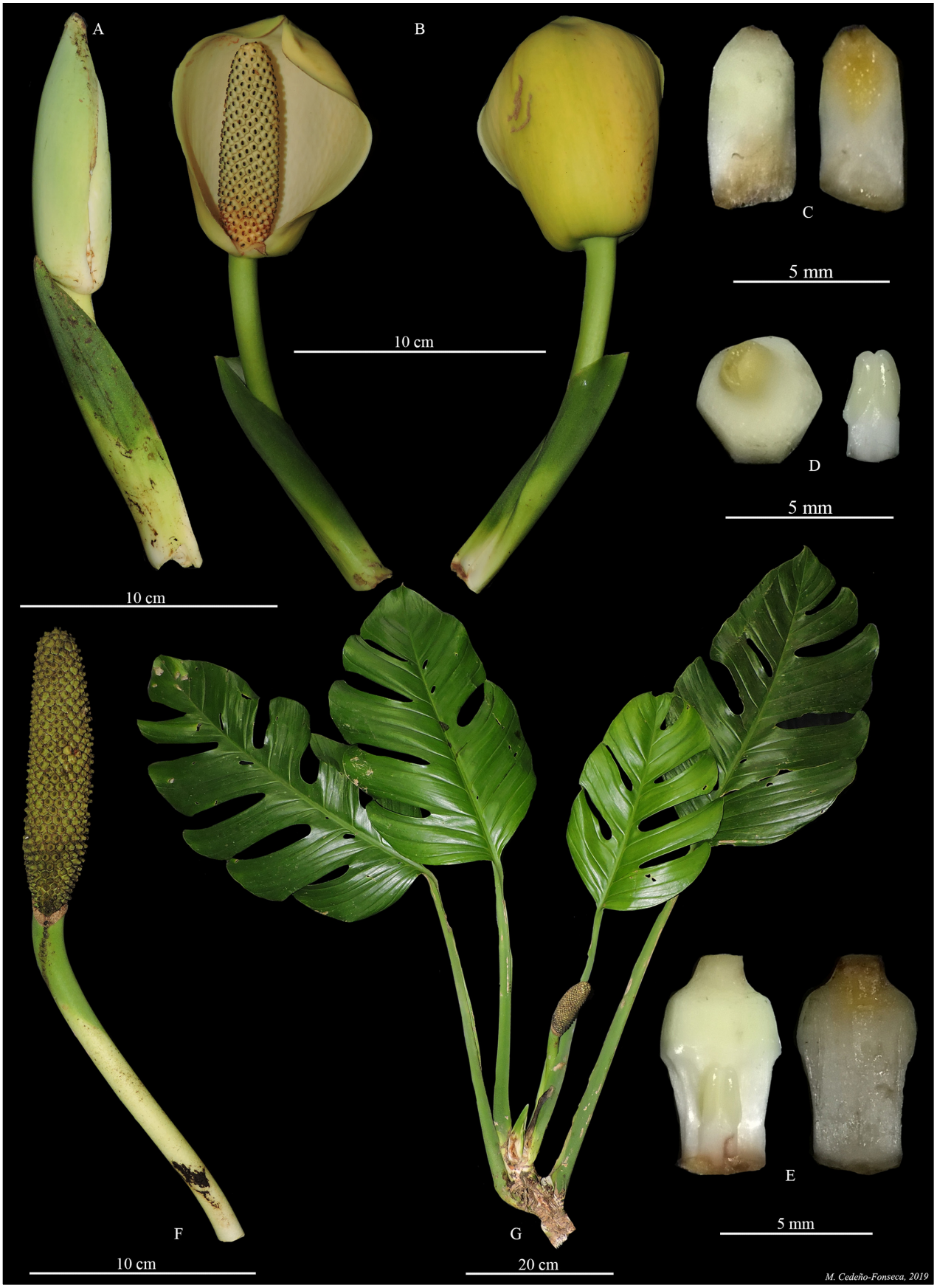

FIGURE 26. *Monstera donosoensis* from Colón, Panama. (A) Developing inflorescence. (B) Front and back views of open inflorescence. (C) Sterile flower; in lateral view (left) and longitudinal section (right). (D) Stylar plate with stigma (left), and individual stamen (right). (E) Fertile flower; in lateral view (left) and longitudinal section (right). (F) Immature infructescence. (G) Adult plant. Image from Cedeño-Fonseca *et al.* (2020b).



FIGURE 27. *Monstera donosoensis*. Adult plant growing 2 m above the ground in a tree in Santa Fe, Panama. Photo by M. Cedeño-Fonseca. (Not collected).

El Cope (2.2 km N of lumber sawmill), 750–900 m, *T.B. Croat 44750* (MO!); Near continental divide along lumber road 5.2 mi N of El Cope, 1.5 mi N of lumber camp. Cloud forest on steep slopes, 900 m, *T.B. Croat 44574* (MO!); North of El Copé, 500 m, *G. D'Arcy 11294* (MO!); Foot of Cerro Pilón, above El Valle de Antón, Rain forest, 2000 ft, D.M. *Porter et al. 4431* (MO!); Trail between the Río Blanco and the Continental Divide north of El Cope and El Petroso sawmill, 400–1700 ft, *K.J. Sytsma et al. 2605* (MO!); North rim of El Valle de Antón, near Cerro Turega, 650–700 m, *R.E. Woodson & R.W. Schery 185* (MO!); **Colón:** Santa Rita Ridge Road, 4–6 km from Transisthmian Highway. Disturbed primary forest, 150–200 m, *T. Croat 34281* (MO!); Santa Rita Arriba, Bosque secundario, orillas de la carretera, 380 m, *O. Ortiz et al. 3452* (MO!, PMA!); **Darien:** Cerro Tacarcuna massif west ridge, vicinity of summit camp, lower montane wet forest, 1500–1600 m, *A. Gentry & S. Mori 14161* (MO!); **Panamá:** Chepo, El Llano–Cartí Road, 7–12 km from Interamerican Highway, 360–400 m, *T. Croat 25155* (MO!); Capira, Cerro Campana, along trail to Summit, 780–875 m, *Croat 25194A* (MO!); Capira, Cerro Campana, along trail to summit, 780–875 m, *T. Croat 25244* (MO!); Cerro Jefe, 21 km above Pan-Am Highway, 600 m, *T. Croat 35890* (MO!); Capira, Middle slopes of Cerro Campana, ca. 1 mile from Interamerican Highway, 150 m, *T. Croat 35990* (MO!); Chepo, Road from El Llano to Cartí, 8.7 km N of the Panamerican Highway, 200–300 m, *J. Folsom & G. Small 6162* (MO!); Near top of Cerro Jefe to 1 mile beyond, 900–1000 m, *A. Gentry 3499* (MO!); Cerro Jefe, in forest alongside road north off of road to tower, 820 m, *B.E. Hammel & G. McPherson 14534* (MO!); Chepo, Along newly cut road from El Llano to Carti-Tupile; 12 miles above Pan-Am Highway, Primary forest, 200–500 m, *R. Liesner 693* (MO!); Capira, Summit of Cerro Campana, Rain forest, 3220 ft, *D. Porter 4951* (MO!); El Llano-Cartí Road, tropical moist forest, 12 km from Pan American Hwy, 1000 ft, *K.J. Sytsma 1745* (MO!); Chepo, 16–18 km from Interamerican Highway on the El Llano-Cartí Road, 400 m, *E.L. Tyson & M.H. Nee 7356* (MO!); **San Blas:** El Llano-Cartí Road, 350 m, *de G. Nevers & G. Herrera 4356* (MO!); **Veraguas:** Santa Fe, 5 miles W of Santa Fé on road past Escuela Agricola Alto Piedra on Pacific

side of divide, 800–1200 m, *T.B. Croat 23053* (MO!); 2/10 mile beyond fork in road at Escuela Agricola Alto Piedra on road to Rio Calovebora, 750 m, *T.B. Croat & J. Folsom 33969* (MO!); "Cerro Tute" ridge up from former Escuela Agrícola, Santa Fé, moist forest, 800–1000 m, *W. Hamilton & R. Dressler 3042* (MO!); Santa Fe, Along steep trail to summit of Cerro Tute, ca. 3 km above Escuela Agricultura Alto Piedra near Santa Fé, 3000–3100 ft, *K.J. Sytsma & T. Antonio 3058* (MO!). Coclé: Near sawmill 16.7 km N of turnoff to Coclesito from Llano Grande, 700 ft, *B.E. Hammel 1836* (MO!).

15. ***Monstera dubia*** (Kunth) Engl. & K.Krause, *Pflanzenr.* IV.23B (Heft 37): 117. 1908. ≡ *Marcgravia dubia* Kunth, *Nov. Gen. Sp.* 7: 169 [folio], 217 [quarto]. 1825. (Figs. 28, 29)

Type:—Novae Andalusiae [VENEZUELA. Sucre or Monagas], prope Cocollar et cœnobium Caripense [near Cocollar (Sucre) and Caripe monastery (Monagas)], alt. 400 hex. [≡ fathoms, i.e. ca. 730 m], [1799], *A. von Humboldt & A. Bonpland s.n.* (lectotype P-P00679587!, designated by Cedeño-Fonseca *et al.* (2022)).

Robust nomadic vine, with appressed-climbing habit at first, then sometimes with the mature shoots free and pendent. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** light brown or beige, warty, dorsoventrally compressed; **internodes** 3–5 cm long, 5–8 mm diam.; **petiole** inconspicuous, dark green, smooth, 6–10 mm long; **blades** obovate, cordate at base, acuminate, coriaceous, 10–18 × 6–10 cm, sometimes variegated, completely appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** yellowish or beige, with abundant pustules that generate a warty surface, cylindrical or dorsoventrally compressed; **internodes** 2–6 cm long, 1.0–3.5 cm diam., 1.7–2.0 times longer than wide; **cataphylls** slightly deciduous; **anchor roots** light brown; **feeder roots** beige, warty; **petiole** light green, white-dotted, striated and pustulate at base, warty, 30–55 cm long, fully sheathed or up to 3 cm long; **petiole sheath** deciduous; geniculum smooth, slightly terete, 2–5 cm long; **blades** ovate to elliptic or oblong, widely cuneate to rounded or truncate at base, sometimes peltate, obtuse to long-acuminate at apex, subcoriaceous or chartaceous, drying greenish-gray, brownish or yellowish, 55–100 × 30–35 cm, 1.6–2.1 times longer than wide, not decurrent on the geniculum; **midrib** flattened adaxially, convex abaxially, drying yellowish or dark brown on both surfaces; **primary lateral veins** 12–25 per side, decurrent on the midrib, bifurcated in the medial part of its length, obscure adaxially, prominent abaxially, departing midrib at 65–75°, drying black or dark brown; **secondary veins** reticulate and prominent; **collective veins** not visible; **fenestrations** absent or present; **margins** entire to pinnatilobed, with 3–6 lobes per side, 1.5–2.5 cm wide where the middle lobes are narrow. INFLORESCENCES on ascending and pendent stems, 1–7 simultaneously at flowering time, subtended by cataphylls which sometimes leave dry fragments on the peduncles; **peduncle** smooth, light green with white dots, 5–10 cm long, 0.7–1.2 cm diam.; **spathe** apically short-acuminate or obtuse, light green during development, pink externally and cream internally at anthesis, coriaceous, completely open at apex, deciduous after anthesis, 8–16 × 7–13 cm, up to 1 cm longer than the spadix; **spadix** white during development, creamy yellow at anthesis, 7–15 cm long, 1.5–3.5 cm diam., 1.5–2.0 times longer than wide; **basal sterile flowers** 3–5 mm long, narrow towards base; **fertile flowers** 4–8 mm long; stamens 1–7 mm long, with laminar filaments; anthers 3–4 mm long; ovary flattened, rectangular in longitudinal section, ribbed, 4–5 × 2–4 mm; style 2–3 × 4–5 mm, compressed and hexagonal; stigmatophore slightly conical, 0.3–0.5 mm long; stigma circular, with a yellowish stigmatic secretion; **berries** with a yellowish green stylar cap during development, mature stylar cap beige-cream; pulp white; **seeds** dark brown with white dots, spherical or oblong, 5–7 mm long.

Distribution and ecology:—From Mexico to Bolivia, Venezuela, French Guiana, Brazil, Trinidad & Tobago, at elevations of 0–450 in *Tropical moist forest* and *Tropical wet forest* life zones; in primary and secondary forest, and open areas.

Phenology:—Flowering registered in January, May, and April. Fruiting in January and April.

Discussion:—The species is a member of sect. *Marcgraviopsis*. It differs from the other species by its smooth and mottled petiole with warts on the base, the deciduous petiolar sheath, the subterete geniculum, the entire or fenestrate leaf blade with the base cordate and sometimes peltate, the primary lateral veins bifurcated at about half their length, inflorescences subtended by deciduous cataphylls in a sympodial series between episodes of monopodial leafy growth, the externally pink spathe and slender flowers with circular stigmas.

Monstera dubia is similar to *M. punctulata*, but the latter has the spathes pale green externally, the petioles verrucate and grooved throughout their length, the leaf blade usually with numerous conspicuous fenestrations between primary lateral veins and grows at elevations above 600 m, while *M. dubia* generally has a less conspicuously fenestrate leaf and grows in the lowlands of the Pacific slope.

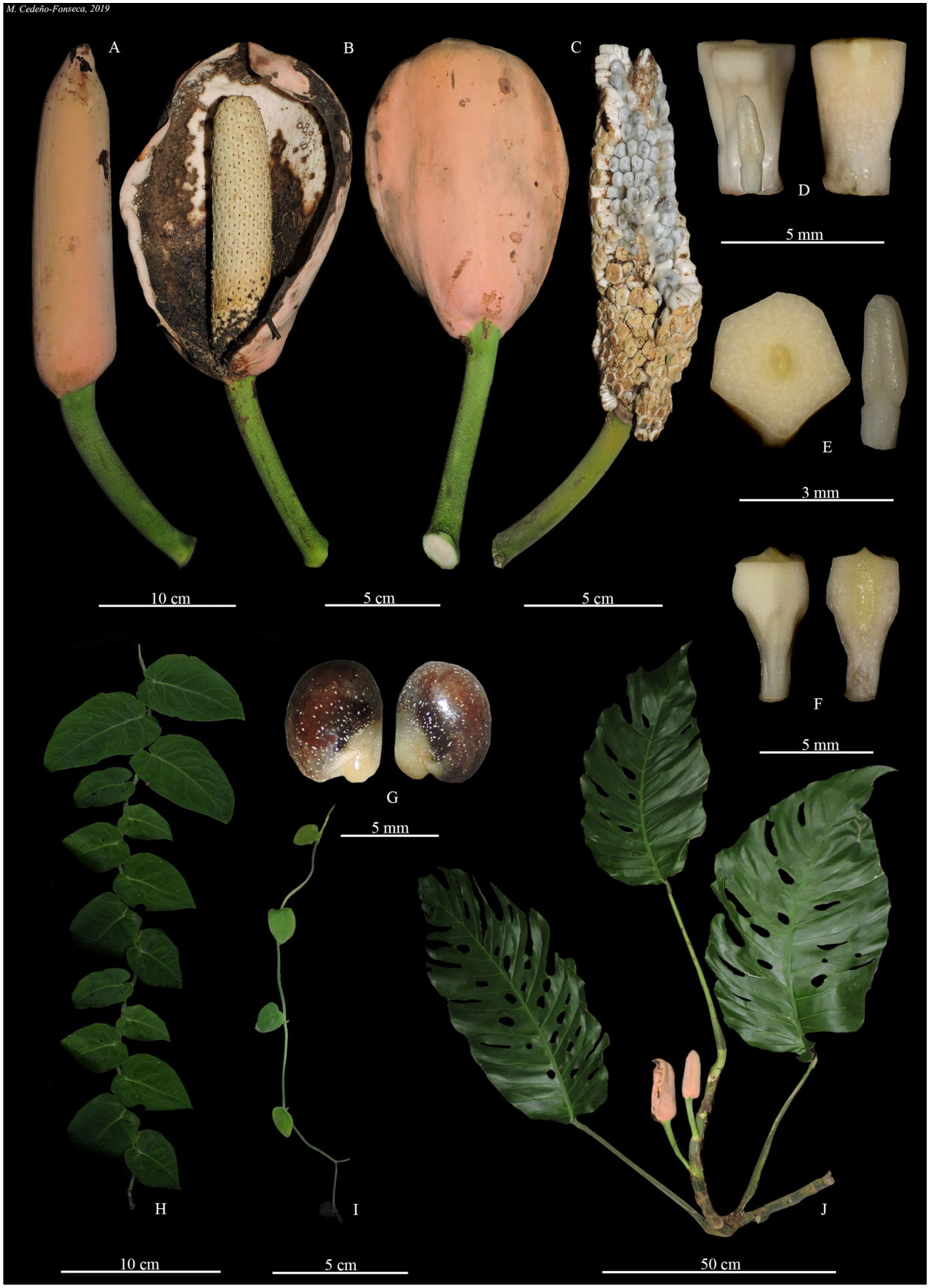

FIGURE 28. *Monstera dubia* from Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detached. (D) Fertile flower; in lateral view (left) and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left) and longitudinal section (right). (G) Seeds. (H) Juvenile plant. (I) Seedling. (J) Portion of adult plant. *M. Cedeño et al. 891* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 29. *Monstera dubia*. Adult plant growing in a tree in Puntarenas, Costa Rica. Photo by M. Cedeño-Fonseca. (Not collected).

For more details about the taxonomic comments and nomenclatural notes see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—MEXICO. **Chiapas:** Acacoyagua. Orillas del río Chicol, al Este de Acacoyagua, 15°22’24”N 092°39’40”W, 125 m, 07 enero 2006, *A. López 175* (HEM, MO); Escuintla. Col. Turquia, 20 km E de Escuintla, 250 m, 05 Jul. 1947, *E. Matuda 20953* (NCU); Esperanza, Escuintla, 15°26’24”N 092°31’12”W, 200 m, 15 Jul. 1948, *E. Matuda 20949* (NCU); La Concordia. Reserva de la Biosfera El Triunfo, Poligono III, Cerro Quetzal, 50 km al Sur de la Colonia Independencia. Bosque mesófilo de montaña, 15°43’N 092°55’W, 2293 m, 1 Jun 2001, *G. López-Hernández 52* (MO!); **Veracruz:** Sayula. Along road under construction, 1 mile W of Sayula de Alemán; ca. 6 mi S of Acayucan, 17°52’12”N 094°57’36”W, 90 m, 03 July 1977, *T.B. Croat 40022* (MO!). GUATEMALA. **San Marcos:** Finca Armenia, vicinity of Rafael de Cuesta, 14°54’36”N 091°53’43”W, 5000 ft, 06 July 1977 – 07 July 1977, *John D. Dwyer 14464* (MO!). HONDURAS. **Olancho:** Campamento. Montaña Los Zapotes 10 km NO de Campamento. Bosque muy húmedo montano bajo, 14°34’31”N 086°43’11”W, 1057 m, 25 Apr 1982, *E.S. López 133* (MO!); **Yoro:** m, *R.L. Liesner 26682* (TEFH!). NICARAGUA. **Atlántico Sur:** Along road between Nueva Guinea and Verdún; Tropical wet forest, 11°40’N 084°27’W, 240 m, 17 Aug. 1983, *J.S. Miller & J.C. Sandino 1107* (MO!); **Boaco:** Cerro Mombachito, 4 km al NO de Camoapa; bosque nublado rodeado por pastizales, 12°24’N 085°33’W, 700–1000 m, 1 feb 1979, *A.Grijalva & M. Araquistain 80-A* (MO!); **Río San Juan:** Reserva Indio-Maiz, Municipio de San Juan del Norte, Río Indio, Cerro Canta Gallo, 11°04’N 083°51’W, 150–200 m, 15 septiembre 1998, *R.M. Rueda et al. 8595* (HULE). COSTA RICA. **Puntarenas:** Forest along Río Paquita, 2 m, 13 August 1936, (Infer.), *C. Dodge & V. Goerger 9764* (CR!, MO!); Garabito, Tárcoles, P.N. Carara, Along N fork (known locally as ”Quebrada Mona”) of Quebrada Bonita, 35 m, 31 August 1985, (Fr.), *M.H. Grayum et al. 5962* (CR!, MO!); Golfito, Puerto Jiménez, Along road between Rincón and Puerto Jiménez, 15 km S of Rincón, disturbed areas along road, 30 m, 4 March 1985, (Fr.), *T.B. Croat & M.H. Grayum 59797* (CR!, MO!); Along road between El Valle de Madraño and La Saena, 2.5 mi N of El Valle de Madroño, 3.5 mi N of turn-off To San José, 11, 6 mi N of Las Margaritas, (vicinity of Chepe, in valley of Río Mamoní, 180 m, 22 July 1994, (Fl., Fr.), *T.B. Croat & G. Zhu 77052* (CR!); Golfito, Jiménez, Colecta en bosque junto al río Rincón, camino a la estación Los Patos, 70 m, 16 May 2000, (Fl.), *L. Acosta 1197* (CR!); Osa, Sierpe, Along road between Rincon and Boscosa, 2 Km W of bridge over Rio Rincon, 50 m, 11 September 1996, (Infer.), *T.B. Croat 79252* (CR!, MO!); Golfito, Golfito, Seccion Esquinas, orilla Quebrada Arenas Bosque Esquinas, 100 m, 15 April 1994, (Fl., Fr.), *J. Quesada 886* (CR!, MO!); 1 mile south of Rio Claro near C.R -Panama Border, 11 August 1971, (Fr.), *J. Vaughan 621* (MO!); Golfito, Serranias de Golfito, Est. Río Bonito, 450 m, 5 October 1996, (Infer.), *E. Fletes 352* (MO!); Golfito, Along Interamerican Highway beside Río Grande, 8 February 1978, (Fr.), *T.B. Croat 32951* (MO!), Parrita, 20 Abril 1985, (Infer.), *E. Valerio 132* (USJ!); Parrita, 10 m, 20 Noviembre 2001, (Fl.), *C. Morales 1497* (USJ!); Golfito, Puerto Jiménez, Camino a la Estación Biológica Piro, 15 m, 28 Mayo 2016, (Infrl., Fr.), *M. Cedeño, et al. 891* (USJ!); Golfito, Puerto Jiménez, Camino a la Estación Biológica Piro, 15 m, 10 May 2016, (Fr.), *M. Cedeño et al. 950* (USJ!); Golfito, Golfito, La Gamba, Río Bonito, 80 m, 28 Octubre 2017, (Fr.), *M. Cedeño et al. 1134* (USJ!); Along road from San Vito (Las Cruces) to Ciudad Neily, 2 July 1984, (Fl.), *M. Grayum 3394* (MO!). PANAMA. Le Clezio, Jan 1969, *Narciso Bristan 63* (MO!); **Canal Area:** Barro Colorado Island. James Zetek Trail, 09°09’31”N 079°52’05”W, 10–100 m, 6 Jul 1931, *D.E. Starry 37* (MO!); Barro Colorado Island. William Morton Wheeler Trail, 09°09’20”N 079°51’10”W, 10–170 m, Jul 1931, *D.E. Starry 110* (MO!); 12 mi s Colon on Rio Providencia, 09°12’54”N 079°58’14”W, 5–140 m, 16 May 1966, *E.L. Tyson & K.E. Blum 4004* (MO!); Flora of Barro Colorado Island. Gatun Lake, Panama Canal, 09°09’N 079°51’W, 10–100 m, 12 Mar 1934, *J.R. Smith 10* (MO!); Barro Colorado Island, Snyder Molino Trail, 09°09’30”N 079°50’20”W, 10–100 m, 11 Jun 1960, *J.E. Ebinger 15* (MO!); Barro Colorado Island, 09°09’N 079°51’W, 10–100 m, 1931, *S. Aviles 90* (MO!); Barro Colorado Island, 09°09’N 079°51’W, 10–100 m, 1931, *S. Aviles 38* (MO!); Barro Colorado Island. Snyder-Molino Trail, 09°09’30”N 079°50’20”W, 10–150 m, 21 Sep 1968, *T.B. Croat 6254* (MO!); Barro Colorado Island. James Zetek Trail, 09°09’31”N 079°52’05”W, 10–100 m, 22 Dec 1970, *T.B. Croat 12862* (MO!); Barro Colorado Island. William Morton Wheeler Trail, 09°09’20”N 079°51’10”W, 10–100 m, 11 May 1968, *T.B. Croat 5476* (MO!); Barro Colorado Island. Barbour-Lathrop Trail, 09°09’30”N 079°49’25”W, 10–100 m, 29 Sep 1968, *T.B. Croat 6551* (MO!); Barro Colorado Island. William Morton Wheeler Trail, 09°09’20”N 079°51’10”W, 10–170 m, 7 Aug 1970, *T.B. Croat 11782* (MO!); Barro Colorado Island. James Zetek Trail, 09°09’31”N 079°52’05”W, 10–100 m, 15 Jun 1970, *T.B. Croat 10877* (MO!); Barro Colorado Island, Allison Armour Trail, 09°09’10”N 079°51’30”W, 10–100 m, 26 Aug 1970, *T.B. Croat 11919* (MO!); Barro Colorado Island. James Zetek Trail, 09°09’31”N 079°52’05”W, 10–100 m, 29 Jul 1970, *T.B. Croat 11654* (MO!); Barro Colorado Island. Along hogback ridge S of Fuertes Cove-Pearson Peninsula, 09°10’07”N 079°51’31”W, 0–20 m, 24 Feb 1969, *T.B. Croat 8148* (MO!); Barro Colorado Island: Thomas Barbour Trail, 09°09’30”N 079°49’20”W, 10–100 m, 3 Apr 1970, *T.B. Croat 9306* (MO!); Barro Colorado Island. Lutz Trail, 09°09’49”N 079°50’17”W, 0–50 m, 20 Aug 1968, *T.B. Croat 5945* (MO!); Barro Colorado Island. Peña Blanca Peninsula,

09°10’10”N 079°52’15”W, 0–10 m, 4 May 1968, *T.B. Croat 5338* (MO!); **Chiriquí:** Along road from Puerto Armuelles to San Bartolo Limite, 7 miles west of Puerto Armuelles, 08°16’N 082°56’W, 120 m, 19 May 1976, *T.B. Croat 35040* (MO!); 1.6 m W of Puerto Armuelles, 08°15’54”N 082°52’54”W, 50 m, 18 February 1973, *T.B. Croat 21918* (MO!); **Coclé:** Quebrada Nicaragua, 08°52’50”N 080°24’24”W, 25 m, 10 Nov 2001, *J.A. Mendieta 18–48* (PAN); Tavidal Abajo, 08°40’52”N 080°10’59”W, 260 m, 23 Agosto 2001 – 24 Agosto 2001, *J.A. Mendieta M. 14–76* (MO!); **Colón:** Río Guanche; ca. 5 km upstream from road to Portobelo. In forest and along slopes near river, 09°30’N 079°40’W, 50 m, 15 Mar 1986, *B.E. Hammel & J. Trainer 14798* (MO!); Thickets and pasture. Along Río Viejo, between the Portobelo road and Quebrada Ruíz, 4 km NE of Puerto Pilón, 09°23’30”N 079°46’30”W, 5 m, 29 September 1973, *M.H. Nee 7187* (MO!); Between Nuevo Tonosí and Río Indio on road from Portobelo and Nombre de Dios. Elevation near sea level, 09°33’N 079°33’W - 09°34’N 079°37’W, 0–5 m, 22 March 1976, *T.B. Croat 33550* (MO!); Between Portobelo and María Chiquita, 09°26’N 079°39’W - 09°33’N 079°45’W, 22 Mar 1976, *T.B. Croat 33581* (MO!); Along Río Guanché, 3–5 km above bridge on Colón-Portobello Road. [Coordinates on original label: 09º30’N, 79º30’W], 09°30’N 079°39’W, 30–100 m, 22 September 1996, *T.B. Croat 79326* (MO!); **Darién:** Cerro Tacarcuna Expedition. South slope of Cerro Tacarcuna; trail from Río Pucuro base camp to westernmost peak. Premontane wet forest, 08°10’N 077°20’W, 1300 m, 30 Jan 1975, *A.H. Gentry & S.A. Mori 14012* (MO!); Parque Nacional del Darién, ridge between Río Topalisa and Río Pucuro, ca. 17 km E of Pucuro; Mi Casita to La Laguna. Primary forest with Jessenia, Socratea, Wettenia, Oenocarpus, 08°03’30”N 077°17’00”W, 600–850 m, 15 Oct 1987, *B.E. Hammel et al. 16227* (MO!); Western [eastern] slope of Serranía de Pirre, below Cana mine, along old road to Boca de Cupa, 07°45’N 077°40’W, 500 m, 06 March 1988, *G. McPherson 12273* (MO!); Parque Nacional Darién. Área alrededor del Campamento de Cana, *J.A. Polanco 3062* (MO!); Parque Nacional Darién. Cerro Pirre. Rancho Frio, cerca de la estación de la antigua ANAM, 08°01’16”N 077°44’04”W, 103 m, 17 April 2016, *O. Ortiz & T. Contreras 2592* (MO!, PMA!); Vicinity of Yaviza, along Río Chucunaque; along interam. hwy. between Pinogana & Yaviza, 1 km from Tuira, 08°09’30”N 077°41’00”W, 6 Jun 1959, *W.L. Stern et al. 133* (MO!); Chepigana. PN Darien, Rancho Frio, Estacion de MIAMBIENTE, a orillas del rio Perresenico, 08°00’42”N 077°26’07”W, 109 m, 05 noviembre 2015, *J. Batista 1477* (MO!, PMA!); **Panamá:** Along road between El Valle de Madraño and La Saena, 2.5 mi N of El Valle de Madroño, 3.5 mi N of turn-off To San José, 11.6 mi N of Las Margaritas, (vicinity of Chepo, in valley of Río Mamoní), 09°14’25”N 079°05’00”W, 180 m, 22 July 1994, *T.B. Croat & G. Hua Zhu 77052* (CR!, MO!, NY!); Capira. Middle slopes of Cerro Campana, ca. 1 mile from Interamerican Highway, 08°43’09”N 079°53’25”W, 150 m, 15 June 1976, *T.B. Croat 35987* (MO!); Chepo. Rio Majé, above first waterfall on steep wooded slopes of narrow valleys, tropical moist forest, 09°06’21”N 078°45’36”W, 50 m, 20 Apr 1976, *T.B. Croat 34434* (MO!); Rio Majé, along river from waterfalls near Bayano Lake to Finca of Choco Indian Eduardo Maycha, ca. 2 miles upstream, 09°06’21”N 078°45’36”W, 30–60 m, 04 May 1976, *T.B. Croat 34603* (MO!); Along Río Maje, ca. 4–5 miles above waterfalls near new Bayano Lake, 09°06’21”N 078°45’36”W, 100 m, 05 May 1976, *T.B. Croat 34725* (MO!); El Llano-Cartí Road, 5–6 miles N of Interamerican Highway at El Llano, 09°15’30”N 078°55’50”W, 350–375 m, 7 May 1976, *T.B. Croat 34772* (MO!); **San Blas:** Cangandí, swampy flat below village and toward Mandinga. [Coordinates on original label: 9°24’N, 79°24’W.], 09°27’30”N 079°07’00”W, 10 m, 05 April 1986, *G. de Nevers et al. 7707* (MO!).

16. ***Monstera egregia*** Schott, *Journal of Botany, British and Foreign* 2: 53–54. 1864. (Figs. 30, 31)

Type:—Mexico (v.v. cult.!) [cultivated plant]. **Neotype (designated here):** Mexico, Veracruz, 8 km. south of Misantla, Lauraceae Forest, 750 m., 26 Dec 1971, *M. Madison 597* (GH! two sheets: 02286762 and 02286700).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** dark green with white dots, smooth, cylindrical; **internodes** 3–8 cm long, 4–7 mm diam.; **petiole** distinct, light green, smooth, 6–15 cm long, sheathed to base of the geniculum; **petiole sheath** persistent and distally involute; **blades** lanceolate, attenuate to truncate at base, acuminate, subcoriaceous, 8–15 × 5–12 cm, not appressed to the phorophyte; **fenestrations** absent or present. ADULT PLANTS: root climbers; **stems** dark green or light brown, smooth, cylindrical; **internodes** 0.3–5.0 cm long, 1.5–5.5 cm diam., 0.2–0.9 times as long as wide; **anchor roots** light brown; **feeder roots** black; **petioles** light green with white dots or white punctations, smooth, 45.0–66.5 cm long, sheathed to base of the lamina, less frequently to base of the geniculum; **petiole sheath** persistent, distally open; geniculum 2.0–3.5 cm long; **blades** ovate, unequal and rounded at base, short-acuminate at apex, subcoriaceous, drying dark brown to blackened above, paler and yellow-brown to dark brown below, 40–76 × 18.5–32.0 cm, 1.9–2.4 times longer than wide, not decurrent on the geniculum; **midrib** ribbed adaxially, convex abaxially, drying black or yellowish on both surfaces, **primary lateral veins** 12–24 per side, strongly sunken adaxially, prominent

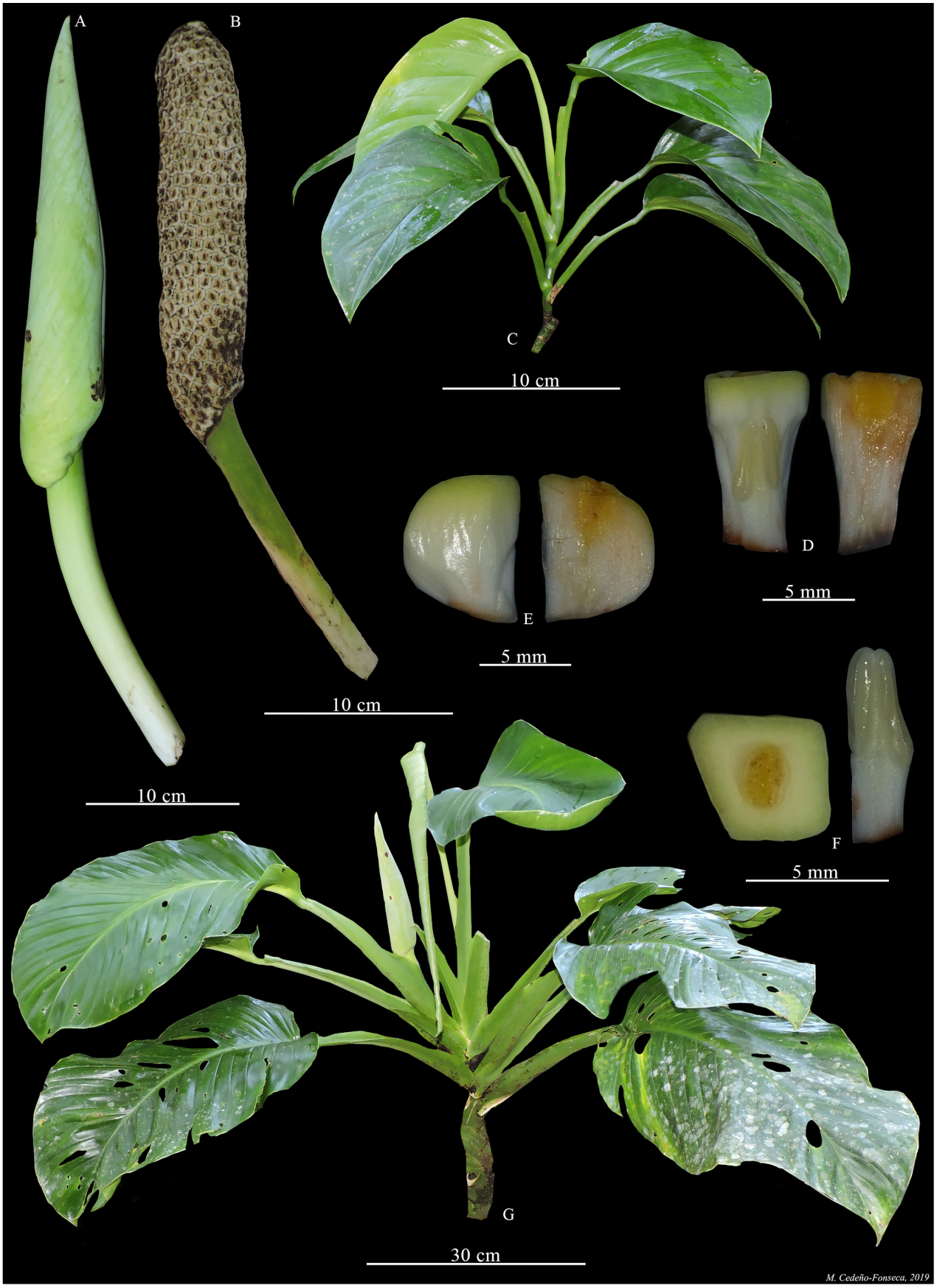

FIGURE 30. *Monstera egregia* from Veracruz, Mexico. (A) Developing inflorescence. (B) Immature infructescence. (C) Portion of juvenile plant. (D) Fertile flower; in lateral view (left) and longitudinal section (right). (E) Sterile flower; in lateral view (left) and longitudinal section (right). (F) Stylar plate with stigma (left) and one stamen (right). (G) Portion of adult plant. *P. Diaz-Jiménez et al.* 1457C (HEM).



FIGURE 31. *Monstera egregia*. Adult plant growing 7 m above the ground in a tree in Veracruz, Mexico. *P. Diaz-Jiménez et al. 1457C* (HEM!). Photo by M. Cedeño-Fonseca.

abaxially, departing midrib at 40–60°, drying generally darker, sometimes paler; **secondary veins** moderately parallel and indistinct, **collective veins** not visible; **fenestrations** absent or present, ellipsoid when present; **margins** entire. INFLORESCENCES on ascending stems, 1 or 2 simultaneously at flowering time, arranged in the leaf axils; **peduncle** smooth, 22–25 cm long; **spathe** long-acuminate, light green during development, creamy-yellow externally and white internally at anthesis, deciduous after anthesis, 14–20 × 7–13 cm, up to 5 cm longer than spadix; **spadix** white (during development and at anthesis), (11)15–20 cm long, 3.0–4.5 cm diam., 5.1 times longer than wide; **basal sterile flowers** 4–6 mm long, with a reddish-brown stigmatic secretion; **fertile flowers** 5–7 mm long; stamens 2–8 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 2.5–3.5 × 1.0–1.5 mm; style hexagonal, 3–4 × 3–4 mm; stigmatophore slightly columnar and sunken on style, 0.3–0.5 mm long; stigma linear, with a reddish-brown stigmatic secretion; **berries** with a white stylar cap during development, mature stylar cap creamy; pulp white; **seeds** 11–15 mm long.

Distribution and ecology:—*Monstera egregia* is known from Mexico (ranging from Veracruz to Oaxaca, Tabasco) and Belize, (Toledo) at 100–1500 m, in *Tropical moist forest* and *Premontane wet forest* life zones.

Phenology:—Flowering registered January to May and October-November. Fruiting in January to March, June, July, August, October and November.

Discussion:—The species, a member of sect. *Monstera*, is recognized by its fully sheathed densely speckled petioles, large entire and non-perforate to markedly perforate leaves with the perforations with mostly a single row on each side, 12–24 primary lateral veins per side, with 2–4 of these aggregated within 2 cm of the base as well as

by the long-pedunculate inflorescence (22–25 cm long) and by having the margins of the style prominently raised on drying.

Monstera egregia was confused with *M. standleyana* but that species is restricted to Nicaragua, Costa Rica and Panama, and differs by its light green and mottled petioles (vs. dark green petioles with slightly wavy wings), fenestrated leaves (vs. usually without fenestrations), stigmatophore slightly columnar and sunken on style (vs. stigmatophore columnar) and stigma linear (vs. stigma circular).

Nomenclatural remarks:—In the original protologue of *M. egregia*, Schott (1864) included the description and some information on the original locality of the species, which he cited as follows: "Mexico (v.v. cult.!)." This suggests that the species was described using a cultivated plant which came from Mexico.

Engler & Krause (1908), in their revision of the Monsteroideae, cited *M. egregia* (as a synonym of *M. karwinskyi*) and referring H. W. Schott's Icones Aroideae et Reliquiae (Schott 1984). Madison (1977), in his revision of *Monstera*, argued that illustrations No. 2238 and 2239 in Schott (1984) could represent the type material of *M. egregia*.

We only managed to have access to illustration No. 2238 which includes three color drawings: (top left) the base of the leaf blade and the upper part of the petiole; (in the middle) the lower surface of the leaf blade and part of petiole; (bottom right) the adaxial part of a portion of the petiole. There is also a fourth pencil drawing (probably made later by Schott?) of the cross section of the petiole. Additionally, in the lower right part of the illustration there are two names annotated by Schott himself (*M. karwinskyi* and *M. egregia*), where traces of erased pencil writings can be observed, as well as pen annotations that overwrite both erased and penciled remnants. Based on our observations, we concluded that the following may have occurred: (1) the author initially thought with some doubt that this plant was *M. karwinskyi*, so he made a pencil annotation as "*Monstera karwinskyi*?"; (2) subsequently, the author changed his mind and crossed out the first identification and then noted (above the epithet karwinskyi) "*egregia*";(3) finally, the author changed his judgment again back to *M. karwinskyi*, so he decided to overwrite the annotations made in pencil and wrote "*karwinskyi*" in ink.

After deeply examining the morphological characteristics of illustration No. 2238, we concluded that it matches perfectly with the characters included in the original protologue of *M. egregia* and not with those of *M. karwinskyi*. It could be that the illustration No. 2238 fit flawlessly with the original description contained in the protologue of *M. egregia*; however, since the illustrations lack significant information, such as dates, it cannot be certain that Schott used it when described the species, so the illustration No. 2238 could not be considered as a holotype or lectotype (see Coelho & Mayo 2007). We tried to trace some original material in the visited/reviewed herbaria, however, we did not have any success. This could be due to the fact that the plant was described when alive and an herbarium specimen was never made. No material of this species was listed by Riedl & Riedl-Dorn (1988) as having been destroyed. Due to the absence of an original material, we designate the specimen *M. Madison 597* (GH, two sheets: 02286762 and 02286700) as neotype.

Additional specimens examined:—MEXICO. **Chiapas:** Escuintla. About 8.5 miles NE of Escuintla on gravel road to El Triunfo, 15°20'52"N 092°34'05"W, 250 m, 21 Aug 1977, *T.B. Croat 43828* (MO!); Palenque. 5 miles SE of Palenque, on road to Chancala, Ocosingo and San Cristóbal de las Casas, 17°28'12"N 091°57'36"W, 200 m, 4 Jul 1977, *T.B. Croat 40139* (MO!); **Guerrero:** San Luis Acatlán. Vicinity of Yoloxochitl, 2.4 E (airline KM), Arroyo que conduce Paraje El Ruidoso, 16°48'36"N 098°42'26"W, 460 m, 24 October 2017, *T.B. Croat 107052* (CUVC, MO); **Oaxaca:** [Mun. San Juan Bautista Valle Nacional]. 4.5 mi S of Valle Nacional, on steep hills above Highway 175 between Tuxtepec and Oaxaca, 17°43'48"N 096°19'12"W, 430 m, 29 Jun 1977, *T.B. Croat 39736* (MO!); [Mun. San Juan Bautista Valle Nacional]. One-half mile S of Valle Nacional, on steep hills over Highway 175 between Tuxtepec and Oaxaca, 17°46'12"N 096°18'00"W, 120 m, 29 Jun 1977, *T.B. Croat 39705* (MO!); Uxpanapa Region, along gravel road from Esmeralda (17 km E of Sarabia) to Río Verde, 1.1 mi S of Esmeralda. Edge of pasture and in forest on karst limestone formation on steep slopes with cliffs. Veg. type: "selva alta perennifolia", 100 m, 18 Jan 1987, *T.B. Croat & D.P. Hannon 63209* (G, MO, RSA, W); Along Hwy 175 between Tuxtepec and Oaxaca, 13 km S of bridge over Río San Juan Bautista at Valle Nacional, 17°43'05"N 096°18'35"W, 747 m, 3 Mar 2008, *T.B. Croat & P. Díaz-Jiménez 100176* (MO!); Tuxtepec. Mun. San Juan Bautista Valle Nacional. Along Highway 175 through Sierra de Juarez between Tuxtepec and Oaxaca, 1.49 miles S of bridge at Valle Nacional, 17°39'36"N 096°19'48"W, 1400 m, 19 February 1979, *T.B. Croat 48005* (MO!); Mun. San Juan Bautista Valle Nacional. Along Highway 175 through Sierra de Juárez between Tuxtepec and Oaxaca, 18.4 mi S of bridge at Valle Nacional at ca. km 140, 17°37'48"N 096°20'24"W, 1500 m, 19 February 1979, *T.B. Croat 48069* (MO!); Mun. San Juan Bautista Valle Nacional. Along Highway 175 through Sierra de Juarez between Tuxtepec and Oaxaca, 1.49 miles S of bridge at Valle Nacional, 17°39'36"N 096°19'48"W, 1400 m, 19 February 1979, *T.B. Croat 47987A* (MO!); **Puebla:** Zacapoaxtla, San Juan Tahitic. A 20 minutos de la finca, caminando en la verde que va para Huaxkouta, 19°56'44"N 097°32'08"W, 1263 m, 22 January 2015, *C. Ledesma & A.S. Hernández 20586* (MO!); Cuauhtémoc. En un sitio llamado La Curva, a 15

minutos del cen de Cuauhtémoc, 20°03’30”N 097°25’38”W, 226 m, 19 November 2015, *M. Jiménez & M. Gorostiza 31070* (MO!); Cuetzalan del Progreso. San Miguel Tzinacapan Village on path SW from San Miguel Tzinacapan, ca. 2.25 km toward Masa: owatah and Ista:ka:t, vicinity of campsite, 20°00’57”N 097°33’23”W, 700 m, 04 November 2017, *T.B. Croat 107317* (MO!); Hueyapan. Saliendo de Nexpan tomando la carretera a Tezuitlan pasando el entronque a Las Gardenias, un pueblo pequeño y siguiendo la carretera hasta una brecha. El lugar se Llama Kwechko. A 15 o 20 minutos de Nexpan por toda la carretera, 19°56’02”N 097°23’20”W, 1248 m, 08 March 2016, *J.D. Amith et al. 82019* (MO!); Zacapoaxtla. San Juan Tahitic Village, trail to Zapotepic, locality Hueyaktepet, next to Arroya de Huaxkonta, 19°57’01”N 097°31’52”W, 1165 m, 02 November 2017, *T.B. Croat 107306* (MO!); Zongozotla. Ca. 6 km from center of town on road to Santa Elena, 19°58’05”N 097°44’04”W - 19°58’44”N 097°44’11”W, 1090–1079 m, 05 November 2017, *T.B. Croat 107406* (MO!, PMA!); **Tabasco:** Tacotalpa. R/a Madrigal 5ta, Sierra el Madrigal, 17°30’20”N 092°49’55”W, 200 m, 23 March 2009, *P. Díaz-Jiménez & A.M. de la Cruz 727* (MO!); Teapa. Muy cerca del municipio de Teapa del estado de Tabasco. Chiapas, 17°28’07”N 092°51’15”W, 720 m, 20 July 2009, *P. Díaz-Jiménez & A.M. de la Cruz 839* (MO!); **Veracruz:** Veracruz: San Andrés Tuxtla, camino al ejido Ruiz Cortínez, 18°31’19”N 095°09’01”W, 1171 m, 06 March 2020, *P. Díaz Jiménez et al. 1457C* (HEM!); Jardin Botanico de la Ebiolotu, 18°28’12”N 094°58’48”W, 17 enero 1972, *A. Lot 1728* (MEXU!, MO!); Along road from San Andres Tuxtla to Ruiz Cortinez, 12 km above turn-off in San Andrez Tuxtla, 18°31’20”N 095°08’53”W, 1136 m, 06 March 2008, *T.B. Croat & P. Díaz-Jiménez 100357* (MO!); Alto Lucero. El Guaya-billal al sureste Rancho Nuevo, 19°46’00”N 096°41’00”W, 1900 m, 08 April 1981, *G. Castillo & F. Vazquez 1447* (F); Hidalgotitlán. m, *G. Castillo-Campos 341* (XAL!); Huatusco. ”El Mirador”, 21 km E of Huatusco at Km 45 along Highway to Puente National, 19°12’36”N 096°52’12”W, 1200 m, 23 August 1977, *T.B. Croat 44022* (MO!); Jesús Carranza. Lomas al S de Pob. 2 (+/- 6 km al S de entronque de terracería La Laguna-Sarabia con camino que va al N a Pob. 2) en nuevo camino a Ejido La Paz; lomerío, suelos prof, selva alta perennifolia con *Dialium*, *Terminalia*, *Licania sparsipilis*, *L. hypoleuca*, *Hirtella triandra, Symphonia, Guarea grandifolia, Calophyllum, Sloanea meianthera*, etc., 17°12’N 094°38’W, 200 m, 2 Jul 1987, *T.L. Wendt et al. 5777* (MO!); Las Choapas. m, *E. López 218* (XAL!); Minatitlán. Uspanapas, 14 km E of Campamento La Laguna (Poblado D.S.), 7.5 km N along small road through Rubber Plantation; in forest on limestone crags, 17°18’36”N 094°24’00”W, 150 m, 7 Oct 1986, *B.E. Hammel & M. Merello 15562* (MO!, US!); Misantla. 8 km S of Misantla on road to Xalapa. Liquidambar montane rain forest, 19°52’48”N 096°51’36”W, 750 m, 20 Dec 1971, *M.T. Madison 582* (SEL!); 8 km S of Misantla on road to Xalapa, 19°52’48”N 096°51’36”W, 750 m, 20 Dec 1971, *M.T. Madison 587* (SEL!); Lauracea forest, 8 km S of Misantla on road to Xalapa, 19°52’48”N 096°51’36”W, 21 Dec 1971, *M.T. Madison 591* (SEL!); Lauraceae forest, 8 km S of Misantla, on the road to Xalapa, 19°52’48”N 096°51’36”W, 21 Dec 1971, *Michael T. Madison 590* (SEL!); Pajapan. m, *G. Castillo-Campos et al. 13355* (XAL!); San Andrés Tuxtla. m, *G.A. Salazar 210* (MEXU!); m, *G. Ibarra et al. 2138* (MEXU!); m, *G. Ibarra & L. Cortés 501* Estación de Biología Tropical Los Tuxtlas, N of San Andrés Tuxtla between Sontecomapan and Montepio. Along broad trail and new border road through virgin forest. Veg. type: ”selva alta perennifolia”, 18°34’48”N 095°03’36”W, 150–200 m, 17 Jan 1987, *T.B. Croat & D.P. Hannon 63160* (AAU, ENCB!, KRAM, M, MO!, RSA, SAR, Z); Soteapan. m, *J.I. Calzada 5144* (XAL!); Yecuatla. Along a very winding road from Naolinco to Misantla, 13 km. by road S of turnoff to Yecuatla and 6 km. by road N of Paz de Enríquez. Mun. Yecuatla, 19°51’00”N 096°48’30”W, 1200 m, 02 April 1983, *M.H. Nee et al. 26363* (F); Zongolica. Wooded area on the north side of airdrone Campo Experimental de Hule, El Palmar, 19 Nov 1944–20 Nov 1944, *J.V. Santos 3635* (MICH, MO). BELIZE. **Toledo:** Limestone hills of the central Bladen Nature Reserve, Maya Mountains. Creekside in forest on alluvium, 16°29’41”N 088°54’43”W, 260 m, 15 March 2011, *S.W. Brewer et al. 5706* (BRH!, MO!).

17. ***Monstera epipremnoides*** Engl., *Bot. Jahrb. Syst.* 37: 118. 1905. (Figs. 32, 33)

Type:—Costa Rica. ‘[San José,] La Uruca, 1100 m., July 1890, *P. Biolley 2846*’ [(lectotype B! seen on-line, barcode B100141893, isolectotypes BR! [with label data of *Pittier 2486*], CR! [with label data of *Biolley 2846*, pro parte — mixtum: one un-numbered sheet of two], designated by Madison (1977)).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical, white-dotted; **internodes** 4–7 cm long, 5–10 mm diam.; **petiole** distinct, light green with white dots, smooth, 7–10 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** ovate to lanceolate, obtuse or attenuate at base, acuminate, coriaceous, 13–17 × 4–9 cm, not appressed to the phorophyte; **fenestrations** absent or present, frequently arranged on one side of the blade when present. ADULT PLANTS: root climbers; **stems** beige to dark or light green, smooth, cylindrical; **internodes** 1–7 cm long, 1.5–4.0 cm diam., 0.6–1.7 times as long as wide; **cataphylls** greenish-white, deciduous; **anchor roots** dark brown; **feeder**

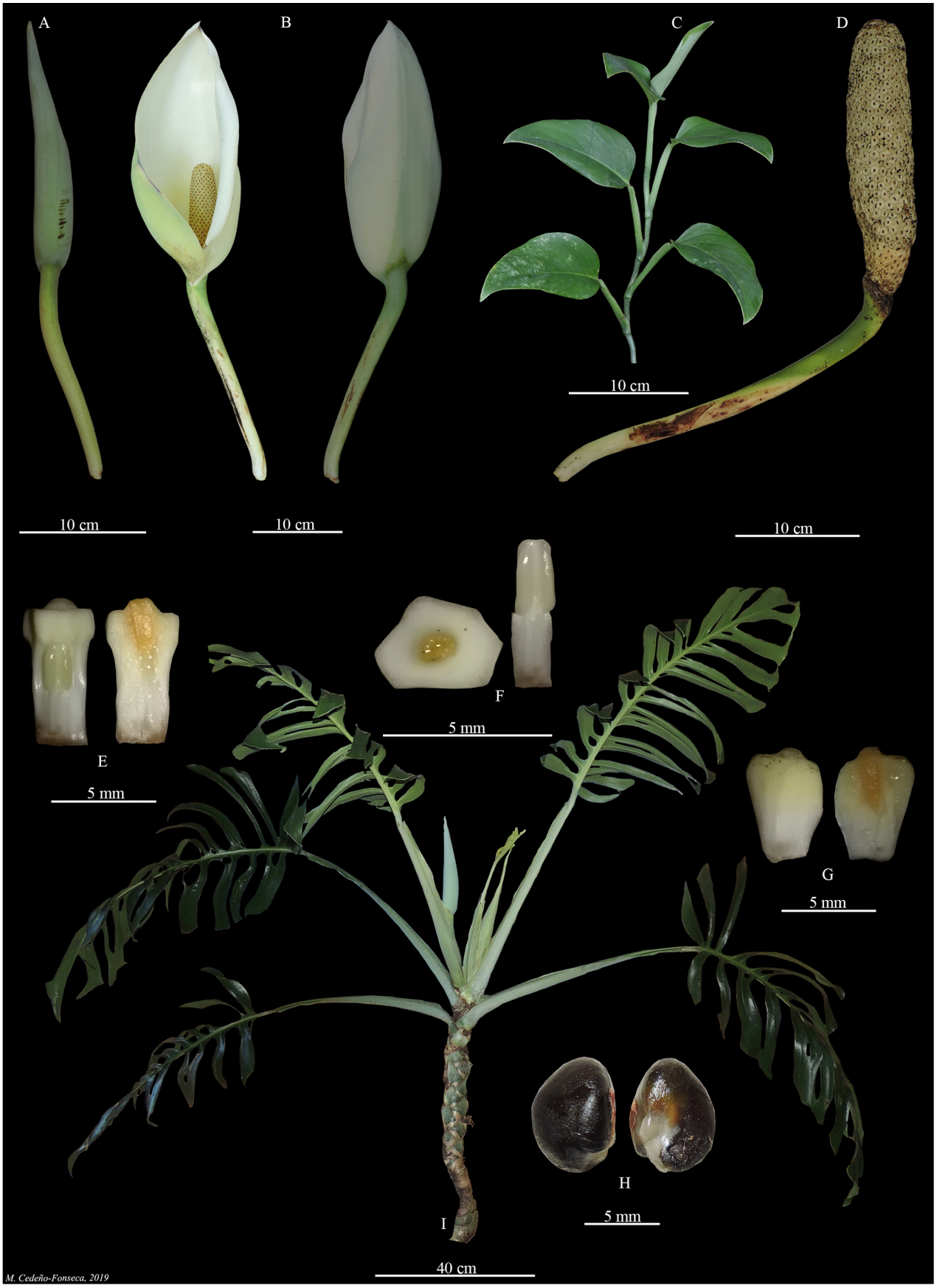

FIGURE 32. *Monstera epipremnoides* from Dota, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Juvenile plant. (D) Immature infructescence. (E) Fertile flower; in lateral view (left) and in longitudinal section (right). (F) Stylar plate with stigma (left) and one stamen (right). (G) Sterile flower; lateral view (left) and longitudinal section (right). (H) Seeds. (I) Adult plant. *M. Cedeño et al. 1275* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 33. *Monstera epipremnoides* from Tarrazú, Costa Rica. Adult plant growing 2 m above the ground in a tree in Tarrazú, Costa Rica. *M. Cedeño 1701* (USJ). Photo by M. Cedeño-Fonseca.

roots beige; **petiole** light green, whitish or mottled, smooth, 30–50 cm long, sheathed to base of the geniculum; **petiole sheath** persistent and thick; geniculum smooth, flat adaxially, convex abaxially, white spotted, 3–5 cm long; **blades** ovate to elliptic or oblong, broadly rounded or truncate at base, short-acuminate at apex, coriaceous, drying light brown, dull beige or bright brown, 20–70 × 20–40 cm, 1.5–2.2 times longer than wide, slightly decurrent on the geniculum, decurrent portion 1–3 mm; **midrib** ribbed adaxially, convex abaxially, drying dark brown or matte-beige on both surfaces; **primary lateral veins** 9–20 per side, departing midrib at 80–90°, sunken above, prominent below, drying dark brown; **collective veins** not visible; **fenestrations** absent or present, on each side of the midrib when present; **margins** entire or deeply pinnatifid, with 3–15 lobes per side, each 1.8–9.0 cm wide, wider lobes fenestrated with up to 4 veins. INFLORESCENCES on ascending and pendent stems, 1 or 2 simultaneously at flowering time, arranged in the leaf axils or into cataphylls; **peduncle** light green, 7–20 cm long; **spathe** acuminate, green during development, cream, yellowish green or white externally and white internally at anthesis, coriaceous, completely open at apex with the margins overlapping at base and revolute in the medial part, deciduous or marcescent after anthesis, 15–25 × 8–13 cm, up to 13 cm longer than the spadix; **spadix** white during development, cream-yellowish at anthesis, 10–15 cm long, 1.5–3.5 cm diam., 3.4–5.5 times longer than wide; **basal sterile flowers** 4–5 mm long, with a yellowish stigmatic secretion; **fertile flowers** 4–8 mm long; stamens 3–7 mm long, with laminar filaments; anthers 3–4 mm long; ovary rectangular in longitudinal section, ribbed, 5–6 × 2–3 mm; style compressed and hexagonal, 2–4 × 3–4 mm; stigmatophore conical, 0.5–1.0 mm long; stigma circular, with a yellowish stigmatic secretion; **berries**

with a light-green stylar cap during development, mature stylar cap creamy-white; pulp white; **seeds** black, spherical, 4–6 mm long.

Distribution and ecology:—*Monstera epipremnoides* is known from Costa Rica and Panama. In Costa Rica it is known from both slopes of the Cordillera de Talamanca, occurring at 1200–2200 m, in *Tropical wet forest* and *Premontane rain forest* life zones. In Panama it is known from only the one collection from Chiriquí, growing at 1200–1400 in a *Premontane rain forest* life zone.

Phenology:—Flowering in January, March-May and September. Fruiting in February-March, June, August-September and December.

Discussion:—This species is a member of sect. *Monstera.* It differs from the other species of the genus by the mottled or whitish petiole, the persistent petiolar sheath with open wings, pinnatifid leaf blades with fenestrations on each side next to the midrib, the green spathe yellowish externally and up to 13 cm longer than the spadix, and the circular stigma, slightly raised on a stigmatophore. It is similar to *M. monteverdensis* but differs in that the latter has green or mottled petioles with the sheath deciduous, leaves which are pinnatifid but without fenestrations on each side next to the midrib, spathes which are light green or yellowish externally.

Specimens of *M. oreophila* which have their blade with the perforations broken through along the margins can be confused with specimens of *M. epipremnoides* but that species differs in having deciduous petiole sheaths and a pink spathe on the inside (Grayum, 2003; Cedeño-Fonseca *et al.* 2022).

For more details about the taxonomic comments and nomenclatural note see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—COSTA RICA. **Puntarenas:** Parrita, Parrita, San Josecito, Finca de Marvin Abarca, Fila Chonta, 1400 m, 24 November 2003, (Fl.), *A. Quesada 1231* (CR!); **San José:** Mora, Tabarcia, Z.P. Cerros de Escazú, Río Negro, entrando por Palmichal, 1500 m, 4 March 1990, (Fl.), *L. Vargas et al. 991* (CR!); Pérez Zeledón, Rivas, Del límite del Parque al sendero Termómetro, 2000 m, 5 May 1997, (Fl.), *R. Aguilar 5079* (CR!); Pérez Zeledón, Rivas, Sendero al Chirripo, fila cementerio La Máquina, colectado en bosque y orilla de potrero, 1900 m, 16 September 1997, (Fr.), *E. Alfaro 1437* (CR!); Turrubares, San Luis, Vecindades de Llano Caite, 1500 m, 5 March 1993, (Fr.), *Q. Jiménez 1184* (CR!, MO!); Acosta, Cangrejal, Cerros de Caraigres, Alto Reflis, camino a Fila Aguabuena, 1600 m, 2 January 1997, (Fl.), *J. Morales 5977* (CR!, MO!); Mora, Tabarcia, Santa Ana, Targuá, 1300 m, 6 November 2004, (Fl.), *D. Santamaría 249* (CR!); Dota, Copey, Cedro Eco Lodge, 1900 m, 9 February 2018, (Fl.), *M. Cedeño et al. 1274* (USJ!); Dota, Copey, Cedro Eco Lodge, 1900 m, 9 February 2018, (Fl., Fr.), *M. Cedeño et al.* 1275 (USJ!); San José, Escazú, Escazú, Cerro Pico Alto, 1758 m, 22 September 2018, (Fl.), *M. Cedeño & K. Benavides 1476* (USJ!); Turrubares, San Pedro, San Pablo de Turrubares, 300 m, 9 December 2004, (Fl., Fr.), *D. Santamaría 338* (CR!); Acosta, Sabanillas, Sabanas, 2 km al sur de la Escuela, 1062 m, 30 October 2001, (Fl.), *A. Quesada et al. 760* (CR!); Acosta, Cangrejal, Z.P. Caraigres, Cuenca del Pirrís-Damas, Alto Reflis, falda Norte, Fila Aguabuena, 1800 m, 16 February 2001, (Fr.), *J. Morales 7490* (CR!).

18. ***Monstera filamentosa*** Croat & Grayum, *Phytologia* 82: 43. 1997. (Figs. 34, 35)

Type:—COSTA RICA. Heredia: S base of Cerros Sardinal, Chilamate de Sarapiquí (N side of Río Sarapiquí), 4 Jul 1985, *M. Grayum & B. Hammel 5539* (holotype MO!, isotype CR!).

Nomadic vine, appressed-climbing and pendent. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** dark green, dorsoventrally compressed; **internodes** 3–5 cm long, 2–4 mm diam.; **blades** appressed to the phorophyte. ADULT PLANTS: root climbers; **stems** brown to light brown, dorsoventrally compressed and markedly sulcate on one side; **internodes** 3–4(10) cm long, (0.6)1–2 cm diam., 2–3 times longer than wide; **cataphylls** pink, marcescent and fibrous; **anchor roots** black; **feeder roots** dark brown; **petiole** brown, grooved at base and smooth towards the geniculum, slightly terete at apex, 25–55 cm long, sheathed to base of the geniculum or 2 cm below it; **petiole sheath** deciduous with fibrous residues; geniculum smooth or striated, grooved adaxially, convex abaxially, 3–5 cm long; **blades** narrowly elliptic to lanceolate-oblong, broadly cuneate to rounded or cordate to subcordate at base, acuminate at apex, membranous, drying light green, yellowish or dull beige, 35–105 × 25–40 cm, not decurrent on geniculum; **midrib** flattened adaxially, convex abaxially, drying light or yellowish brown on both surfaces; **primary lateral veins** 12–30 per side, departing midrib at 80–90°, sunken adaxially, prominent abaxially, drying yellowish or light brown; **secondary veins** prominent and reticulated; **collective veins** present along the margins of the lobes; **fenestrations** present, arranged along midrib with filamentous strands connecting between the lobes; **margins** deeply pinnatifid, 6–15 lobes per side, each 2–3 cm wide, each lobe with 1 or 2 veins and a collective vein along the margin. INFLORESCENCES on ascending stems, 1 or 2 simultaneously at flowering time, arranged into cataphylls; **peduncle**

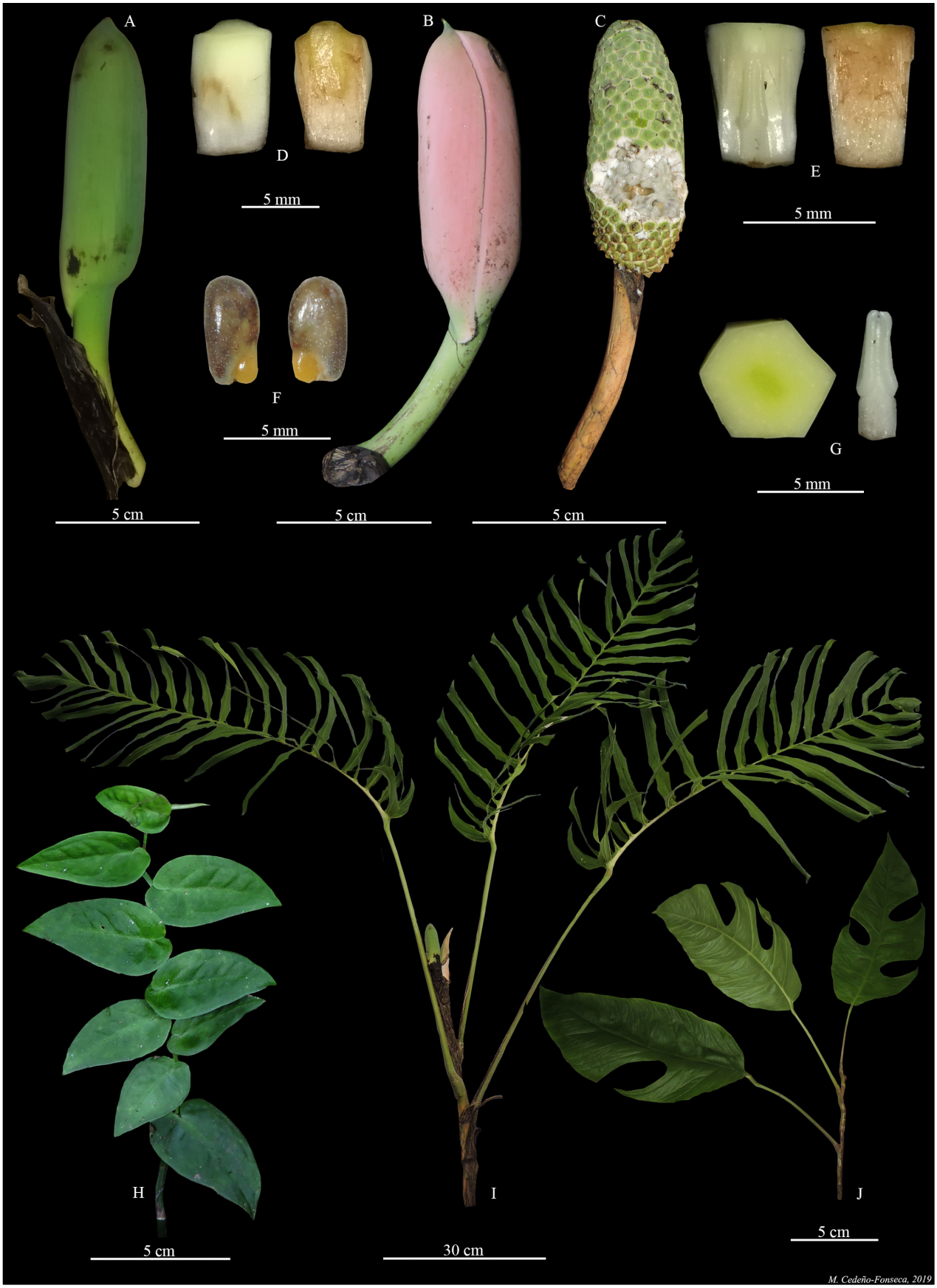

FIGURE 34. *Monstera filamentosa* from Golfito, Costa Rica. (A) Developing inflorescence. (B) Inflorescence in female anthesis with pink spathe. (C) Mature infructescence, stylar plates detached. (D) Sterile flower; lateral view (left) and longitudinal section (right). (E) Fertile flower; in lateral view (left) and in longitudinal section (right). (F) Seeds. (G) Stylar plate with stigma (left) and one stamen (right). (H) Juvenile plant. (I) Adult plant. (J) Pre-adult plant. *M. Cedeño et al. 1352, 1627 & 1704* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 35. *Monstera filamentosa* from Golfito, Costa Rica. (A) Stem with fibrous remains of cataphylls (black arrow). (B) Petiolar sheath with fibrous residues (white arrow). (C) Part of the leaf blade shows filaments connecting the lobes (arrow *ii*) and marginal collecting veins in each lobe (arrow *i*). (D) Pale pinkish young cataphylls (white arrow). *M. Cedeño et al. 1704* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

smooth, 4–10 cm long; **spathe** dark green during development, pink externally and pale pink internally at anthesis, deciduous at the end of anthesis; **spadix** white during development, cream at anthesis, 6–11 cm long, 1.5–2.5 cm diam., 4.1–4.5 times longer than wide; **basal sterile flowers** 4–5 mm, with a transparent stigmatic secretion; **fertile flowers** 5–8 mm long; stamens 2–6 mm long, with laminar filaments; anthers 2–3 mm long; ovary quadrangular in longitudinal section, ribbed, 3–4 × 2–3 mm; style compressed and hexagonal, 1–2 × 3–4 mm; stigma linear, sunken over style; **berries** with a green stylar cap during development, mature stylar cap dark green; pulp white; **seeds** yellowish and light brown with white dots, 4–6 mm long.

Distribution and ecology:—*Monstera filamentosa* ranges from Costa Rica to extreme NW Colombia at 0–700 m, in *Tropical wet forest* and *Premontane rain forest* life zones.

Phenology:—Flowering in January, April, July-September. Fruits in August-September, and January.

Discussion:—The species is a member of sect. *Marcgraviopsis*. It differs from the other species of the genus in Costa Rica by its brown petiole, grooved at base and smooth toward the geniculum, adaxially flat and abaxially convex, the petiolar sheath deciduous with fibrous residues, the leaf blade pinnatifid (with the lobes themselves weakly

pinnately lobed) and fenestrate on each side next to the midrib with very slender filaments connecting the lobes, each lobe with a distinct submarginal collective vein and the spathe dark green during development, pink externally and pale pink internally at anthesis (Cedeño-Fonseca *et al.* 2022).

Monstera filamentosa is a seldom-collected species in Costa Rica; the majority of the collections are sterile or include only the spadix. The spathe color notes derive from the first and second author's field observations. Madison (1977) treated material of this species as *Monstera punctulata*, from which it is amply distinct (Cedeño-Fonseca *et al.* 2022).

Additional specimens examined:—COLOMBIA. **Chocó:** East side, Serrania del Darien, approached from Acandi. Slightly disturbed forest, near (small) Finca Las Cascadas, 08°30'N 077°20'W, 80–100 m, 9 Jan. 1983, *A. Juncosa 590* (MO!, US!). COSTA RICA. **Heredia:** Sarapiquí, La Virgen, Area between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 495 m, 8 April 1986, (Infer.), *M.H. Grayum 6890* (CR!, MO!); Sarapiqui, Zona Protectora, N slopes of Volcán Barba 300–400 m, 18 January 1983, (Fr.), *M.H. Grayum 3172* (MO!); **Limón:** Pococí, Colorado, Cerro Coronel, E of Laguna Danto, Tall evergreen forest on gentle to moderately steep slopes, 75 m, 15 September 1986, (Infer.), *W. Stevens & O. Montiel 24366* (CR!, MO!); Siquirres, Pacuarito, Forested ridges and slopes between Río Pacuare and Quebrada Diablo, ca. 2.5 km E of Siquirres, 150 m, 5 October 1986, (Infer.), *M.H. Grayum et al. 7701* (CR!); Matina, Batán, Cordillera de Talamanca, Ridge between separating Quebrada Cañabral from Río Barbilla, and slopes leading down to the latter, 300 m, 4 September 1988, (Fr.), *M.H. Grayum 8762* (CR!, MO!); Pococí, Colorado, Cerro Coronel, E of Laguna Danto, Tall evergreen forest on gentle to moderately steep slopes, 75 m, 16 January 1986, (Infer.), *W. Stevens 23789* (CR!, MO!); Pococí, Colorado, R.N.V.S. Barra del Colorado, Forests and pastures between Río Chirripocito and pastures between Río Chirripocito and Río Sardina ("Sardinal" on Chirripó Atlántico quadrangle), m, 21 April 1990, (Infer.), *M.H. Grayum 9808* (CR!, MO!); Pococí, Colorado, P.N. Tortuguero, Lomas de Sierpe, 1 km al O del puesto del P.N. en el Río Sierpe, Topografía Quebrada con pendientes medianamente pronunciadas, Suelo bien drenado, 100 m, 11 August 1998, (Fr.), *R. Robles et al. 2001* (CR!, MO!); North end of Tortuguero National Park and near the Bocas de las Lagunas de Tortuguero, Swamp forest, 0–30 m, 23 September 1978, (Infer.), *W. Burger 11279* (MO!); Hamburg Finca, 55 m, 19 February 1926, (Infer.), *P. Standley 48874* (MO!); **Puntarenas:** Osa, Sierpe, R.F. Golfo Dulce, Península de Osa, Along road between Rincón de Osa and Rancho Quemado, ca. 10 km W of main Rincón-Pto. Jiménez, 100 m, 4 March 1985, (Infer.), *T.B. Croat & M.H. Grayum 59751* (CR!, MO!); Golfito, Golfito, Sobre Fila Golfito, 400 m, 9 June 2000, (Fl.), *L. Acosta 1676* (CR!); Osa, Sierpe, Aguabuena, margen izquierda de Quebrada El Campo, 200 m, 22 September 1990, (Infer.), *G. Herrera 4352* (CR!, MO!); Parque Nacional, Sector Esquinas, 200–300 m, 12 September 1996, (Infer.), *T.B. Croat 79293* (INB, MO); Puntarenas, Golfito, Puerto Jiménez, Los Mogos, 40 m, 24 March 2018, (Fl.), *M. Cedeño et al.1352* (USJ!); Puntarenas, Golfito, Golfito, Camino hacia las Antenas, 389 m, 4 February 2019, (Infer.), *M. Cedeño & A. Hay 1627* (USJ!). PANAMA. **Bocas del Toro:** Along road between Fortuna Dam and Chiriquí Grande, 7.3 mi N of bridge over Fortuna Dam, 3.2 mi N of Continental Divide. [Coordinates on orginal label: 08º45'N 82º15'W], 08°49'00"N 082°12'36"W, 700 m, 10 March 1985, *T.B. Croat & M.H. Grayum 60233* (MO!); **Colón:** Santa Rita ridge road; ca. 22 km from transisthmian highway. In forest on ridges, slopes and draws near end of road, 09°25'N 079°40'W, 500 m, 17 February 1986 – 18 February 1986, *B.E. Hammel et al. 14499* (MO!); Teck Cominco Petaquilla mining concession. Collected with M. Merello, 08°49'39"N 080°40'28"W, 200 m, 21 February 2008, *G. McPherson 20123* (MO!); Teck Cominco Petaquilla mining concession, 08°49'28"N 080°39'29"W, 180 m, 21 September 2007, *G. McPherson 19759* (MO!); Santa Rita Ridge Road, along trail at end of road which goes to Río Indio, beginning 10.6 km from Iransisthmiam Hwy, 3 km beyond hydrographic station, 09°22'30"N 079°41'30"W, 380 m, 13 Apr. 1976, *T.B. Croat 34337* (MO!); **Darién:** Pinogana. Along headwaters of Río Tuquesa, ca. 2 km air distance from the Continental Divide, in vicinity of upper gold mining camp of Tyler Kittredge, 08°33'30"N 077°29'00"W, 600 m, 25 August 1974, *T.B. Croat 27179* (MO!); **San Blas:** El Elano-Cartí Road, 14 mi N of Panamerican Highway, 09°21'N 078°57'W, 300 m, 12 July 1988, *T.B. Croat 69243* (MEXU, MO, NY, PMA, TEX); Along El Llano-Cartí road, 10.5 miles from Interamerican Highway, 09°21'30"N 078°58'00"W, 550 m, 14 March 1985, *T.B. Croat 60488* (MO!).

19. ***Monstera florescanoana*** Croat, T. Krömer & Acebey, *Revista Mexicana de Biodiversidad* 81(2): 225–228, 1A–B, 2A–D. 2010.

Type:—MEXICO. Veracruz: Comunidad Cruz Gorda, Congregación San Salvador, 990 m, 17 June, 2008, *T. Krömer, J. Viccon-Esquivel, N. Martínez-Correa and J. R. Fernández-Contreras 3334* (holotype MO-6065968!, isotypes B, K, MEXU!, US, XAL!).

Nomadic vine, appressed-climbing. SEEDLINGS: unknown. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical; **internodes** 1–3 cm long, 0.5–9.0 mm diam.; petiole distinct, dark green and pruinose, smooth,

10–15 cm long, sheathed up to half their length, **petiole sheath** deciduous; **unsheathed portion** slightly ribbed; **blades** broadly ovate, strongly cordate at base, acuminate, membranous, 7–15 × 5–8 cm, not appressed to the phorophyte; **fenestrations** present. ADULT PLANTS: root climbers; **stems** dark green, smooth, cylindrical or slightly flattened, dark brownish-black, matte, smooth (superficial view), finely and closely ridged; **internodes** 1.8–3.0(6.0) cm long, 0.5–1.0 cm diam., 1.8–3.0 times longer than wide; **petiole** dark green, smooth and pruinose, 17–24 cm long, sheathed to base of the geniculum or 1 cm below it; **petiole sheath** persistent; geniculum smooth, 1.5 cm long; **blades** ovate, glaucous below, rounded to weakly subcordate at base, subcoriaceous, acuminate, drying black, yellowish or greenish, unequal, 14.3–34.0 × 5.2–20.5 cm, one side is wider (0.7–2.0 cm) than the other, 1.2–1.5 times longer than wide; **midrib** obtusely sunken and concolorous adaxially, narrowly rounded and concolorous abaxially (when dry); **primary lateral veins** 3–6 per side, departing midrib at 45–55°; **fenestrations** generally on both sides, sometimes lacking perforations on one side (mainly in young or pre-adult plant's leaves), generally with 2–4 perforations in one series per side, rarely larger perforations in two series per side (adult plant's leaves), 0–4 perforations on the narrow side of the blade, 2–4(6) perforations on the wider side, 1.5–9.5 × 0.7–4.8 cm, ellipsoid to ovate. INFLORESCENCES with a smooth, green **peduncle**, 2.0–5.7 cm long; **spathe** long acuminate, yellow green externally at anthesis, 10–20 × 5–10 cm, up to 6 cm longer than the spadix; **spadix** 6.7–9.5 cm long, 2.3–3.0 cm diam., sessile or stipitate, stipe 10 mm long, drying 3 mm diam.; **basal sterile flowers** 3–5 mm long; **fertile flowers** 5–6 mm long; stamens 1–6 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary quadrangular in longitudinal section, ribbed, 3–4 × 3.5–4.0 mm; stigma circular, deeply sunken medially when dry, black with a medial brown margin; **berries** with a greenish stylar cap during development, mature stylar cap color unknown; pulp unknown; **seeds** unknown.

Distribution and ecology:—*Monstera florescanoana* is endemic to Mexico, known only from the type locality in Veracruz State in the understory of the humid montane forests of the Atzalán municipio (bosque mesófilo de montaña, *sensu* Rzedowski, 1978), at 990–1430 m. This is probably the equivalent to *Premontane wet forest* in the Holdridge life zone system.

Phenology:—Flowering registered in May and June. Fruiting in June and October.

Discussion:—The species, a member of section *Monstera*, is closely related to *Monstera siltepecana* Matuda, from which it differs in having smaller petioles and geniculum, and blades that are glaucous below on living plants, fewer perforations that are only in 1 (rarely 2) series on each side and fewer primary lateral veins, a frequently persistent petiole sheath and a smaller inflorescence (peduncle and spadix). On the other hand, it shares with *M. siltepecana* the same drying color and texture, even the same venation.

Monstera florescanoana may also be confused with *Monstera dubia*, but *Monstera dubia* differs in having typically thicker stems which are usually densely tuberculate, leaf blades thicker with more conspicuous tertiary venation, larger petioles, geniculum and leaves, as well as a larger inflorescence.

Additional specimens examined:—MEXICO. **Hidalgo:** Tlanchinol. m, *I. Luna et al. 618* (MEXU!); **Querétaro:** 1.5 km al sureste de Neblinas, municipio de Landa. Bosque de *Lonchocarpus* y *Ulmus*, ladera de cerro, 800 m, 27 Jun 1990, *H. Rubio 1764* (MO!); 1.5 km al noroeste de El Humo, municipio de Landa. Bosque de encino- somerio, ladera de cerro, 1070 m, 9 May 1989, *H. Rubio 652* (MO!); Landa de Matamoros. Los Tubos, 3 km al Norte de San Juan. Bosque de Liquidambar, orilla de arroyo, cañada, 1000 m, 19 Sep 1988, *H. Rubio 151* (MO!); 4 km al N de Agua Zarca. Bosque mesófilo de montaña, 21°13'48"N 099°05'24"W, 700 m, 31 Jul 1991, *S. Zamudio & E. Carranza 8236* (MO!); **Veracruz:** Communidad Cruz Gorda, Congregación San Salvador. Bosque mosófilo de Montaña, 19°52'30"N 097°12'43"W, 990 m, 17 June 2008, *T. Krömer et al. 3334* (B, K, MEXU, MO, US, XAL).

20. ***Monstera gambensis*** M. Cedeño & M.A. Blanco, *Webbia* 75(1): 123–132. 2020. (Figs. 36, 37)

Type:—COSTA RICA. Puntarenas Province, Golfito Cantón, Golfito, La Gamba, sendero sobre quebrada, 94 m, 27 May 2016, *M. Cedeño, A.P. Karremans & I. Chinchilla 890* (holotype USJ!).

Nomadic vine, appressed-climbing. SEEDLINGS: unknown. JUVENILE PLANTS: root climbers; appressed-climbing; **stem** dark green, slightly rough; **internodes** 3–5 cm long, 4–10 mm diam.; **petioles** visible (i.e., the leaves not shingling), dark green or light, slightly rough, 3–5 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** more or less horizontal, not flattened to the substrate of the phorophyte, 4–7 × 3–4 cm, obovate or lanceolate, subcordate to truncate at base, acuminate at the apex, thinly coriaceous, without fenestrations. ADULT PLANTS: root climbers; **stem** terete, dark green, rough; **internodes** 1–4 cm long, 0.5–1.0 cm diam., 2–3 times longer than wide; **anchor roots** black and corky, 4–6 cm long, **feeder roots** black and semi-corky, both with black root hairs; **petioles** light green or whitish, rough to the geniculum, 17–22 cm long, sheathed to 2–3 cm below base of the

geniculum; **petiole sheath** involute and persistent, the free portion slightly grooved; geniculum elongate, 0.5–1.0 cm long; **blades** lanceolate, attenuate at base, acuminate at the apex, subcoriaceous, 12–24 × 5–10 cm, decurrent on the geniculum (the decurrent part 0.5–1 mm wide); **midrib** convex to the middle of the blade abaxially, slightly rough; **primary lateral veins** 5–13 per side, impressed or indistinct abaxially, prominent on the underside, departing midrib at 35–45°; **fenestrations** (when present) one or two close to each other on the same side of the blade near its middle part; **collective veins** not visible; **margins** entire. INFLORESCENCES on ascending stems; **peduncle** rough throughout, 20–25 cm long; **spathe** unknown; **spadix** 7–10 × 1.3–1.6 cm, color unknown; **basal sterile flowers** 3–4 mm long; **fertile flowers** 4–5 mm long; stamens 2–4 mm long, with laminar filaments; anther 1–2 mm long; ovary prismatic, longitudinally ribbed, 2–3 × 2–3 mm; style hexagonal, 1–2 × 3–5 mm; stigma linear; **berries** yellow when ripe; pulp white; **seeds** black, 2–3 mm long.

Distribution and ecology:—Endemic to Costa Rica, where it has been found growing low on the supporting trees (ca. 2 m above ground level), in rain forest at La Gamba Biological Station, Cantón Golfito, mostly at 50–100 m, in *Tropical wet forest* life zones.



FIGURE 36. *Monstera gambensis* from Golfito, Costa Rica. (A) Adult plant with non-perforated leaves. (B) Juvenile plant. *M. Cedeño et al. 890* (USJ). Image from Cedeño-Fonseca *et al.* (2020d).

Phenology:—Flowering has not been observed, fruiting was recorded in May.

Discussion:—The species, a member of section *Monstera*, differs from other species by its rough whitish stem and petioles, its persistent entire involute petiole sheath, and entire adult leaf blade with or without fenestrations. In size it is similar to *Monstera obliqua,* but it is differentiated by having smaller leaves (12 × 5 vs. 35 × 14 cm), rough petiole (vs. smooth), and persistent petiole sheath (vs. deciduous). In Costa Rica, *Monstera obliqua* is found only in the extreme southeast of the country (Caribbean slope, Grayum 2003), while *M. gambensis* is known only from a single collection in La Gamba de Golfito (Pacific slope).

This species is also similar to *Monstera minima* but that has smaller petioles (2–6 cm), leaf blades (9–14 × 2–4 cm), and spadices (ca. 4.4 × 09–1 cm) and is only known from the northern (Caribbean) coast of Panama and along the Pacific slope of northern Colombia, in the Chocó region (Jácome & Croat 2002). In Costa Rica, *Monstera gambensis* is found in lowland tropical wet forest at elevations up to ca. 100 m. The individuals observed were climbing in undisturbed forest on small trees no more than 2.5 m high, with abundant shade in the understory.



FIGURE 37. *Monstera gambensis* from Golfito, Costa Rica. (A) Support roots (*i*) and a feeding root (*ii*) both corky and blackened. (B) Petiole sheath margins persistent and involute in adult plants (arrow). (C) Petioles with sheath margins persisting, whitish and asperous (arrow). (D) Internodes of adult plant (arrow). (E) The shallowly channeled distal portion of the petiole (arrow). (F) Portions of either dead epidermis or epicuticular waxes that give a whitish appearance and an asperous texture to the surface of the petioles. *M. Cedeño et al. 890* (USJ). Image from Cedeño-Fonseca *et al.* (2020d).

21. ***Monstera gentryi*** Croat, M.Cedeño & O.Ortíz, Phytotaxa 514 (3): 213–217. 2021. (Figs. 38, 39)

Type:—PANAMA. Chiriquí: Boquete, camino hacia el Cerro Pata de Macho, aproximadamente 1.0 km desde la entrada de Tree Trek, 1748 m, 23 Sept. 2019, *O.O. Ortiz, M. Cedeño, Z. Samudio & Z. Serracín 3756* (holotype PMA!, isotypes MO!, USJ!).

Robust nomadic vine, appressed-climbing. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** light or dark green, smooth; **internodes** 2–4 cm long, 3–7 mm diam.; **petiole** conspicuous, light green, smooth,

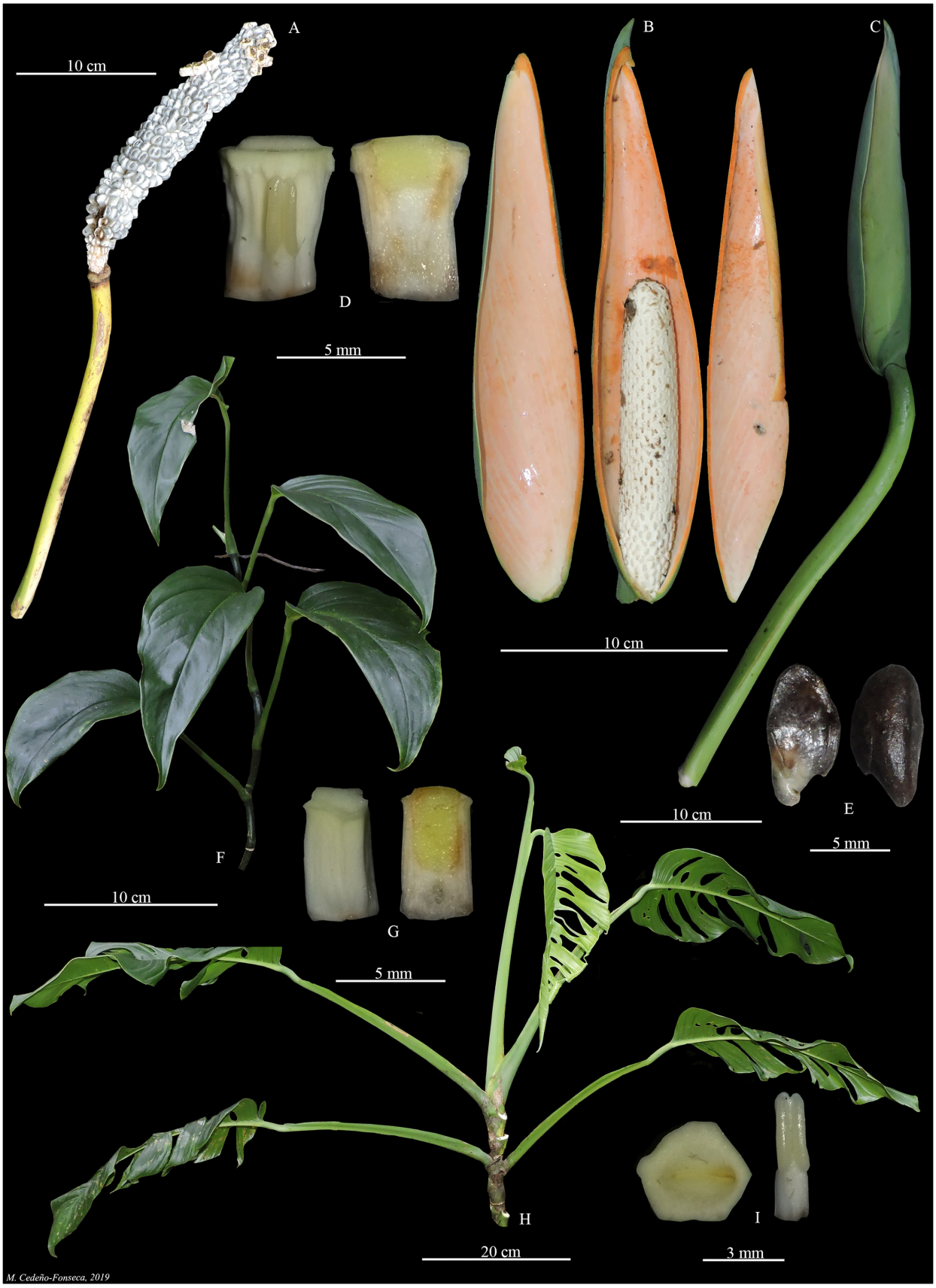

FIGURE 38. *Monstera gentryi* from Boquete, Panama. (A) Mature infructescence, stylar plates detached in the middle part. (B) A longitudinal cut of the inflorescence in female anthesis, showing adaxial (internal) surface of spathe. (C) Developing inflorescence. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Seeds. (F) Portion of juvenile shoot. (G) Sterile flower; in lateral view (left), and in longitudinal section (right). (H) Portion of adult shoot. (I) Stylar plate, top view (left), and individual stamen (right). *O. Ortiz et al. 3756* (PMA). Image from Cedeño-Fonseca *et al.* (2021a).



FIGURE 39. *Monstera gentry*. Adult plant growing 5 m above the ground in a tree in Boquete, Panama. *0. Ortiz et al. 3756* (PMA). Photo by M. Cedeño-Fonseca.

7–20 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** lanceolate or ovate, subcordate to truncate at base, acuminate at apex, 8–16 × 3.5–4.8 cm, not appressed to the phorophyte; **fenestrations** present or absent. ADULT PLANTS: root climbers; **stems** dark or light green, drying light brown, smooth, cylindrical; **internodes** 1–4 cm long, 2–4 cm diam., 0.8–1.0 times as long as wide; **anchor** and **feeder roots** black; **petiole** light green or yellowish green, smooth, 34–50 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; geniculum smooth, sulcate adaxially, convex abaxially, 2–4 cm long; **blades** narrowly ovate, asymmetrically rounded at base, sometimes obtuse on one side and rounded on the other, acuminate at apex, subcoriaceous, drying slightly dark brown to yellowish-brown, matte above, slightly paler, yellowish-brown and faintly glossy below, 33–40 × 15.8–20.5 cm, 1.7–2.4 times longer than wide, 0.9–1.1 times longer than petiole, decurrent on geniculum, decurrent portions 0.5–1.0 mm wide; **midrib** ribbed adaxially, convex abaxially, drying yellow-brown; **primary lateral veins** 13–25 per side, departing midrib at 60–75°, strongly sunken adaxially, prominent abaxially, drying yellow-brown; **secondary veins** parallel but becoming reticulated toward the margin; **collective veins** more or less visible; **fenestrations** present, usually comprising small sub-circular holes 0.6–2.5 cm long, located near the midrib, these often scattered among 7–9 larger oblong elliptical perforations, each 4.0–10.5 × 1.5–3.0 cm, these often extending from near the midrib to near the outer margin, the larger perforations often tearing through to the margins; **margins** entire or pinnatilobed

(due to tearing of the perforations that extend to the margin), 2–6 lobes per side reaching the midrib, 1–6 cm wide. INFLORESCENCES produced on ascending stems; **peduncle** smooth, 15–30 cm long, 5–7 mm diam.; **spathe** long-acuminate, green-glaucous externally during development, green-glaucous or pinkish externally and light orange-yellow internally at anthesis, 14–20 × 5–10 cm, up to 10 cm longer than the spadix; apparently persistent after anthesis; **spadix** white during development, creamy-white at anthesis, 9.0–11.7 cm long, 1.3–1.8 cm diam.; **basal sterile flowers** 4–5 mm long; **fertile flowers** 5–6 mm long; stamens 1.5–6.0 mm long, with laminar filaments; anthers 1.5–3.0 mm long; ovary rectangular in longitudinal section, ribbed, 3–4 × 3.0–3.5 mm; style hexagonal, 1.5–2.0 × 3.0–3.5 mm; stigmatophore slightly columnar; stigma linear; basal sterile flowers 4–5 mm long; **berries** with creamy white stylar caps during development, mature stylar caps creamy; pulp white; **seeds** matte black, 4 × 5 mm.

Distribution and ecology:—*Monstera gentryi* is endemic to Panama, known only from western Panama between eastern Chiriquí Province (Cerro Pata de Mache), Gnäbe-Buglé Province (Cerro Colorado) and Veraguas Province at 900–1500 m, in *Lower montane rainforest* and *Premontane rain forest* life zones.

Phenology:—Flowering has been recorded from December to April, July, September and October, and fruiting in January to May, August and September.

Discussion:—The species is member of sect. *Monstera* characterized by its moderately small stem, mostly short internodes; fully sheathed light brown drying petioles with a persistent sheath, narrowly ovate, inequilateral, heavily fenestrate blades with smaller holes along the midrib and large perforations extending nearly across the width of each half of the blades as well as by the moderately long peduncle, the pinkish spathe, cylindroid spadix which is often yellowish at anthesis, and is about 5 times longer than wide and much shorter that the spathe.

Monstera gentryi is most easily confused with *M. oreophila*. That species differs in being less robust with more slender stems, leaves with less diverse perforations usually with only a few small holes and otherwise also with fewer large perforations. In addition, the upper blade surfaces of *M. oreophila* have the minor veins less prominent, scarcely raised with the intervening areas moderately smooth while the lower surface is evenly and prominently striate as well as densely granular. In addition, the spathe of *M. oreophila* is thinner and proportionately shorter in relation to the length of the spadix (the spadix of *M. oreophila* is 0.73 times as long as the spathe whereas in *M. gentry* the spathe is less than 0.56 times as long). While both species have short pale lineations on the upper blade surface those of *M. oreophila* are less uniform and less prominent while those of *M. gentryi* are both more numerous and more uniform.

Another species similar to *M. gentryi* is *M. lentii* which differs by having leaf blades bearing a single row of perforations, these usually beginning very near the midrib and extending more than 2/3 of the way to the margins as well as having primary lateral veins often 2.0–2.5 cm apart. In contrast the leaf blades for *M. gentryi* has two rows of perforations usually with a series of small perforations near midrib and with a second larger set usually beginning very near the midrib and extending more than 2/3 of the way to the margins as well as by having the primary lateral veins much closer together, especially near base.

Additional specimens examined:—PANAMA. **Bocas del Toro:** [including some areas currently part of Comarca Ngäbe Buglé]: Ridge north of Campamiento Luchio, 2000 m, 18 March 2004, *A. Monro & E. Alfaro 4476* (BM!, INB!, PMA!); Cerro Colorado, 9.2 miles W of Chamé; along trail E of road which leads down to stream, 1450–1480 m, 06 July 1988, *Croat 69029* (MO!); **Chiriquí:** [including some areas currently part of Comarca Ngäbe Buglé]: Bocas & Chiriqui, Cerro Colorado mine area, in elfin woods on divide road, along trail into Bocas and in woods on Pacific slope, from Chami station to ca. 9 miles along road, 1100–1750 m, 27 March 1986–31 March 1986, *B.E. Hammel & J. Trainer 14974* (MO!); Bocas & Chiriquí Cerro Colorado mine area; in elfin woods on divide road, along trail into Bocas and in woods on Pacific slope; from Chami station to ca. 9 miles along road, 1100–1750 m, 27 March 1986–31 March 1986, *B.E. Hammel & J. Trainer 14930* (MO!); Road to Cerro Punta National Park from Alto Quiel and Boquete, 1850 m, 16 January 1986, *G. McPherson 8045* (MO!); Cerro Colorado; road along top, border of Chiriqui-Bocas del Toro provinces, 1500–1750 m, 13 August 1977, *J. Folsom et al. 4725* (MO!); De la estation (Cotito) a lo largo del camino a Los Pozos, 1200 m, [no date], *J. Aranda & B. Araúz 1351* (PMA!); Along Río Caldera (Boquete region), and on slope to the east, ca. 3.5 km NW of Bajo Mono, 1600 m, 8 February 1986, *M.H. Grayum 6466* (MO!); Along trail between N fork of Río Palo Alto and Cerro Pate Macho, ca. 6 km NE of Boquete, 1600–1700 m, 06 February 1986, *M.H. Grayum et al. 6395* (MO!); Cerro Pate de Macho, 1800 m, 6 January 1983, *J. Schmalzel 1363* (MO!); Vicinity of Cerro Colorado Copper Mine development, 28 miles above San Félix, 9–10 miles above turn off to Escopeta, 1200–1500 m, 13 March 1976, *Croat 33267* (MO!); Cerro Colorado, along mining road 24 mi above bridge over Río San Félix, north of village of San Félix), 1430–1500 m, 22 November 1979, *T.B. Croat 48502* (MO!); 6 km past divide in road to Alto Quiel from Boquete, 1730 m, 19 February 1986, *W. Hoover 1339* (CM!, MO!); Vicinity of Cerro Colorado Copper Mine Development, 28 miles above San Felix, 9–10 miles beyond turnoff to Escopeta, 1200–1500 m, 14 March 1976, *Croat 33267* (MO!); Fortuna Dam area, 1070 m, 3 August 1984, *W. D'Arcy 16015* (MO!); Boquete, Corregimiento

Los Naranjos, Parque Internacional La Amistad, entrando por el sitio llamado Bajo de Mono, 700–900 m, 28 January 2013, *A. Zuluaga & E. Olmos 908* (PMA!); Corregiemiento Los Naranjos, Parque Internacional La Amistad, entrando por el sitio llamado Bajo de Mono, 700–900 m, 28 January 2013, *A. Zuluaga et al. 907* (PMA!); Bajo Mojo Chorro trails out of Boquete, 01 June 1972, *J. Luteyn 3066* (DUKE!); Vicinity of Boquete, SW slope of Cerro Pate de Macho, 1630–1780 m, 18 June 1987, *T.B. Croat 66379* (MO!); San Felix, Above San Felix along mining road 18–27 milers off of Pan-Am Highway (above Chame or turnoff to Escopeta), 1200–1500 m, 12 March 1976, *T.B. Croat 33154* (F!); **Coclé**: El Valle, vicinity of La Mesa near Mr. Furlong's finca, 900 m, 12 May 1973, *A. Gentry 7434* (MO!); Plants purchased in El Valle market, plants from Mesa, 17 April 1977, *J. Folsom 2660A* (MO!); Cerro Tigrero, 1000–1350 m, 26–28 September 2001, *J. Mendieta 17–421* (PMA!); Cerro Pilón (above El Valle de Antón), 13 April 1971, *T.B. Croat 14337* (MO!); **Veraguas:** Santa Fe, Corregimiento El Pantano, Parque Nacional Santa Fe, Alto Los Gonzales o Alto El Viro, 800–1000 m, 16 January 2013, *A. Zuluaga et al. 890* (PMA!); Corregimiento Santa Fe, Parque Nacional Santa Fe, sendero tercer Brazo, cerca de la cabaña del Parque, 17 January 2013, *A. Zuluaga et al. 889* (PMA!); Cerca de El Cinco, 1000 m, 20 February 2010, *A. Ibáñez et al. 6186* (PMA!); Mountains, 3.5–4.5 mi above Santa Fé, 700–800 m, 13 December 1971, *A. Gentry 3080* (MO!); Slopes of Cerro Tute, near Escuela Agricola Alto Piedra, NW of Santa Fé; 1000–1050 m, 30 November 1979, *T.B. Croat 48923* (MO!).

22. ***Monstera gigas*** Croat, Zuluaga, M. Cedeño & O. Ortiz, Webbia 76(2): 272–275. 2021. (Figs. 40, 41)

Type:—Panama. Chiriquí: Fortuna Dam area, unnamed creek to E of road flowing into Río Hornito near Quebrada Moro, 1200 m, 16 Jun 1984, *W. Churchill 5508* (holotype MO-3216379–821!, isotype PMA!).

Very robust to gigantic, pachycaulous, appressed-climbing nomadic vine or rarely terrestrial. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; unknown. ADULT PLANTS: root climbers; **stems** pale green, smooth, cylindrical; **internodes** 1.5–2.0 cm long, 3–11 cm diam., 0.2–0.5 times as long as wide; **anchor roots** unknown; **feeder roots** unknown; **petiole** light green, white-dotted, smooth, (45)66–81(140) cm long, sheathed up to (0.36)0.74–0.86 its total length; **petiole sheath** slightly persistent, drying dark brown with pale brown margins; geniculum white-dotted, 13–17 cm long, 3 cm diam.; **leaf-blades** narrowly ovate-elliptic, rounded on both sides, subcordate on one side and rounded on the other side, or unequal (one side 4–5 cm wider) at base, short-acuminate at apex, moderately coriaceous, (43)72–86(140) × (25)34–40(61) cm, 1.67–2.20 times longer than wide; **fenestrations** absent or present; **margins** entire; **midrib** weakly sunken and colorless to weakly discolored toward the distal margin, greenish white and thicker than broad abaxially, convex toward the apex, closely rounded and pale brown below; **primary lateral veins** (21)24–65 per side, sunken and colorless adaxially, closely narrowly rounded and pale abaxially, departing the midrib at (40°)55–75° toward the apex and 80–90° in the lower part of the blade; **secondary veins** parallel, moderately prominent adaxially. INFLORESCENCES on ascending stems; **peduncle** smooth, 34.0–38.5 cm long, 1.7–2.2 cm diam.; **spathe** acuminate, white at anthesis, coriaceous, 30–34 × 15.0–18.5 cm; **spadix** white at anthesis, 20.0–25.5 cm long, 3.2–4.2 cm diam.; **basal sterile flowers** 3–5 mm long; **fertile flowers** 5–6 mm long; stamens with laminar filaments; anthers 1.5–2 mm long; ovary rectangular in longitudinal section, ribbed, 4–5 × 1.5–2.5 mm; style hexagonal, 1.5–2.0 × 1.5–2.0 mm; stigma circular; **berries** with a white stylar cap when ripe; **seeds** unknown.

Distribution and ecology:—*Monstera gigas* is endemic to Panama where it is known only from the type locality in the region of the Fortuna Lake at 1200–1300 m, in a *Premontane rain forest* life zone.

Phenology:—Fruiting has been recorded in January, April, July, and September.

Discussion:—The species is member of sect. *Monstera* characterized by its usually nomadic-vine (but sometimes terrestrial) habit, large stems with short, stout internodes, subterete, pale yellowish brown petioles sheathed to within 13–17 cm from the base (to 36 cm on preadult leaves), and ovate-elliptic, grayish-drying, entire and non-perforated, short-acuminate leaf blades, rounded at the base and with 24–65 primary lateral veins per side, as well as by its moderately short-pedunculate, massive, green-white spathes, green spadices, and flowers with a narrow style covered for nearly its entire width by the stigma, the latter bearing a tubular extension that protrudes beyond the end of its center.

Leaves at the upper end of the size range for this species, exceeding 3 m in length, are the largest so far know in the genus, and the plant is perhaps the most massively constructed member of its entire subfamily.

Additional specimens examined:—PANAMA. **Chiriquí:** Vicinity of Gualaca, ca. 8.6 mi from Planos de Hornito on the road to the La Fortuna dam site, 4000 ft, *T. Antonio 5002* (MO!); Along road between Gualaca and Fortuna dam site; 7.9 mi beyond (NW) of Los Planes de Hornito; virgin forest, 1300 m, *T.B. Croat 49904* (MO!); Gualaca-Chiriquí Grande, 4.8 mi beyond IRHE facilities at Dam, 4 mile N of bridge over Bayano Lake, along gravel road which turns

off main highway, 100 m beyond pipeline marker 108, *T.B. Croat 68031* (MO!); Chiriquí, Gualaca, Hornito. Fortuna, camino a Chiriquí Grande, 1230 m, *M. Cedeño et al. 2328* (MO, PAM, USJ); **Veraguas:** Vicinity of Santa Fe on slopes of Cerro Tute-Arizona above school at Alto Piedras; on trail to summit, 900–1100 m, *G. McPherson 13672* (MO!).



FIGURE 40. *Monstera gigas* from Fortuna, Panama. Adult plant with the stem beige, 11 cm diam., and leaves up to 3 m of length. *M. Cedeño et al. 2328* (PMA). Image from Cedeño-Fonseca *et al.* (2020b).



FIGURE 41. *Monstera gigas* from Fortuna, Panama. Michael Mittermeier (left) with a leaf up to 3 m of length, and Marco Cedeño and Orlando Ortiz (right) with a leaf up to 2 m of length. *M. Cedeño et al. 2328* (PMA). Image from Cedeño-Fonseca *et al.* (2020b).

23. ***Monstera glaucescens*** Croat & Grayum, *Phytologia* 82: 44. 1997. (Figs. 42, 43)

Type:—COSTA RICA. Heredia: Estación Biológica La Selva, at confluence of Rio Sarapiquí and Rio Puerto Viejo, Atlantic slope, 50–75 m, 5 Nov 1988, *M.H. Grayum 8972* (holotype MO!).

Nomadic vine, appressed-climbing. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; stems dark green, smooth and pruinose, cylindrical; internodes 3–8 cm long, 3–5 mm diam.; petioles distinct, dark green, smooth, 4–7 cm long, sheathed up to half their length; **petiole sheath** persistent; **blades** lanceolate, truncate at base, acuminate at apex, subcoriaceous, 9–15 × 4–7 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** light to dark green, smooth and pruinose; **internodes** 2–3(10) cm long, 1.0–2.5 cm diam., 1.2–2.0 times longer than wide; **cataphylls** light-green or light green-pruinose, persistent or deciduous; **anchor roots** light brown; **feeder roots** dark brown; **petiole** light green and pruinose, smooth, 25–45 cm long, sheathed to half or 3 cm below base of the geniculum; **petiole sheath** persistent and closed; **unsheathed portion** slightly ribbed; geniculum smooth, slightly sunken adaxially, convex abaxially, 1.0–2.5 cm long; **blades** ovate to elliptical, broadly cuneate to rounded, truncated or subcordate at base, acuminate at apex, subcoriaceous, drying glossy, light brown, reddish or black, 25–45 × 15–30 cm, 1.4–1.7 times longer than wide, decurrent on the geniculum, decurrent portion 1–2 mm wide; **midrib** ribbed adaxially, convex abaxially, drying reddish or black on both surfaces; **primary lateral veins** 6–18 per side, occasionally two of them emerge together from the midrib and then spreading towards the margin, sunken adaxially, prominent abaxially, departing midrib at 55–65°, drying reddish and black; **secondary veins** reticulate towards the margin; **collective veins** not visible; **fenestrations** absent; **margins** entire or deeply pinnatifid with 2–7 lobes per side. INFLORESCENCES on ascending stems, 1 or 2 simultaneously at flowering time, arranged in the leaf axils or into cataphylls; **peduncle** smooth, 12–25 cm long; **spathe** acuminate and completely open at apex, with overlapping basal margins, yellowish green during development, creamy white externally and white internally at anthesis, marcescent and turning dark blue at the end of anthesis, 15–22 × 9–14 cm, up to 12 cm longer than the spadix; **spadix** white during development, cream at anthesis, 4–10 cm long, 1.0–3.0 cm diam., 3.5–5.0 times longer than wide; **basal sterile flowers** with a spherical ovary and a conical stigmatophore, with an orange stigmatic secretion, 4–5 mm; **fertile flowers** 4–6 mm long; stamens 1–5 mm long, with laminar filaments; anthers 2–3 mm long; ovary cylindrical, rectangular in longitudinal section, ribbed, 3–4 × 2–3 mm; style compressed and hexagonal, 0.5–2.0 × 3–4 mm; stigma linear, cleft on top surface of style, with an orange stigmatic secretion; **berries** with a yellowish green stylar cap during development, mature stylar cap creamy; pulp white; **seeds** dark-brown, globose, 5–7 mm long.

Distribution and ecology:—*Monstera glaucescens* ranges from southeastern Nicaragua and Costa Rica (Atlantic slope) to E Panamá and Colombia (Chocó), at 0–850 m, in *Tropical wet forest* and *Premontane wet forest* life zones.

Phenology:—Flowering has been recorded in January and October. Fruiting in January-February, April, June, and November-December.

Discussion:—The species is a member of sect. *Monstera*. It differs from the other species of the genus in Costa Rica by its light green, pruinose petiole, sheathed to half or 3 cm below the base of the geniculum, persistent and closed petiolar sheath, pinnatilobed leaf blade without fenestrations, the externally and internally white/cream acuminate spathe, and sterile flowers with the ovary spherical and with a conical stigmatophore. It is similar to *Monstera pinnatipartita*, but the latter species has persistent, involute petiolar sheaths, the leaf blade deeply pinnatifid, and occurs only on the Pacific slope.

The species is not easily confused with any other but could be confused with *M. bocatorensis* which has the pinnae of the blade markedly unequal and drying light-yellow brown on the lower surface. In contrast *M. glaucescens* has leaf blades that dry dark brown and have much narrower pinnae with more long-tapered more prominently falcate pointed lobes.

Additional specimens examined:—NICARAGUA. **Atlántico Sur:** Río Punta Gorda, Atlanta, al SE de ”La Richard” Loma San Jorge, 11°31’N 084°04’W, 150–160 m, 13 noviembre 1981, *P.P. Moreno & J.C. Sandino 13047* (MO!); Río Punta Gorda, Atlanta, al SE de ”La Richard” Loma San Jorge, 11°31’N 084°04’W, 150–160 m, 13 noviembre 1981, *P.P. Moreno & J.C. Sandino 13054* (MO!); Río Punta Gorda, al este del la Corriente la Guitarrona, 11°31’N 084°10’W, 50–100 m, 24 Febrero 1994, *R.M. Rueda et al. 3484* (MO!); Río Punta Gorda, al este del la Corriente la Guitarrona, 11°31’N 084°10’W, 50–100 m, 24 Febrero 1994, *R.M. Rueda et al. 3491* (HULE, MO); Caño Costa Riquita, ca. 1.8 km SW of Colonia Naciones Unidas, above (S of) road between Colonia Nuevo Léon and Colonia Naciones Unidas, 11°43’N 084°18’W, 150–180 m, 06 November 1977 – 07 November 1977, *W.D. Stevens 5030* (MO!); **Río San Juan:** Municipio El Castillo, Comunidad Laureano Mairena, a 5 km del Río Santa Crucita, 11°03’18”N 084°27’17”W, 60 m, 4 Julio 2005, *C. Guadamuz 3621* (HULE, MO); Municipio El Castillo, Comunidad

Laureano Mairena, a 5 km del Río Santa Crucita, 11°03’18”N 084°27’17”W, 60 m, 4 Julio 2005, *C. Guadamuz 3621-A* (MO!); Near Caño Chontaleño, 20 km NE of El Castillo, 11°08’N 084°12’W, 200 m, 18 April 1978 – 21 April 1978, *D.A. Neill & P.C. Vincelli 3489* (HNMN!, MO!); Municipio el Castillo, Reserva Indio-Maiz, Cerro Bolívar, 10°51’N 084°10’W, 150–280 m, 30 noviembre 1998, *R.M. Rueda et al. 9298* (HULE, MO); Municipio del Castillo. Estación Biológica Bartola, Sobre el rio Bartola a 3 kilometre de le desembocodura, 10°58’00”N 084°19’50”W, 50–100 m, 27 julio 1998, *R.M. Rueda et al. 8201* (HULE, MO); Municipio del Castillo, Estación Biológica Bartola, sobre el Río Bartola a 3 km de la desembocadura, 10°58’00”N 084°19’50”W, 50–100 m, 28 julio 1998, *R.M. Rueda et al. 8274* (HULE, MO); Municipio el Castillo, Reserva biológica ”Indio-Maiz”, Caño el Sarnoso, 10°55’N 084°17’W, 100 m, 3 diciembre 1998, *R.M. Rueda et al. 9394* Municipio el Castillo, Reserva Indio-Maiz; Cerro el Diablo, 11°01’N 084°12’W, 250–350 m, 8 diciembre 1998, *R.M. Rueda et al. 9575* (HULE); Reserva Indio-Maiz, Municipio de el Castillo, a lo largo del caño el Pavon, a 3 km de sa desembocadura en el Río Bartola, 11°01’N 084°16’W, 100–150 m, 1 Enero 1997, *R.M. Rueda 5175* (HULE); Reserva Indio-Maíz, Municipio de el Castillo, a lo largo del caño el Pavon, a 3 km de su desembocadura en el Río Bartola, 11°01’N 084°16’W, 100–150 m, 31 Diciembre 1996, *R.M. Rueda 5131* Reserva Indio-Maíz, Municipio de el Castillo, en los alrededores de la desembocadura del Río Bartola, 10°58’N 084°20’W, 30–50 m, 13 Enero 1997, *R.M. Rueda 5691* (HULE, MO); Reserva Indio-Maíz, Municipio de el Castillo, 3 km al norte de la desembocadura del Caño Chontaleño, 11°05’N 084°15’W, 150–200 m, 13 Febrero 1997, *R.M. Rueda 5741* (HULE, MO); Reserva Indio–Maíz, Municipio de el Castillo, 3 km al norte de la desembocadura del Caño Chontaleño, 11°05’N 084°15’W, 150–200 m, 13 Febrero 1997, *R.M. Rueda 5762* (HULE); Reserva Indio-Maíz, Municipio de el Castillo, a lo largo del Caño Chontaleño, 11°06’N 084°14’W, 150–200 m, 14 Febrero 1997, *R.M. Rueda 5803* (HULE, MO); Reserva Indio-Maíz, Municipio de el Castillo, a lo largo del Caño Chontaleño, 11°09’N 084°11’W, 150–200 m, 17 Febrero 1997, *R.M. Rueda et al. 6026* (MO!). COSTA RICA. **Alajuela:** San Carlos, Pocosol, 2 km N of San Rosa, 15 km N of Boca Arenal on Quesada, Muelle San Carlos, Los Chiles road, 100 m, 28 April 1983, (Fr.), *R. Liesner 15034* (CR!, MO!); Upala, Aguas Claras, Sector Caribe; colectado en bosque y charal, sendero el pantano, 395 m, 11 June 2003, (Fr.), *E. Alfaro 4480* (CR!); San Carlos, Pital, Lagunas La Cureña, 100 m, 30 April 2004, (Fr.), *R. Kriebel 4525* (CR!); San Ramon, Bajo Rodriguez, 300 m, 11 April 1976, (Fr.), *J. Utley 4625* (MO!); San Carlos, 3 km south of Boca de Arenal in trashy patch of remnant forest in midst of cane fields of Hacienda Boca Arenal, 100 m, 6 March 1986, (Fr.), *B.E. Hammel 15320* (MO!); Los Chiles, Los Chiles, Las Delicias, 56 m, 3 March 2017, (Fr.), *M. Cedeño et al. 1041* (USJ!). **Cartago**. Turrialba, Tres Equis, Sendero Principal hacia Barbilla, por la loma, 300 m, 18 October 2000, (Fl.), *E. Mora 1608* (CR!, MO!); **Guanacaste:** La Cruz, Santa Cecilia, Estación Pitilla; 9 Km al S de Santa Cecilia, 700 m, 12 January 1998, (Fr.), *C. Moraga 960* (CR!); La Cruz. Santa Cecilia, Estacion Pitilla, Finca Margarita, 700 m, 17 April 1995, (Fr.), *M. Moraga 162* (CR!); La Cruz, Santa Cecilia, Finca Guillermo Navarro, 480 m, 24 Febrero 2017, (Fr.), *M. Cedeño et al. 1006* (USJ!); **Heredia:** Sarapiquí, Puerto Viejo, Slopes of eastern spur ridge at N end of Cerros Los Arrepentidos, ca. 4 km NW of Puerto Viejo, 60 m, 3 March 1987, (Fl.), *M.H. Grayum et al. 8102* (CR!, MO!); South of Puerto Viejo, 2 km south of Magsasay Penal Colony, west of the road, 200 m, 5 February 1983, (Fr.), *N. Garwood et al. 1111* (CR!); Sarapiquí, La Virgen, Cuenca del Sarapiquí, Lomas de Sardinal, ca. 15 km línea recta N de Puerto Viejo, 275 m, 11 January 1997, (Fl., Fr.), *B.E. Hammel 20623* (CR!, MO!); Sendero entre el campamento Canta Rana y Río Peje, Magsasay, 400 m, 14 January 1983, (Fl.), *I. Chacón 70* (CR!); Sarapiquí, Puerto Viejo, E.B. La Selva, Finca La Selva, Quebrada paralela creciendo sobre un árbol caído, 8 August 1983, (Fl.), *I. Chacón 1132* (CR!); North of Puerto Viejo, 10 km down road, then 7–8 km west in forest, 2 February 1983, (Fr.), *N. Garwood et al. 848* (CR!, MO!); Sarapiquí, La Virgen, Sarapiquí, La Virgen, Golfito, parcela del señor Miguel Angel Picado, 0 m, 10 December 2005, (Fr.), *D. Santamaría 3604* (CR!); Finca La Selva, 80 m m, 22 September 1986, (Fr.), *M.H. Grayum 7667* (MO!); Finca La Selva, 100 m, 27 September 1982, (Fr.), *T. McDowell 222* (MO!); O.T.S. La Selva Reserve, 100 m, 15 April 1986, (Infer.), *T.B. Croat 61217* (MO!); Sarapiqui, Finca La Selva, 100–150 m, 6 January 1978, (Fr.), *T.B. Croat 44322* (MO!); Sarapiquí, Horquetas, Estación Biológica La Selva, 50 m, 24 Jumio 2016, (Fl.), *M. Cedeño 906* (USJ!); Sarapiquí, La Virgen, Reserva Biológica La Tirimbina, 150 m, 16 April 2016, (Fr.), *M. Cedeño & J. Ley 873* (USJ!); **Limón:** Limón, Valle de la Estrella, Cerro Muchilla, Fila Matama, Entrando por el pueblo, El Progreso, Cordillera de Talamanca, 850 m, 9 April 1989, (Fr.), *R. Robles & A. Chacón 2735* (CR!); Pococí, Colorado, R.N.V.S. Barra del Colorado, Forests and pastures between Río Chirripocito and pastures between Río Chirripocito and Río Sardina (”Sardinal” on Chirripó Atlántico quadrangle), 12 m, 21 April 1990, (Fl.), *M.H. Grayum 9800* (CR!, MO!); Pococí, Jiménez, Guápiles, Wet forest remnants on the road from Guápiles to the Río Chirripó, 300 m, 7 April 1982, (Fr.), *K. Barringer & J. Gómez 2359* (CR!); Pococí, Colorado, P.N. Tortuguero, Parque Nacional Tortuguero, Estación Agua Fría, primera loma aproximadamente 6 km al SE. Cerros Azules, 70 m, 23 January 1988, (Fr.), *R. Robles 1579* (CR!); Pococí, Colorado, P.N. Tortuguero, Estación Agua Fría; Segunda loma aproximadamente 7 km al sureste, Cerros Azules, 70 m, 21 January 1988, (Fr.), *R. Robles 1558* (CR!); Talamanca, Bratsi, Between Cahuita and

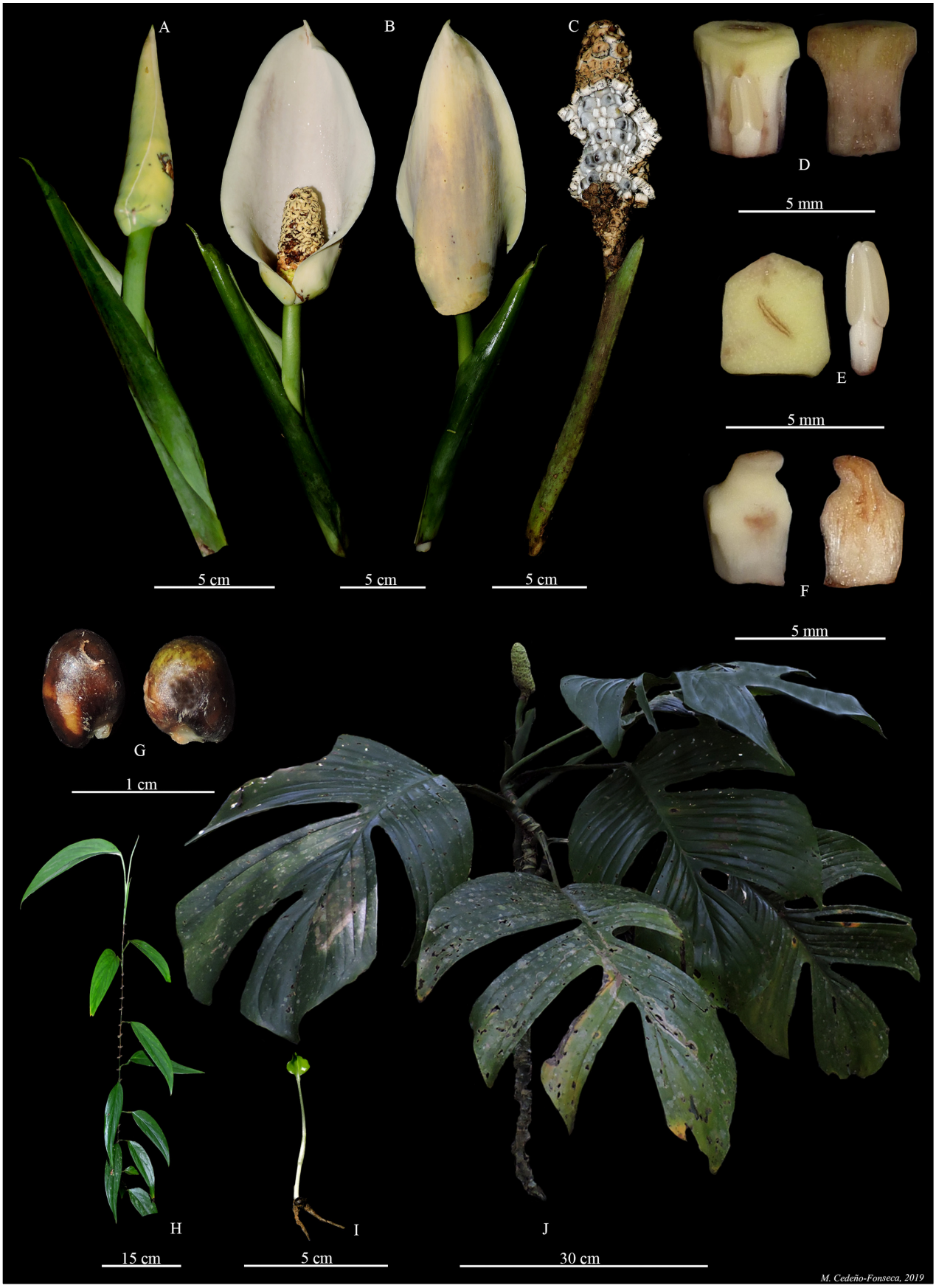

FIGURE 42. *Monstera glaucescens* from Sarapiquí, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detaching. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Seeds. (H) Juvenile plant. (I) Seedling. (J)Adult plant. *M. Cedeño et al. 873* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 43. *Monstera glaucescens*. Adult plant growing 2 m above the ground in a tree in Guápiles, Costa Rica. Photo by M. Cedeño-Fonseca. (Not collected).

the oil drilling platforms beyond Suretka, Southern Limón, 200 m, 23 April 1982, (Fl.), *K. Barringer et al. 2643* (CR!, MO!); Limón, No georreferenciado, 9 June 1983, (Fr.), *K. Barringer 3043* (CR!); Limón, Siquirres, Pacuarito, Forested ridges and slopes between Río Pacuare and Quebrada Diablo, ca. 2.5 km E of Siquirres, 150 m, 5 October 1986, (Fl.), *M.H. Grayum et al. 7702* (CR!, MO!); Pococí, Colorado, P.N. Tortuguero, Estación Agua Fría; Segunda loma aproximadamente 7 km al sureste, Cerros Azules, 70 m, 21 January 1988, (Fr.), *R. Robles 1553* (CR!); Vicinity El Copé, 5–6 mi N of El Copé, along trail which leads into the lowlands from old Riviera saw works área, 700 m, 8 July 1994, (Fl.), *T.B. Croat & G. Zhu 77200* (CR!); Pococí, Guapiles, Guápiles, Bosque Lluvioso, 350 m, 12 October 2005, (Fl.), *L. Acosta 3698* (CR!); Pococí, Guapiles, Pococi, along Rio Corinto near Braulio Carrillo-Guapiles HWy, 1 km S of turnoff to Puerto Viejo, 250 m, 30 August 1996, (Infer.), *T.B. Croat 78748* (CR!, MO!); Pococí, Guapiles, Guápiles, Finca INBio, Sendero de Las Aves, 300 m, 7 June 2007, (Infer.), *A. Soto 1593* (CR!); Pococí, Guapiles, R.B. Bosque Lluvioso, Sendero Los Gigantes, 315 m, 21 February 2008, (Fr.), *L. Vargas 3047* (CR!, MO!); Hacienda Tapezco-Hacienda La Suerte, 40 m, 14 March 1978, (Fl.), *C. Davidson 6938* (MO!); Talamanca, 7 km SW of Bribrí, 100–250 m, 4 May 1983, (Fr.), *L. Gómez 20372* (MO!); Parque Nacional Tortuguero Estación Agua Fría, Aproximadamente 12 Km al Noreste, 80–100 m, 2 March 1988, (Fr.), *R. Robles 1672* (CR!, MO!); Finca Montecristo, 25 m, 18 February 1926, (Fr.), *P. Standley 48938* (MO!); Finca Montecristo, 25 m, 18 February 1926, (Fr.), *P. Standley 48945* (MO!); Finca Montecristo, 25 m, 18 February 1926, (Fr.), *P. Standley 49010* (MO!). PANAMA. **Darién:** Río Balsa between Manene and Guayabo, 07°44'N 077°50'W, 100 m, 08 November 1967, *James A. Duke & Norton H. Nickerson 14956* (MO!); **Panamá:** Cerro Jefe Region; 0.8 mi beyond turn-off to Altos de Pacora (near branch in road to antennas to Cerro Jefe), 09°15'N 079°29'W, 770 m, 4 July 1994, *T.B. Croat & G. Zhu 76637* (MO!); **San Blas:** (Comarca de Kunayala): Nusigandí, El Llano-Cartí Road, 10.1 mi N of Interamerican Hwy, then ca. 0.5 mi N, Paseo Mariska near road, 09°20'N 078°59'W, 300 m, 20 Jul 1994, *T.B. Croat & G. Zhu 77026* (MO!). COLOMBIA. **Chocó:** Bahia Solano. Corregimiento El Valle, carretera entre el puente sobre la quebrada Tundó y el km 7 del Valle-Bahía Solano, 06°21'N 076°26'W, 0 m, 25 Abril 1989, *J. Espina et al. 2980* (MO!).

24. ***Monstera guzmanjacobiae*** Díaz-Jiménez, M.Cedeño, Zuluaga & Aguilar-Rodríguez, *Phytotaxa* 437 (1): 039–046. 2020. (Figs. 44, 45)

Type:—MEXICO. Veracruz: Municipio Catemaco, La Palma, Selva alta perennifolia, 18º33'21''N, 95º03'35''W, 56 m, 31 May 2014, *Pedro Díaz Jiménez & Valeria Guzmán Jacob 1305* (holotype MO!, isotypes MEXU!, XAL!).

Nomadic vine, appressed-climbing with pendent branches. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** smooth, light-green, dorsiventrally compressed; **internodes** 4–8 cm long, 3–5 mm diam.; **petiole** inconspicuous, 1.0–2.5 cm long; **blades** obovate, cordate at base, short-acuminate at apex, coriaceous, 6–9 × 5–8 cm, occasionally white spotted, completely appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green, scaly or with a light brown, thin and exfoliating epidermis, sometimes semiglossy, slightly with greenish pustules, rarely smooth, sulcate on one side; **internodes** 6–12 cm long, 0.8–2.5 cm diam., 4.8–7.5 times longer than wide; **cataphylls** deciduous; **anchor roots** brown; **feeder roots** beige and corky, up to 35 cm long; **petiole** matte-green, glaucous towards base, smooth towards the geniculum, striated at base, scarcely white-spotted, 15–25(30) cm long, sheathed up to 1.5 cm before or to base of the geniculum; **petiole sheath** marcescent with fibrous fragments, apically prolonged as a ligule 1.5–3.0 cm long; geniculum light or dark green, smooth or striated, terete, 0.5–3.5 cm long, 0.4–1.0 cm diam.; **blades** chartaceous to subcoriaceous, ovate to broadly elliptic, cordate to semi-cordate at base, acute or acuminate at apex, 18–59 × 15–37(40) cm, dark green, glossy above and bright light green below, drying light brown above and dull green below; **perforations** absent or present, 1–4 per side, oblong-elliptic, generally arranged in one side; **margins** entire; **midrib** sunken adaxially, prominent abaxially, **primary lateral veins** 5–9 per side, whitish and prominent abaxially, departing midrib at 65–70°; **secondary veins** parallel and joined near the medial part of the blade to the margin. INFLORESCENCES curved or rarely erect, at an angle of 40–60°, on ascending or pendent stems, arranged in the axils of the leaves or into cataphylls; **peduncle** green or yellowish, smooth towards the apex, with greenish-white pustules at base, 5–20 cm long, 0.8–2.0 cm diam.; **spathe** obtuse or mucronate, light green or yellowish green during development, white to creamy internally and green-yellowish or yellowish externally at anthesis, cucullate, coriaceous, 15–19 × 12–15 cm, marcescent after anthesis, without enveloping the spadix, up to 1 cm longer than the spadix; **spadix** white during development, white-creamy at anthesis, 8–16 cm long, 2–4 cm diam., with a sterile flowered slender region towards base; **basal sterile flowers** with a transparent stigmatic secretion, 4–6 mm long; **fertile flowers** 5–7 mm long; stamens 1–6 mm long, with laminar filaments; anthers 1.5–2 mm long; ovary quadrangular in longitudinal section, ribbed, 4–5 × 3.5–4.0 mm; style pyramidal and conical, 3.5–4.0 × 2.5–3.5 mm; stigma linear, with a yellowish stigmatic secretion; **berries** with a green stylar cap during development, mature stylar cap yellowish-green; pulp white; **seeds** pale yellow and brown, ovate-oblong, 6–9 × 5–7 mm; strophiole thick, yellow.

Distribution and ecology:—*Monstera guzmanjacobiae* is endemic to the Los Tuxtlas region of Mexico. It is known from the municipality of Catemaco between La Palma and the road between Tebanca and Miguel Hidalgo, at 400 m, in a *Tropical wet forest* life zone.

Phenology:—Flowering and fruiting was recorded in February, March, April, May, June and November.

Discussion:—The species is member of sect. *Marcgraviopsis* and is characterized by the ligule of the petiole sheath 1.5–3.0 cm in length, the adult plant's leaf blade with fenestrations (1–4 perforations) often only on one side or lacking fenestrations, the inflorescence erect or inclined, the flowers with a conical pyramidal style, the seeds with a yellowish color and with a thick yellow strophiole.

Monstera guzmanjacobiae is similar to *M. luteynii* but this is endemic from Costa Rica and has non-fenestrate blades and flowers with truncate style. It could also be confused with *M. tuberculata*, because both have pendent habit, although the latter has leaf blades two to three times smaller, rarely fenestrate, and the inflorescences are completely pendent (inclined between 40–60° and rarely erect in *M. guzmanjacobiae*). Adult plants of *M. guzmanjacobiae* have leaf blades similar to those of pre-adult plants of *M. punctulata*. However, in this latter species, the fenestrations have varied sizes and some reach the edge of the blades.

Additional specimens examined:—MEXICO. **Veracruz:** Municipio Catemaco, La Palma, Acahual (con elementos de selva alta perennifolia), 18º33'12''N, 95º03'41''W, 30 m, 20 September 2018, *P. Díaz-Jiménez, et al.* 1427 (MEXU!, UJAT!); Municipio Catemaco, Tebanca, relicto de selva alta perennifolia, 18º22'13''N, 95º00'56''W, 361 m, 25 February 2019, *P. Díaz-Jiménez & M. M. Alarcón* 1429 (XAL!).

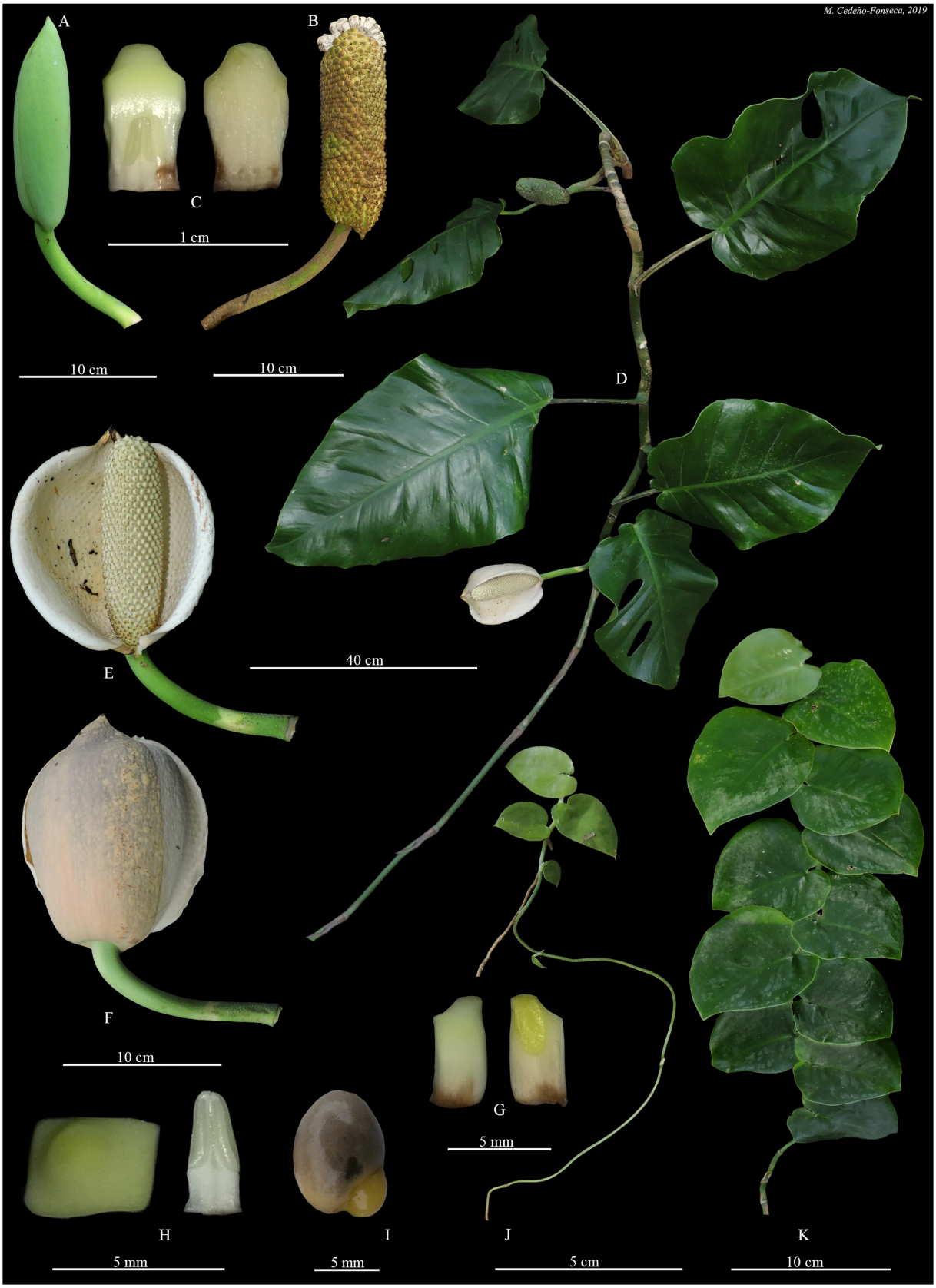

FIGURE 44. *Monstera guzmanjacobiae* from Veracruz, Mexico. (A) Developing inflorescence. (B) Infructescence with stylar caps mostly already detached. (C) Fertile flower; in lateral view (left), and in longitudinal section. (D) Adult plant showing pendent inflorescence and developing flagellum. (E) Inflorescence with open spathe, front view. (F) Inflorescence with open spathe, back view. (G) Sterile flower; lateral view (left), and longitudinal section (right). (H) Stylar plate with stigma (left) and one stamen (right). (I) Seed. (J) Seedling transforming into a juvenile shingle-leaved plant. (K) Juvenile plant. *P. Diaz-Jiménez et al. 1429* (XAL). Image from Díaz-Jiménez *et al.* (2020).



FIGURE 45. *Monstera guzmanjacobiae*. Adult plant growing in the locality type in Veracruz, Mexico. *P. Diaz-Jiménez et al. 1429* (XAL). Photo by M. Cedeño-Fonseca.

25. ***Monstera harrisoniorum*** Croat, M.Cedeño & O.Ortíz, ***sp. nov.***

The species is characterized by its hemiepiphytic habit, petiolar sheath deciduous, leaf blades broadly ovate, obtuse to rounded at base, and flowers with truncated style and linear stigma.

Type:—PANAMA. Panamá: Santa Rita Ridge Road, 23 Mar. 1972, *J. D. Dwyer & A. Gentry 9546A* (holotype, MO!-2092911).

Nomadic vine, appressed-climbing habit. SEEDLINGS: unknown. JUVENILE PLANTS: root climbers; **stems** smooth, dark green; **internodes** 2–5 cm long, 4–7 mm diam.; **petiole** distinct, dark green, smooth, 6–15 cm long, fully sheathed; **petiole sheath** deciduous; **blades** ovate, rounded at base, short-acuminate at apex, coriaceous, 10–20 × 9–12 cm, not appressed to the phorophyte; **fenestrations** absent or present. ADULT PLANTS: root climbers; **stem** dark or slightly light green, smooth, cylindrical; **internodes** 2–4(10) cm long, 1.0–2.5 cm diam., 1.6–2.0 times longer than wide; **anchor roots** dark brown; **feeder roots** black and with radical trichomes; **petiole** dark green, smooth, 12–30 cm long, sheathed to base of the geniculum, **petiole sheath** deciduous; geniculum smooth, slightly ribbed, sulcate

adaxially, convex abaxially, 1.5–2.5 cm long; **blades** broadly ovate to ovate, unequal and obtuse to rounded at base, short-acuminate at apex, coriaceous, drying dark brown and faintly glossy above, slightly paler below, 15.5–25.5 × 8.3–16.5 cm, 1.5–1.8 times longer than wide; **midrib** slightly ribbed adaxially, convex abaxially, drying blackish or yellowish on both surfaces; **primary lateral veins** 5–8 per side, slightly sunken adaxially, prominent abaxially, departing midrib at 35–45°, drying blackish or yellowish; **collective veins** not visible; **fenestrations** absent or present, perforations arranged near the midrib with one side of blade usually more prominently fenestrated; **margins** entire. INFLORESCENCES on ascending stems; **peduncle** smooth, 14 cm long, 4 mm diam.; **spathe** unknown; **spadix** unknown during development, green to brown at anthesis, matte, 8.3 cm long, 1.6 cm diam., 5.3 times longer than wide; **basal sterile flowers** 3–5 mm long; **fertile lowers** 5–7 mm long; stigma linear; **berries** unknown; **seeds** unknown.

Etymology:—The species is named in honor of American biologists and Cerro Jefe flora and fauna specialists Jerry and Linda Harrison.

Distribution and ecology:—*Monstera harrisoneorum* is endemic to Panama, known only from the type locality at 980 m, in a *Premontane rain forest* life zone.

Phenology:—Fruiting was recorded in March.

Discussion:—The species, a member of section *Monstera*, is characterized by its hemiepiphytic habit at 2.5–3.0 m above the ground, the pale brown-drying stem with the dried epidermis greatly fissured-ridged and flaking, petioles sheathed to the geniculum and promptly deciduous, sharply sulcate geniculum, coriaceous, glossy, weakly bicolorous blades with the midrib sunken above, narrowly rounded and paler below, primary lateral veins quilted-sunken and concolorous above, narrowly rounded and slightly paler below.

Monstera harrisoneorum could be confused with pre-adult individuals of *Monstera donosoensis*, but differs in having leaf-blades broadly ovate, obtuse to rounded at base (vs. ovate to elliptic, rounded or truncate at base), and in having flowers with the truncated style (vs. flowers with style hexagonal and strongly conical, and distally cylindrical). It could also be confused with *Monstera dissecta*, but differs by having leaf-blades broadly ovate, and obtuse to rounded at base (vs. ovate to elliptical or oblong, cuneate to rounded or truncate at base), petiolar sheath deciduous (vs. petiolar sheath persistent), and flowers with the truncated style (vs. flowers with style hexagonal with a stigmatophore cupuliform).

Additional specimens examined (paratypes):—PANAMA. **Colón:** Santa Rita Ridge, 23 Mar 1972, *J.D. Dwyer & A. Gentry 9546A* (MO!); **Panamá:** Altos de Cerro Azul, cerca de la entrada del camino que va hacia los miradores Vistamares y Atakaya, 09°14’46”N 079°24’24”W, 903 m, 17 March 2018, *O. Ortiz et al. 2952* (MO!, PMA!); Chagres National Park: vic. Cerro Jefe, between Altos de Cerro Azul and Cerro Jefe, SW slopes of Cerro Jefe, 09°13’39”N 079°23’20”W, 980–990 m, 02 March 2015, *T.B. Croat et al. 106207* (MO!); Panamá. Cerro Jefe, at summit, 15.4 miles from Panamerican Highway, 09°14’02”N 079°22’30”W, 1000 m, 05 December 1979, *T.B. Croat 49093* (MO!).

26. ***Monstera integrifolia*** Zuluaga & Croat, *Phytotaxa* 334(1): 6. 2018. (Figs. 46, 47)

Type:—PANAMA. Chiriquí: Distrito Gualaca, corregimiento Hornito, Reserva Forestal Fortuna, trails near Chiriquí Research Center Jorge L. Arauz, 1200–1500 m elevation, 31 Jan 2013, *A. Zuluaga 916* (holotype WIS, isotypes PMA!, MO!).

Nomadic vine, appressed-climbing. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** dark green with white dots, cylindrical; **internodes** 2–8 cm long, 4–10 mm diam.; **petiole** distinct, dark green with white dots, smooth, 8–10 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous or slightly persistent; **blades** lanceolate, truncate at base, acuminate at apex, 8–14 × 5–8 cm; not appressed to the phorophyte; collective veins visible; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green or yellowish, sometimes white-spotted, cylindrical; **internodes** 2–4 cm long, 1.4–2.0 cm diam., 1.4–2.0 times longer than wide; **anchor roots** and **feeder roots** dark brown; **petioles** dark green, whitish or with white dots, smooth, 10–30 cm long, sheathed to base of the geniculum; **petiole sheath** slightly persistent or deciduous with fibrous fragments; geniculum smooth with white dots, sulcate adaxially, convex abaxially, 1–3 cm long; **blades** lanceolate, cuneate or attenuate at base, acuminate at apex, coriaceous, 30–40 × 9–13 cm, 2.0–2.6(3.3) times longer than wide, slightly decurrent on geniculum, decurrent portion 1–2 mm wide, drying black with light brown dots; **midrib** ribbed adaxially, convex abaxially, **primary lateral veins** 5–10 per side, slightly sunken adaxially, prominent abaxially, departing midrib at 35–45°; **secondary veins** parallel across primary lateral veins, reticulate towards the margins; collective veins slightly visible; **fenestrations** absent or present, generally the fenestrations break at the margin; **margins** pinnatilobed with 2–3 lobes per side. INFLORESCENCES on ascending stems, arranged in the axils of the leaves; **peduncle** smooth, 6–15 cm long, 0.6–1.2 cm diam.; **spathe** acuminate, light green during development, white to cream internally and green externally at

anthesis, 15–18 × 8–9 cm, up to 8 cm longer than the spadix; **spadix** white (both during development and at anthesis), 8–10 cm long, 1.7–2.0 cm diam., 0.6–0.9 times as long as peduncle; **basal sterile flowers** 4–5 mm long; **fertile flowers** 4–5 mm long; stamens 2–4 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 2–4 × 2–3 mm; style hexagonal, 2–4 × 3–4 mm; stigmatophore conical, 0.5–1.0 mm long; stigma circular with a yellowish stigmatic secretion; **berries** with a white stylar cap during development, mature stylar cap unknown; pulp unknown; **seeds** unknown.



FIGURE 46. *Monstera integrifolia*. Adult plant growing in the Premontane rain forest in Ngäbe Buglé, Panama. *M. Cedeño et al. 2458* (PMA). Photo by M. Cedeño-Fonseca.

Distribution and ecology:—*Monstera integrifolia* ranges from northern Costa Rica to western Panama at 1000–2000 m, in *Tropical wet forest* or *Premontane rain forest* life zones.

Phenology:—Flowering has been recorded in November. Fruiting in December.

Discussion:—The species is a member of sect. *Monstera*. It is distinguished by having narrow leaf blades with primary lateral veins that arise from the midrib at an angle of 35°, whitish and mottled petioles, with a petiolar sheath that disintegrates as fibrous residues, and flowers with a conical stigmatophore. It could be confused with *Monstera anomala* and *M. standleyana*. *Monstera anomala* never has fenestrate leaf blades and the flowers have an elongated style with a constriction in the middle. *M. standleyana* plants are usually more robust, have a columnar stigmatophore, and inhabit lower elevations (0–1360 m).

Monstera integrifolia is most similar to *M. xanthospatha*, a species endemic to the West and Central Cordilleras of Colombia at elevations between 1500–2300 m. Both species are small plants, flowering when they are less than 10 m tall, and inhabit montane cloud forests. *Monstera integrifolia* differs from *M. xanthospatha* in having shorter petioles and peduncules (9–14 vs. 13–25 cm), a longer spadix (8–10 vs. 5–7 cm), and flowers with raised styles (vs. flat).



FIGURE 47. *Monstera integrifolia*. Adult plant growing 2 m above the ground in the Premontane rain forest in Costa Rica. *M. Cedeño et al. 2458* (PMA). Photo by M. Cedeño-Fonseca.

Additional specimens examined:—COSTA RICA. **Cartago:** Turrialba, Chirripo, Moravia de Chirripó, Bosque nuboso, 1602 m, 20 December 2019, (Fr.), *M. Cedeño et al. 638* (USJ!); Turrialba, Chirripo, Moravia de Chirripó, Bosque nuboso, 1602 m, 20 December 2018, (Fr.), *M. Cedeño et al.1639* (USJ!); Turrialba, Chirripó, Tayutic, Jicotea, Siguiendo la Fila Vereh, entre la Cueva del Sapo y Fila Vereh, 1634 m, 22 December 2018, (Fl., Fr.), *G. Herrera 8005* (CR!, MO!); **Heredia:** Sarapiqui, La Virgen, Primary forest along Rio San Rafael, Atlantic slope of Volcan Barva, 1500 m, 12 April 2019, (Fr.), *M.H. Grayum 7017* (MO!). PANAMA. **Bocas del Toro:** Prov. Cerro Colorado, 9.2 miles W of Chamé; along trail E of road which leads down to stream, 08°35'N 081°50'W, 1450–1480 m, 06 July 1988, *T.B. Croat 69067* (MO!, PMA!); **Chiriquí:** Fortuna Dam site, 08°44'N 082°15'W, 1400–1600 m, 15 September 1977, *J. Folsom et al. 5598* (MO!); Ridges and summit of Cerro Hornito, above Los Planes de Hornito. Elfin forest, 08°42'N 082°06'W, 2100 m, 14 March 1982, *S. Knapp et al. 4220* (MO!); Cerro Hornito, S facing slope approached from Los Planes de Hornito, 08°41'N 082°10'W, 1750–1900 m, 22 September 1987, *T.B. Croat 67978* (MO!); Along road to Fortuna dam site on Río Chiriquí, N of Gualaca, 7.7 mi beyond Francisco Linare's lane, 19.2 mi beyond bridge over the Río Está; 9.1 mi beyond Los Planes de Hornito; 8 mi beyond jct. in road to tunnel, 08°42'N 082°14'W, 1300 m, 27 Nov 1979, *T.B. Croat 48742* (MO!); Fortuna Dam Area, Fortuna-Chiriquí Grande, 5.3 miles N of center of Fortuna

Dam, then 1.4 miles W along gravel road to Continental Divide Trail, 08°44'N 082°17'W, 23 June 1994, *T.B. Croat & G. Hua 76344* (MO!); Gualaca. Corregimiento Hornito, Reserva Forestal Fortuna, senderos cerca al centro de investigaciones Jorge L. Arauz, 08°47'N 082°13'W, 1200–1500 m, 31 enero 2013, *A. Zuluaga 916* (PMA!); **Panamá:** Capira. Cerro Campana, along trail to summit, 08°41'27"N 079°55'02"W, 780–875 m, 20 July 1974, *T.B. Croat 25194* (MO!).

27. ***Monstera juliusii*** M.Cedeño & Croat, *Phytotaxa* 461(3): 186. 2020. (Fig. 48)

Type:—COSTA RICA. Puntarenas: Buenos Aires, Biolley, Parque Internacional de La Amistad, Cerro Frantzius, 2000 m, 5 February 2018, *M. Cedeño, I. Chinchilla, J. Jiménez & J. Porras 1220* (holotype USJ!, isotype MO!).

Robust nomadic vine, appressed-climbing. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stem** smooth, dark green with white spots; **internodes** 4–7 cm long, 4–6 mm diam.; **petioles** conspicuous, dark green with white spots, smooth, 7–12 cm long, sheathed throughout, sheath margins convolute, persisting; **blades** ovate; without **fenestrations**, acuminate at apex, subcordate to truncate at base, coriaceous, 9–15 × 7–10 cm, not flattened against the phorophyte. ADULT PLANTS: root climbers; **stem** dark, opaque beige, smooth, terete; **internodes** 1–3 cm long, 1.5–2.5 cm diam., 0.6–1.2 times as long as wide; **support roots** light brown, 2–4 cm long, **feeder roots** dark brown; **petioles** whitish green or with minute white spots, smooth, 25–60 cm long, sheathed to within 2 cm before or up to base of the geniculum; **petiole sheath** thick and persistent; **geniculum** smooth, 5–10 mm long; **blade** lanceolate to ovate in outline, entire or partially pinnatilobed, narrowly rounded, shortly acuminate at apex, subcordate to obtuse at base, decurrent onto the geniculum, the decurrent portion 1–2 mm wide, coriaceous, 25–60 × 15–30 cm; **midrib** grooved adaxially, transversally convex abaxially; **primary lateral veins** 13–17 per side, moderately sunken above, prominently raised below; **collective veins** not visible; **fenestrations** rounded near the midrib, oval toward the margin; **margin** sometimes breaking. INFLORESCENCES on ascending stems; **peduncle** smooth, 15–23 cm long; **spathe** acuminate, light green in developing inflorescences, greenish-yellow externally and white internally at anthesis, thick, completely open at the apex, the margins slightly overlapping at base, deciduous after anthesis, 15–30 × 7–11 cm, up to 15 cm longer than the spadix; **spadix** white in developing inflorescences, yellowish cream at anthesis, 8–14 cm long, 1.5–3.0 cm diameter; **basal sterile flowers** 4–5 mm long with a transparent secretion; **fertile flowers** 5–7 mm long; stamens 2–6 mm long, with filament laminar; anther 2–3 mm long; ovary rectangular in longitudinal section, ridged, 4–5 × 2–3 mm; style hexagonal, 2–3 × 3–4 mm; stigmatophore cupular, 0.5–1.0 mm long, stigma linear, with yellowish discharge; **berries** with the stylar layer white-cream at maturity; pulp white; **seeds** smooth, green or light brown, sub-elliptical, 5–7 mm long.

Distribution and ecology:—*Monstera juliusii* ranges from eastern Costa Rica to western Panama in the Cordillera de Talamanca in Puntarenas Province, and in western Panama in Chiriquí Province, at 1650–2010 m. In Costa Rica is it known from a *Premontane rain forest* life zone while in Panama it occurs in *Lower montane rain forest* life zones.

Phenology:—Flowering January to March, August-September. Fruits in January, February and September.

Discussion:—The species is a member of sect. *Monstera*. It differs from other species by the combination of leathery leaves with whitish or mottled petioles, thick and persistent petiole sheath margins, and by spathes yellowish green externally and white internally.

Herbarium material of *Monstera juliusii* has been confused with *M. standleyana*, but the latter species has deep green petioles with white dots, usually non-perforate (rarely with few fenestrations), usually entire (rarely with few lobes), lanceolate to ovate leaf blades, creamy yellow spathes with brown spots on the outside, cream on the inside, and laterally flattened stigmatophores.

Additional specimens examined:—COSTA RICA. **Puntarenas:** Coto Brus, P.I. La Amistad, Cordillera de Talamanca, Estación Pittier, Sendero Altamira, 1700 m, 28 January 1995 (fl.), *A. Mora 12* (CR-INB, MO); Buenos Aires, Biolley, Cordillera de Talamanca, Cerro Frantzius to Valle de Silencio, Oak-Podocarpus-laurel forest with *Chusquea longifolia* understory, 2250 m, 7 September 1984, (fl.), *G. Davidse et al. 28563* (MO!); Buenos Aires, Biolley, Camino a Casa Coca, 1600 m, 5 February 2018, (fr.), *M. Cedeño et al. 1219* (USJ!); Coto Brus, Pittier, P.I. La Amistad, Cordillera de Talamanca, Estación Pittier, Sendero Fila Pittier, 1900 m, 27 January 1995 (fl., fr.), *A. Mora 1* (CR!, MO!); Cantón Buenos Aires, distrito Changuena, Boques en Fila Anguciana, Finca Bonillas, 1480 m, 25 abril 2020, *M. Cedeño et al. 1716* (USJ!). PANAMA. **Chiriqui:** distrito Renacimiento, corregimiento Río Sereno, Mount Totumas Cloud Forest, *O. Ortiz et al. 2803* (PMA!).

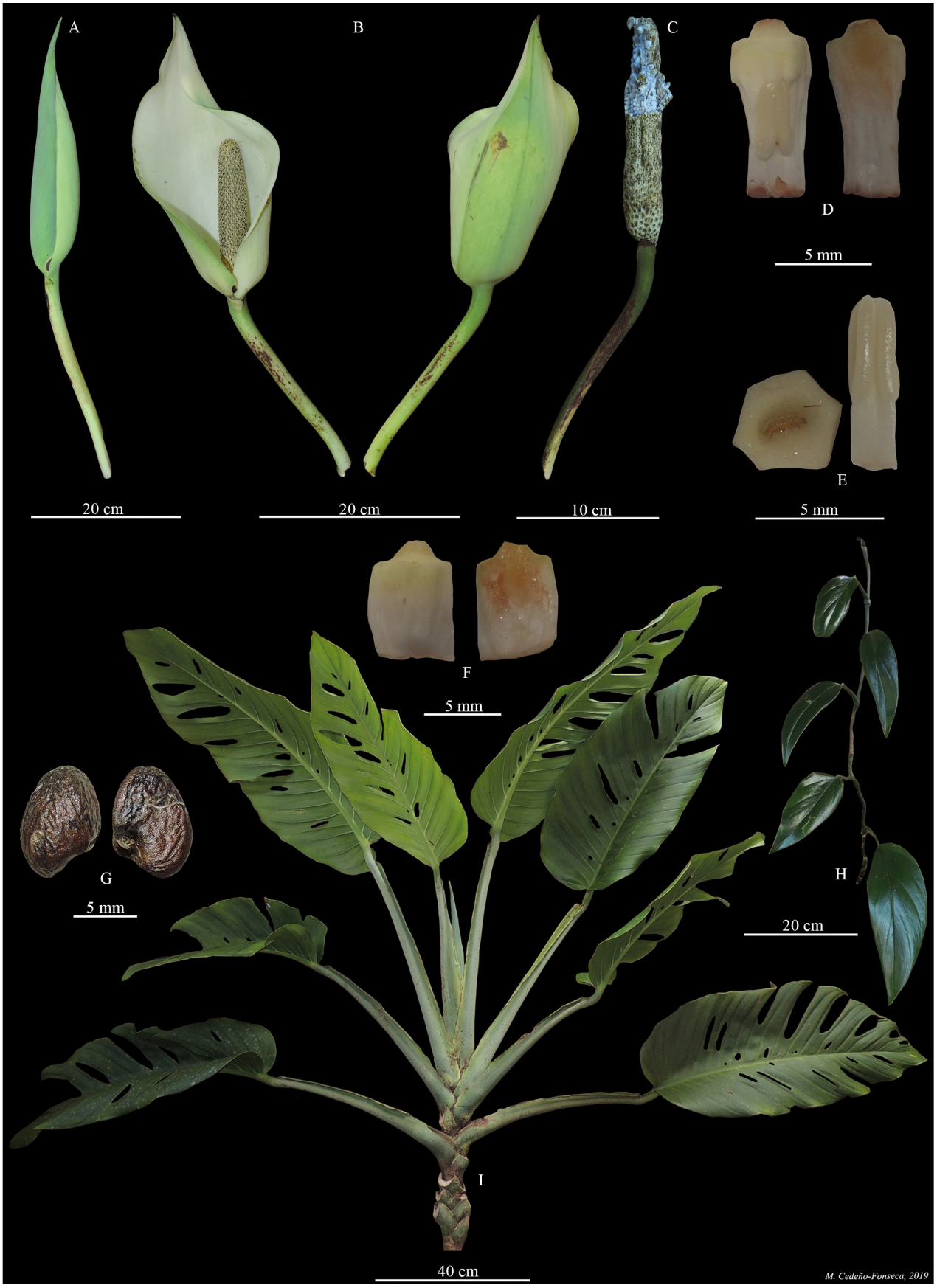

FIGURE 48. *Monstera juliusii* from Puntarenas, Costa Rica. (A) Developing inflorescence. (B) Open inflorescence, front and back views. (C) Mature infructescence, stylar plates detached toward the apical part. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; in lateral view (left), and longitudinal section (right). (G) Seeds. (H) Portion of juvenile plant. (I) Adult plant. *M. Cedeño et al. 1220* (USJ). Image from Cedeño-Fonseca *et al.* (2020b).

28. ***Monstera lentii*** Croat & Grayum, *Phytologia* 82: 46. 1997. (Figs. 49, 50)

Type:—COSTA RICA. Cartago: 10 km S of Cartago by air, along confluence of Río Empalme and Río Estrella, 1 km S of Palo Verde by road, 1450 m, *R.L. Liesner & E.J. Judziewicz 14549* (holotype MO!, isotype RSA).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical; **internodes** 3–10 cm long, 2–5 mm diam.; **petiole** visible, dark or light green, smooth, 8–14 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** obovate, subcordate to truncate at base, acuminate at apex, subcoriaceous, 8–14 × 7–11 cm, not appressed to the phorophyte, collective veins distinct; **fenestrations** absent or present. ADULT PLANTS: root climbers; **stems** light green, dark or light brown, smooth, cylindrical; **internodes** 2–4(35) cm long, 1.0–3.5 cm diam., 0.5–1.1 times as long as wide; **cataphylls** light green, deciduous but leaving dry fragments on the peduncle; **anchor roots** black; **feeder roots** light-brown; **petiole** light green or strongly speckled with white dots, smooth, 25–75 cm long, sheathed to base of the geniculum; **petiole sheath** persistent, revolute, open or closed; geniculum smooth, slightly sulcate adaxially, convex abaxially, 1.0–2.5 cm long; **blades** ovate to oblong, broadly cuneate to rounded or subcordate at base, acuminate at apex, subcoriaceous, drying reddish, black with reddish dots, light-brown or shiny-black, 25–60 × 17–45 cm, 1.4–1.6 times longer than broad, decurrent on geniculum, decurrent portion 1–3 mm wide; **midrib** ribbed adaxially, convex abaxially, drying reddish, light brown, or black on both surfaces; **primary lateral veins** 10–25 per side, forked or trifurcated, sunken adaxially, strongly prominent abaxially, departing midrib at 65–75°, drying reddish, black or light brown; **secondary veins** parallel, reticulate towards the margin, undulate in most of its length when dry; **collective veins** not visible; **fenestrations** absent or present, arranged along the midrib; **margins** entire, pinnatilobed or deeply pinnatifid, with 2–9 lobes per side of 2–15 cm wide. INFLORESCENCES on ascending stems, 2–4 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** smooth, 7–25 cm long; **spathe** acuminate, light green during development, yellowish green externally and white internally at anthesis, completely open at apex, light-brown, marcescent at the end of anthesis, 12–20 × 6–10 cm, up to 10 cm longer than the spadix; **spadix** white during development, cream at anthesis, 5–15 × 1–4 cm, 3.5–5.0 cm times longer than wide; **basal sterile flowers** 4–5 mm long, with a rust-red stigmatic secretion; **fertile flowers** 5–8 mm long; stamens 2–7 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary flattened, rectangular in longitudinal section, ribbed, 4–5 × 2–3 mm; style hexagonal, 4–5 × 3–4 mm; stigmatophore strongly conical, slender, 2–5 mm long; stigma circular, with a transparent stigmatic secretion; **berries** with a light-green stylar cap during development, mature stylar cap creamy-yellow; pulp white; **seeds** black with reddish dots, globose, 4–6 mm long.

Distribution and ecology:—*Monstera lentii* ranges from Costa Rica to western Panamá, and closely along the continental divide, north of the Cordillera de Talamanca, at 1050–1650 m, in *Premontane rain forest* life zones.

Phenology:—Flowering has been recorded in February–April, July, and December, and fruiting in February–March, July–August, and November.

Discussion:—The species, a member of sect. *Monstera*, is characterized by its petiole mottled or light green, the petiolar sheath persistent with open wings, the leaf blade entire or pinnatilobed with few fenestrations, externally yellowish spathe and slender flowers toward base with circular stigma, elevated by strongly and narrowly conical stigmatophore (a unique characteristic among species of the genus).

Previously, *Monstera lentii* was confused with *M. dissecta*, but the latter is distinguished by the conical form of the stigmatophores and its distribution in cloud forests in the Pacific sector of the Talamanca mountain range.

Populations of *Monstera lentii* in the foothills of the Turrialba Volcano have white or speckled petioles, pinnatilobed leaf blades without fenestrations, the spadix stipitate for 1–2 cm and without a region of sterile flowers, and cylindrical stigmatophore with round stigma. These populations could represent a different species, as the populations around the type locality and the Central Valley do not have these characteristics. The populations in western Panama are separated by a considerable distance from those in Costa Rica and Panamanian specimens have stigmas which dry yellowish and have leaf blades that are often more noticeably pinnatifid adult blades with lobles up to 2–4 cm wide, but these differences would not seem sufficient for recognition at the species level.

Additional specimens examined:—COSTA RICA. **Cartago:** El Guarco, San Isidro, 10 km Sof Cartago by air, Along Confluence of rio Empalme and rio Estrella, 1 km S of Palo Verde by road, Paloverde is 1.5 km S of Panamerican High way on road to Estrella, 1450 m, 21 April 1983, (Fr.), *R. Liesner & E. Judziewicz 14549* (CR!); Cartago, Llano Grande, Z.P. Río Tiribí, Zona de bosque de jaúl, 1826 m, 10 August 2009, (Fl.), *S. Lobo et al. 2467* (CR!); Along road between Moravia and Quebrada Platanillo, 3–5 km from Finca Racine in Moravia, Disturbed primary forest (marketable lumber trees removed), 30 June 1976, (Fr.), *T.B. Croat 36615* (CR!, MO!); La Unión, San Rafael, Z.P. Cerros de La

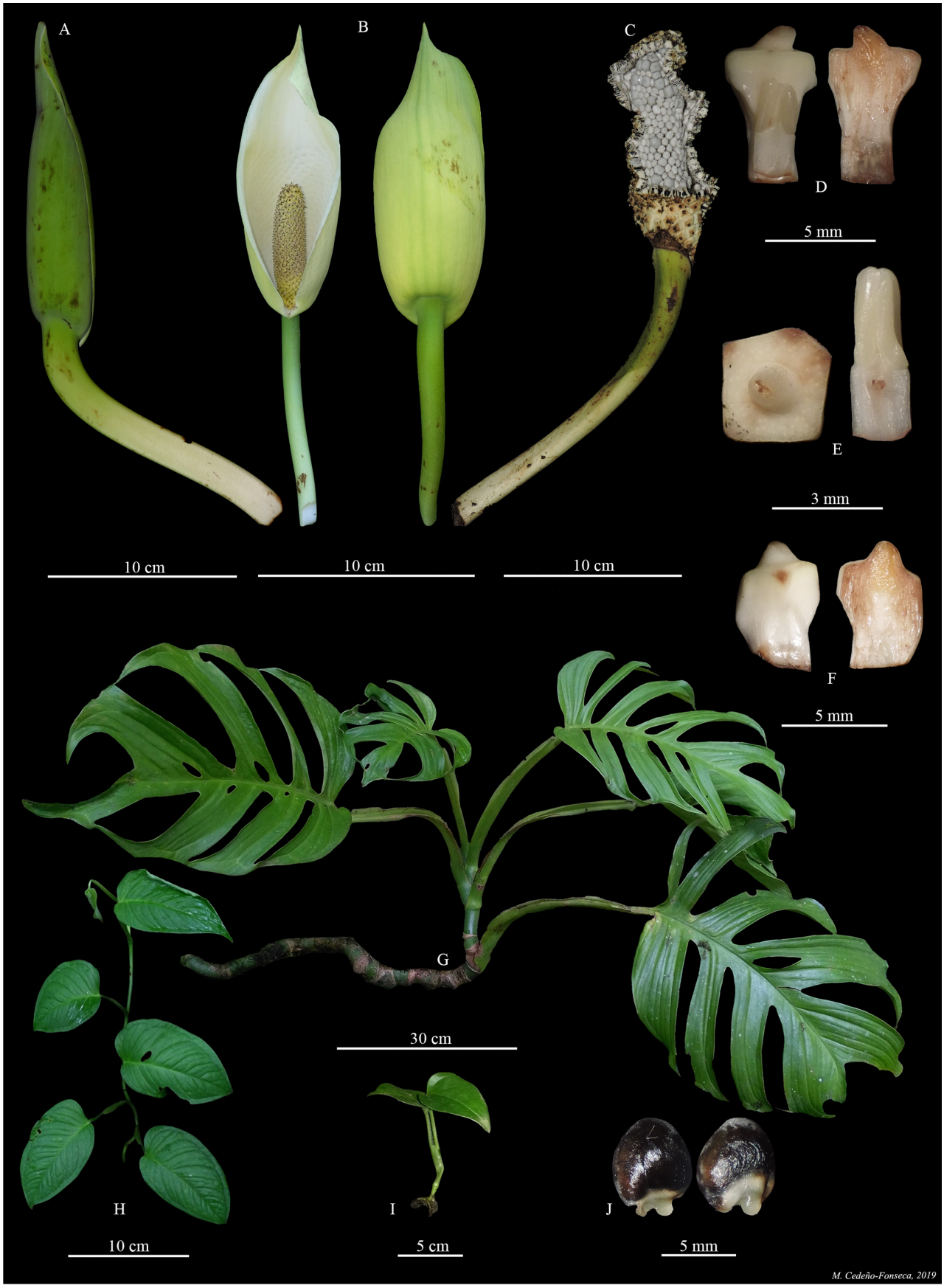

FIGURE 49. *Monstera lentii* from Cartago, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detaching. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Adult plant. (H) Juvenile plant. (I) Seedling. (J) Seeds. *M. Cedeño et al. 912* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 50. *Monstera lentii*. Adult plant growing 1.5 m above the ground in Fortuna, Panama. *M. Cedeño et al. 2463* (PMA). Photo by M. Cedeño-Fonseca.

Carpintera, Laderas hacia Tres Ríos, 1560 m, 23 January 2007, (Fr.), *A. Cascante & J. Sánchez 1670* (CR, USJ); Paraíso, En bosque secundario del que se abastece de agua a la ciudad, 24 October 1986, (Infer.), *R. Hernández 861024* (CR!); El Guarco, San Isidro, Hills above El Muñeco, along Río Sombrero, disturbed forest, 1500 m, 28 July 1983, (Infer.), *K. Barringer & E. Christenson 4144* (CR!, MO!); R.F. Río Macho, Sendero número 4. 1400 m, 26 March 1992, (Fl.), *V. Nilsson & R. Manfredi 125* (CR!); Paraíso, En bosque secundario del que se abastece de agua a la ciudad, 24 October 1986, (Infer.), *R. Hernández 86102412* (CR!); Paraíso, Orosi, R.F. Río Macho, Sendero Atraz da casa, lado oeste para a direita, 1250 m, 30 April 1993, (Fl.), *V. Nilsson et al. 345* (CR!); La Unión, San Diego, Z.P. Cerros de La Carpintera, Bosque del campo Escuela Istarú de los Scouts, 750 m, 3 August 2006, (Fl.), *A. Cascante et al. 1608* (CR!); Cartago, San Nicolás, Z.P. La Carpintera, Propiedad de Campo Escuela Iztarú, Bosque por canchas al sur del área administrativ, 1623 m, 19 July 2007, (Fr.), *A. Cascante 1775* (CR!); La Unión, Dulce Nombre, Z.P. Río Tiribí, Faja de bosque ripario, alrededores de puesto Pizote (AyA), 1600 m, 23 April 2008, (Fl.), *A. Cascante & A. Quesada 1925* (CR!); Paraíso, Orosi, P.N. Tapantí, Margen izquierda Río Grande de Orosí, Estribaciones Alto Peralta, 1800 m, 17 December 1992, (Fl.), *G. Herrera 5766* (CR!); Paraíso, Orori, Sendero La Pavas, 1400 m, 7 March 2000, (Fr.), *L. Acosta 543* (CR!); Paraíso, Orori, Estacion Tapanti, camino Alto Patillos, cerca del mirador, Sendero Los Palmitos, 1350 m, 21 July 1994, (Fl.), *D. Garcia 340* (CR!, MO!); Paraíso, Orori, Rio Humo, Camino al túnel, 1600 m, 20 July 1994, (Fr.), *E. Lepiz 489* (CR!); Paraíso, Orori, Sector Quebrada Segunda, 1300 m, 1 February 1995, (Fl.), *G. Mora 501* (CR!); Paraíso, Orori, Estacion Tapanti, Rio Grande de Orosi, Sector a Segunda, 300 m, 13 March 1995, (Fr.), *G. Mora 568* (CR!); Turrialba, Along camino Raíz de Hule, 1200–1400 m, 1 July 1976, (Fr.), *T.B. Croat 36723* (MO!); Turrialba, Along camino Raíz de Hule, 1200–1400 m, 1 July 1976, (Fl.), *T.B. Croat 36748* (MO!); Turrialba, Santa

Cruz, Santa Cruz de Turrialba, hacia Bajos Bonilla, 1931 m, 19 December 2019, (Fr.), *M. Cedeño et al. 1628* (USJ!); Turrialba, Chirripo, Moravia de Chirripó, bosque primario, 1196 m, 21 December 2019, (Fr.), *M. Cedeño et al. 1635* (USJ!); Turrialba, Chirripo, Moravia de Chirripó, bosque primario, 196 m, 22 December 2019, (Fr.), *M. Cedeño et al. 1636* (USJ!); Turrialba, Chirripo, Moravia de Chirripó, bosque primario, 1196 m, 23 December 2019, (Fr.), *M. Cedeño et al. 1637* (USJ!); Alvarado, Capellades, Carretera a Pacayas, 728 m, 8 November 2018, (Fr.), *M. Cedeño et al. 1498* (USJ!); Alvarado, Capellades, Carretera a Pacayas, 1728 m, 8 November 2018, (Fr.), *M. Cedeño et al. 1500* (USJ!); Paraiso, Reserva de Tapantí, 1300–1800 m, 1 November 1982, (Fr.), *L. Gómez 18772* (MO!); Paraiso, Along tributary of Quebrada Casa Blanca Tapantí, 1350 m m, 6 August 1984, (Fl.), *M.H. Grayum 3696* (MO!); Paraiso, Hill just to north of Quebrada Casa Blanca, 1350 m, 26 August 1984, (Fr.), *M.H. Grayum 3889* (MO!); Paraiso, Disturbed primary forest, 1400 m, 16 April 1967, (Fl.), *R. Lent 824* (MO!); Paraiso, Tapantí Hydroelectric Reserve, 1600–1700 m, 23 June 1976, (Infer.), *T.B. Croat 36192* (MO!); Paraiso, Hacienda Queverí, 1630 m, 15 July 1984, (Fr.), *M.H. Grayum 3490* (MO!); Turrialba, Tayutic, 1500 m, 26 July 1995, (Fl.), *G. Herrera 8130* (CR!); Turrialba, Along road between Juan Viñas and Turrialba, 1 July 1976, (Infer.), *T.B. Croat 36827* (MO!); Paraiso, Tapantí Reserve, 1500–1800 m, 29 September 1987, (Fr.), *T.B. Croat 68291* (MO!); Turrialba, Alvarado, Capellades, Santa Cruz, Linderos del Río Turrialba, 1750 m, 19 June 2015, (Fr.), *M. Cedeño 794* (USJ!); Paraíso, Orosi, Parque Nacional Tapantí, Proyecto Tapantí-Micorriza de Melania Fernández, 1260 m, 29 Junio 2016, (Fl.), *M. Cedeño & M. Fernández 912* (USJ!); Paraíso, Paraíso, Bosque secundafrio municipal, calle Mero, 1400 m, 6 July 2015, (Fl.), *M. Mata et al. 3* (USJ!); La unión, San Ramón, Finca Siete Manantiales, 1450 m, 3 December 2017, (Fr.), *M. Cedeño 1178* (USJ!); **Limón:** Limón, Valle La Estrella, N flank of Fila de Matama in headwaters of Rio Boyei, 1200 m, 16 August 1995, (Fr.), *M.H. Grayum 11025* (CR!, MO!); Talamanca, Bratsi, Amubri, Alto Lari, Kivut, Subiendo entre las cabeceras del Rio Lari y Rio Dapari, 1550 m, 15 March 1992, (Fl.), *G. Herrera 5358* (CR!); **San José:** San José, Near Río Tiribí along road to Planta Eléctrica María del Rosario, SW of Rancho Redondo, Montes de Oca m, 24 June 1984, (Infer.), *M.H. Grayum & P. Sleeper 3304* (CR!); Curridabat, Tirrases, Remnant forest above río Tiribi, near Maria del Socorro Power Plant, 5 km NW of Tres Ríos, 1700 m, 28 May 1967, (Fr.), *R. Lent 1006* (CR!); Vázquez de Coronado, Cascajal. P. N. Braulio Carrillo, Bajo La Hondura, 800 m después del portón, 1400 m, 2 November 2005, (Fr.), *L. Acosta 3777* (CR!); Vázquez de Coronado, Cascajal, Bajo La Hondura, entrendo por antiguo camino de mulas, 1400 m, 10 February 2000, (Fr.), *A. Rodríguez 5734* (CR!); Desamparados, San Miguel, Camino rural entre pequeños fragmentos de bosque y potreros arbolados a 4.5 km E de Tobosi, siguiendo la carretera 228, 1850 m, 8 April 2015, (Fl.), *A. Cascante & C. Trejos 2538* (USJ!). PANAMA. **Bocas del Toro:** Hill just south of Chiriquí Grande; at end of pipeline access road 2 mi N of 2nd large bridge north (10 mi.) of cont. divide; in forest along ridge and draws. [Coordinates on orginal label: 8º54'N, 82º10'W], 08°55'48"N 082°12'30"W - 08°56'12"N 082°13'48"W, 350–500 m, 10 March 1986, *B.E. Hammel et al. 14747* (MO!); Faudas dlk "Cerro Faiso Fatorega" PILA, Perito # 13, 09°10'05"N 082°39'44"W, 1392 m, 05 August 2008, *D. Santamaría et al. 7744* (PMA!); Alto Uril Rancho Santin, PILA, Peunto # 7. Apros 1 km al Norte de R. Santin, 09°07'07"N 082°40'05"W, 1293 m, 31 July 2008, *D. Santamaría et al. 7621* Fortuna Dam region, along continental divide trail bordering Chiriqui. [Coordinates on orginal label: 8º45'4"N, 82º15'4W"], 08°46'18"N 082°13'00"W, 1200–1300 m, 23 Dec 1986, *G. McPherson & J. Aranda 10057* (MO!); Along road between Fortuna Dam and Chiriquí Grande, along gravel road which departs main hwy. near Continental Divide (4.5 mi N of bridge over Fortuna Lake), just S of border with Bocas del Toro Province. [Coordinates on orginal label: 08º44'N, 82º17'W], 08°47'06"N 082°13'18"W, 1170 m, 22 June 1987, *T.B. Croat 66659* (MO!); Along Continental Divide from road branching N off main Fortuna-Chiriquí Grande Highway near Continental Divide, 1.1 miles from main highway, 08°44'N 082°17'W, 1200 m, 11 March 1985, *T.B. Croat & M.H. Grayum 60347* (MO!); Changuinola. Cerro Frío, headwaters of Río Tskui. Point, 09°15'39"N 082°30'00"W, 1100 m, 28 October 2008, *A.K. Monro et al. 6379* Cerro Frío, headwaters of Río Tskui. Point 20, 09°15'17"N 082°30'21"W, 1300 m, 23 October 2008, *D. Santamaría et al. 7779* PILA. Estacion Santin. Bosque primario conel dosel de hasta 30 m de altura, predominado por Cedreia tonduzii, Quercus insignis, Gordonia fruticosa y Euterpe precatoria, 09°07'08"N 082°39'51"W, 01 August 2008, *D. Solano 5631* (MO!); **Chiriquí:** Vicinity of Fortuna Dam, in valley south of lake. Forest, 08°45'04"N 082°15'04"W, 1200–1300 m, 25 December 1986, *G. McPherson & J.E. Aranda 10124* (MO!); Just W of the Fortuna Camp, 08°44'N 082°15'W, 1400–1600 m, 12 Sep 1977, *J.P. Folsom et al. 5358* (MO!); NE del campamento Fortuna (Hornito), sitio de presa, después de excavaciones geológicas hasta la finca Santamaría, 08°45'N 082°14'W, 1000–1200 m, 15 agosto 1976, *M.D. Correa et al. 2465* (MO!); NE del campamento de Fortuna (Hornito sitio de presa). Camino hacia la finca Landau, 08°45'N 082°15'W, 1000–1200 m, 24 Sep 1976, *M.D. Correa et al. 2688* (MO!); Resevea Forestal Fortuna. Bosque cercano a la quebrada Honda. Sendero Nitrof, 08°45'05"N 082°14'27"W, 1202 m, 29 enero 2013, *O. Ortiz et al. 1135* (MO!, PMA!); Gualaca-Chiriquí Grande Road over Fortuna Lake, along gravel road which departs main highway near Continental Divide, (4.5 mi N of middle of bridge over Fortuna Lake), just S of border with Bocas del

Toro Province, 08°44'N 081°17'W, 1170 m, 23 June 1987, *T.B. Croat 66670* (MO!); Along road between Fortuna Lake and Chiriquí Grande; 4.5-5 km N of dam over Fortuna Lake, 08°45'N 082°13'W, 1100–1135 m, 08 March 1985, *T.B. Croat 59988* (MO, UB); Vicinity of Fortuna Dam site on Río Chiriqui beyond Gualaca 9.4 mi beyond Gate to Francisco Linare's house, 20.9 mi from bridge over Río Estí, 10.8 mi beyond Los Planes de Hornito, 08°42'N 082°14'W, 1400 m, 27 Nov 1979, *T.B. Croat 48720* (MO!); Along road between Gualaca and Fortuna dam site; 10 mi NW of Los Planes de Hornito, 08°45'N 082°17'W, 1260 m, 10 Apr 1980, *T.B. Croat 50077* (MO!); Cerro Colorado, along road above San Félix, 29 km above bridge over Río San Félix (7.9 km above turnoff to Escopeta), 08°32'07"N 081°49'11"W, 1500 m, 14 July 1976, *T.B. Croat 37080* (MO!); Fortuna Dam Area, Fortuna-Chiriquí Grande, 1.8 mi NW of center of dam, 08°45'N 082°18'W, 1080 m, 27 June 1994, *T.B. Croat & G. Zhu 76499* (MO!); Fortuna Dam Area, Fortuna-Chiriquí Grande, 5.3 miles N of center of Fortuna Dam, then 1.4 miles W along gravel road to Continental Divide Trail, 08°44'N 082°17'W, 23 June 1994, *T.B. Croat & G. Zhu 76318* (MO!, NY!); Boquete. Corregimiento Los Naranjos, Parque Internacional La Amistad, entrando por el sitio llamado Bajo de Mono, 08°50'04"N 082°28'08"W, 28 enero 2013, *A. Zuluaga et al. 911* (PMA!); **Coclé:** Vicinity El Copé, 5–6 miles N of El Copé, along trail which leads into the lowlands from old Riviera saw works area, 08°40'14"N 080°35'34"W - 08°41'18"N 080°35'58"W, 600–800 m, 08 July 1994, *T.B. Croat & G. Zhu 77200* (CR!, MO!); **Panamá:** Road past Altos de Pacora, 3–3.5 mi NE of Altos de Pacora, 7.8–8.2 mi above Pan Am Highway, 11.1–11.6 mi beyond Lago Cerro Azul, 09°15'N 079°25'W, 700–750 m, 19 June 1988, *T.B. Croat 68681* (MO!); Panamá. Cerro Jefe, 0.5 km south of the summit, 09°13'30"N 079°22'35"W, 950 m, 04 Feb 1973, *P. Busey & T.B. Croat 260* (MO!).

29. ***Monstera limitaris*** M.Cedeño, *Phytotaxa* 376: 37. 2018. (Figs. 51)

Type:—COSTA RICA. Puntarenas: Corredores, Canoas, Barrio el Triunfo, margen del Río, 130 m, 27 September 2017, *M. Cedeño, I. Chinchilla, A.P. Karremans & G. Rojas-Alvarado 1129* (holotype USJ! [2 sheets], isotype PMA! [2 sheets]).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** smooth, light green; **internodes** 3–4 cm long, 4–10 mm diam.; **blades** not appressed to the phorophyte. ADULT PLANTS: root climbers; **stems** beige, cylindrical; **internodes** 2–3 cm long, 1.5–3.5 cm diam., 0.8–1.3 times as long as wide; **cataphylls** light-green with a very reduced blade; **anchor roots** brown; **feeder roots** corky, light-beige; **petiole** whitish with dark pustules at base, smooth towards base of the geniculum, 30–55 cm long, fully sheathed; **petiole sheath** deciduous or semi-persistent, convolute, forming a ligule of 2–4 mm; geniculum concave, smooth, sulcate adaxially, convex abaxially, 3.0–4.5 cm long; **blades** sub-ovate to sub-orbicular, oblique, cordate to obtuse at base, acuminate at apex, subcoriaceous, drying yellowish, 35–55 × 20–35 cm, decurrent-wavy on the geniculum, with 5–7 undulations of 3–5 mm wide; **midrib** ribbed adaxially, convex abaxially, drying yellowish or pale on both surfaces, **primary lateral veins** 17–23 per side, sunken adaxially, prominent abaxially, departing midrib at 75–85°, drying yellowish or pale; **secondary veins** reticulate; **collective veins** visible; **fenestrations** present along each side near to the midrib; **margins** pinnatilobed due to tearing of the perforations that extend close to the margin, 3–6 lobes per side, reaching to the middle of the blade. INFLORESCENCES on ascending stems, 1–3 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** smooth, 10–15 cm long; **spathe** acuminate, white during development, white-yellowish externally and white internally at anthesis, thin membranous, open at apex, forming a tube at base, deciduous after anthesis, 13–18 × 6–10 cm, up to 8 cm longer than the spadix; **spadix** white during development, cream at anthesis, 9–12 cm long, 1.0–2.5 cm diam.; **basal sterile flowers** 3–5 mm long with a transparent stigmatic secretion; **fertile flowers** 5–6 mm long; stamens 2–5 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 4–5 × 2–3 mm; style hexagonal, 1–3 × 4–5 mm; stigmatophore columnar, 0.5–1.5 mm long; stigma linear, with a transparent stigmatic secretion; **berries** with a light-green stylar cap during development, mature stylar cap creamy; pulp white; **seeds** black, 4–6 mm long.

Distribution and ecology:—*Monstera limitaris* is known only from the border between Costa Rica (Puntarenas province) and Panama (Chiriquí province), at 130 m. The collection sites consist of isolated trees in open agricultural areas (potreros) on the banks of a small river.

Phenology:—Flowering has been recorded in October and May. Fruiting was registered between October and December.

Discussion:—The species, a member of sect. *Monstera*, differs from the other species of the genus in Costa Rica by the petiole with white dots sheathed throughout its length, the sheathe semi-persistent, little fenestrated leaf blades on each side next to the central nerve, with pinnatilobed margins, white spathe-externally yellowish and internally white, with overlapping margins (forming a tube) in the basal room.

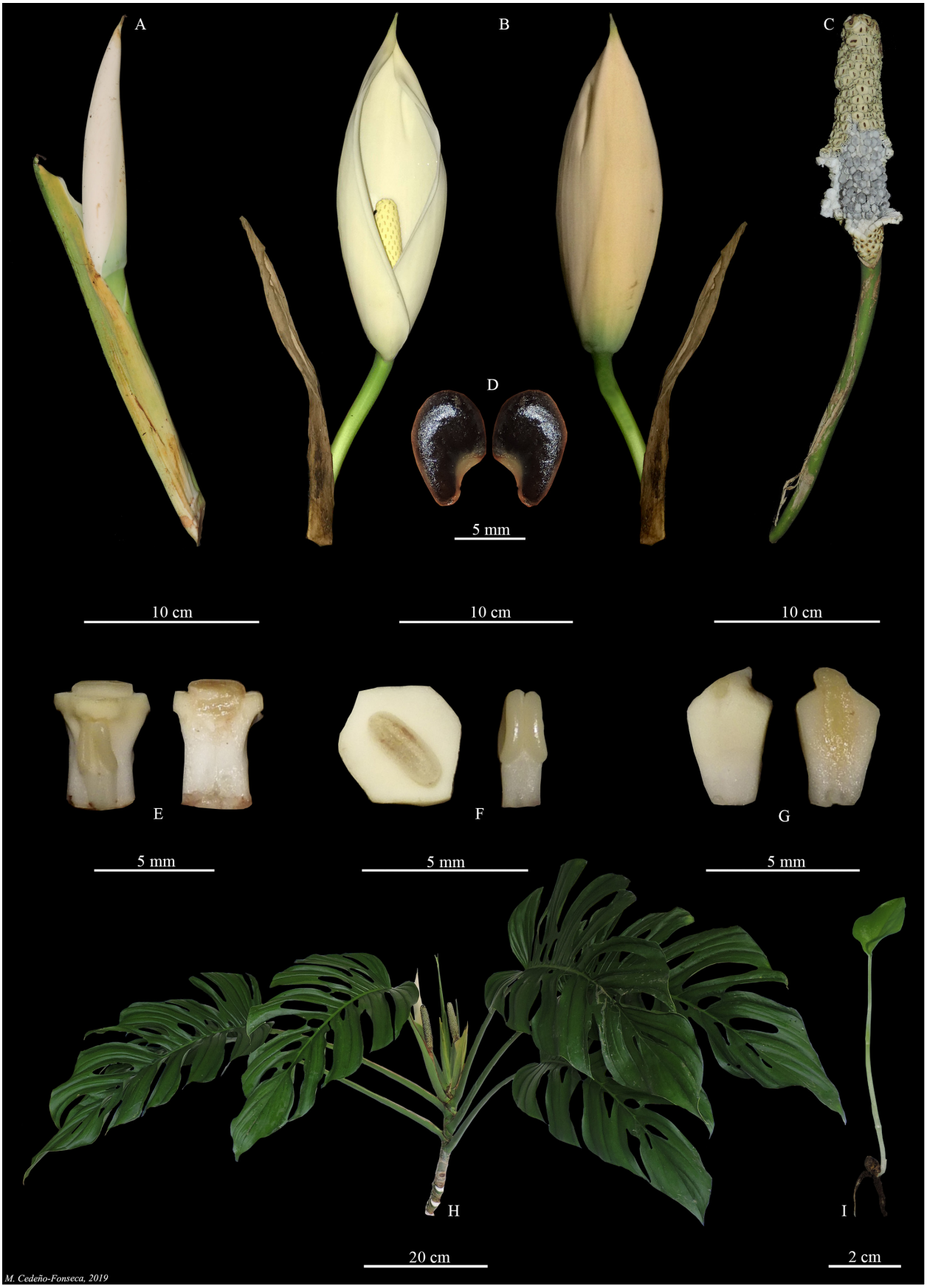

FIGURE 51. *Monstera limitaris* from Puntarenas, Costa Rica. (A) Inflorescence development. (B) Front and back views of open inflorescence. (C) Mature infructescence, stylar plates detached. (D) Seeds. (E) Fertile flower; in lateral view (left), and longitudinal section (right). (F) Stylar plate with stigma (left) and one stamen (right). (G) Sterile flower; in lateral view (left), and in longitudinal section (right). (H) Adult plant. (I) seedling. *M. Cedeño et al. 1129* (USJ). Image from Cedeño-Fonseca *et al.* (2018).

Monstera limitaris is similar to *Monstera dissecta* but the latter species differs in having leaves with smooth petioles (not verruculose) with persistent and revolute sheaths, non-crenate geniculum margins, blades with entire to pinnatifid margins without fenestrations along the midrib, a yellow-cream spathe externally, semi-conical stigmatophore and orange stigmatic secretion.

Additional specimens examined:—PANAMA. **Chiriquí:** Alanje. Las Moras, creciendo en cerca viva en terrenos semi-inundable, 08°21'46"N 082°35'49"W, 20 m, 06 junio 2018, *M. Stapf 1307* (FT!, MO!, PMA!, USJ!).

30. ***Monstera luteynii*** Madison, *Contr. Gray Herb.* 207: 89. 1977. (Fig. 52)

Type:—COSTA RICA. Alajuela: along road to and around the edge of Laguna Hule, NE of Cerro Congo, and about 8 km NW of the village of Cariblanco, 20 km N of Vara Blanca, alt. 740–900 m, June 1972, *J. Luteyn 3227* (holotype MO!, isotypes US!, DUKE!).

Nomadic vine, appressed-climbing and pendent habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **blades** appressed to the phorophyte. ADULT PLANTS: root climbers; **stems** light brown, warty with pustules, cylindrical and sulcate; **internodes** 3–10 cm long, 1.0–1.5 cm diam., 3.2–6.6 times longer than wide; **anchor roots** 2–4 cm long; **feeder roots** whitish and corky; **petiole** smooth and striated at base, 8–13 cm long, sheathed to base of the geniculum, prolonged into a free ligule 1–3 cm long; **petiole sheath** deciduous; geniculum striated abaxially, terete, 0.5–1.0 cm long; **blades** ovate to broadly elliptic, rounded to truncate, cordate or subcordate at base, acuminate at apex, coriaceous, drying yellowish or black with yellowish green, 12–16 × 9–13 cm, not decurrent on geniculum; **midrib** flattened adaxially, convex abaxially, **primary lateral veins** 4–6 per side, obscure adaxially, prominent abaxially, departing midrib at 35–50°; **secondary veins** prominent and reticulated towards the margin; **collective veins** not visible; **fenestrations** absent; **margins** entire. INFLORESCENCES on pendent stems; **peduncle** smooth, 3–5 cm long, 5–8 mm diam.; **spathe** obtuse, unknown color; **spadix** unknown during development, creamy-white at anthesis, 6–8 cm long, 1.7–2.0 cm diam., 1.6–3.4 times longer than wide; **basal sterile flowers** 3–5 mm long; **fertile flowers** 3–6 mm long; stamens 1–6 mm long, with laminar filaments; anthers 1–2 mm long; ovary unknown; style compressed and hexagonal, 1–2 × 3–4 mm; stigma linear or circular; **berries** with an olive-green stylar cap during development, mature stylar cap green; pulp white; **seeds** dark-brown with white dots, elongated, 4–6 mm long.

Distribution and ecology:—*Monstera luteynii* is endemic to Costa Rica known only from the Atlantic watershed in the Cordillera de Tilarán, Cordillera Central and the Cordillera de Talamanca at 360–900 m, in *Tropical wet forest* life zones.

Phenology:—Flowering has been recorded in November, and fruiting in March.

Discussion:—The species is a member of sect. *Marcgraviopsis.* It is known from the type locality in Cariblanco (around the Hule Lagoon), the sector of Peñas Blancas in San Carlos and the Monteverde Biological Reserve on the Quebrada Celeste in the basin of the Peñas Blancas River and Cartago in the sector of Las Vueltas. It resembles *Monstera pittieri* (both bloom on hanging stems), but that species has flowers somewhat separated on the spadix. Madison (1977) distinguished *Monstera luteynii* by having ovate leaves less than twice as long as wide, verrucate stems and petioles, whereas *M. pittieri* has lanceolate leaves, 2–5 times longer than broad, and smooth stems and petioles.

Additional specimens examined:—COSTA RICA. **Alajuela:** San Ramón, Ángeles, Remnant trees in pasture, 2 km N.E. of La Balsa de San Ramón, 900 m, 26 September 1976, (Fl.), *R. Lent 3889* (CR!, MO!); San Ramón, Peñas Blancas, Quebrada Celeste, Rio Penas Blancas, Campo, 900 m, 6 November 1989, (Fl.), *E. Bello 1468* (CR!); **Cartago:** Jiménez, Lurtes arbres a Las Vueltas, 635 m, 1 Enero 1898, (Fr.), *A. Tonduz 12841* (MO!).

31. ***Monstera maderaverde*** Grayum & Karney, *Economic Botany* 66(2): 209–211, f. 3–5. 2012.

Type:—HONDURAS. Atlántida: Mazapita Cloud Forest, Cordillera Nombre de Dios. ca. 7.2 km (direct point to point distance) SSE of Mesapita, on ridge forming the divide between Río Mazapa and Río Mezapita, 1160 m, 7 Nov. 2010, *A. Karney s.n.* (holotype MO-6240501–02!).

Nomadic vine, appressed-climbing and pendent habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **blades** apparently not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** green; **internodes** 12.5–17.5 cm long, 0.7–1.0 cm diam., 17.5–18.0 times longer than wide; **petiole** smooth, 12.5–17.5 cm long, sheathed 4–6 cm before base of the geniculum; **petiole sheath** marcescent to deciduous; **unsheathed portion** terete; geniculum 0.5–0.8 cm long; **blades** ovate to suborbicular, truncate to cordulate at base,

short-acuminate at apex, coriaceous, 12.8–16.0 × 8.0–14.6 cm, drying blackish, slightly shorter to slightly longer than petiole; **midrib** ribbed adaxially, prominent abaxially; **primary lateral veins** 2–4 per side, poorly defined per side, departing midrib at 35–50°; **secondary veins** parallel (or reticulated towards the margin); **margins** entire; **perforations** absent or occasionally present (at least 1.5 cm in diam.). INFLORESCENCES on pendent, erect stems; **peduncle** terete, smooth, 9–13 cm long, 0.3 cm diam.; **spathe** obtuse to mucronate, light green during development, yellow suffused with green tint externally and white internally at anthesis, completely open at apex, 4–6 × 4–5 cm, as long as the spadix; **spadix** unknown during development, white suffused with a yellow tint at anthesis, 4.8–7.8 cm long, 1.6–2.2 cm diam.; **basal sterile flowers** slender towards base; **fertile flowers** 4–7 mm long; anthers 1 mm long; ovary 3–4 × 2–3 mm; style hexagonal; stigma linear; **berries** with a greenish stylar cap during development, mature stylar cap yellowish at base and dark green towards base; pulp white; **seeds** unknown.

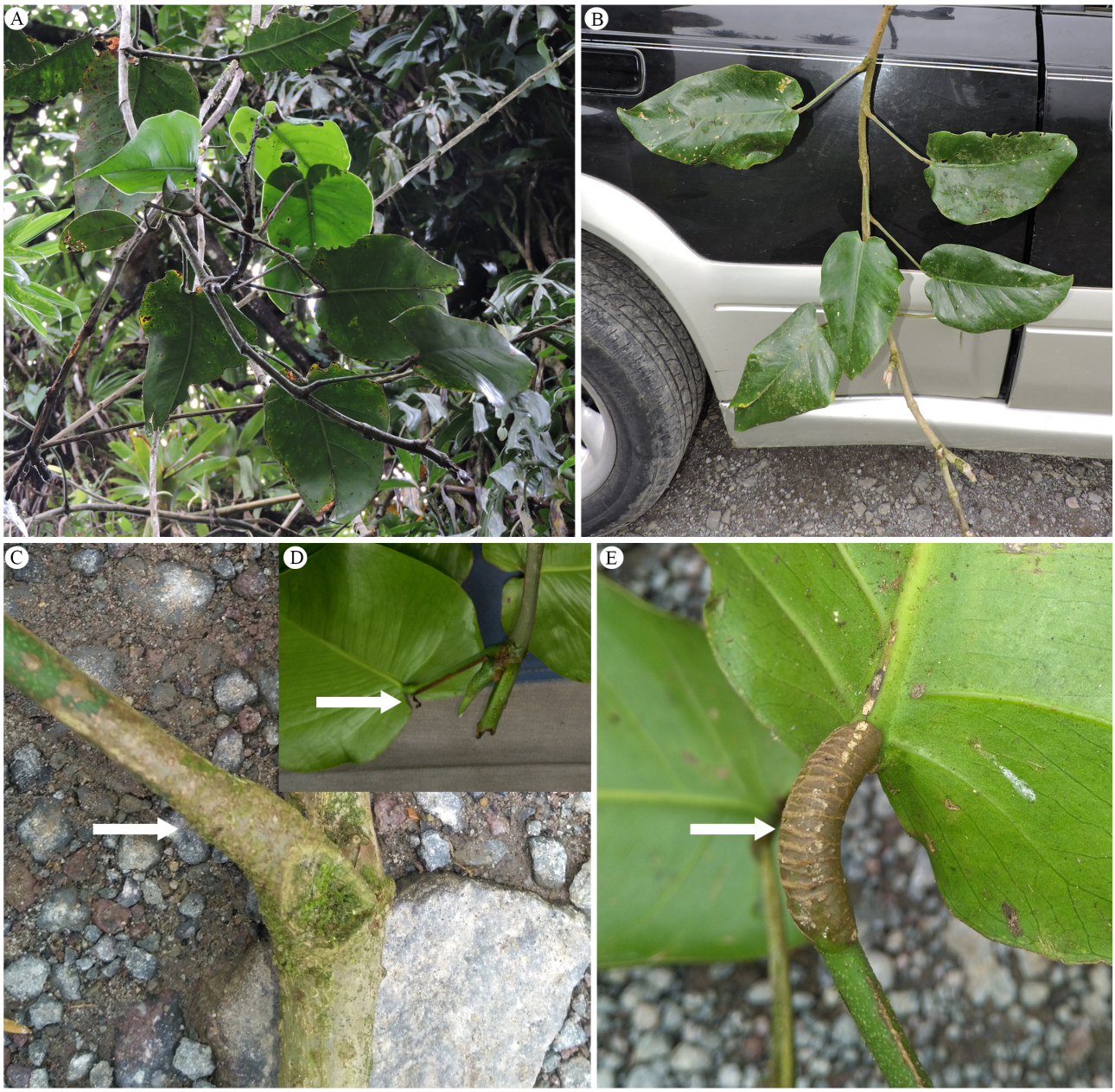

FIGURE 52. *Monstera luteynii* from San Ramon, Costa Rica. (A) Branching pendent habit. (B) Stem with entire cordate leaves. (C) Stem and base of petioles densely verrucose with light brown pustules. (D) Leaves on a hanging stem with a persistent but dry sheath and a 2 cm long ligule (arrow). (E) Densely striate and terete scaly geniculum. *M. Cedeño et al. 1672* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

Distribution and ecology:—*Monstera maderaverde* is endemic to Honduras, known only from the type locality in the Cordillera Nombre de Dios, at 1160 m, in cloud forest in a *Premontane wet forest* life zone.

Phenology:—Flowering in November.

Discussion:—The species, a member of sect. *Tornelia*, is characterized by it hemiepiphytic, somewhat scandent habit, slender stems with a somewhat flaking epidermis, long-petiolate leaves, slender inconspicuously sheathed petioles, broadly ovate, weakly veined, acuminate, dark gray-brown-drying blades which are broadly rounded at base with weak venation, and long-pedunculate inflorescence with a narrowly obovate spadix.

Monstera maderaverde could be confused with the Costa Rican endemic *M. luteynii*, with which it shares leathery leaf-blades of similar size and shape (Karney & Grayum 2012). But it differs because *M. luteynii* belongs to the sect. *Marcgraviopsis* Madison with juvenile plants with shingle-forming leaves, adult with pendulous stem habit, shorter petioles (8–13 cm long), and larger spadices (6–8 × 1.7–2.0 cm) on shorter peduncles (3–5 cm long). (Karney & Grayum 2012).

Additional specimens examined:—HONDURAS. **Atlántida:** Mezapita Cloud Forest, Cordillera Nombre de Dios. Ca. 7.2 km SSE of Mezapita (as the crow flies), on ridge forming the divide between the basins of the Ríos Mezapa and Mezapita, 15°30’39”N 087°19’41”W, 1160 m, 07 November 2010, *Alexander P. Karney s.n.* (MO!); **Yoro:** Yoro. Camino Real de San José Texíguat a Campo Nuevo en un lugar llamado Las Letras al oeste del Cerro Cabeza de Negro, 15°28’00”N 087°26’05”W, 1010 m, 24 abril 1995, *Reinaldo Aguilar & Randall J. Evans 4076* (COL, CUVC, MEXU, MO, PMA, US).

32. ***Monstera membranacea*** Madison, *Contr. Gray Herb.* 207: 55. 1977. (Figs. 53, 54)

Type:—COSTA RICA. Prov. San José: [Puriscal], western slope of Cerro Tufares, 800 m, 2 October 1972, *M. Madison 738* (holotype GH! [2 sheets], isotypes CR!, MO!).

Nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical; **internodes** 3–8 cm long, 2–4 mm diam.; **petiole** distinct, light green, smooth, 3–6 cm long, sheathed up to half its length, **petiole sheath** persistent; **blades** ovate, cordate at base, acuminate at apex, membranous, 7–10 × 3–6 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** bright green, glossy, smooth, cylindrical; **internodes** 1–3 cm long, 1.0–2.5 cm diam., 1.0–1.2 times longer than wide; **cataphylls** with a very reduced blade, light green, deciduous; **anchor roots** black; **feeder roots** light brown; **petiole** light green, smooth, 25–60 cm long, sheathed up to the medial part or 5–7 cm before base of the geniculum; **petiole sheath** persistent; **unsheathed portion** terete; geniculum smooth, slightly terete, 1.0–2.5 cm long; **blades** ovate or elliptic, subcordate to cordate at base, obtuse at apex, membranous, drying greenish, yellowish, grayish or blackish, 18–55 × 15–30 cm, 1.1–1.8 times longer than wide, decurrent on geniculum, decurrent portion 1–2 mm wide; **midrib** ribbed adaxially, convex abaxially, drying reddish, blackish or yellowish on both surfaces; **primary lateral veins** 8–12 per side, bifurcated or trifurcated, markedly reticulated towards the margin, strongly sunken adaxially, prominent abaxially, departing midrib at 65–70°, drying yellowish, blackish; **secondary veins** reticulate; **collective veins** not visible; **fenestrations** absent or present, arranged in a single series near the midrib, on one or both sides; **margins** entire or pinnatilobed, 4–10 lobes per side. INFLORESCENCES on ascending stems, 1–5 simultaneously at flowering time, arranged in the axils of the leaves or subtended by cataphylls; **peduncle** smooth, 9–20 cm long, **spathe** long-acuminate, light green during development, yellowish-green externally and cream internally at anthesis, coriaceous, open in the medial part, closed at base and apex, deciduous as fragments post-anthesis, 10–17 × 5–9 cm, up to 5 cm longer than spadix; **spadix** white during development, cream at anthesis, 7–11 cm long, 1.0–3.5 cm diam., 5.4–5 times longer than wide; **basal sterile flowers** 4–5 mm long, with a yellowish stigmatic secretion; **fertile flowers** 5–7 mm long; stamens 1–2 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary square in longitudinal section, ribbed, 2–3 × 3–4 mm; style compressed and hexagonal, 2–3 × 3.5–4.0 mm; stigmatophore slightly cupuliform, at base slightly cleft on the style; stigma circular, with a yellowish stigmatic secretion; **berries** with a yellowish-green stylar cap during development, mature stylar cap yellow; pulp orange; **seeds** globose, green with reddish dots, 4–7 mm long.

Distribution and ecology:—*Monstera membranacea* ranges from Costa Rica (Caribbean south and Central Pacific to south) to Panamá (Chirquí), at 0–800 m, in *Tropical wet forest* life zones.

Phenology:—Flowering has been recorded in November, and fruiting from March to July.

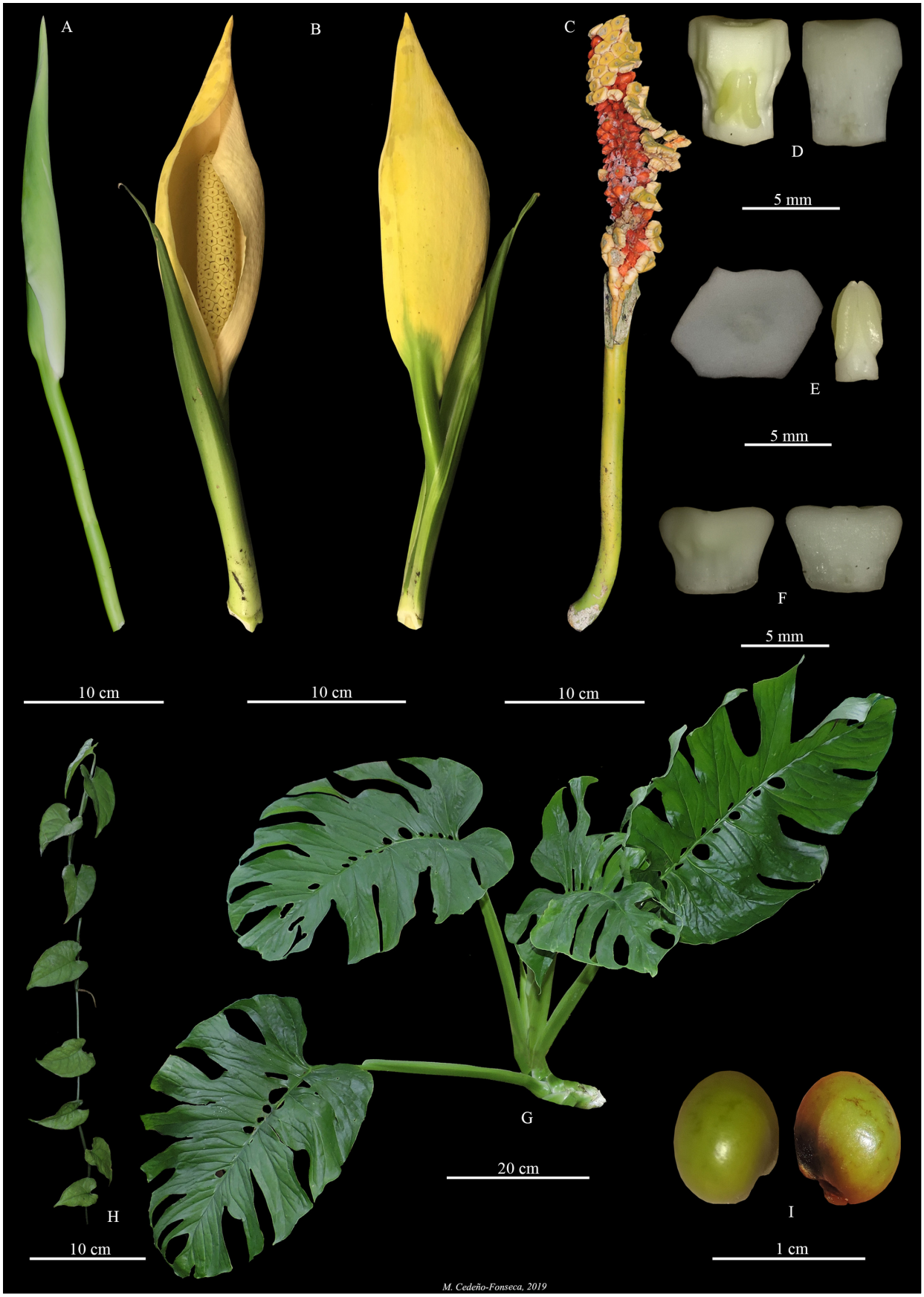

FIGURE 53. *Monstera membranacea* from Manzanillo, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detaching. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Adult plant. (H) Juvenile plant. (I) Seeds. *M. Cedeño et al. 1532* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 54. *Monstera membranacea*. Adult plant growing 2 m above the ground in Golfito, Costa Rica. (Not collected). Photo by M. Cedeño-Fonseca.

Discussion:—The species is a member of sect. *Monstera*. It differs from the other species of the section by its light green petiole sheathed to half of its length with persistent wings, the bright green, distinctly membranous leaf blade, the spathe yellow externally and cream internally, with its margins overlapping at the base and apex (open only in the middle), and its infructescence with the stylar layer yellow green and the fruits with orange pulp. In the pre-adult state, *Monstera membranacea* can be confused with *M. filamentosa*, but the latter has brown petioles, sheathed to the base of the geniculum and with the wings of the sheath deciduous.

Additional specimens examined:—COSTA RICA. **Limón:** Talamanca, Between Bri Bri and Sixaola, 20–70 m, 5 July 1983, (Fl.), *K. Barringer 3500* (MO!); Talamanca, Bríbri, R.V.S.M. Manzanillo, 20 m, 3 March 2018, (Fr.), *M. Cedeño & M. Jiménez 1332* (USJ!); Talamanca, Telire, Camino a Sibody, 130 m, 30 Abril 2017, (Fr.), *M. Cedeño et al. 1088* (USJ!); Talamanca, Cahuita, Bosques de Manzanillo, 50 m, 9 January 2017, (Fl., Fr.), *M. Cedeño et al. 1106* (USJ!); **Puntarenas:** Slopes above airport, disturbed priamary forest, Rincón, 150 m, 11 February 1974, (Fr.), *R. Liesner 2061* (CR!, MO!); P.N. Carara, Estación Quebrada Bonita, 30 m, 29 September 1983, (Fr.), *I. Chacón 1408* (CR!); Garabito, Tárcoles, P.N. Carara. Estación Quebrada Bonita, Bosque primario, 50 m, 27 July 1990, (Fl.), *E. Bello 2379* (CR!, MO!); Golfito, Puerto Jiménez, P.N. Corcovado, Lower Lookout Trail, 25 m, 31 July 1988, (Fr.), *C. Kernan 744* (CR!); Osa, Sierpe, 50 m, 24 March 1973, (Fr.), *W. Burger & J. Gentry 8865* (CR!, MO!); Golfito, Jiménez, Sector Los Patos, colecta en bosque a orilla del río Rincón, 70 m, 17 May 2000, (Fl.), *L. Acosta 1248* (CR!, MO!); Golfito, Jiménez, Sector Los Patos, colecta en bosque a orilla del río Rincón, 70 m, 17 Mayo 2000, (Fr.), *L. Acosta 1252* (CR!); Golfito, Jiménez, In low, flat forest from Rio Sirena to Rio Pavo, 25 m, 2 April 1988, (Fl., Fr.), *B.E. Hammel 16638* (CR!, MO!); Golfito, Jiménez, La Palma, Rio Rincon aguas arriba, camino a Cerro de Oro, 100 m, 30 July 1990, (Fr.), *G. Herrera 4062* (CR!, MO!); Golfito, Jiménez, Sirena, Pavo Trail to old airstrip, 1 m, 21 June 1989, (Fr.), *C. Kernan 1173* (CR!); Osa, Moist forest in valley-bottoms, 50–200 m, 1 September 1970, (Fr.), *W. Burger 7212* (MO!); Along highway to Golfito from Panamerican Hwy. at Río Claro, 60 m, 14 September 1987, (Infer.), *T.B. Croat 67592* (MO!); Forest at eastern base of Fila Barriganes. Ca. 1 km S and 3 km W of Clañasas, 60 m, 4 March 1985, (Infer.), *T.B. Croat 59821A* (MO!); Lowland Forest between guard station and Quebrada Bonita, 40 m m, 25 July 1985, (Fl.), *M.H. Grayum 5706* (MO!); Osa, Corcovado National Park, Primary forest on hills 0 km to 1 km W of the park headquarters at Sirena, 0–200 m m, 4 July 1977, (Fl., Fr.), *R. Liesner 2828* (MO!); **San José**. Acosta, Sabanillas, Acosta, Las Vegas, Rio Parritilla, camino a Alto Pitales, 200 m, 3 May 1997, (Fr.), *J. Morales 6179* (CR!, MO!); Puriscal, Chires, Camino viejo a Quepos, A orillas del camino, 700 m, 21 May 2005, (Fr.), *D. Santamaría 2052* (CR!). PANAMA. **Chiriquí:** Burica Peninsula, 8 mi west of Puerto Armuelles, 08°17'N 082°56'W, 200 m, 02 March 1973, *T.B. Croat 22494* (MO!); **Panamá:** Le Clezio, Jan 1969, *N. Bristan 69* (MO!).

33. ***Monstera minima*** Madison, *Contr. Gray Herb.* 207: 55. 1977.

Type:—PANAMA. Comarca de San Blas: trail E of Cangandí-Mandinga airport road, 2–5 mi. S of Mandinga airport, 27 Oct 1967. *J.A. Duke 14758* (holotype MO-2051569!).

Nomadic vine, appressed-climbing habit. SEEDLINGS: unknown. JUVENILE PLANTS: unknown. ADULT PLANTS: root climbers; **stems** dark green, cylindrical; **internodes** 1–2 cm long, 0.5–0.7 cm diam., 2.8–3.0 times longer than wide; **anchor** and **feeder** roots black and corky; **petiole** 2–6 cm long, sheathed up to 3 cm before base of the geniculum, **petiole sheath** deciduous; **unsheathed portion** slightly terete; **blades** lanceolate, narrowly acute at base, long-acuminate at apex, dark green adaxially, slightly paler abaxially, 9–14 × 2.0–4.0 cm, 4.0–5.6 times longer than wide; **primary lateral veins** 4 or 5 per side, obscure or slightly sunken adaxially, slightly prominent and colorless abaxially, departing midrib at 35–45°, **secondary veins** not visible; **fenestrations** absent; **margins** entire. INFLORESCENCES on ascending stems, erect; **peduncle** light green, matte, 16–18 cm long, 3–4 mm diam.; **spathe** acuminate, ellipsoid, matte, creamy externally at anthesis; coriaceous, 6.5–7.5 × 3.2–4.0 cm; **spadix** white during development, creamy-yellow at anthesis, 4.4 × 3.5 cm; **fertile flowers** 2.5–4.5 mm long; stamens 0.5 mm long, with laminar filaments; anthers 0.3 mm long; style prismatic, moderately smooth, 6–7 mm diam.; stigma ellipsoid, deeply sunken with pale brown margins; **berries** with a green stylar cap; pulp white; **seeds** 0.4–0.5 mm diam.

Distribution and ecology:—*Monstera minima* is known only from the Caribbean coast of Panama (San Blas Province) and along the Pacific slope of northern Colombia (Chocó), at 50–150 m, in *Tropical wet forest* life zones. It occurs mainly in undisturbed forests in the lower 3 m of the forest, growing over shrubs and small trees in heavily shaded and humid conditions.

Phenology:—Known only from fruiting collection in October.

Discussion:—The species, a member of sect. *Monstera*, is characterized by its appressed-climbing habit, petioles sheathed throughout, lanceolate acuminate blades which are acute at base, inconspicuous primary lateral veins as well as by the long-pedunculate inflorescences with a creamy yellow spathe and white spadix.

Monstera minima is the smallest species in the section and it can easily be confused with other small species of the section, such as *M. gambencis*, *M. obliqua* and *M. xanthospatha*. *Monstera minima* differs from these species by the complete absence of perforated blades, peduncle longer than the flowering spadix and leaves (blade and petiole), and by the dark brown-drying leaves. In contrast to *M. gambencis* is endemic from La Gamba, Costa Rica, *M. minima*, *M. xanthospatha* is known only from the Cordillera Central and Cordillera Occidental of Colombia at 600–1700 m and *M. obliqua* is widespread, ranging from Costa Rica to French Guinea, Brazil and Bolivia.

Additional specimens examined:—PANAMA. **San Blas:** Trail east of Cangandi-Mandinga airport road, 2–5 miles south of Mandinga airport, 09°25'N 079°05'W – 09°27'N 079°05'W, 27 October 1967, *James A. Duke 14768* (MO!). COLOMBIA. **Chocó:** Nuquí. Corregimiento de Arusí, Estación Biológica El Amargal, Jan 1999 – Apr 1999, *J. Jácome 280* (MO!).

34. ***Monstera mittermeieri*** M.Cedeño, *Phytotaxa* 514(3): 217. 2021. (Fig. 55)

Type:—COSTA RICA. Puntarenas. Buenos Aires. Buenos Aires. Olan, Sendero a Cerro Arbolada, 2000 m 15 January 2017, *M. Cedeño, I. Chinchilla, A. Karremans & D. Bogarin 1013*, (holotype USJ!, isotype MO!).

Robust nomadic vine, with appressed-climbing habit. SEEDLINGS bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** light green with white dots, smooth; **internodes** 4–6 cm long, 3–5 mm diam.; **petiole** conspicuous, dark or light green, smooth, 7–12 cm long, sheathed to base of the geniculum; **petiole sheath** semi-persistent; blades lanceolate, attenuate or truncate at base, acuminate at apex, coriaceous, 8–13 × 2–5 cm, not appressed to the phorophyte; **fenestrations** 1 or 2 elongate. ADULT PLANTS: root climbers; **stems** light-gold, cylindrical; **internodes** 1–5 cm long, 1.0–2.5 cm diam., 1–2 times longer than wide; **anchor roots** beige; **feeder roots** brown; **petiole** dark green, finely asperous, 40–60 cm long, sheathed to base of the geniculum; **petiole sheath** thin and semi-persistent; geniculum smooth, flattened adaxially, convex abaxially, 1–2 cm long; **blades** lanceolate or oblong, rounded, subcordate to obtuse at base, acuminate at apex, subcoriaceous, 35–55 × 14–30 cm, decurrent on geniculum (continuous with petiole sheaths), decurrent portion 2–4 mm wide; **midrib** grooved adaxially, convex abaxially; **primary lateral veins** 20–28 per side, sunken adaxially, prominent abaxially, departing midrib at 75–85°; **secondary veins** reticulate; **collective veins** visible along the margin; **fenestrations** present, the ones located along each side of the midrib small and roundish, the ones located farther from the midrib much larger and elongated; **margins** entire or pinnatilobed, due to tearing of the fenestrations that extend to the margin. INFLORESCENCES produced on ascending stems; **peduncle** smooth, 15–35 cm long; **spathe** acuminate with revolute margins, light green and pruinose externally and pale pink internally at anthesis, turning whitish after female anthesis, thick, completely open at apex, marcescent after anthesis, 15–20 × 9–12 cm, up to 5 cm longer than the spadix; **spadix** white during development, yellowish-cream at anthesis, 13–17 cm long, 1.5–2.5 cm diam.; **basal sterile flowers** green, 4–6 mm long, with a transparent stigmatic secretion; **fertile flowers** 5–7 mm long; stamens 2–6 mm long, with laminar filaments; anthers 2–3 mm long; ovary rectangular in longitudinal section, ribbed, 4–5 × 2–3 mm; style hexagonal, 2–3 × 3–4 mm; stigmatophore columnar, 0.5–1.0 mm long; stigma linear, with a transparent secretion; **berries** with a yellowish-green stylar cap during development, mature stylar cap white-cream; pulp white; **seeds** green, spherical, 6–8 mm long.

Distribution and ecology:—*Monstera mittermeieri* is endemic to Costa Rica. It is present in the Pacific watershed in the Cordillera of Talamanca, at 2000–2100 m. It lives in *Premontane rain forest* life zones, in the internal part of the forest, on trees with abundant bryophytes.

Phenology:—Flowering and fruiting has been recorded in January.

Discussion:—The species is a member of sect. *Monstera*. It differs from the other species of the genus by the rough petiole, sheathing throughout its length with the sheath persistent, the leaf blade with elongated fenestrations towards the margin, and the light green spathe, glaucous externally and pale pink internally. It could be confused with *Monstera epipremnoides*, but that has a mottled or whitish petiole, a deeply pinnatifid leaf blade with fenestrations on each side next to the midrib or reaching the margin, and a spathe yellowish-green externally and cream internally. In the light pink spathe coloration, it could be confused with *Monstera oreophila*, but *M. mittermeieri* differs in having the spathe thicker and persistent (vs. thin and deciduous spathe).

Additional specimens examined:—COSTA RICA. **Puntarenas:** Buenos Aires, Buenos Aires, Olan, Sendero a Cerro Arbolada, 2000 m, 15 Enero 2017, *M. Cedeño 1012 et al.* (USJ!); Buenos Aires, Buenos Aires, Olan, Sendero a Cerro Arbolado, 2000 m 15 Enero 2017, *M. Cedeño et al. 1011* (USJ!); Puntarenas, Buenos Aires, Buenos Aires, Gira Transtalamanca, 2060 m, 24 April 2017, (Fl.), *M. Cedeño et al. 1071* (USJ!).

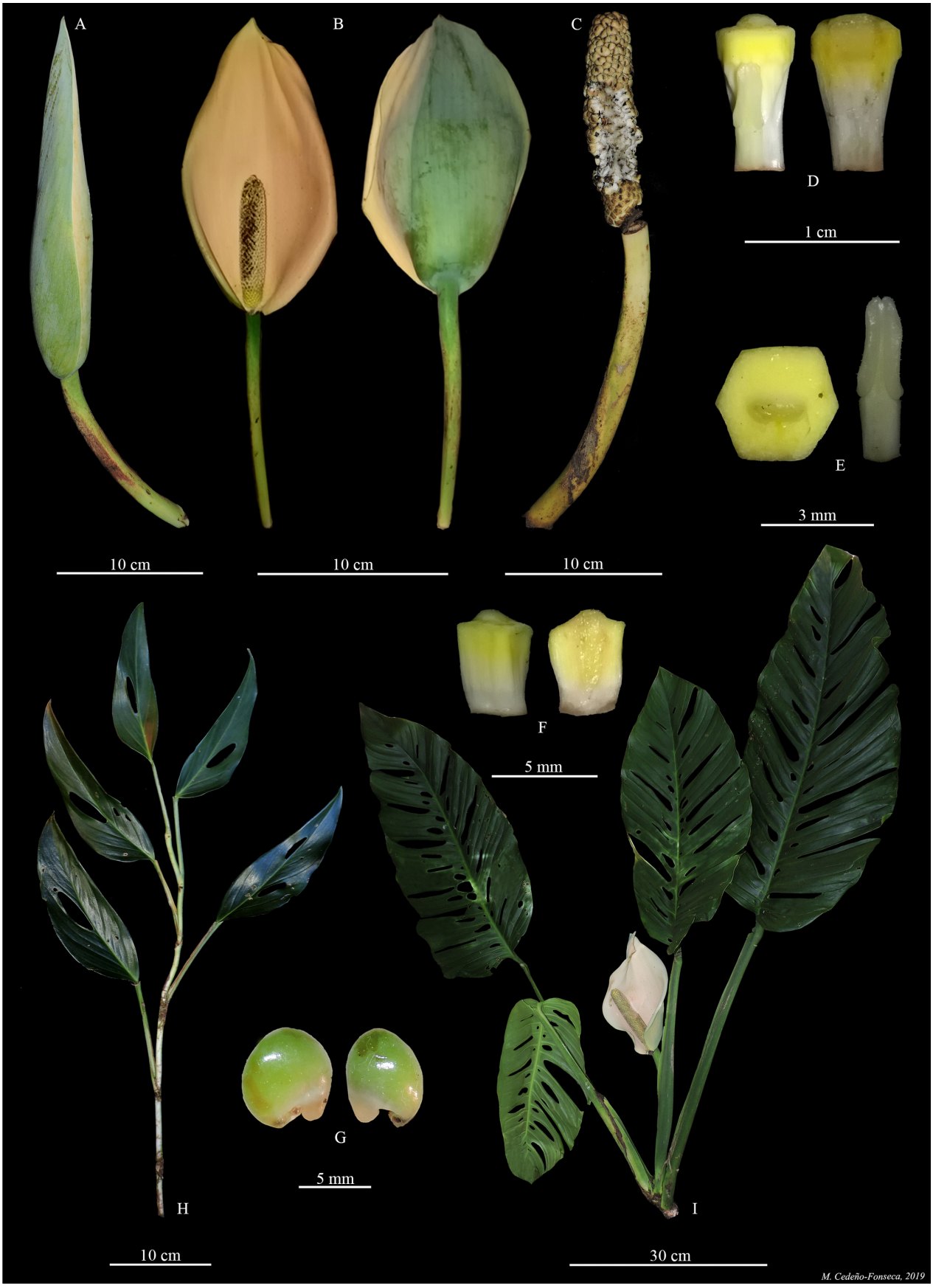

FIGURE 55. *Monstera mittermeieri* from Puntarenas, Costa Rica. (A) Developing inflorescence. (B) Front and back views of open inflorescence. (C) Mature infructescence, stylar plates detached. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; in lateral view (left), and in longitudinal section (right). (G) Seeds. (H) Juvenile plant. (I) Adult plant. *M. Cedeño et al. 1013* (USJ). Image from Cedeño-Fonseca *et al.* (2021a).

35. ***Monstera molinae*** Grayum, *Phytologia* 82: 48. 1997. (Figs. 56, 57)

Type:—COSTA RICA. Guanacaste: Parque Nacional Rincón de la Vieja, the SE slopes of Volcán Santa María, above Estación Hacienda Santa María, 900–1200 m, 27–28 January 1983, *G. Davidse, L.D. Gómez, M. Sousa, C.J. Humphries, N. Garwood, R. Hampshire & M. Gibby 23344* (holotype CR!, isotype MO!).

Nomadic vine, appressed-climbing and pendent habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical; **internodes** 4–6 cm long, 3–5 mm diam.; **petiole** distinct, dark green, smooth, 6–10 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** obovate, subcordate to truncated at base, acuminate at apex, coriaceous, 7–10 × 5–8 cm, slightly appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers with free lateral branches; **stems** beige to light brown, smooth, cylindrical or dorsoventrally compressed and slightly sulcate; **internodes** 2–14 cm long, 0.5–0.6 cm diam., 4–23 times longer than wide; **anchor roots** whitish; **feeder roots** dark brown; **petiole** light green, smooth, 10–25 cm long, sheathing to base of the geniculum or base of the leaf blade; **petiole sheath** persistent or semi-persistent; geniculum smooth, sunken adaxially, convex abaxially, 6–15 mm long; **blades** ovate, oblique, cordate to subcordate or obtuse at base, acuminate at apex, coriaceous, drying reddish with black or brownish dots, 10–30 × 11–25 cm, 1.0–1.4 times longer than wide, decurrent on the geniculum, decurrent portion 1–2 mm wide; **midrib** ribbed adaxially, convex abaxially, drying dark or reddish brown on both surfaces, **primary lateral veins** 7–10 per side (occasionally 2 of them can emerge at once and then spread to the margin), strongly sunken adaxially, prominent abaxially, departing midrib at 75–80°, drying black up to the medial part; **secondary veins** prominent, reticulate towards the margin; **collective veins** not visible; **fenestrations** absent; **margins** entire or pinnatilobed with 2–4 lobes per side. INFLORESCENCES on free lateral shoots and ascending stems, 1–5 simultaneously at flowering time, arranged in the axils of the leaves; **peduncle** smooth, 4–5 cm long; **spathe** obtuse to short acuminate, light green during development, yellowish green externally and white internally at anthesis, completely open at apex, deciduous post-anthesis (tearing in several parts), 8–12 × 5–9 cm, up to 1 cm longer than the spadix; **spadix** white during development, cream at anthesis, 7–15 cm long, 2–3 cm diam., 3.2–3.4 times longer than wide; **basal sterile flowers** 4–5 mm long, with an orange stigmatic secretion; **fertile flowers** 4–7 mm long; stamens 1–2 mm long, with laminar filaments; anthers 1–3 mm long, the filaments do not exceed the styles at anthesis; the flowers on the spadix are separated, allowing exposure of the thecae; ovary square in longitudinal section, ribbed, more slender than style, 2–4 × 2–3 mm; style square, cylindrical or hexagonal, 3–5 × 3–4 mm; stigma linear, cleft on style, black at anthesis; **berries** with a creamy stylar cap during development, mature stylar cap moss-green; pulp grayish; **seeds** light-brown with pale dots, elongated, 5–10 mm long.

Distribution and ecology:—*Monstera moliniae* is endemic to Costa Rica (Atlantic slope and near Continental Divide, Cordilleras de Guanacaste, Tilarán and Central), from sea level to more than 1200 m, in *Tropical wet forest* and *Tropical wet forest transition to Premontane wet forest* life zones.

Phenology:—Flowering has been recorded in January to March, May, and November, and fruiting in June and December.

Discussion:—The species is a member of sect. *Marcgraviopsis* characterized by its hemiepiphytic vine-like habit, petioles sheathed to near base of blade with a deciduous sheath, broadly ovate to elliptical blades which are broadly cuneate to rounded or truncate at base, deeply pinnatifid with 2–5 pinnae on at least one side and lacking perforations, 4–8 primary lateral veins per side, peduncles shorter than spadix with the spathe green to olive-green outside, creamy white within.

Monstera molinae is most easily confused with *M. spruceana* which differs in being appressed-climbing with the petioles more than 20 cm long and the blades generally more than 30 cm long as well as by the larger spadices which are 11 to 18 cm long at anthesis. In contrast *M. molinae* has a more scandent habit, petioles less than 20 cm long, blades less than 30 cm long and the spadices about 5–11 cm long.

The populations of *Monstera molinae* are distributed only in the Caribbean slope and are located mainly in primary forests. Adult plants develop hanging reproductive stems. In La Tirimbina Biological Station, the reproductive hanging stems reach the ground, eventually becoming creepers (Cedeño-Fonseca *et al.* 2022).

Additional specimens examined:—COSTA RICA. **Alajuela:** Upala, Aguas Claras, Cuenca del Pizote, 800 m, 4 March 1999, (Infer.), *G. Herrera 1517* (CR!, MO!); Upala, Dos Ríos, P.N. Guanacaste, Cordillera de Guanacaste, Estación San Ramón, Dos Ríos, Límite del parque a 2 km de la casa, 550 m, 27 January 1995, (Fr.), *F. Quesada 191* (CR!, MO!); Camino entre la estación de la Reserva Forestal de San Ramón y el camino a la colonia Palmareña, 1 February 1987, (Fr.), *G. Herrera 499* (MO!); Along road between Cañas and Upala, 400 m, 24 June 1976, (Infer.), *T.B. Croat 36259* (MO!); San Carlos, Llanura de San Carlos, 100 m, 21 February 1966, (Fr.), *A. Molina 17685* (MO!);

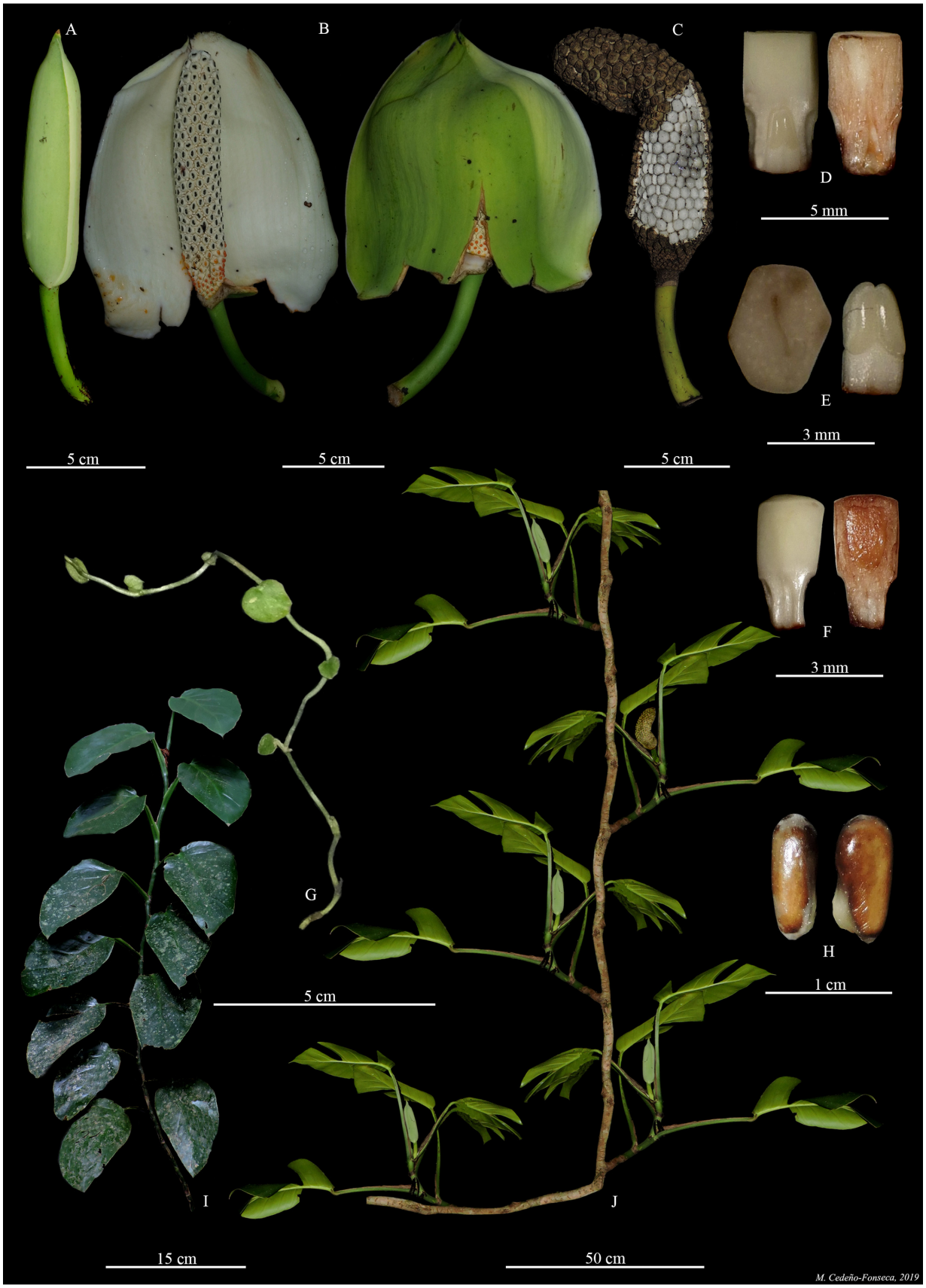

FIGURE 56. *Monstera molinae* from Sarapiquí, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detached. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Seedling. (H) Seeds. (I) Juvenile plant. (J) Adult plant flowering on free lateral shoots. *M. Cedeño et al. 899* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 57. *Monstera molinae*. Adult plant with hanging stems growing 20 m above the ground. Tilarán, Costa Rica. Photo by M. Cedeño-Fonseca. (Not collected).

Remnant evergreen forest and secondary growth in the tropical-premontane wet forest transition zone about 3 km NNE of Bijagua along the new road to Upala, 450 m, 7 November 1975, (Fl., Fr.), *W. Burger 9882* (CR!); Upala, Aguas Claras, Sendero Cabinas Bromelia, 600 m, 15 Diciembre 2016, (Fr.), *M. Cedeño et al. 983* (USJ!); **Guanacaste:** Liberia, Mayorga, Estacion Cacao, Sendero casa de Fran, 1000 m, 9 February 1995, (Fr.), *E. Fletes 52* (CR!); La Cruz, Santa Cecilia, Estacion Pitilla 9 km, S. de Santa Cecilia, 700 m, 14 July 1997, (Fr.), *C. Moraga 910* (CR!, MO!); Parque Nacional Rincón de la Vieja, 900–1200 m, 27 Enero 1983, (Fr.), *G. Davidse 23344* (MO!); Rincón de la Vieja National Park, 800 m, 28 January 1983, (Fr.), *N. Garwood 755* (CR!, MO!); El Dos de Tilaran, 1000 m, 12 April 1986, (Fr.), *W. Haber 4446* (CR!, MO!); **Heredia:** Sarapiqui, Near Puerto Viejo along road near the Río Sucio, 20 m, 27 May 1976, (Fr.), *T.B. Croat 35689* (MO!); Sarapiqui, Sendero entre el campamento Canta Rana y Río Peje, 400 m, 14 January 1983, (Fr.), *I. Chacón 82* (MO!); Heredia, Fila Carrillo, 700 m, 30 March 1984, (Fr.), *L. Gómez 21131* (CR!, MO!); Sarapiquí, La Virgen, Estación Biológica La Tirimbina, Sendero la Ceiba, 150 m, 6 June 2016, (Fr.), *M. Cedeño et al. 899* (USJ!).

36. ***Monstera monteverdensis*** M.Cedeño & Croat, *Phytotaxa* 461 (3): 188. 2020. (Figs. 58, 59)

Type:—COSTA RICA. Puntarenas: Monteverde, Santa Elena, Camino a Selvatura, 1530 m, 11 March 2017, *M. Cedeño, M. Fernández & I. Chinchilla 1045* (holotype USJ!, isotype MO!).

Nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stem** light green with white dots; **internodes** 3–5 cm long, 3–5 mm diam.; **petioles** conspicuous, dark green or light green, smooth, 8–14 cm long, sheathed throughout its length; **petiole sheath** deciduous; **blades** ovate or lanceolate, acuminate at apex, sub-cordate to truncate at base, with or without **fenestrations** (when present, usually on one side of blade, breaking the margin if very close to it), coriaceous, 7–14 × 3–9 cm, not flattened against the phorophyte. ADULT PLANTS: root climbers; **stem** light brown or beige, smooth, terete; **internodes** 1.5–3.5 cm long, 1.0–3.5 cm diam., 1.0–1.5 times longer than wide; **anchor roots** light brown to brown, 3–6 cm long; **feeder roots** light brown; **petiole** dark green with white dots, smooth, 25–50 cm long, sheathed to the middle of the geniculum; **petiole sheath** involute in young leaves, becoming deciduous; **geniculum** smooth, flattened adaxially, rounded abaxially, 2–3 cm long; **blade** ovate to lanceolate in outline, oblique, acuminate at apex, subcordate to obtuse at base, decurrent to the middle of the geniculum, the decurrent portion 1–2 mm wide, coriaceous, 25–60 × 20–30 cm; **midrib** grooved above, transversally convex below; **primary lateral veins** 10–15 per side, impressed above, prominently raised below; **collective veins** slightly visible; **fenestrations** sparse, rarely near the midrib; **margins** pinnatifid with 2–8 lobes per side. INFLORESCENCES on ascending stems; **peduncle** smooth, 14–20 cm long; **spathe** acuminate, light green and pruinose in developing inflorescences, externally light green and pruinose at anthesis, internally white, leathery, open at the apex, the margins overlapping at base, deciduous after anthesis, 15–20 × 9–14 cm, up to 7 cm longer than the spadix; **spadix** cream-colored during development, yellowish cream at anthesis, 6–14 cm long, 1.5–4.0 cm diameter; **basal sterile flowers** 4–6 mm long, with an orange or rusty-red secretion; **fertile flowers** 5–7 mm long; stamens 1–6 mm long, with filament laminar; anther 2–3 mm long; ovary rectangular in longitudinal section, ridged, 4–5 mm long, 2–3 mm diameter; style hexagonal, 2–3 mm long, 4–5 mm diameter, stigmatophore cupular, 0.5–2.0 mm long, stigma linear to rhombic, with orange or rusty-red discharge. **berries** with the stylar layer light green during development, maturing white-cream; pulp white; **seeds** smooth, brown to dark brown, obliquely obovate, 8–10 mm long.

Distribution and ecology:—*Monstera monteveredensis* is endemic to Costa Rica, occurring on both Caribbean and Pacific slopes of the Cordillera de Guanacaste and Cordillera de Tilarán, and the extreme northwestern part of the Cordillera Central, at 500–2300 m, in *Lower montane wet forest*, *Lower montane rain forest* life zones and in the transition zone between *Tropical moist forest* and *Premontane wet forest* life zones.

Phenology:—Flowering has been recorded from December to June and in August, and fruiting has been recorded throughout the year.

Discussion:—The species, a member of sect. *Monstera,* is characterized by its moderately slender stems, nearly fully sheathed petioles with the sheath mostly deciduous or persisting at fragments or fibers, small yellowish brown, narrowly ovate, weakly perforated, short-acuminate, moderately inequilateral leaf blades as well as the inflorescence with the spathe much longer than the stubby spadix.

Monstera monteverdensis has been confused with *M. dissecta* but that species has larger more prominently pinnate leaves and petioles with a persistent sheath. Other species with which *Monstera monteverdensis* has been confused with *M. epipremnoides* and *M. lentii*, but it differs from *M. epipremnoides* by its deciduous (*vs*. persistent) petiolar sheaths, and pinnatifid leaves with few lateral lobes (2–8 per side) and few fenestrations or none (*vs.* pinnatifid with numerous lateral lobes (8–15 per side) with several fenestrations at either side of the midrib). It differs from *Monstera lentii* by its deciduous (*vs*. persistent) petiolar sheaths, thicker spathes, and styles with a cupular stigmatophore of 0.5–2.0 mm (*vs.* a conical stigmatophore of 3–4 mm).

Additional specimens examined:—COSTA RICA. **Alajuela:** San Ramón, Peñas Blancas, Evergreen cloud forest and wet wind-gap formations (lower montane and premontane rain forest life zone) on and near the Continental Divide about 2 to 5 km east and southeast of Monteverde, 1650 m, 17 October 1978, (Fr.), *M. Thomas 738* (CR!, MO!); Woods on Atlantic side of Alto Palomo, 1900 m, 3 January 1970, (Fr.), *R. Lent 1846* (CR!); San Carlos, La Fortuna, Finca El Jilguero, Cumbre del Volcán Chato, 1140 m, 25 November 1992, (Fr.), *G. Herrera 5647* (CR!); R.F. Grecia, En bosque secundario, Bosque del Niño, 1700 m, 2 October 1986, (Fr.), *G. Umaña 104* (CR!); Reserva Forestal Grecia, 1000 m, 16 Enero 1987, (Fl.), *G. Herrera 405* (MO!); San Ramon, Small patch of primary cloud forest on N slope of Cerros Pata de Gallo, 1480 m, 18 November 1988, (Fr.), *M.H. Grayum 9093* (MO!); San Ramon, Along road from San Ramón northward through Balsa, 700–800 m, 29 August 1979, (Fr.), *W. Stevens 13860* (MO!); San Ramon, Along road from San Ramón northward through Balsa, 1100–1150 m, 10 September 1979, (Infer.), *W. Stevens 14129* (MO!); Along road

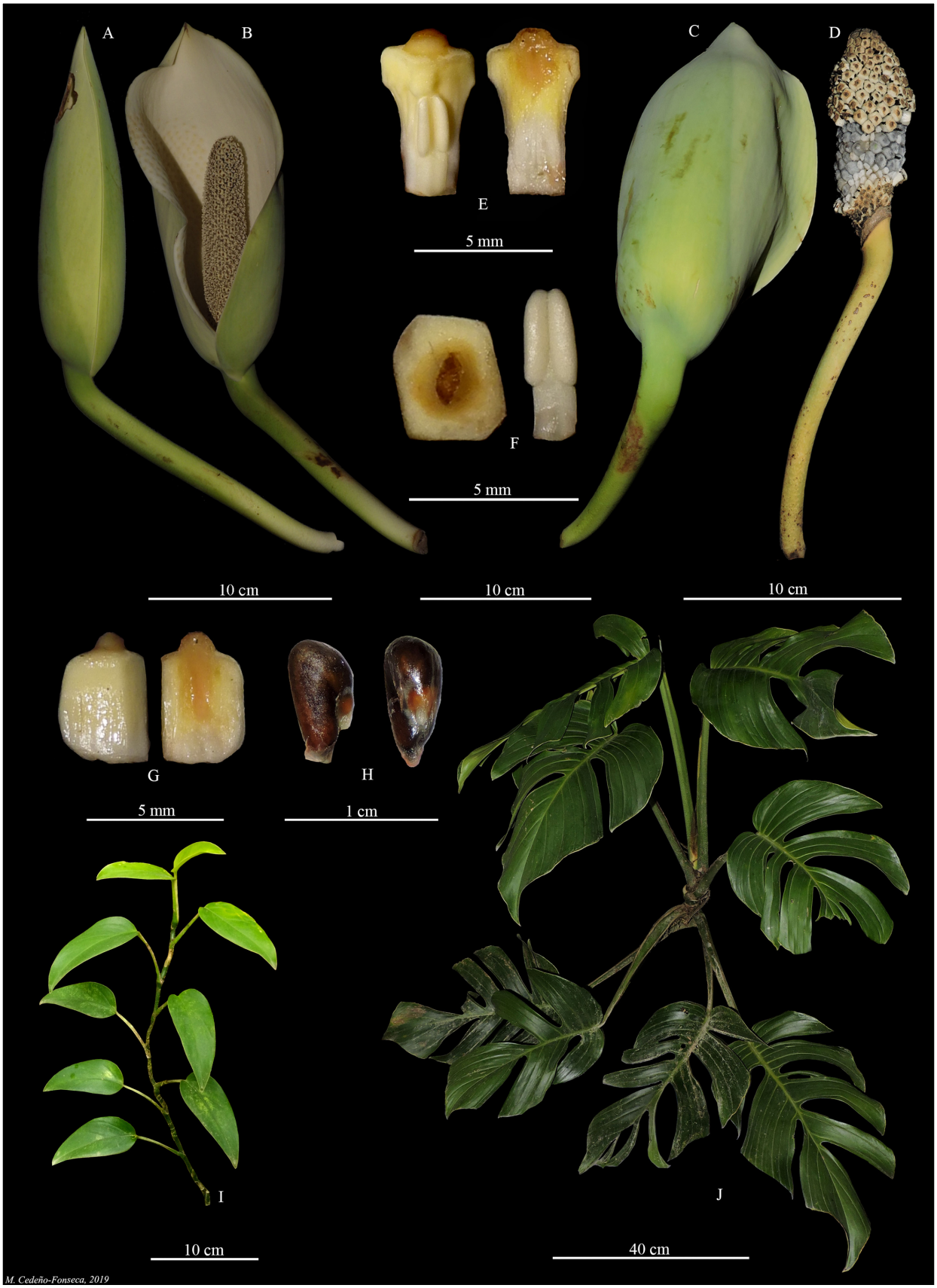

FIGURE 58. *Monstera monteverdensis* from Monteverde, Costa Rica. (A) Developing inflorescence. (B) Open inflorescence, frontal view. (C) Open inflorescence, back view. (D) Mature infructescence, stylar plates detached in the middle part. (E) Fertile flower; in lateral view (left), and longitudinal section (right). (F) Stylar plate with stigma (left) and one stamen (right). (G) Sterile flower; in lateral view (left), and longitudinal section (right). (H) Seeds. (I) Portion of juvenile plant. (J) Portion of adult plant. *M. Cedeño et al. 1045* (USJ). Image from Cedeño-Fonseca *et al.* (2020b).



FIGURE 59. *Monstera monteverdensis*. Adult plant growing in the forests around Monteverde, Costa Rica. Photo by M. Cedeño-Fonseca. (Not collected).

between San Ramón and Balsa, 1200 m, 2 February 1979, (Fr.), *T.B. Croat 46841* (MO!); San Ramón, Ángeles, R.F. San Ramón, Ca. 10 km west of Lagitos; in forest on ridge and secondary woods along Río San Lorencito, 950 m, 30 May 1986, (Fl.), *B.E. Hammel et al. 15239* (CR!, MO!); San Ramón, Angeles, Estacion Rio San Lorenzo, 800 m, 22 April 1994, (Fl., Fr.), *Z. Fuentes 757* (CR!); **Guanacaste:** Cañas, Palmira, Agua Caliente, subiendo el Volcán Tenorio, 1326 m, 19 December 2015, (Fr.), *M. Cedeño & M. Campos 847* (USJ!); Liberia, Curubandé, Estacion Las Pailas; sendero a Santa Maria, 1200 m, 29 May 1994, (Fr.), *D. Garcia 259* (CR!); Cañas, Palmira, Agua Caliente, subiendo el Volcán Tenorio, 1326 m, 19 December 2015, (Fr.), *M. Cedeño & M. Campos 846* (USJ!); Tilarán, Quebrada Grande, R.B. Monteverde, 1 km N Las Nubes Village, 8 km NW Monteverde, premontane rain forest, 200 m, 31 August 1989, (Fl.), *W. Haber & W. Zuchowski 9520* (CR!); Tilarán, Tronadora, R.B. Monteverde, 3.5 km N Santa Elena on road to San Gerardo, 0.5 km N of junction road and Río Negro, Lower montane wet forest, 1540 m, 20 August 1988, (Fl.), W. *Haber & W. Zuchowski 8619* (CR!); Tilarán, Tronadora, R.B. Monteverde, Trayecto de la Torre a Río Negro, división entre Alajuela - Puntarenas y Guanacaste, entre las vertientes Pacífica y Norte, 1650 m, 21 January 1988, (Fr.), *W. Haber & E. Bello 8021* (CR!); Tilarán, Quebrada Grande, Quebrada Grande, Tilaran, Sendero Esperanza-Las Nubes, Division Continental, Bosque pluvial premontano, 1300 m, 24 February 1987, (Fr.), *W. Haber 6685* (CR!, MO!); La Cruz, Santa Cecilia, P.N. Guanacaste, La Cruz - 9 km al sur de Santa Cecilia, Estación Pitilla, 700 m, 28 September 1990, (Fr.), *C. Chávez 187* (CR!, MO!); La Cruz, Santa Cecilia, P.N. Guanacaste, La Cruz - 9 km al sur de Santa Cecilia, Estación Pitilla, 700 m, 24 October 1990, (Fr.), *C. Chávez 297* (CR!); La Chirripa ridge, 1000 m, 8 May 1986, (Fl.), *W. Haber 4858* (MO!); Río Chiquito valley, 700 m, 12 April 1986, (Fr.), *W. Haber 4456* (MO!); Río Chiquito de Tilaran, Río Negro, 1450 m, 1 July 1986, (Fr.), *W. Haber 5168* (MO!); Guanacaste, Cañas, Palmira, Agua Caliente, subiendo el Volcán Tenorio, 1326 m, 19 December 2015, (Fr.), *M. Cedeño & M. Campos 843* (USJ!); Guanacaste, Cañas, Palmira, Agua Caliente, subiendo el Volcán Tenorio, 1326 m, 19 December 2015, (Fl.), *M. Cedeño & M. Campos 845* (CR!); Guanacaste, Tilarán, Tilarán, Camino a Tilarán, 1325 m, 21 November 2018, (Fr.), *M. Cedeño & A. Cascante 1502* (USJ!); **Heredia:** Colonia Virgen del Socorro, Cariblanco. 1000 m, 3 June 1983, (Fl.), *C. Chacón & B. Ocampo 67* (CR!); Heredia, Barva, Concepción, Subiendo al Parque Nacional Braulio Carrillo, sector Volcán Barva, 2300 m, 26 February 2018, (Fl., Fr.), *M. Cedeño et al.1353* (USJ!); San Isidro, Heredia and San José provinces, 1600–1800 m, 13 September 1978, (Fr.), *W. Burger 11023* (MO!); **Puntarenas:** Puntarenas, Monteverde, Santa Elena, Camino a Selvatura, 1530 m, 11 Marzo 2017, *M. Cedeño et al. 1045* (MO!, USJ!); 2 km NE Santa Elena on border of Monteverde Reserve, Upper San Gerardo, 1550 m, 20 November 1988, (Fr.), *W. Haber 8795* (CR!, MO!); Monteverde community, 1400 m, 15 May 1986, (Fr.), *W. Haber 4927* (MO!); Hills above Santa Elena, 1450 m, 11 June 1986, (Fr.), *W. Haber 5054* (MO!); Puntarenas, Monteverde, Monteverde community, Pacific slope, 500 m, 28 August 1989, (Fr.), *W. Haber 9336* (CR!, MO!); Monteverde Cloud Forest Reserve,1600 m, 14 January 1986, (Fr.), *W. Haber 4274* (MO!); Puntarenas, R.B. Monteverde; Cordillera de Tilarán, Cerro Ojo de Agua, 1600 m, 24 August 1993, (Fl.), *E. Bello 5235* (CR!, MO!); Puntarenas, Monteverde, Community, En faja de bosque perturbado cerca de Divis de Reserva, 1540 m, 23 junio 1977, (fl.), *V. Dryer 1521* (CR!).

37. ***Monstera ngabensis*** Croat, ***sp. nov.*** (Figs. 60, 61)

The species is characterized by its nomadic vine, appressed-climbing habit, greenish-white internodes with light yellow-brown peeling epidermis, leaves with deciduous sheaths, small perforations on one side of the leaf, as well as by the moderately long-pedunculate inflorescence with a stubby white spadix.

Type:—PANAMA. Comarca Ngäbe-Buglé: Parcela 8. Nole Duima/Kankintú, cerca de Entrada de Hacha. La Nevera, Filo de la cordillera, bosque montano primario, 1750 m, 25 Aug, 2012, *Melisa Ayala, Alicia Ibáñez, Ángela Celis, Noris Flores, Jorge Castillo 1504* (holotype PMA!-106396).

Nomadic vine, appressed-climbing habit. SEEDLINGS: unknown. JUVENILE PLANTS: unknown. ADULT PLANTS: root climbers; **stems** greenish brown; **internodes** 2–3 cm long, 1 cm diam., 2–3 times longer than wide, dark brown drying, finely striated, yellow-brown brittle epidermis; **petioles** 25 cm long, sheathed 1 cm before base of the geniculum; **petiole sheath** deciduous, with fibrous persistent residues, pale brown; **blades** ovate, 25.0 × 15.5 cm, 1.6 times longer than wide, moderately thin, faintly bicolorous, dark green and matte adaxially, faintly paler abaxially, drying dark brown and matte adaxially, slightly paler and semi-glossy abaxially; **midrib** drying slightly paler adaxially and reddish brown, narrowly rounded and paler abaxially; **primary lateral veins** 7 per side, weakly convex and colorless adaxially, closely rounded and slightly paler abaxially; **secondary veins** mostly parallel with some crossed oblique veins; upper surface granular, lacking short pale lines; lower surface densely pale mottled, sparsely coarse-granular; **fenestrations**

present, arranged on one side only, oblong; **margins** entire. INFLORESCENCES erect; **peduncle** 20 cm long, 8 mm diam., drying with a scaly yellow-brown squamous epidermis, the underlying tissue blackened; **spathe** unknown; **spadix** greenish-white or white, 11.2 cm long, 2.5 cm diam., 4.5 cm times longer than wide; **basal sterile flowers** 3–4 mm long; **fertile flowers** 5–6 mm long; stamens with laminar filaments; ovary ribbed, 3–5 × 1–2 mm; style hexagonal, 1–2 × 1–2 mm; stigmatophore thickly columnar; stigma linear with a deep medial cleft, thick, conspicuous margins, pale brown; **berries** white; **seeds** unknown.

Distribution and ecology:—*Monstera ngabensis* is endemic to Panama, know only from the type locality in Comarca Ngäbe-Buglé, at 1750 m, in a *Montane rain forest* life zone.

Phenology:—Flowering in August.

Etymology:—The species named for the Comarca Ngäbe-Buglé where it was first collected.

Discussion:—The species is a member of sect. *Monstera* characterized by its nomadic vine, appressed-climbing habit, greenish-white internodes with light yellow-brown peeling epidermis, moderately short-petiolate leaves with deciduous sheaths, ovate, dark brown-drying blades which are more or less acute at the apex and inequilaterally rounded at base with small perforations on one side, as well as by the moderately long-peduculate inflorescence with a stubby white spadix only 4.4 times longer than broad.

The species shares characters with both *M. mittermeieri* and *M. oreophila* but differ from both in having up to 7 pairs of primary lateral veins whereas the other two species have more than 14 veins per side.



FIGURE 60. *Monstera ngabensis*. Adult plant growing in Ngäbe-Buglé, Panama. *A. Ibañez 1504* (PMA). Photo by A. Ibáñez



FIGURE 61. *Monstera ngabensis*. Adult plant growing in Ngäbe-Buglé, Panama. *A. Ibañez 1504* (PMA). Photo by A. Ibáñez

38. ***Monstera obliqua*** Miq., *Linnaea* 18: 79. 1844. (Figs. 62, 63)

Type:—SURINAME. [Wanica]: Vredenburger-Zandrits, October 1842, *H.C. Focke 719* (holotype U n.v., photos: BH, SEL! sheet 006766).

Monstera falcifolia Engler, *Bot. Jahrb.* 37: 117. 1905. TYPE:—BRASIL. Amazonas, Jurua Miry, July 1901, Ule 5622 (holotype B, photos: BH, GH, US, isotypes K, L!, MG, photo: BH).

Monstera fendleri Engler, *Bot. Jahrb.* 37: 117. 1905. TYPE:—TRINIDAD. 1877-1880, *Fendler 736* (holotype K!, isotypes NY, P!).

Monstera sagotiana Engler, *Bot. Jahrb.* 37: 117. 1905. TYPE:—GUYANA FRANCESA, Karouany, *Sagot 609* (holotype BM!, photo: BH).

Monstera snethlagei Krause, *Notizbl. Bot. Gart. Berlin-Dahlem* 9: 272. 1925. TYPE:—BRASIL, Maranhão, Jury-assu, Mta. de Allegria, Ketterpflanze im Igapowald, gelb, Hüllblatt ebenfalls gelb, 14 November 1923, *Snethlage 327* (holotype B, photos: BH, F!, GH, US).

Nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** smooth, dark green; **internodes** 3–5 cm long, 2–5 mm diam.; **petiole** conspicuous, dark green, smooth, 5–11 cm long, sheathing to base of the geniculum; **petiole sheath** deciduous; **blades** lanceolate, truncate at base, acuminate at apex, subcoriaceous, 7–13 × 2–4 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** smooth, light to dark green; **internodes** 2–10 cm long, 0.3–0.8 mm diam., 10.0–12.5 times longer than wide; **cataphylls** light-green, deciduous but leaving dry fragments on peduncles; **anchor roots** black; **feeder roots** black; **petiole** light green, smooth, 5–18 cm long, sheathing to the geniculum, **petiole sheath** deciduous; geniculum smooth, 3–5 mm long; **blades** lanceolate to narrowly elliptical, cuneate at base, acuminate at apex, membranous to subcoriaceous, drying blackish, reddish, light brown or grayish, 12–23 × 3–10 cm, not decurrent on geniculum;

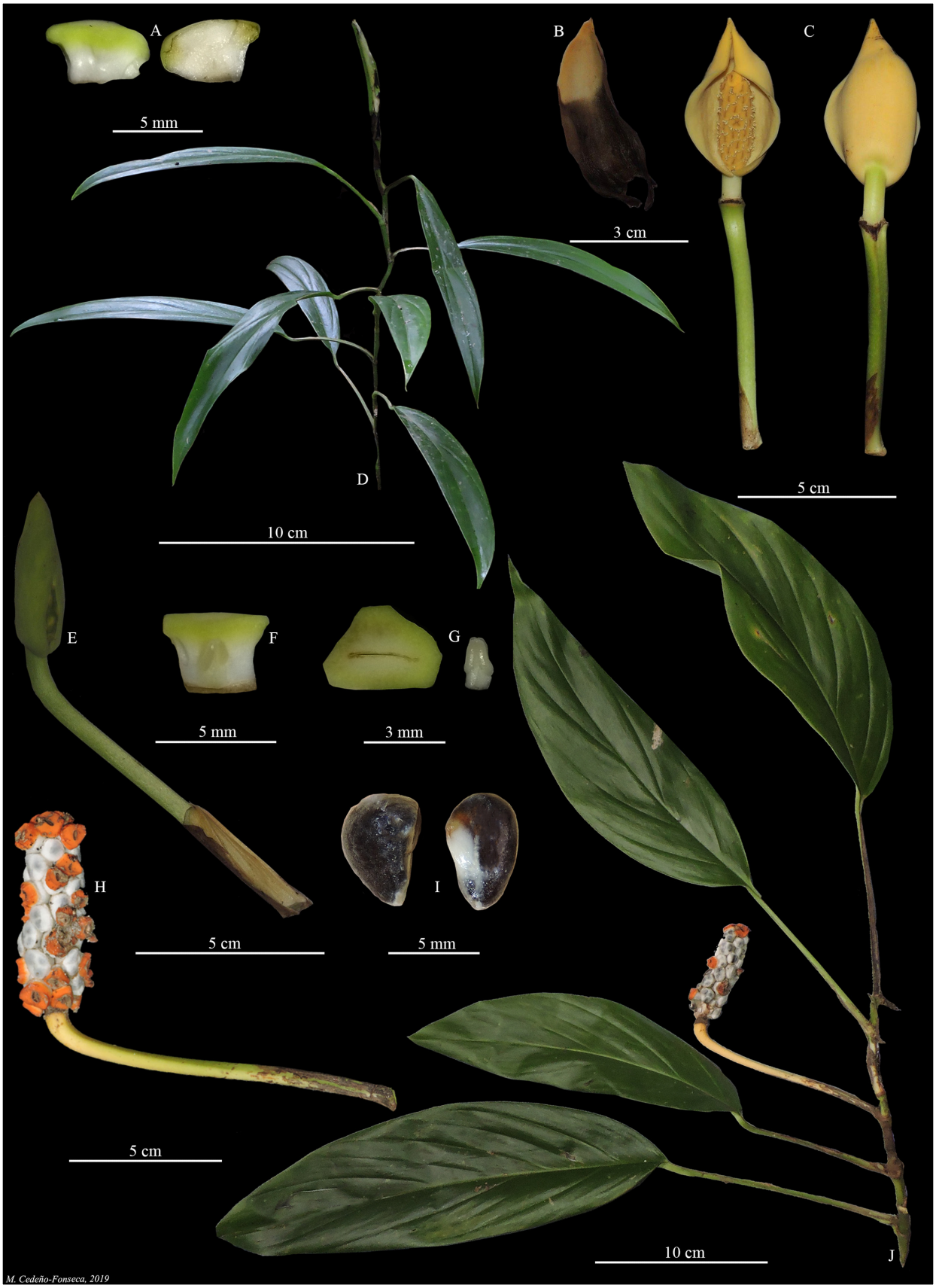

FIGURE 62. *Monstera obliqua* from Manzanillo, Costa Rica. (A) Sterile flower; in lateral view (left), and in longitudinal section (right). (B) Spathe anomaly: a small second spathe. (C) Front and back views of open inflorescence, with scar of atypical second spathe on the peduncle. (D) Juvenile plant. (E) Developing inflorescence. (F) Fertile flower. (G) Stylar plate with stigma (left) and one stamen (right). (H) Mature infructescence, stylar plates detached toward the apical part. (I) Seeds. (J) Adult plant. *M. Cedeño et al. 1481* (USJ). Image from Cedeño-Fonseca *et al.* (2020g).



FIGURE 63. *Monstera obliqua*. Adult plant growing in the forests around Manzanillo, Costa Rica. *M. Cedeño et al. 2201* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

midrib ribbed adaxially, convex abaxially; **primary lateral veins** 4–8 per side, obscure adaxially, prominent abaxially, departing midrib at 35°–50°; **secondary veins** inconspicuous; **collective veins** not visible; **fenestrations** absent or scarcely developed (in Central America); **margins** entire. INFLORESCENCES on ascending stems, 1–3 simultaneously at flowering time, arranged in the axils of the leaves or cataphylls; **peduncle** smooth, 10–17 cm long, 5–6 mm diam.; **spathe** acuminate, light-green during development, yellow externally and white internally at anthesis, the margins towards the apex involute, deciduous at the end of anthesis, up to 4 cm longer than the spadix; **spadix** with green style margins and white at the medial part during development, cream at anthesis, 3–5 × 0.5–1.0 cm; **basal sterile flowers** scarce or absent; **fertile flowers** 4–7 mm long; stamens 1–2 mm long, with laminar filaments; anthers 1–2 mm long; ovary square in longitudinal section, ribbed, 1.5–2.0 × 1.5–2.0 mm; style square or hexagonal, 1.5–2.0 × 2.5–3.0 mm; stigma linear; **berries** with a moss-green stylar cap during development, mature stylar cap orange; pulp white; **seeds** black, 3–5 mm long.

Distribution and ecology:—*Monstera obliqua* ranges from Costa Rica to the Pacific slope and adjacent lowlands of the departments of Chocó and Valle in Colombia, and to Venezuela, the Guianas, and throughout the Amazon basin, at 0–1410 m, in *Tropical moist forest, Tropical lower montane wet forest* and *Montane moist forest* life zones.

Phenology:—Flowering has been recorded from July to November. Fruiting in January, March July and November.

Discussion:—The species is a member of sect. *Monstera*. It differs from the other species of the genus in Costa Rica by its slender petioles (<0.5 cm diam.), sheathed to the base of the geniculum, the entire, narrowly lanceolate, not or hardly fenestrate leaf blade; the infructescence with the stylar layer orange with white pulp beneath. Vegetatively, individuals of *Monstera obliqua* with fenestrate leaves can be confused with the dry forest morphotype of *M. adansonii*. Another species with which it could be confused is *M. gambensis*, which has the petiole rough, persistent petiolar sheaths with involute wings, and is known only from a collection on the Pacific side in the area of La Gamba, Golfito.

In its current conception, *Monstera obliqua* is a very variable and widespread species, including forms with widely varying and sometimes extreme leaf fenestration patterns, occurring across much of lowland wet tropical South America. It may be that further study will show that it covers several species. There are a number of synonyms based on South American and West Indian representatives which it is beyond the scope of this paper to evaluate (Cedeño-Fonseca *et al.* 2022).

Additional specimens examined:—COSTA RICA. COSTA RICA. **Limón:** Talamanca, Sixaola, San Miguel de Sixaola, Finca -albergue de ASACODE, 35 m, 28 July 1994, (Fr.), *J. Sánchez et al. 340* (CR!); Talamanca, Bratsi, Suretka, Bosques cercanos al sitio de exploración petrolera, 200 m, 19 July 1995, (Fl., Fr.), *A. Cascante et al. 551* (CR!); Limón, Talamanca, Cahuita, Between Bri Bri and Sixaola, NW of Paraíso, Disturbed forest, 50 m, 5 July 1983, (Fr.), *K. Barringer et al. 3489* (CR!, MO!); Talamanca, Sixaola, Hills between headwaters of Quebrada Mata de Limón and upper branches of Quebrada Tigre, and lowland forest of Quebrada Tigre drainage, Finca Anai, (Sixaola region), 28 m, 18 November 1984, (Fl., Fr.), *M.H. Grayum et al. 4458* (CR!, MO!); Talamanca, Sixaola, Headwaters of quebrada Mata de Limón, westernmost fork, Finca Anai, (Sixaola region), 23 m, 17 November 1984, (Fr.), *M.H. Grayum et al. 4439* (CR!, MO!); Talamanca, Cahuita, Gandoca, El Llano entre Fila Manzanillo y Río Creek. Atrás de la playa, 80 m, 27 March 1995, (Fr.), *G. Herrera & E. Sandoval 7600* (CR!); Limón, Valle La Estrella, Fila Espavel, 200 m, 3 July 2000, (Fr.), *L. Acosta 2117* (CR!); Talamanca, Sixaola, Sendero Cerillo, 1 m, 3 March 1999, (Fr.), *U. Chavarría 1920* (CR!); Talamanca, Sixaola, San Miguel, senderos en la ruta a Manzanillo, 30 m, 16 January 1997, (Fr.), *J. González 1582* (CR!); Lugar, Camino entre Fila Dimat y Río Uren, 22 October 1985, (Fr.), *L. Gómez 23765* (MO!); Ca. 10 miles S of Punta Cahuita, 70 m, 11 August 1977, (Infer.), *T. Croat 43199A* (MO!); Talamanca, Bribri, Proyecto ARA, 4 m, 30 September 2018, (Fl., Fr.), *M. Cedeño et al. 1481* (USJ!); Talamanca, Bribri, Proyecto ARA, 4 m, 30 September 2018, (Fr.), *M. Cedeño et al. 1482* (USJ!). PANAMA. **Bocas del Toro:** Above Chiriquí Grande on side road 10 mi from continental divide; on trail off pipeline trace, 8°55'N, 82°10'W, 300 m, 28 May 1988, *G. McPherson 12569* (MO!); Hill just south of Chiriquí Grande; at end of pipeline access road 2 mi N of 2nd large bridge N (10 mi.) of cont. divide, 8°54'N, 82°10'W, 350–500 m, 10 Mar 1986, *B.E. Hammel et al. 14743* (MO!); Vicinity of Chiriquí Lagoon, 8 Oct 1940, *H. Wedel 1091* (MO!); Milla, 7.5, 26 July 1971, *T.B. Croat & D. Porter 16277* (MO!); **Chiriquí:** Chiriquí Grande-Fortuna, along Continental Divide from road branching N off main Fortuna-Chiriquí Grande Highway near Continental Divide, 1.1 mi from main highway, 8°44'N, 82°17'W, 1200 m, 11 Mar 1985, *T.B. Croat & M.H. Grayum 60347* (MO!); **Coclé:** Cerro Pilon near El Valle, 700–900 m, 700–900 m, 10 June 1967, *J. Duke 12155* (MO!). Between Cerro Pilon and El Valle, 700–900 m, 15 Aug 1967, *J. Duke 13993* (MO!); El Valle, 1000 m, 24 Dec 1972, *A. Gentry 6893* (MO!); El Valle; end of road leading to Turstico Hotel, 11 May 1977, *J. Folsom 3111* (MO!); Trail between the Río Blanco and the Continental Divide N of El Cope and El Potroso sawmill, 400–1700 ft, 14 Dec 1980, *J. Sytsma et al. 2580* (MO!); Vicinity of El Valle, 600–1000 m, 8 Dec 1938, *P. Allen 1227* (MO!). Mountains beyond La Pintada,

400–600 m, 16 Feb 1935, *Hunter & P. Allen 544* (MO!); Cerro Pilón, 2000–2700 ft, 28 Mar 1969, *J. Dwyer et al. 4565* (MO!); Continental divide N of Penonome on road to Coclesito, 1600 ft, 25–26 July 1978, *B.E. Hammel 4039* (MO!); Foot of Cerro Pilón, above El Valle de Antón. Rain forest, 2000 ft, 28 Mar 1969, *D. Porter et al. 4612* (MO!); El Valle de Anton, La Mesa, 1000 m, 1 Apr 1973, *Helen et al. 3011* (MO!); El Valle site, on the end of the trail from the end of the road to the site, 24 Apr 1968, *Kirkbride 1082* (MO!); Continental divide, 4 mi past Llano Grande on road to Cascajal, NW of Penónome, 500 m, 9 Apr 1981, *J. Sytsma 3878* (MO!); Road from Penonomé to Coclecito, 9 km N of Llano Grande, tributary on Río Caseaja, 11 Oct 1978, *W. D'Arcy & B.E. Hammel 12282* (MO!); **Colón:** Santa Rita Ridge, Santa Rita (Arriba)-Cerro Azul, 09°20'21''N, 79°46'47''W, 200–260 m, 23 July 1990, *M.H. Grayum & R. Evans 9922* (MO!); Santa Rita Ridge Road, 6.5 mi E of Boyd-Roosevelt Hwy, 09°21'15"N, 79°44'00"W, 370 m, 16 July 1994, *T.B. Croat & G. Zhu 76941* (GB, MO, SAR); 25–26 kms from Transisthmica Hwy on Santa Rita Ridge, 09°26'N, 079°37'W, 500 m, 21 Oct 1981, *S. Knapp et al. 1733* (MO!); Santa Rita Ridge, E of Agua Clara rain gauge, 4 March 1973, *H. Kennedy 2753* (MO!); Santa Rita Ridge, In forest on Tassell's property, 8 Nov 1974, *S. Mori & Kallunki 3026* (MO!); Santa Rita lumber road, 8.7 km E of Transisthimian Highway, 15 June 1977, *J. Folsom 3690* (MO!); Santa Rita Ridge Road, 7.8 km from the Boyd-Roosevelt Hwy, ca 25 km W of Colón, 23 Aug 1975, *S. Mori & R. Dressler 7907* (MO!); Trail S of Río Guanche, on ridge to Cerro Pan de Azúcar, 200 m, 20 Sept 1974, *S. Mori & Kallunki 2031* (MO!); 9 km W of Llano Grande just S of Cascajal, 800 ft, 11 Oct 1978, *B.E. Hammel & W. D'Arcy 5099* (MO!); **Darién:** Vicinity Cerro Pirre, along trail from base camp to Rancho Frio on slopes of Cerro Pirre, 07°58'N, 77°43'W, 200–450 m, 27 July 1994, *T.B. Croat & G. Zhu 77130* (MO!); Parque Nacional Darién, subiendo por la trocha limitrofe desde Casa Vieja hacia Cerro Sapo, 07°58'N, 78°23'W, 500–800 m, 25 May 1991, G. *Herrera et al. 1000* (MO!); Parque Nacional Darién, Serranía de Cerro Sapo, por la trocha limitrofe del PND entre Casa Vieja y Cerro Sapo, 07°58'N, 78°23'W, 20–400 m, 24 Nov 1990, *G. Herrera & J. Polanco 742* (MO!); Parque Nacional del Darién. Slopes of Cerro Mali; head waters of S branch of Río Pucuro; ca. 22 km E of Pucuro, 08°04'30"N, 77°14'00"W, 1300–1400 m, 21 Oct 1987, *H. Cuadros et al. 3912* (MO!); Parque Nacional del Darién. Ridge between Río Topalisa & Río Pucuro ca. 13 km E of Pucuro; Quebrada Pobre to Mi Casita, 8°03'N, 77°20'W, 450–600 m, 14 Oct 1987, *G. Nevers et al. 8316* (MO!); Parque Nacional del Darién Ridge between N & S Branches of Río Pucuro; in forest N of old village of Tacarcuna; ca. 18 km E of Pucuro, 8°05'N, 77°16'W, 600–800 m, 24 Oct 1987, *B.E. Hammel et al. 16486* (MO!); Cerro Tacarcuna Expedition. South slope of Cerro Tacarcuna above Río Pucuro base camp, 700–1000 m, 25 January 1975, *A. Gentry & S. Mori 13899* (MO!, PMA!); Cerro Tacarcuna Expedition. Trail from Pico Mali to old Tacarcuna village on Río Tacarcuna, premontane wet forest, 700 m, 7 Feb 1975, *A. Gentry & S. Mori 14181* (MO!); Cativo Swamp, Río Chucunaque, ca. 1/2 hr below Morti, 18–31 May 1967, *J. Duke 11749* (MO!). 10 km NE of Jaqué, headwaters of Río Pavarandó, 1400 ft, 30 Jan 1981, *J. Sytsma & W. D'Arcy 3352* (MO!); 10 km NE of Jaqué, ridge between Río Tabuelita and Río Pavarandó, 1400–1600 ft, 1 Feb 1981, *W. D'Arcy &. J. Sytsma 14551* (MO!); Near Jacque at Enseñada del Guayabo, Apr 1980, *N. Garwood 1024* (MO!); Cerro Mali: Cerro Tacarcuna Expedition, Trail from Tacarcuna village on Río Tacarcuna to Cerro Mali, 800–1300 m, 16 Jan 1975, *J. Gentry & S. Mori 13601* (MO!); Parque Nacional Darién: S of Garachine near Pacific coast above Casa Vieja along boundary trail, W flank of Serranía Sapo, 7°58'N, 78°23'W, 150–300 m, 22 May 1991, *Hensold 1083* (MO!, PMA!); Punta Guayabo Grande: N of Punta Guayabo Grande, trail to ridge top, 200–600 ft, 21 Apr 1980, *T. Antonio & J. Hahn 4346* (MO!, PMA!); **Panamá:** Along trail to Cerro Brewster from Río Pacora Valley, 9°20'N, 79°15'W. Forested slopes c. 650 m, 9°20'N, 79°15'W, 650 m, 21 Nov 1985, *G. McPherson 7558* (MO!); 1 mi N Cerro Azul, 2300 ft, 27 May 1966, *E. Tyson & K. Blum 4088* (FSU, MO); El Llano-Carti Road, 10 km from Interamerican Hwy, 5 Oct 1974, *S. Mori & Kallunki 2326* (MO!); Campo Tres, 3 mi NE of Altos de Pacora, 500–800 m, 10 Mar 1973, *R. Liesner 578* (MO!); Cerro Azul, 23 June 1972, *T.B. Croat 17304* (MO!); El Llano-Cartí Road, 09°16'N, 078°58'W, 1000 ft, 6 Sep 1980, *J. Sytsma 996* (MO!); El Llano-Carti road, 12 km N of Pan. Am. Hwy at El Llano, 400 m, 11 Mar 1974, *M. Nee 10450* (MO!); Cerro Azul, 24 Mar 1969, *D. Porter et al. 4070* (MO!); *D. Porter et al. 4098* (MO!); 2–3 mi S of Goofy Lake, road to Cerro Jefe, 2000–2200 ft, 10 Dec 1966, *H. Lewis et al. 264* (MO!); Near foot of Loma Larga, east of Cerro Azul (Goofy Lake), 5 Apr 1973, *R. Dressler 4319* (MO!, PMA!); vicinity of Finca Neptuno, 3.5 km NE of Lago Cerro Azul on road to Cerro Jefe, 600–800 m, 11 May 1974, *M. Nee 11524* (MO!). El Llano-Carti Road, 9.6 km from Inter-American Highway, 350 m, 26 May 1975, *S. Mori & Kallunki 6402* (MO!); **Comarca Guna Yala:** Nusagandí, 30 May 1993, *Marrianne 25* (MO!); Trail from mouth of Río Irgandí to a tributary of Río Cartí Senni. Two hours through second growth, one hour through forest, 9°25'N, 78°51'W, 9°25'N, 78°51'W, 20 Dec. 1985, *G. Nevers & G. Herrera 6580* (MO!); Cangandi, 9°24'N, 79°24'W. 9°24'N, 79°24'W, 30 m, 10 Feb 1986, *G. Nevers & G. Herrera 7041* (MO!); Cangandi, hills around village, Assoc: Cespedizia macrophylla, 9°24'N, 79°24'W, 9°24'N, 79°24'W, 50 m, 13 Dec. 1985, *G. Nevers et al. 6487* (MO!, PMA!); El Llano-Cartí Road, 19.1 km from Interamerican Hwy; elev. 350 m. 9°19'N, 78°55'W, 9°19'N, 78°55'W, 350 m, 4 Mar 1985, *G. Nevers et al. 4951* (MO!); Campamanto Nusgandi, en ELC a 19.1 km de la vía

Panamaericana, Sendero Wedar Igar, 9°11'N, 78°15'W, 200–350 m, 31 Oct 1992, *G. Herrera et al. 1265* (MO!, PMA!); Nusagandí; El Llano-Cartí Road, 9 mi N of main highway; Nergan Igar (Nergan Trail), 09°20'N, 79°00'W, 350 m, 2 July 1994, *T.B. Croat & G. Zhu 76563* (CM, MO); Trail east of Cangandi-Mandinga airport road, 2–5 mi S of Mandinga airport. 27 Oct 1967, *J. Duke 14813* (MO!); Cerro Habú, trail from Río Sidro, primary wet forest, 09°23'N, 078°49'W, 800–1400 ft, 18 Dec 1980, *J. Sytsma et al. 2635* (MO!); On trail to inland village of Armila, 3 to 8 km SW of Puerto Obaldía, 21 June 1975, *S. Mori et al. 6798* (MO!); Puerto Obaldía and trail to Colombian Frontier, 0–500 m, 28 Apr 1980, *W. D'Arcy 13624* (MO!); 3–4 hours up Río Mulatupu, 17 Aug 1967, *Kirkbride 229* (MO!); El Llano-Cartí road, 10.5 mi from Interamerican Hwy, 09°18'N, 079°58'W, 550 m, 14 Mar 1985, *T.B. Croat 60487* (MO!); Nusagandi: Sendero Wedar, 9°18'N, 78°58'W, 300–400 m, 19 July 1986, *McDonagh et al. 174* (BM); **Veraguas:** Slopes of Cerro Tute, along trail from between first and second creeks N of height above Alto de Piedra; forest,08°30'N, 81°07'W, 600–750 m, 21 March 1987, *G. McPherson 10730* (MO!); Trail on ridge to summit of Cerro Tuté, Cordillera de Tute. 1 km past Escuela Agricola Altos de Piedra, just W of Santa Fe, upper montane and elfin forest, 08°36'N, 081°06'W, 1250–1410 m, 15 December 1981, *S. Knapp & J. Sytsma 2532* (MO!); Vicinity of Escuela Agricola Alto Piedra near Santa Fe, 0.3 mi beyond the fork in the road near the agricultural school toward Atlantic coast, along trail to top of Cerro Tute, 1050–1150 m, 29 November 1979, *T.B. Croat 48887* (MO!, PMA!); Carribbean slope above Río Primero Brazo 5 mi NW of Santa Fe, 700–1200 m, 18–19 Mar 1973, *R. Liesner 801* (MO!); Along trail to summit of Cerro Tute, ca. 3 km above Escuela Agricultura Alto Piedra near Santa Fé, 2600–2800 ft, 4 Jan 1981, *J. Sytsma & T. Antonio 2987* (MO!); Vicinity of Escuela Agricultura Alto Piedra, near Santa Fé along trail to top of Cerro Tute, 2800 ft, 3 Apr 1980, *T. Antonio 3978* (MO!); Along road from Santa Fé to Río Calovebora 0.6 mile beyond Escuela Agricola Alto Piedra, 735 m, 4 Apr 1976, *T.B. Croat & J. Folsom 34133* (MO!); 0.6 mi beyond Escuela Agricola Alto Piedra, 730 m, 4 Apr 1976, *T.B. Croat & J. Folsom 34000* (MO!); Caribbean slope above Río Primero Brazo 5 mi NW of Santa Fé, 700–1200 m, 18–19 Mar 1973, *T.B. Croat 23146* (MO!); Road beyond Escuela Agricola Alto Piedra, above Santa Fé, Atlantic watershed, 800–1000 m, 1 Jan 1975, *J. Luteyn & R. Wilbur 4566* (DUKE!); 1 km past Agricultural School, forested slope to the rear. Road from Santa Fe, 1000–1200 m, 5 Feb 1977, *J. Folsom & L. Collins 1610* (MO!).

39. ***Monstera oreophila*** Madison, *Contr. Gray Herb.* 207: 54. 1977. (Figs. 64, 66)

Type:—PANAMA. Chiriquí: vicinity of Boquete, Finca Collins, 5500 ft., oak-laurel cloud forest, 24 July 1959, *W.L. Stern, K.L Chambers, J.D. Dwyer & J.E. Ebinger 1104* (holotype MO!, isotypes GH!, LE!, US!).

Robust nomadic vine, with appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS; root climbers; **stems** light or dark green, smooth or rough; **internodes** 2–8 cm long, 3–6 mm diam.; **petiole** distinct, light or dark green, smooth or warty, 7–15 cm long, sheathed to base of the geniculum; **petiole sheath** persistent or deciduous; blades lanceolate, ovate, subcordate to rounded at base, acuminate at apex, 8–16 × 3–11 cm, not appressed to the phorophyte; **fenestrations** present or absent. ADULT PLANTS: root climbers; **stems** dark or light green, smooth or warty, cylindrical; **internodes** 1–5 cm long, 2–4 cm diam., 0.5–1.2 times as long as wide; **anchor roots** black, **feeder roots**, suberose; **cataphylls** light-green, warty or smooth, deciduous; **petiole** dark or light-green, smooth or distinctly warty, 25–70 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous with fibrous residues; geniculum smooth, sulcate adaxially, convex abaxially, 2–5 cm long; **blades** ovate to lance-ovate or oblong, asymmetrically cuneate to rounded or subcordate at base, short to long-acuminate at apex, subcoriaceous, drying yellowish, brownish, or very dark brown to almost black, 25–75 × 20–35 cm, 1.3–2.0 times longer than wide, decurrent on the geniculum, decurrent portions 0.5–2.0 mm wide; **midrib** sulcate adaxially, convex and smooth to markedly warty abaxially, drying blackish or yellowish; **primary lateral veins** 11–45 per side, departing midrib at 75–90°, rarely forked, sunken adaxially, prominent abaxially, drying blackish or yellowish; **secondary veins** parallel but becoming reticulated toward the margin; **collective veins** not visible; **fenestrations** present (rarely absent), the ones located along each side of the midrib small and roundish, the ones located farther from the midrib much larger and elongated; **margins** entire or pinnatilobed due to tearing of the fenestrations that extend to the margin, 3–7 lobes per side, the sinuses reaching halfway or all the way to the midrib, 0.5–6.0 cm wide. INFLORESCENCES produced on ascending stems, 1–5 per synflorescence, with or without subtending cataphylls; **peduncle** smooth or warty, 13–40 cm long; **spathe** acuminate to long-acuminate, glaucous-green externally during development, glaucous-green or pinkish externally and light orange-yellow internally at anthesis, becoming torn at base and hanging (reflexed) from the midrib base during the staminate phase of anthesis, deciduous soon after anthesis, 10–16 × 8–11 cm, up to 6 cm longer than the spadix; **spadix** white during development, yellow at anthesis, 7–15 cm long, 1.3–3.0 cm diam., 4.4–5.5 times longer than wide; **basal sterile flowers** 4–6 mm long, with a transparent secretion; **fertile flowers** 5–7 mm long; stamens 1.5–7.0 mm long,

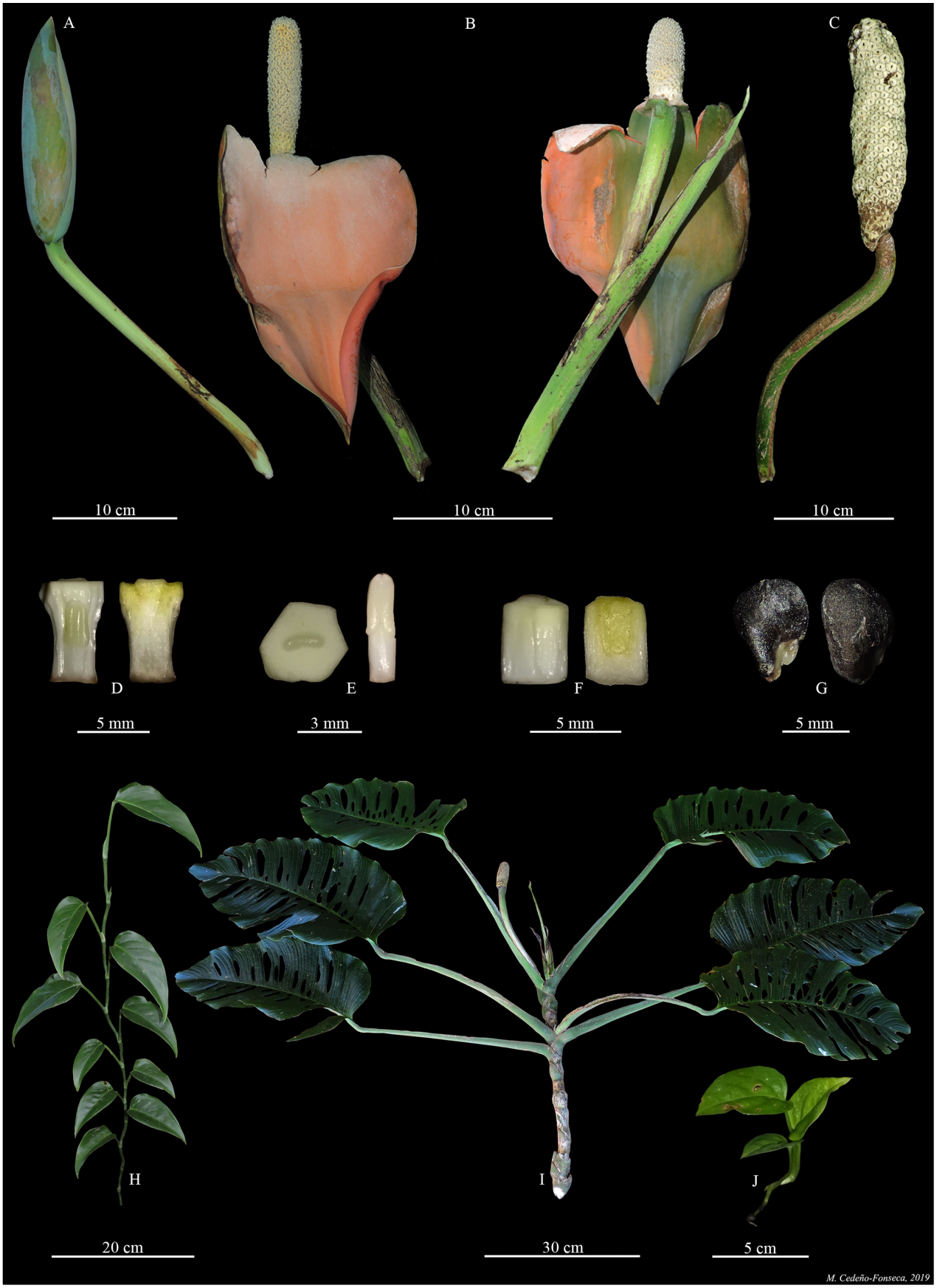

FIGURE 64. *Monstera oreophila* from Costa Rica. (A) Developing inflorescence. (B) Front and back views of open inflorescence with pendent spathe. (C) Mature infructescence. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; in lateral view (left), and in longitudinal section (right). (G) Seeds. (H) Juvenile plant. (I) Adult plant. (J) seedling. *M. Cedeño et al. 1272* (USJ). Image from Cedeño-Fonseca *et al.* (2021a).

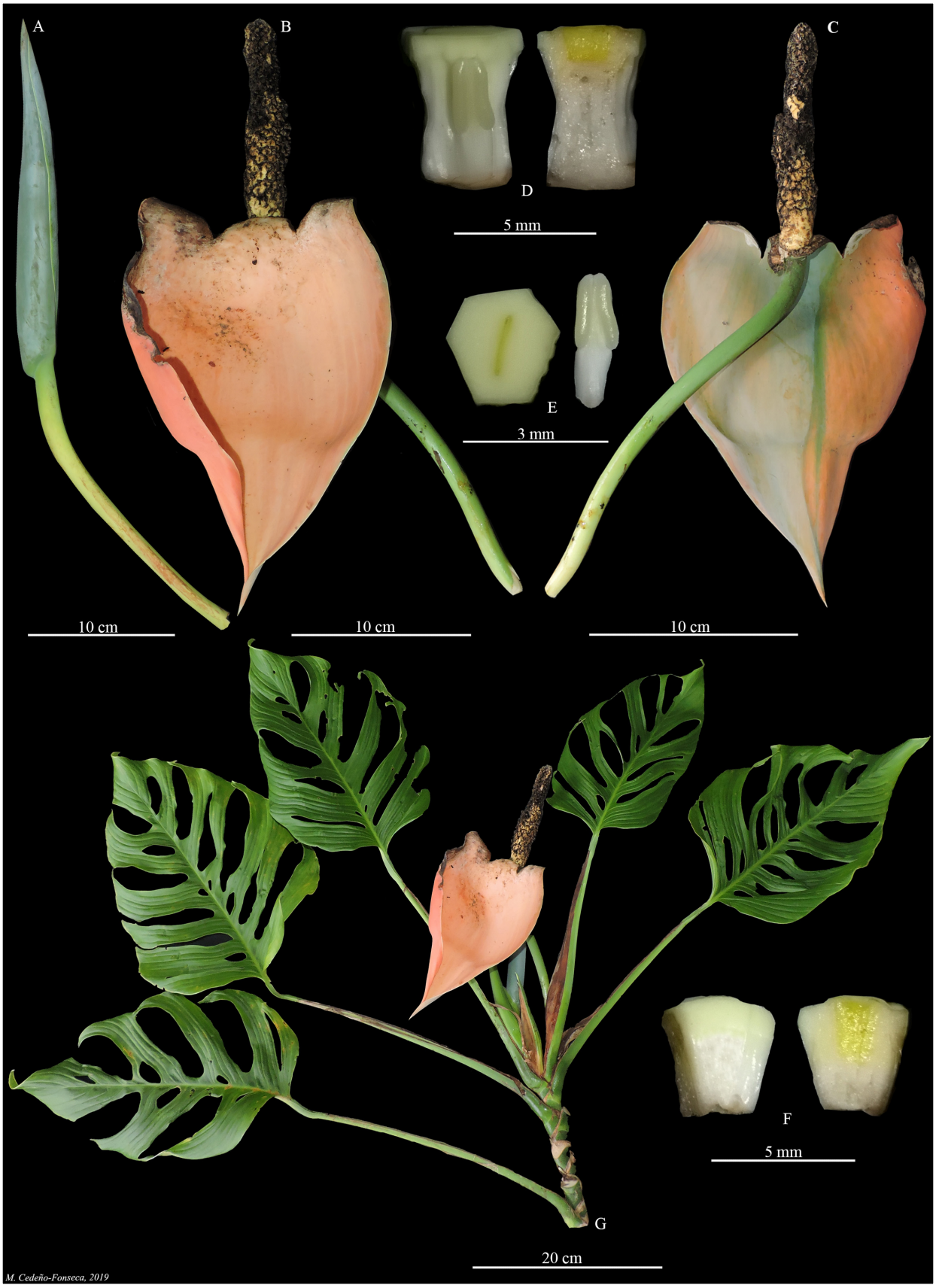

FIGURE 65. *Monstera oreophila* from Boquete, Panama. (A) Developing inflorescence. (B) Inflorescence with pendent spathe (torn at base) showing the internal (adaxial) surface. (C) Inflorescence with pendent spathe (torn at base) showing the external (abaxial) surface. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate top view (left), and individual stamen (right). (F) Sterile flower; in lateral view (left), and in longitudinal section (right). G. Portion of adult shoot. *Ortiz et al. 3359* (PMA). Image from Cedeño-Fonseca *et al.* (2021a).



FIGURE 66. *Monstera oreophila* from Panama (A–D) and from Costa Rica (E–G). (A) Adult plant with smooth petioles. (B) Inflorescence with pendent spathe (torn at base) showing the internal (adaxial) surface and the spadix with herbivore damage. *Ortiz et al. 3359* (PMA!). (C) Adult plant with pendent spathe showing the internal (adaxial) surface. (D) Petiole with tiny white warts. (E) Adult plant with erect spathe (not torn at base yet). (F) Inflorescence with pendent spathe (torn at base) showing the internal (adaxial) surface. (G) Petiole with tiny white warts. *M. Cedeño et al. 1272* (USJ). Image from Cedeño-Fonseca *et al.* (2021a).

with laminar filaments; anthers 1.5–3.0 mm long; ovary rectangular in longitudinal section, ribbed, 3–5 × 2.0–3.5 mm; style hexagonal, 1.5–2.0 × 2–4 mm; stigmatophore absent or present, slightly columnar; stigma linear; **berries** with light green to creamy-white stylar caps during development, mature stylar caps creamy-white; pulp white; **seeds** black, oblong, 5–7 mm long.

Distribution and ecology:—*Monstera oreophila* ranges from Costa Rica to Panama, occurring at 800–2300 m, in *Tropical wet forest*, *Premontane wet forest*, *Premontane rain forest* and *Lower montane rain forest* life zones.

Phenology:—Flowering has been recorded in February-March, May, and October-November, and fruiting in February-April, August, October, and December.

Discussion:—The species, a member of sect. *Monstera, is* characterized by its petiole asperous for its entire length and with deciduous wings, leaf blades fenestrate throughout and sometimes pinnatilobed, the asperous midrib, and the spathe papaya-colored externally and internally. It could be confused with the allopatric *Monstersa buseyi*, but that has the petioles verrucate-asperous, the leaf blade with the midrib smooth, and an externally cream-colored spathe.

In Costa Rica (Central and Talamanca cordilleras), and Panama (Boquete and La Fortuna, Chiriquí Province), the populations of *Monstera oreophila* exhibit asperous or smooth petioles and midribs, salmon to papaya pink spathes, drying yellowish, blackish or dark brown. However, Costa Rican populations in Tilarán and Guacanaste show certain differences, such as the smooth stem, smooth green petioles with the sheath semi-persistent, smooth midribs, heavily fenestrate or pinnatilobed leaf blades, the spathe externally glaucous green and internally light salmon to pale rose, and the prophylls and cataphylls smooth and drying completely yellow (Cedeño-Fonseca *et al.* 2021a, 2022).

Additional specimens examined:—COSTA RICA. **Alajuela:** San Carlos, at terminus of road out of Sucre toward Cerro Porvenir, 2000 m, 24 December 1974, *R. Luteyn 4504* (MO!); San Ramón, Ángeles, R.B. Alberto Manuel Brenes, Las Rocas, 2 Km al Oeste de Finca de Carlos González, 1000 m, 16 February 1994, *G. Herrera & V. Mora 6898* (CR, USJ); San Ramón, San Rafael, N slope of Cerros Pata de Gallo, near summit, Montes del Aguacate, 1495 m, 18 November 1988, *M.H. Grayum et al. 9098* (CR!, MO!); Valverde Vega, North of Grecia, 1800 m, 2 June 1984, *Murphy 1375* (MO!); **Cartago:** Paraíso, Orosi, Parque Nacional Tapantí, 1260 m, 14 June 2016, *M. Cedeño & M. Fernández 900* (USJ!); San Nicolás, Z.P. La Carpintera, ladera sur, finca Hacienda La Lima, 1816 m, 4 October 2007, *A. Cascante 1823* (CR!); Aguacaliente o San Francisco, Camino entre Navarro y Muñeco, ca. 3.0–3.5 km del pueblo de Muñeco, 1530 m, 23 February 2010, *A. Cascante & I. Chacón 2209* (CR!); Mountains south of Muñeco, 5 April 1974, *J. Utley et al. 790* (CR!); La Unión, Río Azul, Quebrada Quebradas, 9 km SE of San José, 1450 m, 19 December 1976, *R. Lent 4005* (CR!); Turrialba, Chirripó, P.N. Barbilla, Cuenca del Matina, Sendero Barthon, Quebrada Avispa, 1600 m, 8 March 2001, *M. Mora 1888* (CR!); La Unión, San Diego, Z.P. La Carpintera, Ladera norte con vista a Tres Ríos, entrando por finca de los Tinoco, 1520 m, 26 March 2008, *A. Cascante et al. 1904* (CR!); Tapantí, 1500 m, 22 October 1983, *I. Chacón 1454* (CR!, MO!); Jiménez, Pejibaye, El Copal, Sendero Gárvula, saliendo a Senderos Ron Ron y Mariposas, 900 m, 29 May 2005, *Solano 2484* (CR!); El Guarco, La Sierra, 2000 m, 14 January 1983, *D. Gómez 19742* (MO!); Turrialba, Along road between Moravia and Quebrada Plantanillo, 1200–1300 m, 30 June 1976, *T.B. Croat 36642* (MO!); Turrialba, Along camino Raíz de Hule, 1200–1400 m, 1 July 1976, *T.B. Croat 36729* (MO!) ; Paraiso, Tapantí Reserve, 1500–1800 m, 29 September 1987, *T.B. Croat 68244* (MO!); Quebradilla, camino hacia poblado de Corralillo, ruta 228, 1890 m, 2 February 2017, *A. Cascante & C. Trejos 2633* (USJ!); Quebradilla, camino hacia poblado de Corralillo, ruta 228, 1890 m, 2 February 2017, *A. Cascante & C. Trejos 2634* (USJ!); Turrialba, Chirripo, Moravia de Chirripó, 1602 m, 20 December 2019, *M. Cedeño et al. 1639* (USJ!); La Unión, San Rafael, Z.P. La Carpintera, límite de propiedad del Campo Escuela Iztarú, 1854 m, 13 June 2007, *A. Cascante et al. 1754* (CR!); **Guanacaste:** Tilarán, Tronadora, 5 km N Monteverde, Western margin of Reserva Biológica Monteverde, junction of road to San Gerardo valley with Río Negro, 1550 m, 23 December 1988, *W. Haber & W. Zuchowski 8948* (CR!); La Cruz, Santa Cecilia, Trail above Estación Pitilla, on east slope of Volcán Orosi 710 m, 30 December 1989, *Gereau & Taylor 3475* (CR!, MO!); Tilarán, Camino a Tilarán, 1325 m, 22 November 2018, *M. Cedeño & A. Cascante 1511* (USJ!); **Heredia:** Barva, San José de la Montaña, Vicinity of Porrosatí, S slope Volcán Barva, 1980 m, 3 April 1987, *M.H. Grayum et al. 8248* (CR!, MO!); Cerro del Gallito, 1800 m, 20 November 1940, *J. León 326* (CR!); San Rafael, Road between San Rafael and Río Las Vueltas, 2100–2200 m, 4 September 1979, *W. Stevens 13992* (MO!); San Rafael, Ángeles, Cordillera Volcánica Central, aprox. 0.7 km NE del Hotel El Tirol, 1820 m, 12 September 2017, *A. Cascante et al. 2623* (USJ!); Vara Blanca vicinity, 1800 m, 25 May 1972, *J. Luteyn 3026* (MO!); Sarapiqui, 7.5 km north of Vara Blanca in the vicinity of Río La Paz Grande, 1270–1350 m, 22 June 1976, *T.B. Croat 36018* (MO!); 4 miles north of Vara Blanca, 1350 m, 26 May 1976, *T.B. Croat 35560* (MO!); Varablanca, R. F. Cordillera Volcánica Central, Cuenca del Sarapiquí, 9 km NE de la casa de Pablo Serrano, Proyecto ALAS, 1450 m, 16 April 2005, *D. Santamaría 1811* (CR!, MO!); Varablanca, Cerro Chompipe (falda norte) San Rafael, 2100 m, 16 December 1993, *A. Cascante et al. 137* (CR!); Varablanca, Alto del Roble, ladera norte del Cerro Chompipe, por entrada a torres del ICE, 2044 m, 11 November 2008, *A. Cascante et al. 2049* (CR!); Forest along ridge between Río Sardinal and headwaters

of Quebrada Arrayanes, 1850–2000 m, 20 April 1986, *M.H. Grayum 7302* (MO!); **Puntarenas:** Buenos Aires, Potrero Grande, Estacion Tres Colinas, Finca Benito Acuna, 1700 m, 10 September 1996, *E. Alfaro 765* (CR!); Buenos Aires, Potrero Grande, Puesto Tres Colinas, Sendero Rompe Fuegos, 2100 m, 20 September 1996, *B. Gamboa 711* (CR!); Buenos Aires, Potrero Grande, Potrero Grande, La Lucha-Tres Colinas, Fila entre Cerro Seno y Cerro Kebé, 2100 m, 24 February 2008, *D. Santamaría 7197* (CR!); Coto Brus, Upper Río Burú, 2010 m, 19 August 1983, *D. Gómez et al. 21704* (CR!, MO!); Coto Brus, Sabalito, I Campamento ACLA, Camino a Cerro Echandi, 1900 m, 12 April 1998, *E. Alfaro 1561* (CR!); Coto Brus, Upper Río Burú, 2010 m, 19 August 1983, *D. Gómez 21415* (MO!); Coto Brus, Sabalito, Zona Protectora Las Tablas, Finca Sandí-Hartmann "El Capricho", camino a El Surá, 2000 m, 30 April 2016, *M. Cedeño et al. 883* (USJ!); Coto Brus, San Vito, E.B. Las Cruces, Las Cruces Tropical Botanical Garden, 6 km W of San Vito de Java, 1200 m, 6 March 1984, *T.B. Croat 57250* (CR!, MO!); Coto Brus, Sabalito, Sendero a Cerro Echandi, 1580 m, 11 February 1998, *B. Gamboa 2144* (CR!); Coto Brus, San Vito, Along trail between Las Cruces Botanical Garden and Rio Jaba, ca. 3.5 Km SE of San Vito de Coto Brus, 1200 m, 12 September 1985, *M.H. Grayum 5976* (CR!); Coto Brus, San Vito, Fila Cruces. 1150–1200 m, 22 May 1995, *I. Chacón 131* (USJ!); Guacimal, Ojo de Agua, 1600 m, 20 April 1989, *E. Bello 803* (CR!, MO!); Puntarenas, Monteverde, Camino a Selvatura, 1590 m, 22 November 2018, *M. Cedeño & A. Cascante 1507* (USJ!); Puntarenas, Monte Verde, R.B. Monteverde, Cordillera de Tilarán, 1520 m, 19 August 1984, *M.H. Grayum 3876* (CR!, MO!); Puntarenas, Monte Verde, R.B. Monteverde, Cordillera de Tilarán, Sendero Tranquilo, 1.5 km SE of Cerro Amigos, 1400 m, 19 August 1995, *D. Penneys et al. 671* (CR!, MO!); **San José:** Acosta, Palmichal, Cedral, Cerro Rabo de Mico, 2100 m, 25 July 1991, *F. Morales 87* (CR!, MO!); Aserrí, Tarbaca, Tranquerillas, 1500 m, 2 February 1941, *Echeverría 237* (CR!); Aserrí, San Gabriel, Tranquerillas-Aserrí, 1500 m, 2 February 1946, *Echeverría 238* (CR!); Dota, Copey, Quebrada Grande, Finca Cedrela Eco-Lodge, 1800 m, 9 February 2018, *M. Cedeño et al. 1272* (USJ!); Dota, Copey, San Gerardo de Dota, Sendero Los Robles, 2200 m, 21 May 1997, *J. González 1908* (CR!); Dota, Copey, Cedro Eco Lodge, 1900 m, 9 February 2018, *M. Cedeño et al. 1272* (USJ!); Dota, Copey, Cedro Eco Lodge, 1900 m, 9 February 2018, *M. Cedeño et al. 1273* (USJ!); Desamparados, San Miguel, Altos Tablazo, área no protegida, Aprox. 2.5–3.0 km al Oeste del pueblo de Jericó, por la cruz de la avioneta, 1915 m, 5 March 2008, *A. Cascante & A. Quesada 1877* (CR!); Alto de la Palma on finca Porvenir Ca 5 km north of San Jeronimo, 1500 m, 18 August 1975, *J. Utley et al. 2904* (CR!, MO!); Montes de Oca, Cultivo en La Paulina [cultivated], 26 August 1971, *A. Rodríguez 1311* (CR!); Mora, Tabarcia, Cedral, 2250 m, 22 April 2004, *A. Quesada 1404* (CR!); Pérez Zeledón, Páramo, Hills around Rio Savegre, near Finca Zacatales, 2000 m, 1 August 1991, *Gay 1559* (CR!); Pérez Zeledón, Páramo, Cerca al Rio Quebradas; Carretera Interamericana km 117; 1750 m, 9 December 1996, *B.E. Hammel 20583* (CR!, MO!); Santa Ana, Salitral, Cuenca alta del Río Uruca, arriba de Matinilla, 1950 m, 5 May 2009, *A. Cascante et al. 2114* (CR!); Tarrazú, San Carlos, No protegida, Cuenca del Pirrís-Damas, Región Tarrazu, 1500 m, 28 December 1998, *B.E. Hammel & J. Morales 21834* (CR!, MO!); Vázquez de Coronado, Dulce Nombre de Jesús, Entrando por San Jerónimo, Camino rural, conocido localmente como calle la torre, 1517 m, 24 February 2009, *A. Cascante & D. Solano 2090* (CR!); Vazquez de Coronado, Boundary between Province of San José and Province of Cartago, 1800–1900 m, 30 May 1985, *M.H. Grayum 5292* (MO!). PANAMA. **Bocas del Toro:** La Fortuna dam area, north of dam; along continental divide trail west of oleoducto road, 08°47'N 082°15'W, 1200–1300 m, 11 February 1986, *B.E. Hammel & G. McPherson 14453* (MO!); Along trail on divide separating Chiriqui and Bocas del Toro. [Coordinates on orginal label: 8.45N 82.15W], 08°45'53"N 082°12'40"W, 1150 m, 22 October 1985, *G. McPherson 7214* (MO!); **Chiriquí:** End of road of Aguacata SW side of volcano near waterfall, 08°49'N 082°34'W, 7000 f, 12 Apr 1979, *B.E. Hammel et al. 7011* (MO!); Cerro Punta region, Alto los Guerra road W of Bambito, 08°53'N 082°37'W, 1800–2200 m, 13 July 1983, *C.W. Hamilton & K. Krager 3898* (MO!); Audobon Camp. Cerro Punta, 08°51'N 082°36'W, 1800 m, Jul 1972, *E.L. Tyson 6601* (GH, MO); 6 miles above Cerro Punta on the Boquete trail, 08°51'N 082°33'W, 7500 ft, 07 March 1974, *E.L. Tyson 7154* (IBE, MO); Cerro Punta, 08°51'30"N 082°34'30"W, 6000 ft, 06 March 1974, *E.L. Tyson 7137* (IBE); Fortuna Dam region, above northern edge of lake, 08°45'N 082°15'W, 1100 m, 27 April 1986, *G. McPherson 9079* (MO!); 3.7 km along road through Bajo Grande from bridge NE of Cerro Punta, 08°50'N 082°32'W, 2250–2400 m, 09 November 1980, *J. Sytsma & W.D. Stevens 2186* (MO!); Cerro Horqueta. [original elevation: 7000 ft.], 08°49'12"N 082°27'18"W - 08°49'42"N 082°26'48"W, 1500–2000 m, 24 July 1966, *K.E. Blum & J.D. Dwyer 2673* (MO!); Camino entre Bambito y La Amenaza, región de Cerro Punta, 08°50'N 082°37'W, 6000 ft, 21 abril 1969, *M.D. Correa 1275* (MO!); Boquete. Tree Trek Mountain Resort, 08°48'56"N 082°23'17"W, 1958 m, 24 August 2018, *O. Ortiz et al. 3359* (MO!, PMA!); Carretera hacia Rio Sereno, NE de Nueva California. Mount Totumas Cloud Forest (Cerro Totuna), *O. Ortiz et al. 2809* (MO!); Vicinity of Casita Alta, Volcán de Chiriquí, 1500–2000 m, 28 Jun 1938 – 2 Jul 1938, *R.E. Woodson et al. 985* (MO!); Near Continental Divide. Riverside, 08°47'N 082°13'W, 1100 m, 21 March 1985, *R.J. Hampshir & C. Whitefoord 792* (BM); Gualaca-Chiriquí Grande road, vicinity of Fortuna Dam at junction of road to IRHE headquarters, 08°45'N 082°18'W, 1200 m, 24 June 1987, *T.B. Croat 66747* (MO!); Cerro Colorado, along road between Río San Félix and Cerro Colorado mining exploration

camp, W of Chame, 08°31’26”N 081°47’16”W, 1400 m, 08 July 1988, *T.B. Croat 69219* (MO!); Vicinity of Bambito, E of volcán, 08°51’N 082°37’W, 1630–1730 m, 15 June 1987, *T.B. Croat 66192* (IBE, MO); Vicinity of Fortuna Dam in valley of Río Chiriquí; along aquaduct to water source for IRHE facilities near dam, 08°45’N 082°18’W, 1200–1300 m, 22 June 1987, *T.B. Croat 66611* (MO!); Vicinity of Las Nubes, Parque La Amistad; 3.5 mi W of Cerro Punta, 2 km inside park along old abandoned roads and trails and virgin forest above road, 08°53’N 082°35’W, 800 m, 28 March 1993, *T.B. Croat 74889* (MO!); Along road to Quebrada Iglesia above I.D.A.A.N. water tower at the edge of Cerro Punta, 08°51’12”N 082°34’01”W, 1980 m, 7 Aug 1974, *T.B. Croat 26380* (MO!); Along road in vicinity of branch in road to Cerro Colorado and Escopeta, above Río San Félix near town of San Felix (ca. 13 miles N of Río San Félix bridge), 08°27’N 081°47’W, 800–1200 m, 15 March 1976, *T.B. Croat 33453* (MO!); Along road in vicinity of branch in road to Cerro Colorado and Escopeta, above Río San Félix near town of San Felix (ca. 13 miles N of Río San Félix bridge), 08°27’N 081°47’W, 800–1200 m, 15 March 1976, *T.B. Croat 33508* (MO!); Methodist Youth Camp between Nueva Swissa and Cerro Punta, 08°51’N 082°35’W, 1870 m, 6 Aug 1974, *T.B. Croat 26273* (MO!); Cerro Pate de Macho ca. 5 mi NE of Boquete, along trail to Continental Divide which leads on to Finca Serrano (Francisco Serrano); pacific slope, 08°48’36”N 082°23’50”W - 08°49’30”N 082°23’42”W, 1800–2200 m, 23 Nov 1979, *T.B. Croat 48561* (MO!); Along the road to the Fortuna Dam site, N of Gualaca, 22.7 mi beyond the bridge over the Río Estí, 11.8 mi N of Los Planes de Hornito, 10.7 mi N of jct. to tunnel, 08°42’20”N 082°13’50”W, 1400 m, 26 Nov 1979, *T.B. Croat 48657* Along road between Gualaca and Fortuna dam site; 10 mi NW of Los Planes de Hornito, 08°45’N 082°17’W, 1260 m, 10 Apr 1980, *T.B. Croat 50098* (MO!); Vicinity of Monte Azul, 1.4 miles N of Entre Ríos on E slopes of Cerro Punta, 3 miles by road from town of Cerro Punta, 08°53’12”N 081°34’48”W, 2250 m, 25 November 1979, *T.B. Croat 48607* (MO!); Las Nubes near Cerro Punta, 08°53’N 082°36’W, 2000 m, 07 August 1974, *T.B. Croat 26464A* (MO!); Along road between Fortuna Lake and Chiriquí Grande; 4.5–5 km N of dam over Fortuna Lake, 08°45’N 082°13’W, 1100–1135 m, 08 March 1985, *T.B. Croat 60003A* (MO!); Fortuna Dam Area: Trail to Meteorological Station of Río Hornito, beginning 0.5 km S of Centro de Cientificos, 08°45’N 082°18’W, 23 June 1994, *T.B. Croat & G. Zhu 76312* (AAU, CM, MO, OOM, US); Fortuna Dam Area, Fortuna-Chiriquí Grande, 0.7 m; NW of center of dam, 08°46’N 082°18’W, 1080 m, 27 June 1994, *T.B. Croat & G. Zhu 76478* (K, MO); Parque Nacional Volcán Barú. Sendero Los Quetzaltes, 08°50’58”N 082°32’34”W, 2239 m, 22 julio 2017, *J.S. Vergara 2* (MO!, PMA!); Ca. 3.7 km E of bridge NE of Cerro Punta on road through Bajo Grande, 08°50’00”N 082°32’00”W, 2250–2400 m, 09 November 1980, *W.D. Stevens 18163* (MO!); Boquete. Corregimiento Los Naranjos, Parque Internacional La Amistad, entrando por el sitio llamado Bajo de Mono, 08°50’N 082°29’W, 700–900 m, 28 enero 2013, *A. Zuluaga et al. 910* (PMA!); Southwestrn slopes of Cerro Horquete about 6 km northwest of Boquete, 1700–1800 m, 28 December 1971, *R.L. Wilbur et al. 15459* (DUKE!); At Monte Rey, above Boquete, 08°46’00”N 082°25’36”W, 1170 m, 21 July 1971, *T.B. Croat 15792* (MO!); East of Boquete on Cerro Azul near Quebrada Jaramillo, 08°46’N 082°22’W, 1620–1700 m, 11 August 1974, *T.B. Croat 26812* (MO!); East of Boquete on Cerro Azul near Quebrada Jaramillo, 08°46’N 082°22’W, 1620–1700 m, 11 August 1974, *T.B. Croat 26893* (MO!); At Monte Rey, above Boquete, 08°46’00”N 082°25’36”W, 1170 m, 21 July 1971, *T.B. Croat 15711* (MO!); Gualaca. Corregimiento Hornito, Reserva Forestal Fortuna, senderos cerca al cnetro de investigaciones Jorge L. Arauz, 08°47’N 082°13’W, 1200–1200 m, 30 enero 2013, *A. Zuluaga 915* (PMA!); Corregimento Hornto, Reserva Forestal Fortuna, senderos cerca alcentro de investigaciones Jorge L. Arauz, 08°47’N 082°41’W, 1200–1500 m, 31 enero 2013, *A. Zuluaga 918* (PMA!); Reserva Forestal Fortuna. Sendero Samudio, 08°44’04”N 082°14’57”W, 1205 m, 06 noviembre 2013, *O. Ortiz et al. 1774* (MO!); **Darién:** Parque Nacional Darién, cerro Pirre, 07°46’00”N 077°44’06”W, 1600 m, *A. Zapata et al. 1616* (PMA!); Cerro Tacarcuna Expedition. Cerro Mali base camp, Colombian border, 08°07’N 077°14’W, 1500 m, 22 Jan 1975, *A.H. Gentry & S Mori 13790* (MO!); Serranía de Pirre, trail ca. 1 mi SSW of Cerro Pirre summit, 07°56’N 077°42’W, 1200 m, 15 Jul 1977, *R.L. Hartman et al. 4679* (MO!); Serranía Pirre, 1.5–2.5 mi S on ridge from intersection with trail down to Rancho Frío. Clouf forest. [Original coordinates 8º01’N, 77º43’W], 07°57’N 077°43’W, 900–1000 m, 11 July 1977, *R.L. Hartman et al. 4499* (MO!); Serranía de Pirre, along ascent of Serranía de Pirre above Cana gold mine between Río Cana and Río Escucha Ruido, 07°46’N 077°43’W - 07°46’N 077°44’W, 1310–1430 m, 27 July 1976, *T.B. Croat 37817* (MO!).

40. ***Monstera pinnatipartita*** Schott, *Oesterr. Bot. Wochenbl.* 7: 197. 1857. (Figs. 67, 68)

Type:—VENEZUELA. Distrito Federal: Caracas, *H.G. Reichenbach s.n.* (holotype W destroyed, see Riedl & Riedl-Dorn, 1988). — VENEZUELA. Zulia: Distrito Perijá, ca. 13 airline km NE of intersection of the Maracaibo-La Fría Hwy. (Hwy. 6) and the Río Aricuaisá (near intersection of LAGOVEN picas 80-2 and 19), 40 m, 20 June 1980, *G. Davidse, A.C. González & R.A. León 18286* (neotype MO!, isoneotype VEN, designated by Grayum (1997)).

[*Monstera dilacerata* auctt. non (Koch & Sello 1853) K.Koch (1855: 5). (i.e. *Epipremnum pinnatum* (L.) Engl.): Standley, *Fl. Panama* 2(3): 31. 1944 (pro parte); Madison (1977: 57, pro parte); Croat (1978: 207).]

Nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** dark green with white dots, smooth, cylindrical or flattened; **internodes** 3–6 cm long, 3–5 mm diam.; **petiole** distinct, dark green, smooth, 4–12 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** lanceolate, subcordate to truncate at base, acuminate at apex, coriaceous, 10–15 × 3–8 cm, not appressed to the phorophyte; **fenestrations** absent or present. ADULT PLANTS: root climbers; **stems** smooth, cylindrical, or slightly dorsoventrally compressed, dark green with white dots; **internodes** 1–3 cm long, 1–3 cm diam., as long as wide; **cataphylls** light or dark, mottled or whitish, persistent or occasionally deciduous; **anchor roots** dark brown; **feeder roots** dark brown; **petiole** light or dark-green, mottled to whitish, smooth, 15–65 cm long, sheathed up to 3–6 cm before the geniculum or to base of the geniculum; **petiole sheath** persistent, involute; geniculum smooth, sunken adaxially, convex abaxially, 2–3 cm long; **blades** ovate to lanceolate-ovate, broadly cuneate to rounded or truncate at base, obtuse to short-acuminate at apex, subcoriaceous to coriaceous, drying yellowish, blackish or light brown, 20–70 × 20–35 cm, (1.2)1.7–2.1 times longer than wide, decurrent on the geniculum, decurrent portion 1–2 mm wide; **midrib** ribbed adaxially, convex abaxially, drying black or yellowish on both surfaces; **primary lateral veins** 6–20 per side, slightly sunken adaxially, prominent abaxially, departing midrib at 35°–75°, drying black or yellowish; **collective vein** not visible; **fenestrations** absent or present; **margins** deeply pinnatifid, 3–10 lobes per side, 1.5–5.0 cm wide, 1–3 veins per lobe. INFLORESCENCES on ascending stems, 1–3 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** smooth, mottled, 10–25 cm long, 1.0–1.5 cm diam.; **spathe** acuminate to long-acuminate, yellowish green externally during development, white yellowish externally and white internally at anthesis, overlapping basal margins, deciduous after anthesis; 12–20 × 6–9 cm, up to 7 cm longer than the spadix; **spadix** white during development, creamy-yellow at anthesis, 6–15 cm long, 1.3–2.5 cm diam., (4.4)5.5–9.1 times longer than wide; **basal sterile flowers** 3–5 mm long, with a rusty-red stigmatic secretion; **fertile flowers** 4–7 mm long; stamens 2–6 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 4–6 × 3–4 mm; style hexagonal, 2–3 × 3–5 mm; stigmatophore columnar, 0.3–0.5 mm long; stigma linear, with an orange stigmatic secretion; **berries** with a yellowish-green stylar cap during development, mature stylar cap cream-white; pulp white; **seeds** oblong, black, 5–6 mm long.

Distribution and ecology:—*Monstera pinnatipartita* ranges from El Salvador and Costa Rica to Panama and Colombia (Magdalena, Bolívar, Huila, Valle, Risaralda, Nariño, Meta and Caquetá), northern Venezuela, western Ecuador (Esmeraldas, Pichincha, Los Rios, Guayas) and Peru (Loreto, Ucayali, San Martín, Huánuco), at 0–600 m, rarely to 1000 m, in *Tropical wet forest*, *Premontane wet* and *Lower montane rain forest* life zones.

Phenology:—Flowering has been recorded in January, September-November. Fruit in January, March-June and October.

Discussion:—The species is a member of sect. *Monstera.* It differs from the other species of the genus by the light or dark green petiole, speckled to whitish, the persistent petiolar sheath with involute wings, the deeply pinnatifid leaf blade, and externally yellowish-white and internally white spathe. It can be confused with individuals of *Monstera dissecta* but that has pinnatilobed leaves with wider lobes (4–10 cm vs. 1.5–5.0 cm in *M. pinnatipartita*).

Monstera pinnatipartita is distributed throughout the Pacific slope, being the most frequent species, growing by estuaries, open areas and primary forest. This species develops hanging stems when the plant cannot continue its ascent, but these hanging stems are never reproductive. Moreover, pre-adult plants can develop inflorescences in ascending stems when they have fenestrate and not pinnatifid leaves (Cedeño-Fonseca *et al.* 2022).

For more details about the taxonomic comments and nomenclatural note see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—EL SALVADOR. Jardín Botanico, Zona 2S, 13°40'N 089°15'W, 800 m, 12 Jul 1989, *R. Villacorta & S. Martínez 308* (MO!). COSTA RICA. **Guanacaste:** Hojancha, Puerto Carrillo, Finca Dyalá, Puerto Carrillo, Bosque situado en el nacimiento de la Quebrada Zapotal, 20 m, 26 December 1988, (Fr.), *L. Flores & C. Herrera 12* (CR!, MO!); Hojancha, Puerto Carrillo, Along Quebrada Zapotal (not on current maps), from Finca Dyalá upstream to near summit of ridge (ca. 2 km ENE of Puerto Carrillo), Península de Nicoya, 60 m, 30 April 1989, (Fr.), *M.H. Grayum et al. 9438* (CR!, MO!), Santa Cruz, Cuajiniquil, Cerro Vista al Mar, 750 m, 16 March 2008, (Fr.), *B. Hammel 24541* (CR!); **Puntarenas:** Montes de Oro, San Isidro, Interamerican Highway km marker 122; patch of forest west of road, 100 m, 4 August 1985, (Infer.), *B.E. Hammel & J. Trainer 14369* (CR!, MO!); Osa Sierpe, P.N. Corcovado, Llorona Forest, 75 m, 29 May 1988, (Fr.), *C. Kernan et al. 549* (CR!); Secondary vegetation on former plantations and pasture and remnants of original tall evergreen forest on steep slopes and stream edges in the Cabo Blanco Nature Reserve, Southern tip of the Nicoya Península, 100 m, 1 December 1969, (Fr.), *W. Burger & R. Liesner*

6607 (CR!, MO!); Golfito, Puerto Jiménez, P.N. Corcovado, Near estación Corcovado, 10 m, 7 December 1989, (Fr.), *Merz 454* (CR!); Golfito, Puerto Jiménez. P.N. Corcovado, Pavo forest, Poorly drained lowland forest, 70 m, 14 July 1988, (Fr.), *C. Kernan 693* (CR!); Osa, Sierpe, Pasture and forest edge along Quebrada Banegas, ca. 4 km W of Rincón de Osa, 40 m, 8 October 1984, (Fr.), *M.H. Grayum 4118* (CR!, MO!); Golfito, Puerto Jiménez, Along road between Rincón and Puerto Jiménez, 15 km S of Rincón, disturbed areas along road, 30 m, 4 March 1985, (Fr.), *T.B. Croat 59796* (CR!, MO!); Golfito, Puerto Jiménez, P.N. Corcovado, Sirena Woods, 50 m, 30 April 1989, (Fr.), *C. Kernan 1062* (CR!); Garabito, Tárcoles, P.N. Carara, Along Quebrada Bonita, Carara Reserve, 35 m, 25 July 1985, (Fr.), *M.H. Grayum et al. 5736* (CR!, MO!); Isla del Caño, 25 July 1985, (Infer.), *R. Soto 2421* (CR!); Osa, Sierpe, Ridge between Quebrada Banegas and Río Riyito, ca. 7 Km W of Rincón de Osa, 200 m, 8 October 1984, (Fr.), *M.H. Grayum 4085* (CR!, MO!); Area del Faro en el lomo de la fila, Isla del Caño, 26 July 1985, (Infer.), *R. Soto 2457* (CR!); Sendero al chorro, Isla del Caño, 13 March 1986, (Fr.), *R. Soto 2886* (CR!); Golfito, Puerto Jiménez, Jiménez, cuenca inferior del Río Piro, 20 m, 16 September 1990, (Fl.), *G. Herrera 4300* (CR!, MO!); Golfito, Puerto Jiménez, P.N. Corcovado, Sirena Woods, 50 m, 30 April 1989, (Fr.), *C. Kernan 1065* (CR!, MO!); Osa, Bahía Ballena, Uvita, San Josecito, Faldas de la fila Alivio, Lado Pacífico de la fila Costeña, Finca Oro Verde, 300 m, 12 January 2000, (Fr.), *M. Blanco 1245* (CR!); Golfito, Jiménez, Estacion Sirena, sendero Rio Claro, 10 m, 11 October 1993, (Fr.), *R. Aguilar 2456* (CR!); Golfito, Jiménez, Alrededor de la Estacion Los Patos, 200 m, 7 June 1994, (Fr.), *R. Aguilar 3356* (CR!); Golfito, Jiménez, Alrededor de la estación, 20 m, 11 September 1998, (Fr.), *R. Aguilar 5534* (CR!, MO!); Osa, Sierpe, Isla del Caño, 0 m, 30 August 2000, (Infer.), *J. Azofeifa 26* (CR!); Osa, Sierpe, Vicinity of Boscosa, at Quebrada Aguabuena, 100 m, 11 September 1996, (Fl., Fr.), *T.B. Croat 79247* (CR!, MO!); Puntarenas, Cóbano, Estacion San Miguel, ca. 2 km S. de Malpais, 18 January 1996, (Infer.), *B.E. Hammel 20115* (CR!); Golfito, Jiménez, Estacion Sirena, al borde del bosque primario, 2 m, 1 October 1990, (Fl.), *J. Saborio 100* (CR!); Corredores, Ciudad Neily, Cerro Punta Gorda, 3 km, northwest of Punta de Burica, Mature rainforest, 200 m, 5 March 1973, (Fr.), *P. Busey 777* (MO!); Osa, Bahía Ballena, Cerros de playa Dominical, 550 m, 30 Octubre 2016, (Fl.), *M. Cedeño et al. 946* (USJ!); Golfito, Puerto Jiménez, Camino a la Estación Biológica Piro, 23 m, 31 Mayo 2016, (Fr.), *M. Cedeño et al. 891* (USJ!); Parrita, En una plantació vieja de palma africana, ca. 4 km después de parrita, 10 m, 20 Enero 2001, (Fr.), *C. Morales 1498* (USJ!); **San José:** Mora, Colón, Z.P. El Rodeo, Bosque de la Universidad para la Paz, Bosque Premontano Húmedo, Fila Diamante, 850 m, 13 December 1993, (Fl.), *A. Cascante et al. 90* (CR!); Mora, Colón, Ciudada Colón, Finca El Rodeo, Camino Universidad para la Paz, 650 m, 27 April 1994, (Infer.), *V. Nilsson & A. Ruiz 441* (CR!); Mora, Colón, Z.P. El Rodeo, Reserva de la Universidad para la Paz, Bosque húmedo premontano, 500 m, 2 May 1994, (Fr.), *V. Nilsson 462* (CR!); Puriscal, Chires, Santa Rosa de Puriscal, Bosque primario y secundario en las faldas de Fila La Cangreja, 500 m, 6 January 1993, (Fr.), *J. Morales 1019* (CR!); Puriscal, Chires, Mastatal de Puriscal; bosque primario en la Quebrada Grande, por la fila y el rio,200 m, 28 May 1994, (Fr.), *J. Morales 2817* (CR!, MO!); Puriscal, Chires, Cerro Pelon, charrales y bosque primario remanente en la cima del cerro y cerca del antiguo camino a Quepos, 920 m, 20 April 1995, (Fr.), *J. Morales 3890* (CR!). PANAMA. **Canal Area:** Drowned forest of Quebrada Bonita, 09°20’04”N 079°35’51”W, 70–80 m, 20 Dec 1934, *C.W. Dodge & P.H. Allen 17126* (MO!); Barro Colorado Island, edge of lake, 09°09’N 079°51’W, 0–5 m, 4 Jul 1931, *D.E. Starry 17* (MO!); Barro Colorado Island, 09°09’N 079°51’W, 10–100 m, 20 Aug 1927, *L.A. Kenoyer 179* (US!); Barro Colorado Island. Snyder-Molino Trail, 09°09’30”N 079°50’20”W, 10–150 m, 30 Sep 1931, *O.E. Shattuck 27* (MO!); Barro Colorado Island. Frank Lutz Trail, 09°09’49”N 079°50’17”W, 0–50 m, 29 Sep 1931, *O.E. Shattuck 6* (MO!); Barro Colorado Island, Gatun Lake, 09°09’N 079°51’W, 0–120 m, 18 Nov 1925 – 24 Nov 1925, *P.C. Standley 41037* (US!); Barro Colorado Island. Shoreline of Lighthouse Cove, north of #8 Front Light, 09°10’18”N 079°51’22”W, 0–5 m, 12 Feb 1969, *T.B. Croat 7906* (MO, RSA, US); Barro Colorado Island, Barbour Trail, 09°09’30”N 079°49’20”W, 10–100 m, 26 Sep 1968, *T.B. Croat 6485* (MO!); Barro Colorado Island, William Morton Wheeler Trail, 09°09’20”N 079°51’10”W, 10–170 m, 30 Mar 1970, *T.B. Croat 9224* (MO!); Barro Colorado Island. Burrunga Point, 09°08’18”N 079°50’29”W, 0–5 m, 17 May 1968, *T.B. Croat 5605* (MO!); Barro Colorado Island. William Morton Wheeler Trail, 09°09’20”N 079°51’10”W, 10–170 m, 17 Jun 1970, *T.B. Croat 10909* (MO!); Barro Colorado Island, clearing at laboratory, 09°09’45”N 079°50’30”W, 50 m, 15 Jan 1969, *T.B. Croat 7251* (MO!); Barro Colorado Island. Snyder-Molino Trail, 09°09’30”N 079°50’20”W, 50 m, 12 Mar 1969, *T.B. Croat 8570* (MO!); Barro Colorado Island. Lutz Trail, 09°09’49”N 079°50’17”W, 0–50 m, 11 Jan 1969, *T.B. Croat 7138* (MO!); Madden Forest (Parque Nacional Soberanía) Las Cruces Trail, 3.6 mi N of Gamboa Road turn-off, 09°06’20”N 079°37’20”W, 140 m, 23 July 1994, *T.B. Croat & G. Zhu 77066* (MO!); **Chiriquí:** Just W of the Fortuna Camp, 08°44’N 082°15’W, 1400–1600 m, 12 Sep 1977, *J.P. Folsom et al. 5358* (MO!); NE del campamento Fortuna (Hornito), sitio de presa, después de excavaciones geológicas hasta la finca Santamaría, 08°45’N 082°14’W, 1000–1200 m, 15 agosto 1976, *M.D. Correa et al. 2465* (MO!); NE del campamento de Fortuna (Hornito sitio de presa). Camino hacia la finca Landau, 08°45’N 082°15’W, 1000–1200 m, 24 Sep 1976, *M.D. Correa et al. 2688* (MO!); Burica Peninsula.

Primary forest; San Bartolo Limite, 12 mi. (20 km) west of Puerto Armuelles, 08°18'N 082°58'W, 400–500 m, 24 Feb 1973, *R.L. Liesner 204a* (MO!); Cerro Colorado, along road above San Félix, 29 km above bridge over Río San Félix (7.9 km above turnoff to Escopeta), 08°32'07"N 081°49'11"W, 1500 m, 14 July 1976, *T.B. Croat 37080* (MO!); **Coclé:** Near Sawmill above El Copé, Atlantic drainage east of sawmill, 08°40'00"N 080°35'30"W, 20 Jun 1978, *B.E. Hammel 3518A* (MO!); **Colón:** La Macha, 08°59'04"N 080°32'35"W, 20 m, 18 Aug 2001, *J.A. Mendieta M. 10–65* (MO!, PMA!); La Macha, 08°59'04"N 080°32'35"W, 20 m, 18 Aug 2001, *J.A. Mendieta 10–208* (MO!, PMA!); Along road between Portobelo and Nombre de Dios, 1.2 mi. beyond the junction of the road to Isla Grande. [Coordinates on original label: 09º36'N, 079º35'W], 09°34'N 079°34'W, 05 April 1980, *T.B. Croat 49800* (MO!); **Darién:** Parque Nacional del Darién, along S branch of Río Pucuro; on ridge in forest E of old village of Tacarcuna; ca. 18 km E of Pucuro, 08°04'N 077°16'W, 600–900 m, 23 Oct 1987, *B.E. Hammel et al. 16449* (MO!); About 10 miles S of El Real on Río Pirre (House no. 22), 08°01'N 077°44'W, 10 August 1962 – 11 August 1962, *J.A. Duke 5461* (MO!); Upper Río Tuquesa, 08°26'N 077°28'W - 08°34'N 077°42'W, January 1973 - May 1973, *J.M. Gustave Le Clézio 14* (MO!); Ensenada del Guayabo, 16–19 km SE of Jaqué, 07°25'N 078°03'W, 0–100 m, 17 Jan 1981, *N.C. Garwood 1025* (MO!); Serrania de Majé. Reserva Privada Chucanti. Cerro Chucanti. Camnino a la cascada, 08°47'31"N 078°26'51"W, 699 m, 06 April 2018, *O. Ortiz 3171* (MO!, PMA!); Moist tropical forest on the upper reaches of Río Tupisa (in and around village of Barranquillita). [Coordinates on original label: 09º00'N, 78º00'W], 08°23'N 077°23'W, 09 February 1985, *S. Kane 33* (MO!); Trail from Canglón-Yaviza road to Río Chucaraque, 7.7 miles E of Canglón, 08°20'08"N 077°48'10"W, 50 m, 06 March 1982, *S. Knapp & J. Mallet 3945* (MO!); 112 miles from Bayano Dam Bridge. vicinity of Canglon, approximately one mile beyond concrete bridge in Canglón toward Yauisa, 08°19'30"N 077°50'00"W, 50 ft, 14 May 1980, *T. Antonio 4551* (MO!); Pinogana. Along headwaters of Río Tuquesa, ca. 2 km air distance from the Continental Divide, in vicinity of upper gold mining camp of Tyler Kittredge, 08°33'30"N 077°29'00"W, 600 m, 25 August 1974, *T.B. Croat 27119* (MO!); **Los Santos:** Above Guanico River; forest on hills west of river, 07°20'N 080°30'W, 550–650 m, 4 January 1989, *G. McPherson 13500* (MO!); **Panamá:** Panamá & Comarca de San Blas, Valle de Madroño; ca. 10 road miles north of La Margarita (by Chepo); in forest just South of and on continental divide along main trail to Cangandi, 09°19'N 079°08'W, 350–450 m, 21 February 1986, *B.E. Hammel & G. McPherson 14525* (MO!); Serranía de Majé. At top of ridge at headwaters of the Río Ipetí Grande, 08°51'N 078°34'W, 100 m, 25 January 1984 – 26 January 1984, *H.W. Churchill & G. de Nevers 4365* (MO!); Serranía de Majé. Trail along Río Ipetí Grande, below confluence with Río Aqua Fria and Charco Rico. Alt. 300 m. 8º55'N, 78º31'W, 08°55'N 078°31'W, 300 m, 23 Jan. 1984, *H.W. Churchill & G. de Nevers 4314* (MO!); Altos de Cerro Azul. Bosque cercano a Comasa, 16 May 2013, *Orlando Ortiz & et al. 1320* (MO!, PMA!); m, *T.B. Croat 68681* (MO!); 6.5 kms from Pan American Highway along road to Cerro Campana Elevation 700 m; 8º41'N; 79º58'W, 08°41'N 079°58'W, 700 m, 13 February 1986, *W.S. Hoover 1317* (CM, MO); Capira. Cerro Campana, sendero desde el mirador a la cima, 08°41'N 079°55'W, 700–1000 m, 12 Jan 1995, *C. Galdames & C.E. Guerra 1889* (MO!); Chepo. Area around Torti Arriba, 08°56'01"N 078°25'25"W, 50–200 m, 31 August 1977, *J.P. Folsom 5160* (MO!); Along trail between Río Majé and Quebrada Brava, 09°06'21"N 078°45'36"W, 60 m, 04 May 1976, *T.B. Croat 34653* (MO!); Panamá. Parque Nacional Soberanía, Camino de Cruces, 09°07'16"N 079°38'37"W, 150 m, 27 Apr 1999, *A. Florpan et al. 4247* (MO!); 5 miles above Interamerican Highway on road to Cerro Azul, 09°07'37"N 079°23'00"W, 240 m, 26 July 1970, *T.B. Croat 11516* (MO!); **San Blas:** Trail from dock to Mandinga Airport to village of Cangandí.[Coordinates on original label: 9º24'N, 79º24'W], 09°27'00"N 079°05'00"W - 09°27'30"N 079°06'00"W, 0–30 m, 10 December 1985, *G. de Nevers et al. 6445* (MO!); Trail east of Cangandi-Mandinga airport road, 2–5 miles south of Mandinga airport, 09°25'N 079°05'W – 09°27'N 079°05'W, 27 October 1967, *J. Duke 14820* (MO!); Puerto Obaldia. Along the coast NE of Puerto Obaldía towards Colombian border. Tropical dry forest, strong sea winds, 08°40'N 077°24'W, 0 m, 18 Apr 1982, *S. Knapp & J. Mallet 4689* (MO!); Along the coast NE of Puerto Obaldía towards Colombian border. Tropical dry forest, strong sea winds, 08°40'N 077°24'W, 0 m, 18 Apr 1982, *S. Knapp & J. Mallet 4682* (MO!); **Veraguas:** Montijo. Parque Nacional Coiba, Jicarón, cima de la isla, bosque maduro, 07°16'04"N 081°37'57"W, 390 m, 27 Jan 2004, *A. Ibáñez et al.2443AI* (MO!); Parque Nacional Coiba. SE de Isla de Jicarón, río Arriba, 07°15'23"N 081°47'50"W, 0–320 m, 26 Apr 1997, *C. Galdames et al. 3862* (PMA!); Sona. Isla Canales de Tierra. En la parcela 1. Bosque maduro. 17NMU 3657, 07°44'53"N 081°34'26"W, 30 m, 26 Feb 2002, *A. Ibáñez & A. Camarena 1700* (MO!); Bahia Honda. Isla Canales de Tierra, entre playa Naranjo y punta, 07°44'N 081°35'W, 02 July 2001, *S. Castroviejo et al. 16120* (MO!).

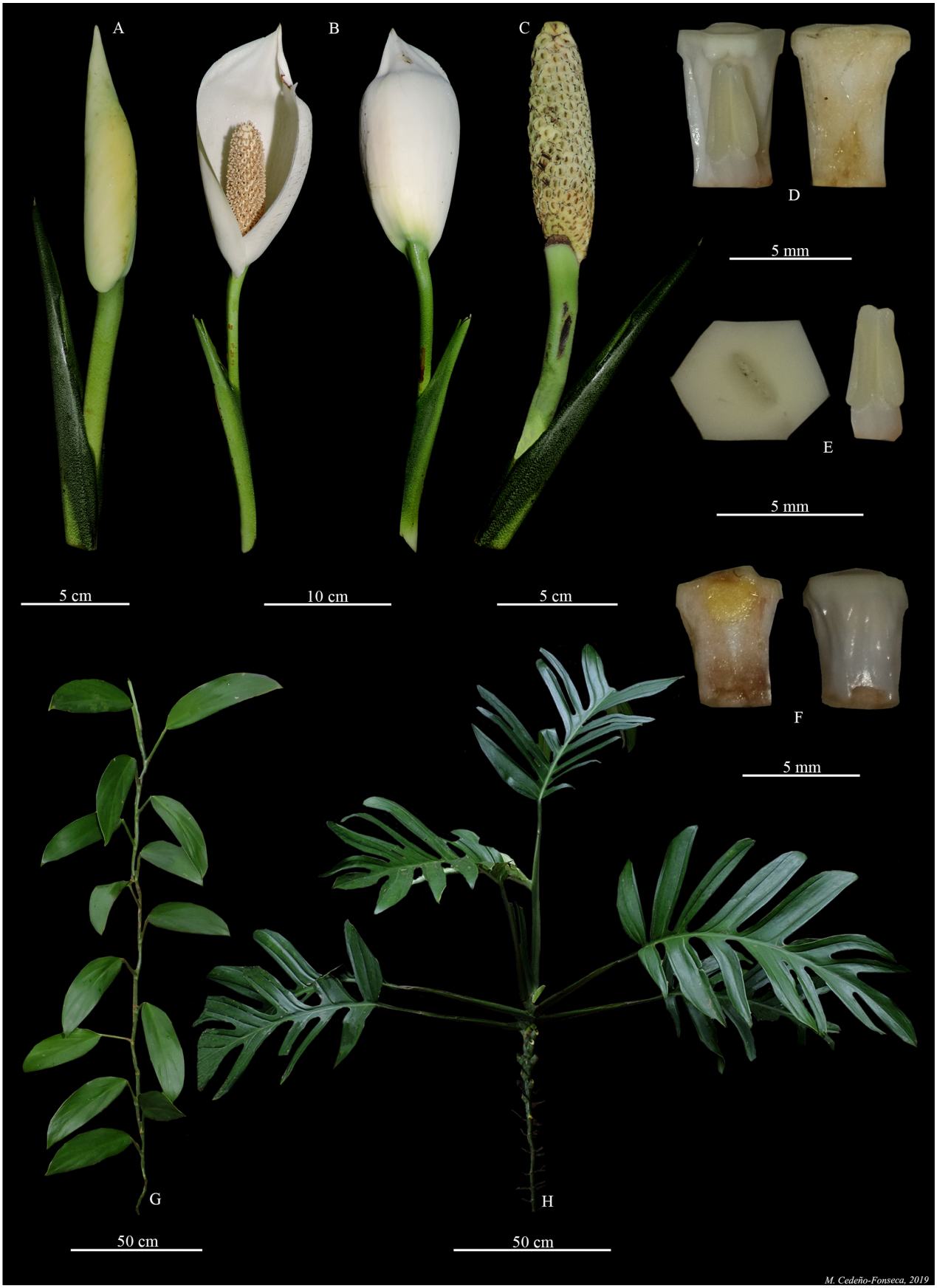

FIGURE 67. *Monstera pinnatipartita*. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Immature infructescence. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Juvenile plant. (H) Adult plant. *M. Cedeño et al. 950* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 68. *Monstera pinnatipartita* from Puntarenas, Costa Rica. Adult plant growing 3 m above the ground. Photo by M. Cedeño-Fonseca. (No collected).

41. ***Monstera pittieri*** Engl., *Bot. Jahrb. Syst.* 37: 116. 1905. (Figs. 69, 70)

Type:—COSTA RICA. [Limón:] Matina, Aug. 1895, *H. Pittier 9766* (lectotype B! seen on-line, photos: BH, SEL!, isolectotypes BR!, CR!, US!, designated by Madison (1977)).

Nomadic vine, appressed-climbing and pendent habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** light to dark green, flattened; **internodes** 4–6 cm long, 3–5 mm diam.; **petiole** slightly visible, dark green, smooth, 6–12 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** lanceolate, subcordate to truncate at base, acuminate at apex, 7–15 × 5–8 cm, slightly appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green, cylindrical or dorsoventrally compressed and slightly sulcate on one side; **internodes** 1–20 cm long, 0.5–1.0 cm diam., usually 3–20 times longer than wide; **anchor roots** dark brown; **feeder roots** corky; **petiole** light or dark-green, smooth, 6–10 cm long, sheathed up to 3 cm before the geniculum or to base of the geniculum; **petiole sheath** deciduous or slightly persistent with fibrous residues, ligule up to 1 cm long; geniculum smooth, flattened adaxially, convex abaxially, 1.5–2.5 cm long; **blades** broad to narrowly ovate, elliptical or oblong or lanceolate, broadly cuneate to rounded or truncated at base, obtuse to short-acuminate at apex, subcoriaceous to coriaceous, drying yellowish, blackish or greenish, 13–18 × 5–10 cm, not decurrent to the geniculum; **midrib** flattened adaxially, convex abaxially, drying yellowish or blackish on both surfaces, wavy distally; **primary lateral veins** 4–7 per side, obscure adaxially, prominent abaxially, departing midrib at 35–45°, drying yellowish or dark brown; **secondary veins** inconspicuous; **collective veins** not visible; **fenestrations** absent or present, one side of the blade more perforated than the other, 1–5 fenestrations per blade; **margins** entire. INFLORESCENCES on pendent stems, 1–9 simultaneously at flowering time, arranged in the axils of the leaves; **peduncle** smooth, 1–4 cm long, 2–6 mm diam.; **spathe** obtuse or mucronate, green externally during development, green externally and white internally at anthesis, tearing longitudinally when fully opened (rarely not tearing), the margins revolute, deciduous after anthesis; 9–12 × 6–8 cm, as long as the spadix; **spadix** white during development, creamy-yellow at anthesis, 4–9 cm long, 1.5–3.5 cm diam., (2.4)3.0–3.6 times longer than wide; **basal sterile flowers** 4–5 mm long, with an orange stigmatic secretion; **fertile flowers** 5–7 mm long; stamens 0.5–3.5 mm long. with laminar filaments; anthers 1.5–2.0 mm long, the filaments not exceeding the styles at anthesis, the styles slightly separated from adjacent ones, allowing exposure of thecae; ovary ribbed, square in longitudinal section, 3–4 × 3–4 mm, narrower than style; style quadrangular, cylindrical or hexagonal, 3–5 × 3–4 mm; stigma linear, black post-anthesis; **berries** with a yellowish-green stylar cap during development, mature stylar cap yellow; pulp white; **seeds** oblong, black, 6–9 mm long.

Distribution and ecology:—*Monstera pittieri* ranges from Costa Rica (Atlantic) and Panama to Colombia, at 0–400 m, in *Tropical moist forest* and *Tropical wet forest* life zones.

Phenology:—Flowering has been recorded in April-May, July-August, and November-December. Fruit in January-December.

Discussion:—The species, a member of sect. *Marcgraviopsis*, is characterized for its pendent habitat and it highly variable blades ranging from ovate to oblong and perforated or not. Plants with oblong blades are never perforated while those with more or less ovate blades have 1–4 small perforations on one side only.

Monstera pittieri is one of a group of species that only bloom on hanging stems. It could be confused with *Monstera tuberculata*, but that species has the petiolar sheath (also deciduous) with a ligule up to 5 cm in length, the leaf blade basally cordate, the spathe yellow or cream externally, spadix with flowers not separated and the infructescence green when ripe. *Monstera pittieri* is also similar to *M. luteynii*, but the latter differs because it has smooth stems, fenestrated leaves and the petiolar sheath reaching the base of the geniculum or up to 3 cm below it (Cedeño-Fonseca *et al.* 2022).

Monstera pittieri is most easily confused with entire leaved forms of *M. obliqua* but that species differs by having less coriaceous, more markedly oblique blades, having the inflorescences born on pendent stem (versus ascending stems for *M. pittieri*), peduncles 10–17 cm long (versus 1–4 for *M. pittieri*), orange mature stylar caps and seeds 3–5 mm diam. (in contrast to having the mature stylar cap yellow and seeds 6–9 mm diam. for *M. pittieri*).

Additional specimens examined:—COSTA RICA. **Alajuela:** Alajuela, Carrizal, Forest along Río Sarapiquí downstream and upstream from crossing of road to Colonia Virgen del Socorro, 740 m, 3 July 1985, (Fl.), *M.H. Grayum 5523* (CR!, MO!); San Ramón, Peñas Blancas, Peñas Blancas river valley NE of San Carlos; in woods on slopes along river, 350 m, 29 June 1985, (Fl., Fr.), *B.E. Hammel et al, 14062* (CR!, MO!); San Carlos, Fortuna, San Carlos, Fortuna, R. B. Arenal Mundo Aventura, 250 m, 30 April 2004, (Fl.), *A. Rodríguez 8767* (CR!); **Cartago:** Jiménez, Pejibaye, R. V. S. La Marta, Pejibaye, Turrialba, 700 m, 20 September 2003, (Fr.), *R. Kriebel 3853* (CR!); **Heredia:** Sarapiquí, La Virgen, P.N. Braulio Carrillo, Estación Magsasay, Bosque primari, 150 m, 2 June 1990, (Fr.),

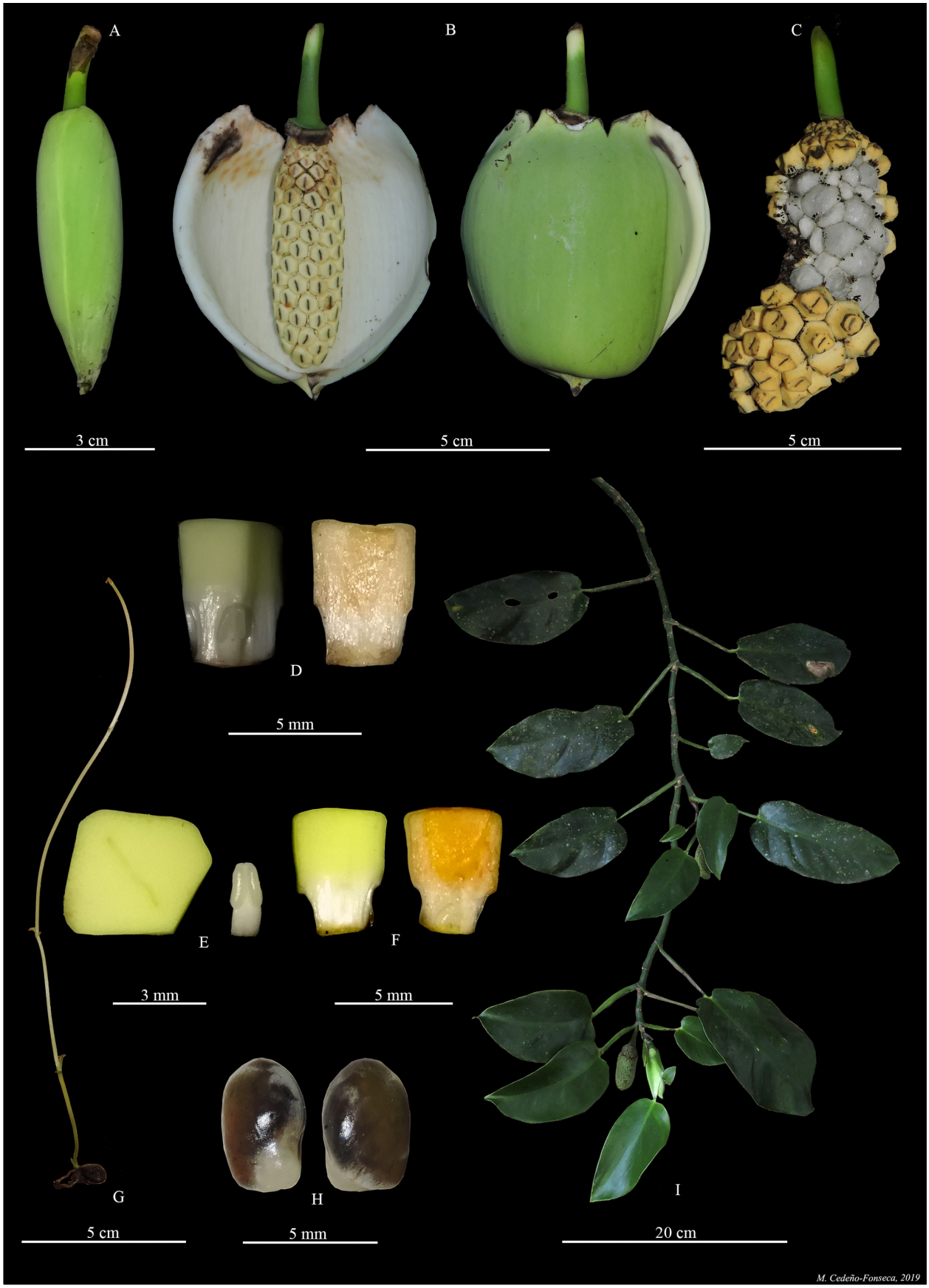

FIGURE 69. *Monstera pittieri* from Manzanillo, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detached toward the apex. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left) and longitudinal section (right). (G) Seedling. (H) Seeds. (I) Adult plant. *M. Cedeño et al. 1106* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 70. *Monstera pittieri* from Manzanillo, Costa Rica. Adult plant with hanging stems. *M. Cedeño et al. 1106* (USJ). Photo by M. Cedeño-Fonseca.

G. Carballo 61 (CR!, MO!); Sarapiquí, Las Horquetas, Some what disturbed primary forest in low, wet area between Río Sucio and railroad tracks, SW of Finca Zona Ocho, Río Frío de Sarapiquí, 110 m, 6 July 1985, (Fl.), *M.H Grayum & B.E. Hammel 5570* (CR!, MO!); Heredia, Path beyond Río Sucio, 400 m, 4 May 1984, (Fr.), *L. Gómez 21205* (MO!); **Limón:** La Concepción, Llanuras de Santa Clara, 250 m, Feb. 1896, *J. Donnell-Smith 6809* (K, US); Talamanca, Sixaola, Headwaters of Quebrada Mata de Limón, central fork, and hills between central and westernmost forks, Finca Anai, Sixaola region, 35 m, 19 November 1984, (Fr.), *M.H. Grayum et al. 4513* (CR!, MO!); Pococí, Colorado, P.N. Tortuguero, Lomas de Sierpe, 1.5 km al O del puesto del parque nacional en el río Sierpe, Topografía quebrada conpendientes medianamente pronunciadas, Suelo bien drenado, 100 m, 12 August 1988, (Fl., Fr.), *R. Robles et al. 2026* (CR!, MO!); Talamanca, Cahuita, R.V.S. Gandoca-Manzanillo, In and around large swamp at Manzanillo, Northwestern end of swamp, 5 m, 2 November 1984, (Fr.), *M.H. Grayum & W. Burton 4341* (CR!, MO!); Limón, Valle la Estrella, R.B. Hitoy Cerere, Cerro Bitarkara, Cordillera de Talamanca, 800 m, 28 February 1989, (Fr.), *G. Herrera & M. Solís 2494* (CR!, MO!); Pococí, Colorado, R. N. F. S. Barra del Colorado, (Refugio Nacional de Vida Silvestre)

Fields and pastures between Río Chirripocito and Río Sardina (”Sardinal” Chirripó Atlantico quadrangle), 12 m, 22 April 1990, (Fl., Fr.), *M.H. Grayum 982*4 (CR!, MO!); Pococí, Colorado, R.N.F.S. Barra del Colorado, Llanura de Tortuguero, Sardinas, 18 m, 1 March 1995, (Fr.), *F. Araya 755* (CR!, MO!); Limón, Valle La Estrella, Pasture adjoining Bananito Lodge, Pasture with a few remnant trees and pockets of disturbed vegetation, 100 m, 26 March 2010, (Fr.), *A. Monro 6609* (CR!, MO!); Talamanca, Cahuita, A orilla de la carretera, 1 Km despues de Cahuita, Ruta a Puerto Viejo, 1 m, 22 October 1997, (Fr.), *A. Rodríguez 2653* (CR!, MO!); Talamanca, Cahuita, Bosques de Manzanillo, 50 m, 9 January 2017, (Fl., Fr.), *M. Cedeño et al. 1106* (USJ!); Limón, Talamanca, Cahuita, Bosques de Manzanillo, 20 m, 30 January 2019, (Fr.), *M. Cedeño & A. Hay 1615* (USJ!); **Puntarenas:** Osa, Sierpe, R.F. Golfo Dulce, Península de Osa, Aguabuena oeste, cerca de casa de Don Beto, 50 m, 21 November 1992, (Fr.), *R. Aguilar 1501* (CR!, MO!); Golfito, Puerto Jiménez, P.N. Corcovado, Dos Brazos de Río Tigre, Jiménez, Cuenca superior del Río Madrigal, margen derecha, 600 m, 8 December 1990, (Fr.), *G. Herrera 4740* (CR!, MO!); Golfito, Puerto Jiménez, P.N. Corcovado, Near estation Sirena, 10 m, 5 December 1989, (Infer.), *Merz 437* (CR!); Golfito, Puerto Jiménez, P.N. Corcovado, Lower Lookout Trail, 25 m, 31 July 1988, (Fr.), *C. Kernan 749* (CR!); Rancho Quemado, Lote de Orellana, Bosque primario, Rincón, 200 m, 15 May 1991, (Fr.), *J. Quesada 518* (CR!); Streams and slopes adjacent to Airfield. Disturbed primary forest, Rincón de Osa, 150 m, 6 February 1974, (Fr.), *R. Liesner 1844* (CR!, MO!); Garabito, Tárcoles, Saddle between Cerros Quebrada Bonita and Montanas Jamaica, headwaters of Quebrada Bonita, and ridge to N, 420 m, 27 July 1995, (Infer.), *M.H. Grayum 10759* (CR!, MO!); Osa, Sierpe, Alrededores de la toma de Agua, Rancho Quemado, Rincon, Bosque primario, 200 m, 15 January 1991, (Fr.), *J. Quesada 324* (CR!); Osa, Hillls north of Palmar Norte, 50–700 m, 21 May 1976, (Infer.), *T.B. Croat 35159* (MO!); Osa, Vicinity of Boscosa at Quebrada Aguabuena, 11 September 1996, (Infer.), *T.B. Croat 79316* (CR!, MO!); **San José:** Perez Zeledón, Barú, Tinamaste, Finca de los Suizos, 650 m, 3 December 1998, (Fl., Fr.), *A. Estrada et al. 1989* (CR, USJ); Turrubares, San Juan de Mata, P.N. Carara, Cuenca del Río Grande de Tárcoles, Puesto Carara, Río Carara abajo de la unión con Río del Sur, 150 m, 5 April 1993, (Infer.), *B.E. Hammel & M.H. Grayum 18939* (CR!, MO!); Acosta, Sabanillas, Fila San Jeronimo, Colorado, en el camino que conduce a Fila Pital, 600 m, 13 April 1999, (Fr.), *J. Morales 7050* (CR!); Acosta, Sabanillas, Acosta, Tiquires, Fila Zoncuano, Falda S., Entre Río Parritilla y Zoncuano, 700 m, 13 May 2001, (Fl.), *J. Morales 8097* (CR!). PANAMA. **Bocas del Toro:** Isla Colón, área de Mimitimbi, 09°26’03”N 082°16’33”W, *A. Zapata et al. 1373* (MO!); Sieyic, 14 October 1993, *FLORPAN, C. Galdames & A. Espinosa 1522* (MO!, PMA!); Fortuna Dam area. Along road to Chiriquí Grande. [Coordinates on orginal label: 8º48’N, 82º10’W], 08°47’12”N 082°11’16”W, 550–650 m, 30 April 1986, *G. McPherson 9155* (MO!); Above Chiriquí Grande, 10 road-miles from continental divide, ca. 2 road-miles along road east of highway. [Coordinates on orginal label: 8º55’4”N, 82º10’4”W], 08°54’28”N 082°09’05”W, 300 m, 10 February 1987, *G. McPherson 10460* (MO!); Along road from Fortuna Dam towards Chiriquí Grande, 10 miles from continental divide, 1 mile along side road. [Coordinates on orginal label: 8º55’N, 82º10’W], 08°55’25”N 082°09’41”W, 120 m, 05 March 1986, *G. McPherson 8557* (MO!); bosque Protector Palo Seco. Finca Willie Mazu, 08°46’43”N 082°12’32”W, 1047 m, 25 August 2018, *O. Ortiz et al. 3385* (MO!, PMA!); Along road between Chiriquí Grande and Fortuna, 13.2 miles W of Chiriquí Grande, 08°50’12”N 082°11’48”W, 310 m, 09 March 1985, *T.B. Croat & M.H. Grayum 60128* (MO!); Along road between Fortuna and Chiriquí Grande, 1.2 mi N of Continental Divide, 5.3 mi N of bridge over Fortuna Dam 4. [Coordinates on orginal label: 08º44’N, 82º17’W], 08°46’06”N 082°12’30”W, 910 m, 12 March 1985, *T.B. Croat & M.H. Grayum 60429* (MO!); **Coclé:** La Mesa, N of El Valle de Antón, 08°38’00”N 080°07’05”W, 840–880 m, 20 Jul 1990, *M.H. Grayum & R.J. Evans 9902* (MO!); **Colón:** Along Río Guanche, 5 km above bridge on Colón-Portobelo road, 09°22’30”N 079°41’30”W, 250 m, 6 Apr 1993, *T.B. Croat 75173* (MO!); **Darién:** Cerro Chucanti. Sendero presidente, 800 m, 22 December 2009, *F. Hernández 1643* (PMA!); Cerro Chucanti. Alrededor de la estación Bioógica, 800 m, 19 diciembre 2009, *F. Hernández et al. 1583 FH* Parque Nacional Darién, trocha entre la Estación Pirre y el Cerro Pirre, 08°00’N 077°45’W, 100–300 m, 11 Feb 1991, *Heraclio Herrera 933* (MO!); Parque Nacional Darién. Cerro Pirre. Rancho Frio. Cascada arriba, 08°00’58”N 077°43’24”W, 164 m, 14 abril 2016, *O. Ortiz & T. Contreras 2570* (MO!); **Panamá:** Along El Llano-Carti road, 9.5 km north of Pan-American highway, along trail west of road, 09°15’N 079°00’W, 200–300 m, 09 April 1987, *G. McPherson 10818* (MO!); Along trail off Llano-Cartí road, c. 4.6 miles from junction with Pan-American Highway, 9º15’N, 79º00’W. Forest c. 350 m, 09°15’N 079°00’W, 350 m, 26 Jan. 1986, *G. McPherson & M. Merello 8153* (MO!); Chepo. 6 km above Pan-Am Highway on road from El Llano to Carti-Tupile, 09°15’32”N 078°57’36”W, 200 m, 18 October 1972, *H. Kennedy 1784* (MO!); El Llano-Cartí highway, 17–20 km north of El Llano, 09°17’45”N 078°56’15”W - 09°18’40”N 078°56’40”W, 08 Mar 1974, *R. Dressler 4637* (MO!); El Llano-Cartí Road, 7–12 km from Interamerican Highway, 09°17’45”N 078°56’15”W, 360–400 m, 18 July 1974, *T.B. Croat 25175* (MO!); Primary forest; along newly cut road from El Llano to Cartí-Tupile; 12 mi above Pan-Am Hwy, 09°18’40”N 078°56’40”W, 200–500 m, 13 March 1973, *T.B. Croat 22847A* (MO!); Panamá. Near top of Cerro Jefe to 1 mile beyond, 09°14’02”N 079°22’30”W, 900–1000 m,

1 Jan 1972, *A. Gentry et al. 3521* (MO!); Cerro Jefe, 21 km above Pan-Am Highway, 09°10'40"N 079°24'30"W, 600 m, 12 Jun 1976, *T.B. Croat 35883* (MO!); 2.5 m N of Goofy Lake on road to Cerro Azul, 09°11'30"N 079°23'55"W, 750 m, 26 July 1970, *T.B. Croat 11545* (MO!); **San Blas:** El Llano-Cartí Rd. Km 19.1, 09°19'N 078°55'W, 350 m, 01 July 1985, *G. de Nevers 5954* (MO!); El Llano-Cartí road, Km 27.8. [Coordinates on original label: 9º19'N, 78º55'W], 09°22'N 078°58'W, 200 m, 02 March 1986, *G. de Nevers 7220* (MO!); Cangandí, 09°26'N 079°07'W, 30 m, 10 February 1986, *G. de Nevers & H. Herrera 7113* (MO!); Yar Bired (Cerro San José), continental divide between Cangandí and San José, 09°20'N 079°08'W, 400–500 m, 05 February 1986, *G. de Nevers & H. Herrera 6950* (MO!); El Llano-Cartí Road, km 19.1, 09°20'N 078°58'W, 350 m, 02 November 1985, *G. de Nevers et al. 6150* (MO!); Cangandí. Hills near village, 09°27'N 079°06'W, 30 m, 27 March 1986, *G. de Nevers et al. 7496* (MO!); El Llano to Cartí Road, 16.5 km N of Panamerican Highway, border of Panama, 09°18'00"N 078°58'30"W, 13 April 1977, *J. Folsom 2603* (MO!).

42. ***Monstera punctulata*** (Schott) Schott ex Engl. in Martius, *Fl. Bras.* 3(2). 1878. 111. ≡ *Anadendrum ?punctulatum* Schott, *Prodr. Syst. Aroid.* 393. 1860. (Figs. 71, 72)

Type:—Cult. Vienna [most probably originally introduced to Germany from ?Mexico by Warszewicz], H.W. *Schott s.n.* (holotype W destroyed — see Riedl & Riedl-Dorn, 1988: 847). — Schott drawing No. 3281 (neotype W!, inventory No. NhMW-AfW-HWSB0012,; designated by Madison, 1977 (as no. '2281'). — Schott drawings No. 3276 & 3279 (epitype W!, inventory No. NhMW-AfW-HWSB0010 & NhMW-AfW-HWSB0011, designated by Cedeño-Fonseca *et al.* 2022).

Robust nomadic vine, canopy plant, appressed-climbing and pendent habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** light-brown or beige, warty with brown pustules; **internodes** 3–8 cm long, 0.5–1.5 cm diam.; **petiole** not visible, dark green, smooth, 2–4 cm long; **blades** obovate or orbicular, cordate to subcordate at base, obtuse to short-acuminate at apex, sometimes white-spotted, sometimes variegated, 5–10 × 4–8 cm, appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** yellowish or beige, warty with abundant pustules, dorsoventrally compressed and sulcate on one side; **internodes** 2–6(20) cm long, 1–4 cm diam., 1.5–2.0 times longer than wide; **cataphylls** deciduous, but leaving dry fragments on the peduncle; **anchor roots** dark brown; **feeder roots** beige, warty and corky; **petiole** light-green with white dots, warty and striated at base, with pustules, 30–65 cm long, sheathed up to 2 cm before base of the geniculum; **petiole sheath** deciduous with fibrous residues; geniculum striated or smooth, flattened adaxially, convex abaxially, 3–5 cm long; **blades** ovate to broadly elliptical or oblong, cordate at base, overlapping posterior lobes, obtuse or acuminate at apex, subcoriaceous to coriaceous, drying yellowish with blackish dots, light green or light brown, 45–110 × 30–45 cm, 1.3–1.6 times longer than wide, not decurrent on the geniculum; **midrib** flattened adaxially, convex abaxially, drying yellowish or light brown on both surfaces; **primary lateral veins** 11–20 per side, prominent on both surfaces, drying yellowish; **secondary veins** reticulate towards the margin and prominent, wavy throughout its length when dry; **collective veins** not visible; **fenestrations** rounded or oval, arranged throughout the blade; **margins** pinnatilobed, 4–9 lobes per side, occasionally 1-nerved and connected by a filament. INFLORESCENCES on ascending and pendent stems, 3–5 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** light-green with pustules generating a warty surface, 6–20 cm long, 1.5–2.5 cm diam.; **spathe** obtuse or mucronate, dark green during development, green suffused with yellowish-green externally and white internally at anthesis, coriaceous, tearing longitudinally when fully opened, deciduous after anthesis, 10–20 × 6–10 cm, as long as the spadix; spadix white during development, creamy-yellow at anthesis, 10–15 cm long, 2.5–3.0 cm diam., 4.0–5.6 times longer than wide; **basal sterile flowers** 4–6 mm long, with yellowish secretion; **fertile flowers** 5–8 mm long; stamens 2–8 mm long, with laminar filaments; anthers 1.5–3.0 mm long; ovary rectangular in longitudinal section, ribbed, 5–6 × 3–4 mm; style hexagonal, 3–4 × 4–5 mm; stigma linear, with transparent sticky secretion; **berries** with a green stylar cap during development, mature stylar cap moss-green; pulp white; **seeds** dark-brown with white dots, oblong, elongated, 6–9 mm long.

Distribution and ecology:—*Monstera punctulata* ranges from Mexico to Panama, at (100) 300–1700 m, in *Premontane wet rain forest* and *Lower montane rain forest* life zones.

Phenology:—Flowering has been recorded in August-September. Fruiting in January-April, June-July.

Discussion:—The species is a member of sect. *Marcgraviopsis* and is characterized by its massive size, strongly flattened stems, frequently warty, whitish speckled petioles with sheath extending to the apex with the sheath usually deciduous, large heavily perforated yellow-green-drying blades which are cordate at base and both pinnatifid and perforate with 12–18 primary lateral veins per side and conspicuous reticulate veins, a single inflorescence, moderately long pedunculate which dries golden yellow in fruit, spathe light green externally, white internally, spathe splitting lengthwise when opened at male anthesis.

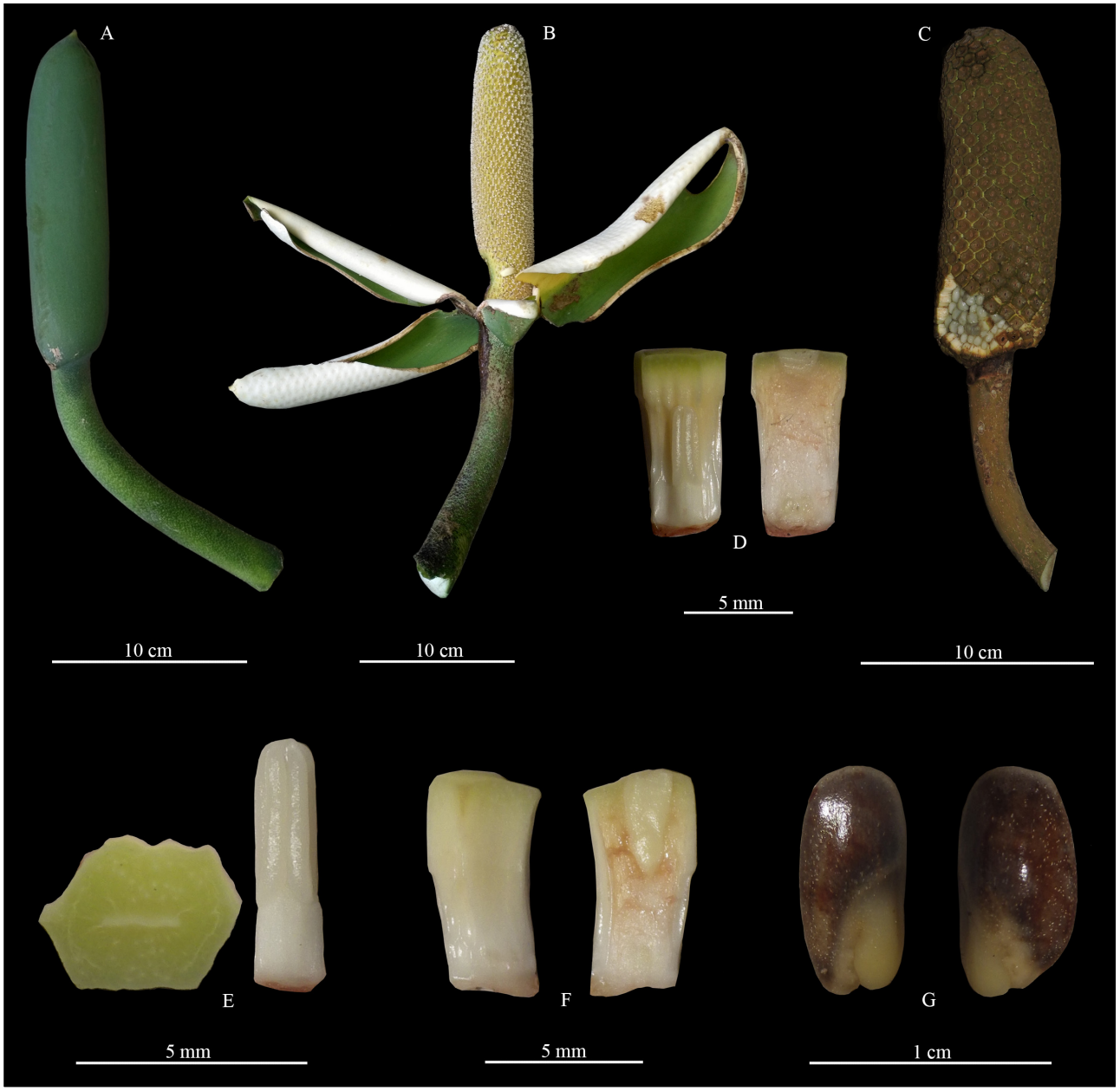

FIGURE 71. *Monstera punctulata* from Cartago Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe torn longitudinally into three strips. (C) Mature infructescence, stylar plates detaching. (D) Fertile flower; in lateral view (left), and in longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Seeds. *M. Cedeño et al. 1127* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

Monstera punctulata is a robust species of pre-montane and cloud forests. The collections in herbaria do not reflect the abundance of this species, because botanists avoid collecting it because of its tendency to bloom in the canopy and because of the large size of the plants, which require a single collection to be represented by up to five parts. Some *Monstera punctulata* plants develop hanging stems, which can be reproductive. Such plants (which could be considered as a morphotype) have little-fenestrated and often entire leaves. However, the morphology of the inflorescence, the flowers and the way of opening the spathe and the color of the ripe fruits are similar in both morphotypes, so they are considered here as variations of the same species (Cedeño-Fonseca *et al.* 2022).

For more details about the taxonomic comments and nomenclatural note see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—MEXICO. **Oaxaca:** Tropical jungle on steep bluff and roadside 8.5 mi. NE of Valle Nacional, old roadbed turnout, 17°50’24”N 096°12’36”W, 300 f, 10 Aug. 1979, *D. Thurm et al. 230* (MO!); Mpio. Sta. María Chimalapa: Paso Piedra de Tigre (Cautza), ca. 8 km al O de Sta. María; selva con Calophyllum, Tapirira, Terminalia, Liquidambar, Laplacea grandis, Ficus, Brosimum, Sloanea tuerckheimii, suelo café, 16°53’N

094°43’W, 220 m, 26 Dec 1985, *H. Hernández 1981* (MO!); Along Highway 175 between Valle Nacional and Oaxaca, 4.3–6 miles above the bridge at Valle Nacional, 17°43’48”N 096°18’36”W, 625–785 m, 21 February 1987, *T.B. Croat & D.P. Hannon 65538* (MO!); Along Hwy 175 between Tuxtepec and Oaxaca, 13 km S of bridge over Río San Juan Bautista at Valle Nacional, 17°43’05”N 096°18’35”W, 747 m, 3 Mar 2008, *T.B. Croat & P. Díaz-Jiménez 100174* (MO!); Mpio. Matías Romero. 7.2 km al O de Esmeralda, en la terracería La Laguna-Sarabia, luego 2.6 km al S por camino; cañón en lomas calizas, selva alta perennifolia de Dialium, Lonchocarpus, Sterculia mexicana, etc., suelos profundos, 17°07’N 094°49’W, 200 m, 8 Mar 1982, *T.L. Wendt et al. 3626* (MO!); Tuxtepec. Mun. Santa Maria Jacatepec, subida al Predio del Aguila, en San Agustin, 25 km al O de la Reforma, carr. a Ayozintepec. Selva alta perennifolia, 17°50’N 096°06’W, 21 Feb 1988, *R. Torres & L. Cortés 11504* (MO!); **Veracruz:** 6 mi. from Catemaco on road to Sontecomapan, 18°28’12”N 095°03’36”W, 380 m, Sept. 1961, *H.E. Moore & G.S. Bunting 8939* (BH); Jesús Carranza. 2 km N of Poblado, 17°15’36”N 094°39’36”W, 120 m, 7 Abril 1982, *M. Vázquez & I. Navarrete 2384* (MO!); 2 km N del Poblado 2. Ejido F.J. Mina. Selva alta-mediana subperennifolia con Dialium guianense, Brosimum alicastrum, Bernoulia flammea, Bursera simaruba, Ficus lapathifolia, Robinsonella mirandae, en estrato arboreo superior y en el intermedio, Dendropanax arboreus, Cymbopetalum penduliflorum, Guarea glabra, Omphalea oleifera. Suelos cársticos, quebrados; macizos rocosos emergentes, 17°16’N 094°40’W, 120 m, 7 Apr 1982, *M. Vázquez & I. Navarrete 2384* (MO!); San Andrés Tuxtla. Along highway between San Andrés Tuxla and Minatitlán, 18°26’24”N 095°12’36”W, 300 m, 29 Jun 1977, *T.B. Croat 39691A* (MO!); Lote 72, Estación de Biología Tropical ”Los Tuxtlas”, carr. Catemaco-Montepio. Selva alta perennifolia, 18°34’N 095°07’W, 640 m, 12 May 2005, *T. Krömer 2179* (MO!); Totutla. Km 45 on highway between Conejo (near Puente Nacional) and Hautusco, Hacienda ‘El Mirador’, slopes of barrance de Santa María, 19°12’00”N 096°45’36”W, 21 Sept. 1961, *H.E. Moore & G.S. Bunting 8861* (BH). BELIZE. **Toledo:** Maya Mountains, Gabriel Camp, Edward’s Central Camp, 16°20’20”N 089°09’36”W, 720 m, 25 Mar 1977, *F.C. Boutin & H. Schlosser 5148* (MO!). COSTA RICA. **Cartago:** La Unión, San Diego, Z.P. La Carpintera, Ladera norte con vista a Tres Ríos, entrando por finca de los Tinoco, 1520 m, 26 March 2008, (Fr.), *A. Cascante et al. 1903* (CR!); La Unión, San Rafael, Z.P. Cerros de La Carpintera, Parche boscoso de Campo Istarú, 1712 m, 23 January 2007, (Fr.), *A. Cascante & J. Sánchez 1667* (CR!); Cartago, Dulce Nombre, Jardín Botánico Lankester, 1360 m, 10 February 2017, (Fr.), *M. Cedeño 1127* (USJ!); **Puntarenas:** Coto Brus, Sabalito, Foothills of the Cordillera de Talamanca, lower montane forest directly N of Las Alturas, 1450 m, 28 August 1983, (Fl.), *G. Davidse 24169* (CR!, MO!); Coto Brus, Pittier, Forested slopes above the lumber camp at the Río Coton (Las Alturas), 1450 m, 18 January 1967, (Fr.), *W. Burger & G. Matta 4559* (CR!); Coto Brus, Sabalito, Along road about halfway between Flor del Roble and Las Alturas de Coto Brus, 1250 m, 13 July 1985, (Fr.), *M.H. Grayum & B.E. Hammel 5691* (CR!, MO!); Coto Brus, San Vito, R.B. Las Cruces, En el camino que va desde La Estación Biológica Las Cruces hasta el Río Jaba, Bosque primario premontano intervenido, 1170 m, 16 June 2003, (Fr.), *R. Moran & M. Mora 6482* (CR!); Coto Brus, 10 March 1987, (Fr.), *M.H. Grayum & J. Affolter 8149* (CR!, MO!); Coto Brus, Sabalito, Z.P. Las Tablas, Cordillera de Talamanca, Quebrada Pizote, Finca Cafrosa San Vito, 1200 m, 22 September 1990, (Fl.), *M. Ramírez 97* (CR!); Coto Brus, Sabalito, 100 m from field station, between fence line and forest edge montane fores, 1600 m, 9 March 1998, (Fr.), *B. Boyle et al.* 5137 (CR, USJ); Coto Brus, Sabalito, Cerro Pando, ridges above the Río Coton and the Río Negro, Southern Puntarenas, Near La Lucha, Remnants near pastures on Río Coton, edge of road, 1400 m, 19 February 1982, (Fr.), *K. Barringer & L. Gómez 1639* (CR!, MO!); Coto Brus, Pittier, Santa María, Sobre sendero al Río Canasta, 1700 m, 30 July 2000, (Infer.), *L. Acosta 2346* (CR!); Canton of Coto Brus; Las Cruces Tropical Botanical Garden, 1200 m, 6 March 1984, (Fr.), *T.B. Croat 57263* (MO!); Coto Brus, Finca Loma Linda, 1150 m, 26 February 1973, (Fr.), *T.B. Croat 22289A* (MO!); Coto Brus, Finca Loma Linda, 1150 m, 26 February 1973, (Infer.), *T.B. Croat 22280* (MO!); Coto Brus, Sabalito, Zona Protectora Las Tablas, 10 km al noreste de Lucha, camino a la Finca Sandí-Hartmann “El Capricho”, 1800 m, 30 Abril 2016, (Fr.), *M. Cedeño et al. 884* (USJ!); Coto Brus, San Vito, Estación Biológica Las Cruces, 1200 m, 5 February 2015, (Fr.), *M. Cedeño et al. 782* (USJ!); Puntarenas, Coto Brus, Sabalito, Foothills of the Cordillera de Talamanca, lower montane forest directly N of Las Alturas, 1450 m, 28 August 1983, (Fl.), *G. Davidse 24169* (CR!, MO!); **San José:** Desamparados, San Miguel, Along quebrada El Tablazo and on forested slope above creek, NE part of Altos Tablazo, 1750 m, 23 April 1985, (Fr.), *MH.. Grayum & G. Schatz 5141* (CR!, MO!); Perez Zeledon, About 4.5 miles southwest of Canaán along gravel road from Rivas, 900 m, 14 August 1977, (Infer.), *T.B. Croat 43434* (MO!); Curridabat, Granadilla, 18 Octubre 1984, (Fr.), *E. Valerio 112* (USJ!). PANAMA. **Chiriquí:** Las Lagunas area W of Hato del Volcán, 08°47’N 082°40’W, 1400 m, 18 March 1983, *C.W. Hamilton & H. Stockwell 3597* (MO!); Near Cerro Colorado, c. 3.5 miles along road from Chami [Chame] Camp. [Coordinates on original label: 8º35’N, 81º45W], 08°28’57”N 081°45’56”W, 1350 m, 17 April 1986, *G. McPherson 9004A* (MO!); Vicinity of Volcán Barú, near Volcán. Near lake shore at Los Lagos de Volcan, 08°45’N 082°40’W, 1400 m, 09 June 1986, *G. McPherson 9449* (MO!); ”Ojo de Agua”, property of Ratidon Hartmann, vicinity of Santa Clara (between Volcán and Río Sereno),



FIGURE 72. *Monstera punctulata* from Puntarenas, Costa Rica. (A) Adult individual. (B) Fenestrated leaf blade, with filaments <0.5 cm wide connecting adjacent lobes (arrows). (C) Stem with fibrous cataphylls (arrow), and five inflorescences. (D) Inflorescence with the spathe starting to open (arrow). *M. Cedeño et al. 782* (USJ). Image from Cedeño-Fonseca *et al.* (2022).

08°51'N 082°45'W, 1520 m, 17 June 1987, *T.B. Croat 66291* (MO, SCZ); Cerro Colorado, along mining road 15.6 mi above bridge over Río San Félix. Disturbed primary forest, 08°31'49"N 081°49'23"W, 1330 m, 21 Nov 1979, *T.B. Croat 48440* (MO!); Vicinity of Planes de Hornito beyond Gualaca ca. 2.5 km W of Finca Linares, high hills, 08°40'N 082°11'W - 08°41'N 082°13'W, 1400–1900 m, 28 November 1979, *T.B. Croat 48848* (MO!); 1 mi east of Cañas Gordas near Costa Rican border on road to Volcán, 08°45'12"N 082°54'24"W, 1100 m, 26 February 1973, *T.B. Croat 22305* (MO!); Along road from Volcán to Río Serano, ca. 12 km from Escuela San Benito in Volcán, 08°49'48"N 082°42'30"W, 1200 m, 8 Aug 1974, *T.B. Croat 26496* (MO!); Along road in vicinity of branch in road to Cerro Colorado and Escopeta, above Río San Félix near town of San Felix (ca. 13 miles N of Río San Félix bridge), 08°27'N 081°47'W, 800–1200 m, 15 March 1976, *T.B. Croat 33510* (MO!); Cerro Colorado, above San Félix along mining road 18–27 miles off of Pan-American Highway (above Chame or turn- off to Escopeta), 08°32'N 081°49'W, 1200–1500 m, 12 March 1976, *T.B. Croat 33074* (MO!); Vicinity of Planes de Hornito beyond Gualaca ca. 2.5 km W of Finca Linares, high hills, 08°40'N 082°11'W - 08°41'N 082°13'W, 1400–1900 m, 28 November 1979, *T.B. Croat 48847* (MO!); Along continental divide on Cerro Colorado, on upper mining road 20–28 miles from San Félix, 08°32'N

081°49’W, 1200–1500 m, 14 March 1976, *T.B. Croat 33333* (MO!); Palo Santo, 3 miles N of Volcán, 08°48’48”N 082°40’12”W, 1350 m, 19 February 1971, *T.B. Croat 13574* (MO!); At fork in road going to Alto Quiel from Alto Quiel from Boquete. [On original label: Elevation 1300 m; 8º48’N; 82º28’W.], 08°47’54”N 082°27’06”W, 1270 m, 19 Feb 1986, *W.S. Hoover 1336* (MO!); **Darién:** Serrania de Majé. Reserva Pivada Chucanti. Sendero los Heliciópteros hacia la cima, 08°47’45”N 078°27’47”W, 1325 m, 04 April 2018, *O. Ortiz et al. 3161* (MO!, PMA!); **Veraguas:** Santa Fe. Above Santa Fe beyond Escuela Agrícola Interamericana, 1.8 miles beyond fork in road on Pacific slope; above rocky ravine on side of Cerro Tute, 08°30’49”N 081°02’11”W, 700–1000 m, 05 April 1976, *T.B. Croat 34195A* (MO!).

43. ***Monstera siltepecana*** Matuda, *Revi. Soci. Mexi. Histó. Natu.* 11: 97, t. 2, f. 9. 1950. (Figs. 73, 74)

Type:—MEXICO, Chiapas, Orillo de Río Naranjo, Cascada, Siltepec, 1200 m, 11 April 1949, *Matuda 18642* (holotype HEM! [at Matuda Herbarium], isotype MEXU!).

Nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical; **internodes** 1–3 cm long, 0.5–9.0 mm diam.; **petiole** distinct, dark green, smooth, 10–18 cm long, sheathed up to the medial part; **petiole sheath** deciduous; **unsheathed portion** slightly ribbed; **blades** ovate to broadly ovate, strongly cordate at base, acuminate at apex, membranous, 10–15 × 5–11 cm, not appressed to the phorophyte; **fenestrations** present, perforations on both sides of the blade, sometimes only on one side. ADULT PLANTS: root climbers; **stems** dark green, green to blue to greenish or brownish, smooth or, sparsely white-spotted, cylindrical or slightly flattened, multiple sulcate, rarely with pustules; **internodes**, 3–8 cm long, 1.0–3.5 cm diam., 2.3–3.0 times longer than wide, the epidermis dries yellow-brown, and then peels off to expose a smooth, blackened surface; **petiole** dark-green, semi-glossy to matte, glaucous at base, sometimes white-spotted, smooth, 15–45 cm long, sheathed to base of the geniculum or 6 cm before it; **petiole sheath** deciduous; geniculum smooth, subterete, 3.0–4.5 cm long; **blades** ovate, sometimes falcate, broadly cordate at base, acuminate at apex, subcoriaceous, drying black, yellowish or greenish, 26–60 × 20–35(44) cm, 1.2–2.0 times longer than wide; **midrib** broadly sunken to flat and moderately colorless to paler adaxially, obtusely angular and paler abaxially; **primary lateral veins** 6–12 per side, faintly sunken and colorless adaxially, convex and slightly paler abaxially; **secondary veins** reticulate, darker and clearly visible to darkly visible abaxially; **fenestrations** absent or present, perforations numerous, mostly arranged in 2–4 series on each side of the midrib, rounded near the midrib, elongated near the margin and extending almost to the margins, rarely with only 1 or 2 perforations; **margins** entire. INFLORESCENCES 1 or 2 simultaneously at flowering time, arranged in the axils of the leaves; **peduncle** smooth to minutely rough, green, 5–12 cm long, 0.5–2.0 cm diam.; **spathe** long-acuminate, light green during development, light-green, greenish-white to light yellow and glaucous externally and pink to white internally at anthesis, coriaceous, fully open, deciduous or marcescent after anthesis, 18–25 × 4.7–6.3 cm, up to 7 cm longer than the spadix; **spadix** white during development, greenish white, white or yellowish green at anthesis, 10–13 cm long, 3.0–3.5 cm diam., 5–7 times longer than wide; **basal sterile flowers** 3–5 mm long; **fertile flowers** 4–6 mm long; stamens 1–5 mm long, with laminar filaments; anthers 1–2 mm long; ovary ribbed, 2.5–3.5 × 2–3 mm; style compressed, pentagonal or hexagonal, 0.5–2.0 × 2–3 mm; stigmatophore cupuliform, 0.5–1.0 mm long, circular when dry; stigma circular; **berries** with a greenish stylar cap during development, mature stylar cap yellowish; pulp white; **seeds** light-brown, 6–7 × 3–5 mm.

Distribution and ecology:—*Monstera siltepecana* ranges from Mexico (Chiapas and Veracruz) to Guatemala, El Salvador, Honduras and Nicaragua, at 10–2500 m, in *Premontane wet rain forest* and *Lower montane rain forest* life zones.

Phenology:—Flowering from February to September. Fruiting from October to March.

Discussion:—The species, a member of sect. *Monstera*, is characterized by its petioles sheathed from the middle or up to the geniculum with deciduous sheath and the free part sharply C-sulcate, ovate blades which are broadly cordate at base with the margins entire and the perforations present or lacking, when present mostly numerous in 2–4 series on each side of the midrib and with secondary lateral veins reticulate as well as by inflorescences with the peduncle shorter than spadix and a spathe that is rose-colored to white inside.

The species may be confused with *M. adansonii* but differs in having sphate long-acuminate (vs. spathe short or long acuminate), spathe pink to white internally at anthesis (vs. spathe white internally at anthesis), berries with mature stylar cap yellowish (vs. berries with mature stylar cap creamy-white). *Monstera siltepecana* also dry grayish or yellow-brown and have primary and secondary lateral veins parallel.

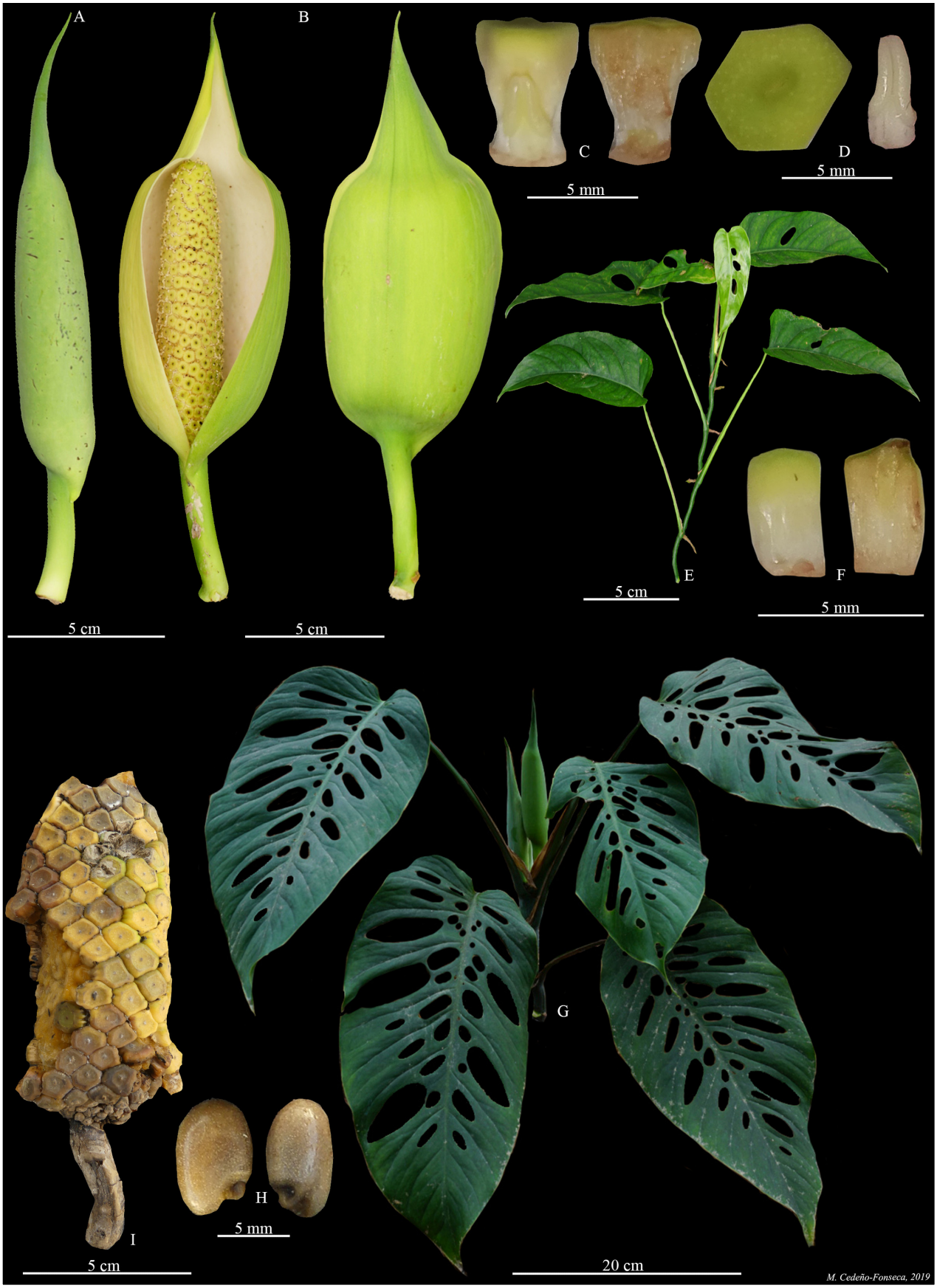

FIGURE 73. *Monstera siltepecana* from Siltepec, Mexico. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Fertile flower; in lateral view (left), and in longitudinal section (right). (D) Stylar plate with stigma (left) and one stamen (right). (E) Juvenile plant. (F) Sterile flower; lateral view (left), and longitudinal section (right). (G) Adult plant. (H) Seeds. (I) Mature infructescence, stylar plates detaching. *P. Diaz-Jiménez et al. 1482* (HEM).



FIGURE 74. *Monstera siltepecana* from locality type in Siltepec, Mexico. Adult plant growing 4 m above the ground. *P. Diaz-Jiménez et al. 1482* (HEM). Photo by M. Cedeño-Fonseca.

Additional specimens examined:—MEXICO. m, *L. Velázquez & G. Isalas 731* (CHIP!); 1841–42, *W.F. von Karwinsky 838* (MW!); **Chiapas:** Chiapas: Municipio Siltepec, camino a Siltepec, 15°27’42”N 092°22’23”W, 2451 m, 10 March 2020, *P. Díaz-Jiménez et al. 1482* (HEM!); Orillo de Río Naranjo, Cascada, Siltepac, 1200 m, 11 April 1949, *E. Matuda 18642* (MEXU!); Hills east of Unión Juárez, lower slopes of Volcán Tacaná, 15°06’N 092°05’W, 1700–2300 m, 03 May 1987, *J.S. Miller et al. 2647* (MO!); Hills east of Unión Juárez, lower slopes of Volcán Tacaná, 15°06’N 092°05’W, 1700–2300 m, 03 May 1987, *J.S. Miller et al. 2649* (MO!); m, *L. Velázquez & G. Isalas s.n.* (CHIP!); Camino San Luis, a 2 km de Laguna el Cofre. Polígono Zona de Amortiguamiento I. Mpio. Cristo. Bosque Mesófilo de Montaña. Hábita: Semiepifita, 15°37’34”N 092°37’45”W, 2010 f, 15 Jun 2005, *M.D. Reynoso 234* (MO!); Municipio of Jaltenango. El Triunfo Reserve. Trail SE from El Triunfo camp, towards Desalve, 15°36’N 092°50’W, 2000 m, 23 February 1990, *R.J. Hampshire 582* (BM); Montaña Piedra Blanca, Laguna del Cofre, Reserva de La Biosfera El Triunfo. Polígono Zona de Amortiguamiento. Municipio Monte Cristo. Bosque tropical perennifolio. Hábito Epífita, 15°37’37”N 092°38’51”W, 1756 f, 15 Jan 2005, *R.R. Santos 500* (MO!); Ixhuatán. 2.5 mi N of Ishuatán (Ixhuatán). In deep high walled ravine along stream, 17°19’21”N 092°59’59”W, 360 m, 17 February 1979, *T.B. Croat 47869* (MO!); La Concordia. m, *J. Guzmán 2* (CHIP!); Reserva de la Biosfera El Triunfo, Poligono IV, Cerro Soconusco, 5 km a linea recta al sur del rancho San Martín. Bosque Mesófilo de Montaña, 2086 m, 17 Jul 2001, *M. Pérez-Farrera 2587* (MO!); Reserva de la Biosfera El Triunfo, Poligono IV, Cerro Soconusco, 5 km a linea recta al sur del rancho San Martín. Bosque Mesófilo de Montaña, 15°46’22”N 093°05’24”W, 2086 m, 17 Jul 2001, *M. Pérez-Farrera 2587* (MO!); La Independencia. 6–10 km NNE of La Soledad along logging road from Las Margaritas to Campo Alegre, 16°25’12”N 091°51’00”W, 1600 m, 26 November 1980, *D.E. Breedlove & F. Almeda 47816* (MO!); La Trinitaria. Lagos de Montebello, along gravel road from blacktop to Dos Lagunas 3 miles W of Dos Lagunas, 16°05’24”N 091°39’36”W,

1460 m, 28 January 1979, *T.B. Croat 46623* (MO!); Along Highway 190, between Guatemalan border at Cuauhtémoc (El Ocotal) and San Cristóbal de las Casas; 21.4 miles N of border, 22.3 miles S of Trinitaria, small ranch W of Highway, 15°52'48"N 092°00'00"W, 760 m, 14 February 1987, *T.B. Croat & D.P. Hannon 64837* (MO!); Motozintla. Above El Rosario, 8 miles S of Motozintla, 15°19'12"N 092°17'24"W, 1800 m, 10 July 1977, *T.B. Croat 40750* (MO!); Ocozocoautla de Espinosa. Along dirt road between San Fernando and Maravillas (near Lago Malpaso), 4–66 miles NW of San Fernando, 16°52'48"N 093°15'36"W, 840–940 m, 15 February 1987, *T.B. Croat & D.P. Hannon 64999* (MO!); Pueblo Nuevo Solistahuacán. Along Highway 195 between Bochil and Pichucalco, 8 mi NW of Pueblo Nuevo Solistahuacán. On steep slopes below lookout, 17°12'36"N 092°57'36"W, 1900–1950 m, 25 January 1979, *T.B. Croat 46424* (MO!); Rayón. Steep slope in the Selva Negra 10 km above Rayón Mezcalapa along road to Jitotol, 17°12'43"N 092°58'06"W, 1700 m, 27 January 1973, *D.E. Breedlove & A.R. Smith 32685* (MO!); Along Highway 195 between Chiapa de Corzo and Pichucalco, ca. 6 miles NW of Pueblo Nuevo Solistahuacán, along mirador overlooking Caribbean slope; Selva Negra lookout point at trail to Col. Pinabeto, vicinity km 99, 17°12'37"N 092°57'19"W, 1915 m, 17 February 1987, *T.B. Croat & D.P. Hannon 65145* (ENCB, MO!, SEL!, TEX); San Cristóbal de las Casas. Santa Cruz en San Filipe, 16°45'00"N 092°37'00"W, 15 Nov 1986, *A.S. Ton & M. Martínez de López 9848* (MO!); Tapalapa. m, *OCHOA 32* (HEM!); Tapilula. Along road between Bochil and Pichucalco, at Desvio Pueblo Nuevo, at lookout site, 51.9 km E of Bochil, near Km 154, 3.4 km W of El Anexo, 17°15'N 093°00'W, 1860 m, 22 August 1996, *T.B. Croat 78628* (CM, MO); Tenejapa. Near Paraje Banabil, 16°46'48"N 092°30'36"W, 2713 m, 08 October 1981, *D.E. Breedlove 53368* (CAS); Evergreen Cloud Forest near Paraje Banabil, 16°46'48"N 092°30'36"W, 2680 m, 12 Jan 1982, *D.E. Breedlove & F. Almeda 57064* (MO!); Unión Juárez. Steep slopes, on the SE side of Volcán Tacaná above Talquian, 15°06'17"N 092°05'25"W, 2200 m, 23 Nov 1980, *D.E. Breedlove & F. Almeda 47732* (CAS); On south slope of Volcán Tacaná, ca. 2 miles N of Colonia Toquian, 15°05'33"N 092°07'28"W, 1700 m, 10 February 1979, *T.B. Croat 47163* (MO!); **Hidalgo:** Along highway 105 between Pachuca and Tampico, along road to San Cristóbal which leaves main highway 100.8 miles NE of Pachuca, vicinity of turn off. 1.5 km from San Cristóbal, 10.5 miles S of Santa María, 36.4 miles S of Huejutla, 20°57'36"N 098°37'48"W, 1550 m, 28 February 1987, *T.B. Croat & D.P. Hannon 65911* (MO!); **Jalisco:** Tapalpa. m, *N.F. Hernández 1976* (CHIP!); **Oaxaca:** 13.7 km E of La Laguna, then 6.7 km N to Belisario Dominguez, 17°19'48"N 094°22'48"W, 130 m, 26 Nov. 1981, *A. Villalobos & I. Navarrete 3482* (CHAPA); Ixtlan. m, *J.G. Rodriguez 250* (SERO); Tuxtepec. Mun. San Juan Bautista Valle Nacional. Along Highway 175 through Sierra de Juarez between Tuxtepec and Oaxaca, 1.49 miles S of bridge at Valle Nacional, 17°39'36"N 096°19'48"W, 1400 m, 19 February 1979, *T.B. Croat 47987* (MEXU!, MO!); **Querétaro:** Ca. 5 km al W de neblinas, camino a El Humo, muncipio de Landa. Bosque mesóiflo, ladera de cerro, 21°15'00"N 099°04'12"W, 1080 m, 9 Dec 1993, *E. Carranza & H. Díaz 4732* (MO!); Landa de Matamoros. 8 km al NE de El Humo, sobre el camino a Neblinas. Laderas calizas con bosque mesófilo de montaña, 21°15'00"N 099°04'12"W, 850–1000 m, 24 May 1989, *S. Zamudio 7306* (MO!); km 6 de la desviacion de Agua Zarca hacia Neblinas, 850 m, 24 Aug. 1988, *S. Zamudio 6717* (IEB!); **Veracruz:** Km 52 on Xalapa-Misantla road, 19°39'36"N 096°53'24"W, 1350 m, Dec 1971, *M. Madison 598* (GH, MEXU); Km 52 on Misantla-Xalapa road, 19°39'36"N 096°53'24"W, 1300 m, 24 Sep 1974, *M. Madison 1717* (GH, MO); Montane liquidambar forest, 12 km S of Misantla on road to Xalapa, 19°51'00"N 096°52'12"W, 20 Dec 1971, *M. Madison 580* (MO!). EL SALVADOR. Jardin Botanico, Zona 2 SE, 13°40'N 089°15'W, 800 m, 10 July 1989, *R. Villacorta & S. Martínez 304* (MO!); **Ahuachapán:** El Impossible Reserve: Campana. montane vergreen rain forest, canopy ca 14 m, 13°51'N 089°54'W, 1400 m, 24/1/98, *A.K. Monro et al. 1971* (BM); A.P. Santa Rita, Ruta 2, 13°48'N 090°04'W, 20 m, 30 Jun 2004, *J.M. Rosales JMR02638* (MO!); Ahuachapán. m, *J. M. Rosales 833* (LAGU); **Morazán:** Mpo. Chilanga, Ctón. Joya del Matazano, Crío. Los Cimientos, A.N.P. Cerro Cacahuatique, sendero del mirador, 13°46'03"N 088°11'32"W, 1482 m, 07 May 2014, *P. Galán & G. Pineda 2897* (LAGU, MO, US); **San Vicente:** Along dirt road on [Volcan] San Vicente, 13°36'N 088°51'W, 23 Jun 1997, *P. Bernhardt 142* (MO!); **Santa Ana:** Volcán El Chingo, 14°07'01"N 089°43'28"W, 1770 m, 01 February 1999, *M.A. Renderos et al. 637* (MO!); Near top of Cerro Verde. [originally reported as part of dept. Sonsonate], 13°49'34"N 089°37'20"W, 2030 m, 30 July 1977, *T.B. Croat 42223* (MO!); Cerro Montecristo ca. 14 miles NE of Metapán, 14°24'09"N 089°22'01"W, 1950–2000 m, 31 July 1977, *T.B. Croat 42390* (MO!); Cerro Montecristo, ca. 14 miles NE of Metapán, along trail to Trifinio (frontier of El Salvador, Honduras, and Guatemala), 14°24'29"N 089°21'41"W, 2100–2400 m, 31 July 1977, *T.B. Croat 42447* (MO!); Metapan. m, *A. Quesada et al. 2184* (MHES); Parque Nacional Montecristo, Cordillera de Metapán, between Los Planes and main road to summit of mountain, 14°25'N 089°22'W, 1900–2000 m, 27 January 1998, *G. Davidse et al. 37159* (BM); m, *L.R. Lara et al. 783* (MHES); **Sonsonate:** Juayua. A la orilla del bosque nebuloso del Cerro El Pilón, ca. 24 km SW of Santa Ana, 13°52'N 089°41'W, 1600 m, 2 Apr 1995, *José Linares 2496* (MO!); Sonsonate. m, *M.A. Renderos & R. Villacorta 541* (LAGU). GUATEMALA. **Alta Verapaz:** Along road to El Estor (Lago Izabal), 2 miles E of highway ca. 14 to Cobán, 15°18'54"N 090°17'38"W, 1300 m, 18 July 1977, *T.B. Croat 41448* (MO!); m, *T.B. Croat & J.*

Vannini 90214 (MO!); Along road between Guatemala City and Cobán, 13.0 Km N of Purulhá, along CA-14 Highway, 1.5 Km S of turn-off to Hwy. 7E to El Estor, vicinity of San Julian. Lower Montane Wet Forest, 15°17'45"N 090°18'54"W, 1525 m, 29 Nov 2003, *T.B. Croat & J. Vannini 90214* (MO!); **Baja Verapaz:** Along road 0–2 miles NE of Purulhá, 15°14'40"N 090°13'43"W, 1400 m, 16 July 1977, *T.B. Croat 41240* (MO!); Along road (National Highway 5) between Guatemala City and Rabinal, between Granados and Rabinal; southern slopes of Sierra de Chuacús, 2.8 miles N of El Chol, 14°59'03"N 090°28'12"W, 1560 m, 25 January 1987, *T.B. Croat & D.P. Hannon 63612* (AAU, IBE, MO, SEL, TEX); Purulha. Along highway CA-14 between El Progreso and Cobán, 3 miles S of Purulhá; 17 miles N of junction with Hwy 17 to Salamá and San Jerónimo, vicinity of km marker 160. On steep slopes W of highway, 15°13'02"N 090°12'39"W, 1620–1720 m, 26 January 1987, *T.B. Croat & D.P. Hannon 63764* (CR, HNMN, INB, MO); Rabinal. At summit of Sierra de Chuacús, at border of Mun. Rabinal and Mun. El Chol, along road between slopes near summit, 15°00'01"N 090°28'06"W, 1800 m, 25 January 1987, *T.B. Croat & D.P. Hannon 63665* (B, CM, F, JBGP, LE, MEXU, MO, VDB, WU, Z); **Chimaltenango:** Zaragoza. m, *M. Véliz RL 007 EPI* (BIGU); **Chiquimula:** m, *L.E. Velásquez & I. Ramírez LV3999* (BIGU); **Guatemala:** 7 miles E of Guatemala City, 14°30'52"N 090°28'32"W, 1840 m, 26 April 1970, *W.E. Harmon 2267* (MO!); 7 miles E of Guatemala City, 14°30'52"N 090°28'32"W, 1840 m, 26 April 1970, *W.E. Harmon 2267* (UMO); Chinautla. m, *M. Véliz & L.E. Velásquez MV22288* (BIGU); San Juan Sacatepequez. m, *J. Valdez JV243* (BIGU); **Huehuetenango:** La Libertad. m, *L.E. Velásquez & P. García LV3752* (BIGU); **Jalapa:** m, *M. Véliz et al. MV16241* (BIGU); **Jutiapa:** Moyuta. m, *L.E. Velásquez & P. García 949* (BIGU); **Quetzaltenango:** m, *M. Véliz & L.E. Velásquez MV22906* (BIGU); m, *M. Véliz & L.E. Velásquez 20079* (BIGU); Along Highway Cito N of jct. with CA2, toward Quezaltenango, in watershed reserve INDE (Inst. Nac. de Electrificación, Guatemala) "Santa María" (Central Hidroeléctrica), Km 199. Loose gray soil, steep slopes W of highway, 14°43'35"N 091°42'31"W, 1200–1300 m, 22 January 1987, *T.B. Croat & D.P. Hannon 63427* (MO!); Zunil. m, *T.S. Quedensley 4816* (BIGU); **Quiché:** Valley of Río de las Violetas, north of Nebaj, 15°24'18"N 091°09'03"W, 5800–6000 ft, 22 Jul 1964, *G.R. Proctor 25221* **Retalhuleu:** El Asintal. m, *L.E. Velásquez LV4390* (BIGU); **Sacatepéquez:** m, *M. Véliz 21012* (BIGU); Alotenango. 2.3 miles SW of Alotenango on road from Antigua to Escuintla, slopes of Volcán del Fuego, 14°27'32"N 090°48'48"W, 1300 m, 26 July 1977, *T.B. Croat 42030* (MO!); 2.3 miles SW of Alotenango on road from Antigua to Escuintla, slopes of Volcán del Fuego, 14°27'32"N 090°48'48"W, 1300 m, 26 July 1977, *T.B. Croat 41962* (MO!). Magdalena Milpas Altas. m, *M. Véliz & L.E. Velásquez MV22230* (BIGU); San Miguel Duenas. San Miguel Dueñas, 14°31'28"N 090°48'04"W, 1470 m, 19 Sep 1992, *M. Véliz 92.2479* (MO!); **San Marcos:** Finca Armenia, vicinity of Rafael de Cuesta, 14°54'36"N 091°53'43"W, 5000 ft, 06 July 1977–07 July 1977, *J.D. Dwyer 14469 A* (MO!); 1 mile above Africa, ca. 3.3 miles above Finca Armenia above San Rafael, 14°56'18"N 091°52'52"W, 1600 m, 13 July 1977, *T.B. Croat 40962* (MO!); 10 miles south of San Marcos along road from San Raphael, 14°56'26"N 091°51'53"W, 2100 m, 13 July 1977, *T.B. Croat 41014* (MO!); Esquipulas Palo Gordo. m, *L. García et al. LGL003* (BIGU); **Santa Rosa:** Volcán Jumaytepeque, 14°20'22"N 090°16'14"W, 6000 f, Dec 1892, *J. Donnell-Smith 4279* (G); **Sololá:** San Lucas Toliman. m, *T. Quedensley 4895* (BIGU); San Pedro La Laguna. m, *P. Pardo 564* (BIGU); **Suchitepéquez:** Cuyotenango. m, *L.E. Velásquez & R. Marin LV2788* (BIGU); **Zacapa:** Slopes of Monte Virgen, around summit of mountain. Sierra de las Minas, 15°15'02"N 089°16'24"W, 2200–2400 m, 12 Jan 1942 – 13 Jan 1942, *J.A. Steyermark 42591* (MO!); Upper reaches of Río Sitio Nuevo, 15°07'18"N 089°43'40"W, 1500–1800 m, 25 Jan 1942, *J.A. Steyermark 43232* (MO!). HONDURAS. **Comayagua:** Montaña de Celaque: Quebrada between Campo Naranja and Campo "Don Thomas", ca. 12 km SW of Gracias, 14°34'42"N 088°40'00"W, 18 May 1992, *G. D'Arcy 17982* (MO!); **Francisco Morazán:** Along road to Parque Nacional La Tigra, 22–25 km NE of Tegucigalpa, 14°12'N 087°07'W, 1850–2125 m, 01 February 1987, *T.B. Croat & D.P. Hannon 64043* (KRAM, L, MO, RSA); **Intibucá:** La Esperanza, 8 km from town on road to Siguatepeque. Cloud forest with Magnolias, 14°24'N 088°04'W, 14 May 1987, *S. Blackmore & M. Chorley 3947* (BM); La Esperanza. Cerro San Cristobal, al oeste de la Esperanza. Bosque montano bajo, 14°19'49"N 088°10'37"W, 2000 m, 1 Mar 1985, *H.J. Ramos 139* (MO!); **La Paz:** Las Trancas, near Guajiquiro-San Isidro road, ca. 11 road (ca. 5 straight line) km NW of Guajiquiro, Reserva Biológica Guajiquiro. Remnant patch of disturbed primary forest, 14°08'30"N 087°52'00"W, 2050 m, 22 May 1993, *R.J. Evans 1705* (MO!); **Lempira:** Río Naranjo. Bosque nublado latifoliado alrededor el Río Naranjo y bajo el Campamento Don Tómas. Parque Nacional de Celaque, 14°33'N 088°40'W, 2300 m, 25 May 1991, *P.R. House 991* (MO!); **Ocotepeque:** Aldea El Portin: Agua Caliente (Guatemalan border)-Santa Rosa de Copán, 18.1 mi E of Santa Fe; 26.8 mi SW of bridge over Río Higuito (or Río Grande) near village of Cucuyagua Copán, 14°28'N 089°15'W, 1800 m, 28 January 1987, *T.B. Croat & D.P. Hannon 63805* (MO!); Belén Gualcho. Catarata La Chorrera, 10 km N de Belén Gualcho, 14°01'18"N 088°46'07"W, 1500–2000 m, 02 abril 1977 – 15 abril 1977, *C.H. Nelson et al. 3966* (MO!); 4 km from town on road from Corquin. Pine woodland with Liquidambar, 14°30'03"N 088°48'01"W, 11 May 1987, *S. Blackmore & M. Chorley 3829* (MO!); **Olancho:** Along Río Olancho, on road between San Esteban and Bonito Oriental, 14.8 miles NE of San Esteban,

15°25’N 085°47’W, 635 m, 07 February 1987, *T.B. Croat & D.P. Hannon 64406* (CM, MO, QCA); **Santa Bárbara:** Cuestas de piedra caliza, 10 km oeste de Lago Yojoa, 14°55’N 088°05’W, 1500–2000 m, 28 April 1973 – 30 April 1973, *A.F. Clewell & D.L. Hazlett 3984* (MO!); **Yoro:** Río Pijol Valley. 7 km south east of Nueva Esperanza. Along forested Quebrada that flows into Río Pijol, and adjacent slopes, 15°12’N 087°35’W, 1300–1500 m, 29 May 1993, *R. Liesner 26682* (EAP, MO). NICARAGUA. **Atlántico Norte:** Cerro Waylawás, east slope of northern range; limestone cliffs, 13°39’N 084°49’W, 100 m, 11 Mar 1979, *J.J. Pipoly III 4368* (MO!); Cerro Waylawás, E side of central range. Limestone peak, 13°38’N 084°48’W - 13°39’N 084°49’W, 100–200 m, 09 March 1979, *J.J. Pipoly III 4203* (MO!); Waní, 0.5–1 km S of village, between Río Prinzapolka and Quebrada San Rafael, 13°42’N 084°50’W, 100 m, 13 March 1979, *J.J. Pipoly III 4592* (MO!); Along banks of Río Prinzapolka, 2 km S of Waní, 13°42’N 084°50’W, 100 m, 16 March 1979, *J.J. Pipoly III 4757* (MO!); **Boaco:** Cerro Mombachito, 4 km al NO de Camoapa; bosque nublado rodeado por pastizales, 12°24’N 085°33’W, 700–1000 m, 1 feb 1979, *A. Grijalva & M. Araquistain 79-A* (MO!); **Carazo:** W bank of Río Escalante at the Carazo-Rivas border, 1 km from coast, 11°31’N 086°10’W, 20 m, 19 Nov 1976, *D.A. Neill 1320* (MO!); **Estelí:** ca 23.5 km (by road) NE of Hwy 1 at Estelí and ca. 2.8 km SE of Laguna Miraflores; disturbed evergreen forest with abundant epiphytes, 13°14’N 086°14’W, 1400 m, 11 June 1981, *J.E. Henrich & W.D. Stevens 383* (MO!); Laguna Miraflores, ca. 26.1 km (by road) NE of Hwy 1 at Estelí, 13°15’N 086°15’W, 1250–1300 m, 10 June 1981 – 11 June 1981, *J.E. Henrich & W.D. Stevens 249* (MO!); **Granada:** Norte de Volcán Mombacho, San José, entre ladera norte del Volcán y cafetales de Finca Las Delicias, 11°49’N 085°58’W, 700–800 m, 10 marzo 1982, *J.C. Sandino 2513* (MO!); **Jinotega:** Km 146, carretera entre Matagalpa y Jinotega, 13°02’N 085°56’W, 1200–1400 m, 25 mayo 1980, *P.P. Moreno 575* (MO!); Municipio de Jinotega. Reserva Natural Cerro Kilambé, 13°34’N 085°41’W, 950–1700 m, 24 Abril 2000, *R.M. Rueda et al. 13454* (MO!); Municipio de Bocay. Reserva Natural Kilambé, 13°42’N 085°42’W, 1200–1700 m, 12 January 2001 – 19 January 2001, *R.M. Rueda et al. 15622* (MO!); Municipio de Wiwili. Reserva Cerro Kilambé, 13°33’N 085°41’W, 1100–1200 m, 29 Agosto 2000 – 1 Septiembre 2000, *R.M. Rueda et al. 14706* Along rock road 3.8 miles SE of Yalí, between Condega on Route 1 and Jinotega on Route 3. Roadside and disturbed primary forest on steep slopes, 13°15’N 086°09’W, 1350 m, 6 Aug 1977, *T.B. Croat 42930* (MO!); Along Hwy. 3 from Jinotega to Matagalpa, ca. 5–8 miles SW of Jinotega. Cloud forest, somewhat disturbed, 13°03’N 085°58’W, 1500 m, 7 Aug 1977, *T.B. Croat 43049* (MO!); Along side road to Hacienda Fundador which turns off Highway 3 about halfway between Jinotega and Matagalpa. Disturbed primary forest, 13°03’N 085°58’W, 1400 m, 8 Aug 1977, *T.B. Croat 43111* (MO!); Along Hwy. 3 from Jinotega to Matagalpa, ca. 3 mi SE of Jinotega. Disturbed forested ravines, 13°03’N 085°58’W, 1200 m, 7 Aug 1977, *T.B. Croat 43041* (MO!); Ca. 1.5 km from Hwy. 3 on road to Aranjuez, 13°02’N 085°55’W, 1360–1380 m, 14 January 1978, *W.D. Stevens 5949* (MO!); Macizos de Peñas Blancas, along trail between finca of Manuel Estrada (El Cielo) and finca of Socorro Mejia, 13°15’N 085°41’W - 13°16’N 085°41’W, 1500–1650 m, 14 January 1979 – 18 January 1979, *W.D. Stevens 11428* (MO!); Along road from Hwy. 3 through La Fundadora, between Las Camelias and La Salvadora; along small tributary of Río Jigüina with steep rock sides, 13°05’30”N 085°53’30”W, 1100–1150 m, 31 October 1979, *W.D. Stevens & A. Grijalva 15314* (MO!); Along road from Hwy. 3 through La Fundadora, between Las Camelias and La Salvadora; along small tributary of Río Jigüina with steep rock sides, 13°05’30”N 085°53’30”W, 1100–1150 m, 31 October 1979, *W.D. Stevens & A. Grijalva 15291* (MO!); N slope of Volcán Yalí, 13°15’N 086°10’W, 1200–1400 m, 25 October 1979, *W.D. Stevens & A. Grijalva 15095* (MO!); Along road from Hwy 3 to La Fundadora; coffee plantations, pastures, and patches of cloud forest, 13°04’N 085°55’W, 1200–1400 m, 28 Sep 1982, *W.D. Stevens et al. 21858* (MO!); **Madriz:** Cerro Volcán de Somoto (Tepesomoto), cerca de la cima, 13°25’N 086°34’W, 1500–1600 m, 16 abril 1980, *M. Araquistain & P.P. Moreno 2161* (MO!); Cerro Volcán de Somoto (Volcán Tepesomoto), 13°26’N 086°35’W, 1400 m, 25 septiembre 1980, *P.P. Moreno 2908* (MO!); Cerro Volcán de Somoto, al S de Somoto, 13°25’N 086°33’W, 1200–1400 m, 3 febrero 1983, *P.P. Moreno 20049* (MO!); Municipio de Somoto. Reserva Natural Tepesomoto. La Patasta, 13°25’N 086°33’W, 1200–1600 m, 18 Mayo 2000, *R.M. Rueda et al. 13633* (MO!); **Matagalpa:** Cordillera Dariense, Santa María de Ostuma, Cerro El Picacho, 13°00’N 085°55’W, 1350–1500 m, 17 March 1977, *D.A. Neill 1578* (MO!); Behind La Selva Negra Hotel, slopes of Cerro Picacho, near the border with Dept. Jinotega, 13°00’N 085°55’W, 1200–1540 m, 23 May 1985, *G. Davidse et al. 30394* (MO!); Camino al Sanatorio de Aranjuez, 13°02’N 085°55’W, 1000–1400 m, 21 febrero 1980, *M. Araquistain & J.C. Sandino 1420* (MO!); Entrada al Hotel Santa María de Ostuma, 9 km al NO de Matagalpa, 13°00’N 085°56’W, 1300–1500 m, 4 mayo 1980, *P.P. Moreno 203-a* (MO!); 9 km N of Matagalpa on Highway 3; disturbed evergreen hillside, 13°00’N 085°55’W, 1350–1400 m, 14 April 1978, *P.C. Vincelli 322* (MO!); W slope and summit of Cerro El Picacho; cloud and elfin forest, 13°00’N 085°55’W, 1350–1590 m, 3 Jun 1983, *W.D. Stevens & P.P. Moreno 22165* (MO!); NW slope of Cerro El Picacho; cloud forest, 13°00’N 085°55’W, 1420–1520 m, 25 May 1983, *W.D. Stevens & P.P. Moreno 22129* (MO!); Macizos de Peñas Blancas, SE side, drainage of Quebrada El Quebradon, slopes N and W of Hda. San Martín. (collection locality straddles border

with Departmento de Jinotega), 13°14’N 085°38’W - 13°15’N 085°39’W, 1000–1400 m, 18 January 1982–20 January 1982, *W.D. Stevens et al. 21091* (MO!); Ca. 0.8 km from Hwy. 3 on road to Aranjuez, 13°02’N 085°55’W, 1360 - 1380 m, 7 May 1980, *W.D. Stevens et al. C. 17099* (MO!); **Nueva Segovia:** Along road between coffee fincas below (S of) Cerro Mogotón, entrance to road at Km 243.5 of Ocotal-Jalapa highway; pine-oak forest on steep slopes of coarse granite, broadleaf forest dominated by Liquidambar and Carpinus in valley bottoms, 13°44’16”N 086°22’50”W, 1390 m, 22 February 2012, *W.D. Stevens & O.M. Montiel 33083* (HULE, MO); **Rivas:** Slopes of Volcán Maderas above coffee plantations above Balgüe, Isla de Ometepe, 11°28’N 085°31’W, 600–800 m, 14 September 1983, *M. Nee & W. Robleto 28044* (MO!); Isla Ometepe, Volcán Maderas, Balgüe; bosque nebliselva muy húmedo, casi puro en Clusia y Cavendishia, 11°26’N 085°30’W, 1200–1260 m, 1 mayo 1984, *W. Robleto 507* (MO!); Isla de Ometepe, N slope of Volcán Maderas on trail from Balgue to Laguna Maderas, 11°27’N 085°32’W, 700–1200 m, 23 Jan 1981, *W.J. Hahn 517* (MO!).

44. ***Monstera spruceana*** (Schott) Engl. in Martius, *Fl. Bras.* 3(2): 115. 1878. — *Tornelia spruceana* Schott, *Oesterr. Bot. Z.* 9(2): 40. 1859. (Figs. 75, 76)

Type:—BRAZIL. [Amazonas:] Rio Negro, São Gabriel, [1852?], *R. Spruce 2293* (holotype K! two sheets: K000434532 & K000434533).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** dark green, smooth, cylindrical; **internodes** 2–8 cm long, 0.5–12.0 mm diam.; **petiole** not visible, dark green, smooth, 4–6 cm long; **blades** obovate, subcordate at base, acuminate at apex, coriaceous, 5–15 × 6–12 cm, appressed to the phorophyte; **fenestrations** present, usually 1 that breaks at the margin. ADULT PLANTS: root climbers; **stems** light or dark-green, cylindrical, warty with pustules; **internodes** 3–8 cm long, 2–6 cm diam., 1.3–1.5 times longer than wide; **anchor roots** light brown; **feeder roots** dark brown with white trichomes; **petiole** light-green, smooth or warty, 25–50 cm long, sheathed to base of the geniculum or to base of the blade; **petiole sheath** deciduous with fibrous fragments; geniculum smooth or warty, sunken adaxially, convex abaxially, 2–4 cm long; **blades** lanceolate or ovate, obtuse, truncate, subcordate or attenuate at base, obtuse to slightly acuminate at apex, coriaceous, drying grayish or blackish, 25–60 × 25–30 cm, 1.2–2.2(3.3) times longer than wide, decurrent on the geniculum, decurrent portion 3–4 mm wide; **midrib** ribbed adaxially, convex abaxially, drying black to dark brown on both surfaces; **primary lateral veins** 10–18 per side, sunken adaxially, prominent abaxially, drying blackish or dark brown; **collective veins** not visible; **fenestrations** present in transition to adult plants; **margins** pinnatilobed, 1–6 lobes per side, 2–4 veins per lobe. INFLORESCENCES on ascending stems, 1 or 2 simultaneously at flowering time, arranged in the axils of the leaves; **peduncle** smooth, 4–10 cm long; **spathe** obtuse to short-acuminate, white internally and light green externally during development, unknown at anthesis; **spadix** white during development, unknown at anthesis, 15–25 cm long, 3–6 cm diam., 8–9 times longer than wide; **basal sterile flowers** 5–7 mm long; **fertile flowers** 6–8 mm long; stamens 2–7 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, rectangular, more slender than style, 3–4 × 2–3 mm; style hexagonal, 3–5 × 3–4 mm, stigma linear; **berries** with a green stylar cap during development, mature stylar cap unknown; pulp unknown; **seeds** unknown.

Distribution and ecology:—*Monstera spruceana* ranges from Costa Rica and Panama to Colombia, Venezuela, the Guianas, Venezuela, Brazil, Ecuador, Peru and Bolivia, at 50–1600 m, in *Premontane wet forest* and *Premontane rain forest* life zones.

Phenology:—Flowering in April and October. Fruiting in December.

Discussion:—The species is a member of sect. *Marcgraviopsis*. It is distinguished by its pinnatilobed adult leaf blade with relatively broad pinnae with divisions extending to very near the midrib, the slightly verrucose or smooth petiole, sheathed up to the base of the geniculum or even up to the base of the blade, the petiolar sheath disintegrating as fibrous residues, short peduncles (<10 cm), long spadices (15–25 cm), and dark green stylar caps after anthesis. Other distinguishing features include the usually grayish to sometimes blackish drying blades.

It is similar to *Monstera anomala,* but that species is distinguished by its completely entire leaves, by the constricted stylar region, and by its occurrence (at least in Costa Rica and Panama) in lowland humid forests (Cedeño-Fonseca *et al.* 2022).

Additional specimens examined:—COSTA RICA. **Alajuela:** Uapala, Slope of cerro Cacao, E to near Río Las Haciendas, 1150 m, 14 August 2007, (Infer.), *M.H. Grayum 12713* (MO!); **Puntarenas:** Puntarenas, Monteverde, Camino a Tilaran, 1325 m, 21 November 2018, (Fr.), *M. Cedeño & A. Cascante 1501* (USJ!); Puntarenas, Osa, Bahía Drake, Camino a Rancho Quemado, 188 m, 3 February 2019, (Infer.), *M. Cedeño, A. Hay 1621* (USJ!); Osa, Sierpe,



FIGURE 75. *Monstera spruceana* from Tilarán, Costa Rica. (A) Adult plant. (B) Juvenile plant in transition to pre-adult stage. (C) Developing infructescence. (D) Longitudinal section of the spadix to show the shape of the ovary (arrow). *M. Cedeño et al. 1501* (USJ). Image from Cedeño-Fonseca *et al.* (2020e).



FIGURE 76. *Monstera spruceana* from Cerro Jefe, Panama. Adult plant growing 1.5 m above the ground. *M. Cedeño et al. 2362* (PMA!). Photo by M. Cedeño-Fonseca.

Along road between Rincon and Boscosa, 2 Km W of bridge over Rio Rincon, 50 m, 11 September 1996, (Fr.), *T.B. Croat 79253* (CR!, MO!). PANAMA. **Chiriquí:** Vicinity of Fortuna Dam site on Río Chiriqui beyond Gualaca 9.4 mi beyond Gate to Francisco Linare's house, 20.9 mi from bridge over Río Está, 10.8 mi beyond Los Planes de Hornito, 1400 m, 27 November 1979, *T.B. Croat 48709* (MO!); Vicinity of Fortuna Dam site on Río Chiriqui beyond Gualaca 9.4 mi beyond Gate to Francisco Linare's house, 20.9 mi from bridge over Río Está, 10.8 mi beyond Los Planes de Hornito, 08°42'N 082°14'W, 1400 m, 27 Nov 1979, *T.B. Croat 48713A* (MO!); **Colón:** Santa Rita Ridge, 5.7 mi from Boyd-Roosevelt Hwy, along road which turns to left off main route, 0.2 mi from jct., 09°21'N 079°44'W, 250 m, 17 July 1994, *T.B. Croat & G. Zhu 76970* (CM, MO); Donoso. Minera Panamá copper-mining concession, slopes and ridges S of Río Botija (along trail to harpy eagle nest), 08°48'55"N 080°39'04"W, 205 m, 27 August 2014, *M.H. Grayum et al. 13193* (PMA!); **Darién:** Parque Nacional del Darién, W slope of Cerro Mali, on ridge between N and S branches of Río Pucuro; ca. 18 km E of Pucuro, 08°04'N 077°16'W, 1000–1200 m, 19 Oct 1987, *B.E. Hammel et al. 16426* (MO!, PMA!); South of El Real, region called Alturas de Nique, near Cana mine; along old Camino Real towards Colombia, 07°45'N 077°40'W, 800–1000 m, 22 August 1987, *G. McPherson 11541* (MO!); Parque Nacional Darién. Cerro Pirre. Rancho Frio, 08°01'16"N 077°44'04"W, 103 m, 13 abril 2016, *O. Ortiz & T. Contreras 2550* (MO!); Distrito de Chepigana. Parque Nacional Darién. Rio Casa Vieja, 676 m, 12 abril 2014, *O. Ortiz et al. 2302* (MO!); Along ascent of Serranía de Pirre above Cana Gold Mine between Río Cana and Río Escucha Ruido. (Holdridge Life Zone Map). [Coordinates on original label as 08°30'N, 77°30'W], 07°45'N 077°41'W - 07°45'N 077°43'W, 600–1000 m, 27 July 1976, *T.B. Croat 37738* (MO!); Serranía de Pirre, along ascent of Serranía de Pirre above Cana gold mine between Río Cana and Río Escucha Ruido, 07°45'N 077°42'W - 07°45'N 077°43'W, 1000–1310 m, 27 July 1976, *Thomas B. Croat 37756* (MO!); Vicinity of gold mine at Cana, 07°45'N 077°41'W, 500–600 m, 26 Jul 1976, *T.B. Croat 37674* (MO!); Vicinity Cerro Pirre, along trail from base camp to Rancho Frío on slopes of Cerro Pirre, 07°58'N 077°43'W, 200–450 m, 27 July 1994, *T.B. Croat & G. Zhu 77123* (MO, SAR); **Panamá:** 900 m, 15 Oct 1972, *M. Madison 763* (GH); Parque Nacional Altos de Campana. Sendero Zamora, 13 septiembre 2000, *R. Aizprúa & L. Martínez B2238* (MO!); Road past Altos de Pacora, 3–3.5 mi NE of Altos de Pacora, 7.8–8.2 mi above Pan Am Highway, 11.1–11.6 mi beyond Lago Cerro Azul, 09°15'N 079°25'W, 700–750 m, 19 Jun 1988, *T.B. Croat 68681A* (MO!); Cerro Campana, 6.1 miles above Pan-American Hwy, 3.2 miles beyond park entrance and Guarda Bosque Station, 08°41'N 079°56'W, 800 m, 23 March 1993, *T.B. Croat 74767* (CM, MO); Capira. Cerro Campana cloud forest, 08°41'N 079°54'W, 600 m, 8 Aug 1970, *J. Luteyn & H. Kennedy 1834* (MO!); Middle slopes of Cerro Campana, ca. 1 mile from Interamerican Highway, 08°43'09"N 079°53'25"W, 150 m, 15 June 1976, *T.B. Croat 35988* (MO!); Chepo. El Llano-Cartí Road, 8.2 miles N of Inter-American Highway, 09°16'55"N 078°55'55"W, 300–350 m, 27 March 1976, *T.B. Croat 33705* (MO!); **San Blas:** (Comarca de Kunayala): Nusigandí, El Llano-Cartí Road, 1–2 mi N of Nusigandi on road to Cartí, 09°20'N 078°59'W, 250–275 m, 2 Jul 1994, *T.B. Croat & G. Zhu 76584* (MO, RSA).

45. ***Monstera standleyana*** G.S.Bunting, *Baileya* 14: 133. 1967 ['1966']. (Figs. 77, 78)

Type:—"Plant cultivated in conservatory, Cornell University, from material of unknown commercial source", Nov 1964, *G.S. Bunting 1543* (holotype GH!, isotypes K!, NY!, UC, US!).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** light to dark green, sometimes white-dotted, smooth, cylindrical; **internodes** 2–6 cm long, 3–5 mm diam.; **petiole** distinct, dark green, smooth, 7–15 cm long, sheathed to base of the geniculum; **petiole sheath** persistent; **blades** lanceolate, subcordate to truncate at base, acuminate at apex, coriaceous, 6–15 × 4–10 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green or beige, smooth, cylindrical; **internodes** 1–3 cm long, 1–5 cm diam., 0.6–1.0 times as long as wide; **anchor roots** dark-brown; **feeder roots** brown, corky; **petiole** light or dark-green, smooth, 20–80 cm long, sheathed to base of the blade, less frequent to base of the geniculum or to 1.5 cm before it; **petiole sheath** persistent with finely wavy margins; geniculum smooth, sunken adaxially, convex abaxially, 2.5–3.5 cm long; **blades** lanceolate-ovate to lanceolate, cuneate to rounded or truncate at base, obtuse to short-acuminate at apex, coriaceous, drying yellowish green with black dots or blackish with white dots on both surfaces, 30–80 × 10–40 cm, 1.9–2.1 times longer than wide, not decurrent on the geniculum; **midrib** ribbed adaxially, convex abaxially, drying black or yellowish on both surfaces; **primary lateral veins** 12–25 per side, strongly sunken adaxially, prominent abaxially, departing midrib at 45–65°, drying yellowish; **secondary veins** parallel and prominent, reticulate towards the margin; **collective veins** not visible; **fenestrations** rarely present; margins entire, rarely pinnatilobed, 3–6 lobes per side. INFLORESCENCES on ascending stems, 1 or 2 simultaneously at flowering time, arranged in the axils of the leaves; **peduncle** smooth, 10–35 cm long; **spathe** acuminate to long-acuminate,

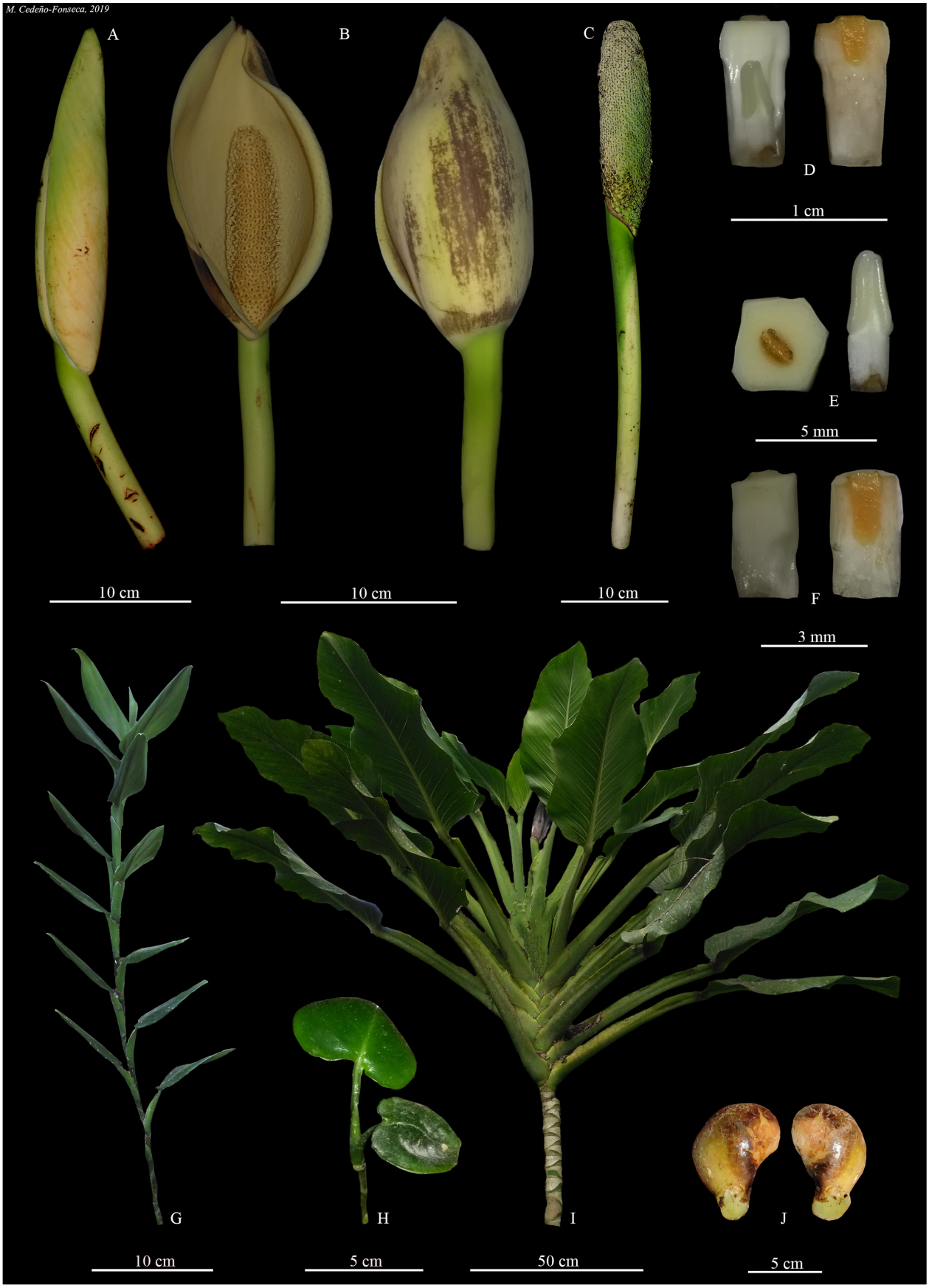

FIGURE 77. *Monstera standleyana* from Cartago, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Immature infructescence. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile flower; in lateral view (left) and in longitudinal section (right). (G) Juvenile plant. (H) Seedling. (I) Adult plant. (J) seeds. *M. Cedeño et al. 875* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 78. *Monstera standleyana* from Manzanillo, Costa Rica. Adult plant of an atypical form with fenestrate/pinnatifid leaves growing 5 m above the ground. Photo by M. Cedeño-Fonseca. (Not collected).

yellowish green externally during development, creamy yellow with brown dots externally and cream internally at anthesis, persistent after anthesis, light brown when dry, 10–17 × 8–12 cm, up to 5 cm longer than the spadix; **spadix** white during development, creamy-yellow at anthesis, 9–20 cm long, 3.5–5.5 cm diam., 5.4–6.8 times longer than wide; **basal sterile flowers** 4–6 mm long, with a rusty-red stigmatic secretion; **fertile flowers** 5–9 mm long; stamens 2–8 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 5–7 × 3–4 mm; style hexagonal, 3–4 × 3–4 mm; stigmatophore columnar, 0.5–1.0 mm long; stigma circular, with a rusty-red stigmatic secretion; **berries** with a green stylar cap during development (covered by cream spathe), mature stylar cap moss-green; pulp gray; **seed** brown with dark dots, oblong, 6–9 mm long.

Distribution and ecology:—*Monstera standleyana* ranges from southeastern Nicaragua, along the Caribbean slope and near the Continental Divide to Central Panama (Veraguas, Panama) and Colombia (Chocó), at 0–1500 m, in *Tropical moist forest* life zones.

Phenology:—Flowering from April to June, August, September and October. Fruiting in January, March, October and December.

Discussion:—The species is member of sect. *Monstera*. It is distinguished from the other species in the genus by the dark green petioles sheathing throughout their entire length, with persistent and slightly wavy wings, entire leaf blade usually without fenestrations, externally yellow, coriaceous and marcescent spathe, enveloping the spadix, and the moss green infructescence. It is similar to *Monstera juliusii*, but the latter is distinguished by its fenestrate, sometimes pinnatilobed leaves (but see below), the externally yellowish green spathe, cream-coloured infructescence, and its distribution on both sides of the Cordillera de Talamanca, at elevations of 1800–2200 m.

Monstera standleyana has been confused with the South American species *M. lechleriana* in the revision of the genus by Madison (1977). *Monstera standleyana* is a common species in lowland moist forests on the Caribbean slope. Adult plants of this species are variable in size, and can become very robust (with leaves up to 160 cm in length).

Individuals of this species have been observed in the Gandoca-Manzanillo Mixed Wildlife Refuge (Southern Caribbean slope), with both entire and fenestrate leaves, but have never been observed in the reproductive state (Cedeño-Fonseca *et al.* 2022).

Additional specimens examined:—NICARAGUA. **Río San Juan:** Near Caño Chontaleño, 20 km NE of El Castillo, 11°08'N 084°12'W, 200 m, 18 April 1978 – 21 April 1978, *D.A. Neill & P.C. Vincelli 3618* (MO!); Municipio de el Castillo, Reserva Indio-Maíz, zona de amortiguamiento, estación biológica La Lupe, 11°08'N 084°21'W, 100–200 m, 16 Marzo 1999, *R.M. Rueda et al. 10428* (MO!); Reserva Indio-Maíz, Municipio de el Castillo, a lo largo del Caño Chontaleño, 11°09'N 084°11'W, 150–200 m, 17 Febrero 1997, *R.M. Rueda et al. 5984* (HULE). COSTA RICA. **Alajuela:** San Ramón, Peñas Blancas, R.B. Monteverde, Río Peñas Blancas, 900 m, 16 December 1987, (Fr.), *W. Haber & E. Bello 7955* (CR!); San Ramón, Ángeles, Reserva Forestal de San Ramón, 1 km north east of the field station, 1000 m, 2 December 1993, (Fr.), *G. Herrera 6702* (CR!); Primary forest, 620 m, 16 September 1972, (Fl.), *R. Lent 2918* (MO!); 3 mi N of San Miguel on road between Vara Blanca and Puerto Viejo, 380 m, 26 May 1976, (Fr.), *T.B. Croat 35667* (MO!); **Cartago:** Jiménez, Pejibaye, Selva, Tausito, Estribaciones de cerro que lleva a río Tausito, 1050 m, 20 January 1996, (Fr.), *A. Cascante & M. Blanco 955* (CR!); Turrialba, Chirripó, Along Quebrada Platanillo near confluence of Quebrada Siripi, Platanillo de Chirripó, 1135 m, 2 March 1990, (Fr.), *M.H. Grayum & D. Hodel 9728* (CR!, MO!); Paraiso, Valley of Jicotea, 500–700 m, 30 June 1976, (Fr.), *T.B. Croat 36535* (MO!); Cartago, Dulce Nombre, Jardín Botánico Lankester, 1360 m, 14 Junio 2016, (Fr.), *M. Cedeño 901* (USJ!); Cartago, Dulce Nombre, Jardín Botánico Lankester, 1360 m, 20 April 2016, (Fl.), M. *Cedeño & M. Blanco 875* (USJ!); **Guanacaste:** In forest on slopes of Volcan Tenorio, 1500 m, 25 August 1980, (Fl., Fr.), *B.E. Hammel 9578* (MO!); **Heredia:** Sarapiquí, La Virgen, Pastures between Río Bijagual and Río Peje, Atlantic slope of Volcán Barva, 500 m, 6 April 1986, (Fl.), *M.H. Grayum & H. Rowell 6810* (CR!, MO!); **Limón:** Pococí, Guapiles, Guápiles, Bosque Lluvioso, 350 m, 12 October 2005, (Fr.), *L. Acosta 3700* (CR!); Pococí, Colorado, Forests and pastures between Rio Chirripocito and Rio Sardina ('Sardinal' on Chirripo Atlantico quadrangle), 12 m, 21 April 1990, (Infer.), *M.H. Grayum 9806* (CR!, MO!); Pococí, Guapiles, Finca Bosque Lluvioso, propiedad del INBio, alrededores de la Estación, 400 m, 11 November 1999, (Fr.), *A. Rodríguez 5387* (CR!, MO!); **Puntarenas:** Coto Brus, San Vito, E.B. Las Alturas, Las Cruces Tropical Botanical Garden, 6 km W of San Vito de Java, Cultivated and native to Costa Rica species, 1200 m, 7 March 1984, (Infer.), *T. Croat 57260* (CR!, MO!); **San José:** Vázquez de Coronado, Cascajal, Braulio Carrillo National Park, along Hwy. San Jose to Siquirres Hwy, along trail to Rio Sucio, site of the Old Carrillo Station, 600 m, 30 August 1996, (Infer.), *T.B. Croat 78786* (CR!, MO!). PANAMA. **Coclé:** Slopes and summit of Cerro Gaital, N of El Valle, 08°40'N 080°07'W, 1000–1400 m, 10 July 1982, *S. Knapp et al. 5975* (MO!); Vicinity of El Copé, N slope of Cordillera, ca. 0.5 miles N of Continental Divide at Alto Calvario, ca. 5.6 miles N of El Copé, 08°40'41"N 080°35'47"W, 800 m, 31 March 1993, *T.B. Croat 75084* (CM, MO); Vicinity El Copé, 5–6 miles N of El Copé, along trail which leads into the lowlands from old Riviera saw works area, 08°40'14"N 080°35'34"W - 08°41'18"N 080°35'58"W, 600–800 m, 08 July 1994, *T.B. Croat & G. Zhu 77218* (MO!, US!); **Panamá:** Capira. Summit of Cerro Campana, 08°41'19"N 079°55'18"W, 3500 f, 21 Oct 1972, *M. Madison 772* (SEL!); **Veraguas:** Santa Fe. Slopes of Cerro Tute, near Escuela Agricola Alto Piedra, NW of Santa Fé; virgin forest along trail to summit, 08°30'20"N 081°07'14"W, 1000–1050 m, 30 Nov 1979, *T.B. Croat 48941* (MO!); Along western fork of road beyond Escuela Agricola Alto Piedra, NW of Santa Fé, Pacific slope. 0.6 mi beyond fork in the road; virgin forest, 08°30'47"N 081°07'30"W, 1300–1350 m, 1 Dec 1979, *T.B. Croat 49057* (MO!).

46. ***Monstera tablasensis*** M.Cedeño, Aroideana 45: 162. 2022. (Figs. 79, 80)

Type:—COSTA RICA. Puntarenas, Coto Brus, Sabalito, Zona Protectora Las Tablas, Finca Sandí, 2000 m, 30 April 2016, *M. Cedeño, M. Blanco & F. Oviedo 879* (holotype USJ!, isotypes MO!, PMA!).

Robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** light green, smooth, cylindrical; **internodes** 2–5 cm long, 3–5 mm diam.; **blades** not appressed to the phorophyte. ADULT PLANTS: root climbers; **stems** dark-green or beige, cylindrical; **internodes** 1–5 cm long, 1–3 cm diam., 1.0–1.6 times longer than wide; **anchor roots** dark brown; **cataphylls** light-green or yellowish, deciduous but leaving dry fragments on the peduncle; **feeder roots** beige; **petiole** light-green, sometimes white-dotted, smooth, 30–60 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous; geniculum smooth, sunken adaxially, convex abaxially, 2–3 cm long; **blades** lanceolate to ovate, cuneate to rounded or sub-truncate at base, acuminate at apex, coriaceous, 30–45 × 20–30 cm, decurrent-wavy on the geniculum with 4–9 undulations of 1–3 mm wide; **midrib** ribbed adaxially, convex abaxially; **primary lateral veins** 15–25 per side, sunken adaxially, prominent abaxially;



FIGURE 79. *Monstera tablasensis* from locality type in Costa Rica. Adult plant with immature infructescence. *M. Cedeño et al. 879* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 80. *Monstera tablasensis* from Boquete, Panama. Adult plant growing 3 m above the ground. *O. Ortiz et al. 2791* (MO, PMA). Photo by M. Cedeño-Fonseca.

secondary veins inconspicuous; **collective veins** slightly visible; **fenestrations** absent or present, rounded near the midrib, oval towards the margin; **margins** entire or pinnatilobed due to tearing of the fenestrations that extend to the margin, 3–6 lobes per side. INFLORESCENCES on ascending stems; 1–3 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** smooth, 10–17 cm long, curved at base of the spadix at an angle of 80°; **spathe** light green during development, yellowish-white externally and white internally at anthesis, marcescent after anthesis, turning dark brown; **spadix** white during development, light-green at anthesis, 12–18 cm long, 2.5–5.0 cm diam.; **basal sterile flowers** unknown; **fertile flowers** unknown; **berries** with a creamish stylar cap during development, mature stylar cap cream; pulp white; **seeds** black, 3–5 mm long.

Distribution and ecology:—*Monstera tablasensis* is endemic to Costa Rica and Panama, and occurs south of the Pacific slope in border between Costa Rica and Panama in the Cordillera de Talamanca, at 1900–2300 m, in *Premontane wet forest* and *Premontane rain forest* life zones.

Phenology:—Flowering in September. Fruiting was recorded in April.

Discussion:—The species is a member of sect. *Monstera* and is characterized by the petiole sheathed along its entire length, deciduous petiole sheath with fibrous residues, acute or wedge-shaped leaf blade at base, coriaceous, and marcescent spathe that does not embrace the spadix. This species is known from a few collections made near the border with Costa Rica and Panama.

Additional specimens examined:—COSTA RICA. **Puntarenas:** Coto Brus, 1960 m, 19 febrero 1997, B. Gamboa 1056 (CR!, MO!); Puntarenas, Coto Brus, 2050 m, 01 marzo 1997, *B. Gamboa 1142* (CR!, MO!). PANAMA. **Chiriquí:** Boquete, 700–9020 m, 28 January 2013, *A. Zuluaga 909* (PMA!); Chiriquí, Boquete 1958 m, 19 mayo 2017, *O. Ortiz et al. 2791* (MO!, PMA!); **Bocas del Toro:** 1150–1200 m, 03 December 1985, *G. McPherson 7695* (MO!).

47. ***Monstera tacanaensis*** Matuda, Anales Inst. Biol. Univ. Nac. Autón, Mexico, Bot. 43(1): 55. 1974 [‘1972’]. (Figs. 81, 82)

Type:—MEXICO. Chiapas: Unión Juárez, falda del Volcán Tacaná, bosque alto húmedo del Chiquihuite, 850–2000 m, 14 Feb. 1969, *E. Matuda 37584* (holotype MEXU!).

Terrestrial plant in walls or nomadic vine from the canopy, appressed-climbing and pendent habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** light-green, smooth, cylindrical; **internodes** 10–18 cm long, 1.0–1.5 cm diam.; **petiole** distinct, 9–20 cm long; **blades** ovate, subcordate to truncate at base, acuminate at apex, coriaceous, 10–17 × 8–13 cm, not appressed to the phorophyte; fenestrations absent or present. ADULT PLANTS: root climbers; **stems** light-green to dark-green, cylindrical; **internodes** 8–15 cm long, 1.5–2.0 cm diam., 5.3–7.5 times longer than wide; **cataphylls** light green or yellowish, deciduous but leaving dry fragments on the peduncle; **anchor roots** slender, black; **feeder roots** grayish, corky; **petiole** dark-green with black dots, smooth, 20–50 cm long, sheathed up to medial part or 6 cm before base of the geniculum; **petiole sheath** deciduous; **unsheathed portion** slightly terete; geniculum smooth, flattened adaxially, cylindrical convex abaxially, 2–5 cm long; **blades** ovate to sub-orbicular, cordate at base, acuminate at apex, subcoriaceous to coriaceous, drying brownish, yellowish or grayish, 18–55 × 18–45 cm, not decurrent on geniculum; **midrib** flattened and prominent adaxially, convex abaxially, drying yellowish or brownish on both surfaces; **primary lateral veins** 4–7 per side, prominent on both surfaces, departing midrib at 85–90°, drying yellowish, brownish or blackish; **secondary veins** slightly prominent; **collective veins** not visible; **fenestrations** absent or present, perforations arranged on each side next to the midrib; **margins** entire or pinnatilobed, 2–5 lobes per side, the perforations between the lobes break, causing a hook-like structure. INFLORESCENCES on ascending or pendent stems, 1–5 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** smooth and pruinose from the middle towards the apex, 8–13 cm long; **spathe** obtuse to short-acuminate, light-green or grayish and completely pruinose during development, pale-pink internally and light-green externally and less pruinose at anthesis, the margins revolute, completely open at apex, deciduous or marcescent after anthesis 13–16 × 10–13 cm, up to 2 cm longer than spadix; **spadix** cream-colored during development and anthesis, 5–15 cm long, 2.0–3.5 cm diam.; **basal sterile flowers** 4–6 mm long, with a transparent stigmatic secretion; **fertile flowers** 5–9 mm long; stamens 0.5–9.0 mm long, with laminar filaments; anthers 2–3 mm long; ovary quadrangular in longitudinal section, ribbed, 4–5 × 4–5 mm; style hexagonal, 1.5–2.0 × 5–7 mm; stigma linear, sunken on style; **berries** with a dark-green stylar cap during development, mature stylar cap moss-green; pulp creamy-white; **seeds** dark green, oblong, 5–10 mm long.

Distribution and ecology:—Southern Mexico (Chiapas), Guatemala, Costa Rica, and Panama. In Costa Rica it is distributed in both watersheds of the Cordilleras de Guanacaste, Tilarán, Central and Talamanca, (Often occurring along the Continental divide and south of the fila Costeña, at 550–2400 m. It lives in *Tropical wet forest*, *Premontane wet forest*, *Premontane rain forest* and *Lower montane rain forest* life zones.

Phenology:—Flowering has been recorded in October-November. Fruit throughout the year.

Discussion:—The species, a member of sect. *Tornelia*, is distinguished from other species by its smooth, deep green, pruinose petioles (sometimes with black dots), cylindrical or almost so between the sheath apex and the geniculum, the geniculum lacking wings, shallowly cordate leaf blades with few perforations or none (when present, all of similar size, and only one between successive primary lateral veins), the spathe green and pruinose externally and pinkish cream internally, and a relatively short spadix (5–15 cm long) that turns dark bluish-green to dark brown during fruit development.

Monstera tacanaensis had been considered a synonym of *M. deliciosa* (Cedeño-Fonseca *et al.* 2020c, 2022). However, the latter has usually thicker stems with a lower internode length-to-width ratio, petioles commonly (but not always) verrucose and distally winged, sheath wings with a small apical ligule, leaf blades deeply cordate, that can have up to 15 fenestrations of very different sizes between successive primary lateral veins, the spathe yellowish externally and cream internally, a relatively long spadix (10–23 cm) with many more florets, and low, cupuliform stigmatophores. The developing fruits of *Monstera deliciosa* turn deep green externally, but never as dark as in *M. tacanaensis*. No pruinosity can be seen on the petioles and spathe of *M. deliciosa*.

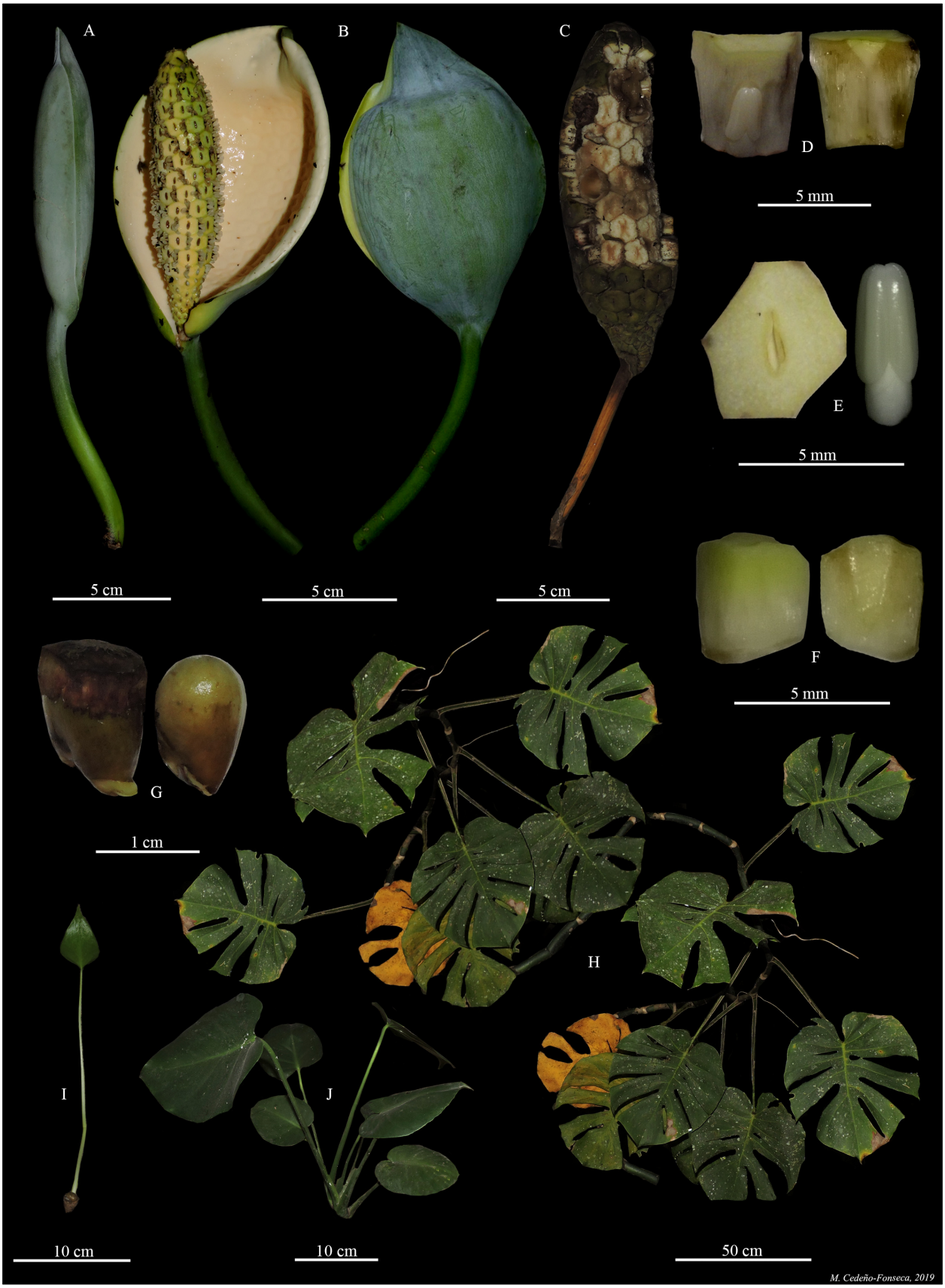

FIGURE 81. *Monstera tacanaensis* from Cartago, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front and back views. (C) Mature infructescence, stylar plates detached. (D) Fertile flower; lateral view (left) and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Sterile floret; lateral view (left), and longitudinal section (right). (G) Seeds; one with persistent stylar plate on top after being extruded from the fruit (left), the other one without stylar plate (right). (H) Portion of adult plant. (I) Seedling. (J) Juvenile plant. *M. Cedeño et al. 834* (USJ). Image from Cedeño-Fonseca *et al.* (2020c).



FIGURE 82. *Monstera tacanaensis*. Adult plant growing in the locality type in Tacaná, Mexico. *P. Díaz-Jiménez et al. 1469* (HEM). Photo by M. Cedeño-Fonseca.

For more details about the taxonomic comments and nomenclatural notes see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—MÉXICO. **Chiapas:** Volcán Tacaná, entre Talquían y puente Malá, 15°05'29"N, 092°05'49"W, 1890 m, 09 March 2020, *P. Díaz-Jiménez et al. 1469* (HEM!); Road to Lacandona Reserva at the Nueva Palestina turnoff, 16°54'36"N, 091°12'00"W, 300 m, 11 Oct. 1986, *B.e Hammel et al. 15668* (MO!); Unión Juárez, Southeast side of Volcán Tacaná above Talquian, 2200 m, 16 Jan. 1973, *D. Breedlove & A. Smith 31690* (MEXU!, MO!); Municipio Unión Juárez, Volcán Tacaná, por el camino de Talquián a la cima del volcán, por la línea divisoria con Guatemala, 1700–2200 m, 4 Feb. 1987, *Martínez et al. 19428* (MEXU!); Volcán Tacaná, camino entre Talquián y Chiquihuaite, 1800 m, 28 Apr. 1987, *Martínez & Reyes 20417* (MEXU!). GUATEMALA. **Quezaltenango:** 1 km from Colomba on road to San Juan, in wet forest, 1800–2000, 31 Aug. 1972, *M. Madison 657* (SEL!). COSTA RICA. **Alajuela:** Alajuela, Sarapiquí. Along Río Sarapiquí at and upstream from crossing of road to Colonia Virgen del Socorro, 750 m, 18 August 1990, (Fr.), *M.H. Grayum 9932* (CR!, MO!); San Ramón, Peñas Blancas, Rio Penas Blancas, Estacion Eladios, 820 m, 14 May 1991, (Fl.), *E. Bello 2683* (CR!, MO!); San Ramón, Peñas Blancas, Rio Penas Blancas, Refugio Aleman's Quebrada Rojas, 850 m, 29 February 1992, (Fr.), *E. Bello 4441* (CR!); **Cartago:** Turrialba, Alvarado, Capellades, Santa Cruz, Linderos del Río Turrialba, 1750 m, 19 June 2015, (Fl., Fr.), *M. Cedeño 795* (USJ!); Cartago, Dulce Nombre, Jardín Botánico Lankester, 1360 m, 26 September 2015, (Fl.), *M. Cedeño & M. Blanco 834* (USJ!); Cartago, Agua Caliente, Sobre camino rural de Lourdes a Muñeco, ca. 1.5 km del poblado de Muñeco, Fragmentos de bosque sobre ladera hacia Río Navarro, 1300 m, 3 March 2015, (Fr.), *A. Cascante & C. Trejos 2513* (USJ!); Along Camino Raiz de Hule, SE of Platanillo (Tsipiri), 1300 m, 1 July 1976, (Fl.), *T.B. Croat et al. 36722* (CR!, MO!); Turrialba, Santa Cruz, Monumento Nacional Guayabo, camino arriba de la casa de la administración, 1100 m, 3 September 1992, (Fr.), *G. Rivera 1970* (CR!); Turrialba, Valle del Reventazón, Grano de Oro, Moravia de Chirripó, 1110 m, 29 June 1993, (Fr.), *P. Campos 92* (CR!, MO!); Pastures in Tapantí, 1200 m, 20 June 1970, (Fr.), *R. Lent et al. 1962* (CR!); Paraíso, Orosi, Camino del pueblo de Río Macho al Embalse, Área de cafetales y pequeños bosques alterados, 1480 m, 26 January 2010, (Fl.), *A. Cascante 2175* (CR!); **Guanacaste:** Tilarán, Tronadora, Lake Arenal; Hills along south side of lake; from Río Chiquito to Río Caño Negro, 650 m, 9 May 1986, (Infer.), *B.E. Hammel & G. Hoopen 15139* (CR!, MO!); Tilarán, Tronadora, Quebrada Grande, Rio Chiquito, Cano Negro, Finca Rodolfo Quesada, 800 m, 10 September 1993, (Infer.), *E. Bello 5400* (CR!, MO!); **Heredia:** Sarapiquí, La Virgen, Primary forest between Río Peje and Río Sardinalito, Atlantic slope of Río Volcán Barva, 750 m, 3 April 1986, (Infer.), *M.H. Grayum 6710* (CR!, MO!); **Limón**. Talamanca, Telire, Gira Transtalamanca, Sendero a la Catarata, 1930 m, 26 Abril 2017, (Fr.), *M. Cedeño et al. 1082* (USJ!); Talamanca, Telire, Alto Urén, Cerro Laúbeta entre Río Lorni y Quebrada Chacho, 1190 m, 1 January 1985, (Fr.), *G. Herrera 3383* (CR, USJ, MO); Talamanca, Telire, Alto Lari,

Kivut, 1400 m, 1 January 1975, (Fr.), *R. Aguilar & W. Roy 1106* (CR!, MO!); Pococí, Guápiles, Los Angeles, San Miguel, siguiendo el camino que va al Volcán Irazú, cuenca media del río Blanquillo, margen izquierdo, 1300 m, 26 February 1990, (Fr.), *A. Chacón et al. 79*0 (CR!, MO!); Talamanca, Telire, P.N. Cordillera de Talamanca, Cordillera de Talamanca, Siguiendo fila frente unión Queb, Kuisa/ R. Lori, De Ujarrás a San José Cabécar, 1850 m, 21 March 1993, (Fl., Fr.), *G. Herrera et al, 5972* (CR!, MO!); Limón, Valle la Estrella, Almirante, Fila divisoria entre la Cuenca superior del río Xichiari y la cuenca superior del río Boyei, 1300 m, 13 August 1995, (Fl., Fr.), *G. Herrera 8450* (CR!, MO!); Pococí, Guapiles, Bosque Lluvioso, 350 m, 14 October 2005, (Fl., Fr.), *L. Acosta 3733* (CR!); Talamanca, Bratsi, Rio Coen, 800 m aguas arriba union Queb. Kirigu, De Ujarras a San Jose Cabecar, 1700 m, 28 March 1993, (Fr.), *A. Fernandez 861* (CR!); Talamanca, Bratsi, Cima a la derecha union Rios Lori y Coen, Entre Ujarras y San Jose Cabecar, 1600 m, 4 April 1993, (Fr.), *A. Fernandez 1029* (CR!); Pococí, Guapiles, Forests mainly to the E of main E branch of Quebrada El Molinete, 480 m, 24 July 1994, (Infer.), *M.H. Grayum 10677* (CR!, MO!); Talamanca, Bratsi, Amubri, Alto Lari, Kivut, Afluente innominado del Rio Lari, margen izquierda, 1500 m, 21 March 1992, (Fr.), *G. Herrera 5412* (CR!); Talamanca, Bratsi, Bratsi, Parque Internacional La Amistad, sendero Transtalamanca, Entre Ujarrás y San José Cabécar, Entre Quebrada Kuisa y Río Lori, 1809 m, 23 February 2007, (Fr.), *A. Rodríguez 10714* (CR!); Talamanca, Bratsi, Bratis, Punto 11 B. Cerca de 1 km NE de Laguna Dabagri, 1571 m, 26 July 2007, (Fr.), *D. Solano 4497* (CR!); **Puntarenas:** Coto Brus, San Vito, Estación Biológica Las Cruces, 1200 m, 2 May 2015, (Fr.), *M. Cedeño 778* (USJ!); Coto Brus, San Vito, Fila Cruces, 1400 m, 27 Abril 1995, (Fr.), *I. Chacón 14* (USJ!); Cloud Forest above Wilson's Finca 6 km s of San Vito de Java. 1523 m, 17 August 1967, (Fr.), *P. Raven & L. Liesner 21860* (CR!); Coto Brus, Sabalito, Z.P. Las Tablas, Cordillera de Talamanca, Quijada del Diablo, San Vito, 1200 m, 1 January 1975, (Fr.), *M. Ramírez & H. Schmidt 192* (CR!); Región Sur Este del Lago Dabagri, cruzando las filas hacia Telire (Laguna Tiestos y fila de los aguacatillos), 1 January 1985, (Fr.), *L. Gómez & G. Herrera 23205* (CR!, MO!); Buenos Aires, Buenos Aires, Along ridge between headwaters of Río Chubugra and Río Kuiyé, ca. 12 km NE of Ujarrás, Cordillera de Talamanca, 2100 m, 20 March 1993, (Infer.), *M.H. Grayum 10387* (CR!, MO!); Buenos Aires, Potrero Grande, No protegida, Cuenca Térraba-Sierpe, Potrero Grande, Tres Colinas, bajando hacia Helechales, ca. 700 m, Bosque junto al camino, 1700 m, 25 April 2006, (Fl.), *A. Rodríguez & D. Santamaría 10141* (CR!, MO!); Buenos Aires, Potrero Grande, No protegida, Cuenca Térraba – Sierpe, Sabanas Helechales parte intermedia, Alrededores de la finca del señor Marcial Vidal, 1090 m, 15 June 2006, (Fr.), *F. González & N. Murakami 556* (CR!, MO!); Coto Brus, Ridge Summit trail on Fila Cruces of Cerro Anguciana, Understory of cloud forest on ridge top, 1535 m, 8 March 1989, (Fr.), *J. Koshear et al. 116* (CR!); Coto Brus, Pittier, Sendero a Cerro Gemelo, 1900 m, 31 July 2000, (Fl.), *L. Acosta 2374* (CR!, MO!); Coto Brus, Sabalito, Zona Protectora Tablas, Cerro Pando, Colecta en bosque y orillas de potreros, 1960 m, 20 November 1996, (Fl.), *E. Alfaro 930* (CR!, MO!); Coto Brus, Pittier, Estacion Pittier, 1680 m, 8 June 1995, (Fr.), *L. Angulo 334* (CR!, MO!); Coto Brus, Pittier, Limite Zona Protectora Las Tablas, sendero a Quebrada Gemela, 1650 m, 30 January 1995, (Fl., Fr.), *M. Chinchilla 25* (CR!, MO!); Coto Brus, Sabalito, Sendero a Cerro Echandi, 1800 m, 10 August 1997, (Fr.), *B. Gamboa 1662* (CR!); Coto Brus, Pittier, Estacion Pittier, Sendero Rio Gemelo, 1650 m, 30 January 1995, (Fl.), *E. Navarro 18* (CR!); Coto Brus, Pittier, Estacion Pittier, Sendero Pittier, 1680 m, 15 June 1995, (Fr.), *A. Picado 241* (CR!); Coto Brus, Pittier, Estacion Pittier, Sendero sobre la Fila hacia el Cerro Pittier, 1640 m, 26 November 1997, (Fr.), *A. Rodríguez 2822* (CR!, MO!); Buenos Aires, Potrero Grande, Potrero Grande, La Lucha, Cerro Seno, Vegetación achaparrada con predominio de Quercus, Cavendishia, Clusia y helechos, 5–9 m x10–70 cm DAP, 2100 m, 23 February 2008, (Infer.), *D. Santamaría 7118* (CR!); Buenos Aires, Potrero Grande, Buenos Aires, Potrero Grande, La Lucha, PILA, Bosque denso de 5–25 m, 1800 m, 25 February 2008, (Fr.), *D. Solano 5164* (CR!, MO!); Coto Brus, Pittier, Coto Brus, Área de Conservación Amistad Pacífico, Parque Internacional La Amistad, Estación Pittier, Sta. María de Pittier, Sendero Cerro Pittier, 1754 m, 17 May 2015, (Infer.), *N. Zamora 7778* (CR!); **San José:** Pérez Zeledón, Rivas, Farmland on steep hills with remnant evergreen forest along streams Río Herradura, tributary of the río Chirripó del Pacífico at 1600 m altitude, northwest of Canán, General Valley, 1600 m, 29 December 1969, (Fr.), *W. Burger & W. Haber 7103* (CR!); Vazquez de Coronado, Cascajal, Pastures and forest remnants along the río Cascajal near the waterfalls at 1600 m, 1600 m, 5 November 1978, (Fl.), *M. Thomas et al. 784* (CR!); Perez Zeledón, Páramo, R.F. Los Santos, Cerro Lira, 2020 m, 8 March 2001, (Fr.), *A. Quesada 563* (CR!); Tarrazú, San Lorenzo, Tarrazú, San Marcos, between Cerro Toro and Cerro Hormiguero along the road between Basurero and Esquipulas, vicinity of Cerro Hormiguero, 1100 m, 5 September 1996, (Infer.), *T.B. Croat 78936* (CR!, MO!); Vázquez de Coronado, Cascajal, Sendero La Montura, entre Estación Quebrada González y Estación Zurquí, 1100 m, 16 February 2000, (Fr.), *A. Rodríguez 5783* (CR!); Cartago, La Unión, San Juan, Centro Comercial Auto-Mercado, 1315 m, 18 August 2018, (Fl., Fr.), *M. Cedeño & M. Blanco 1493* (USJ!). PANAMA. **Bocas del Toro:** Cerro Colorado, 9.2 mi W of Chamé; along trail E of road which leads down to stream, 8°35'N, 81°50'W, 1450–1480 m, 6 Jul. 1988, *T.B. Croat 69073* (MO!); Changuinola, P.I. La Amistad, 9°03'27.8''N, 82°42'18.1''W, 1500 m, 21 Apr. 2008 (fr.), *D.*

Santamaría et al. 7489 (CR, PMA); Changuinola, P.I. La Amistad, Rancho Santín, 9°06’41.9’’N, 82°40’03.7’’W, 1340 m, 31 Jul. 2008 (fl.), *A. Monro et al. 6129* (CR, PMA); Changuinola, Caribbean slopes of Cerro Fábregas, 9°09’51’’N, 082°39’41’’W, 1300 m, 23 Mar. 2005 (fr.), *A. Monro & S. Cafferty 4922* (PMA!); Changuinola, Valle del Risco, Sitio Culebra, P.I. La Amistad, 8°55’N, 82°25.4’W, 700–1000 m, 26 Jan. 2013 (fr.), *A. Zuluaga et al. 902* (PMA!); **Chiriquí:** Fortuna, Grande-Fortuna, Along Continental Divide from road branching N off main Fortuna-Chiriquí Grande Highway near Continental Divide, 1.1 mi from main highway, 8°44’N, 82°17’W, 1200 m, 11 Mar. 1985, *T.B. Croat & M.H. Grayum 60297* (MO!); La Pata del Cedro, 09°04’27”N, 082°44’17”W, 1750 m, 11 Mar. 2004, *E. Alfaro 4322* (MO!, PMA!); Chiriquí Grande, Chiriquí border along Continental Divide on Carretera del Oleoducto, ca 1 km N of Quebrada Arena, IRHE Fortuna Hydroelectric Project, 08°46’N, 082°12’W, 1150 m, 11 May. 1982, *S. Knapp 5087* (MO!); Chiriquí, Along trail between N fork of Río Palo Alto and Cerro Pate Macho, ca. 6 km NE of Boquete. 8°48’N, 82°23.5’W, 1600–1700 m, 6 Feb. 1986, *M.H. Grayum et al. 6398* (MO!); Cerro Punta region, alto Los Guerra road W of Bambito, 8°53’N, 82°37’W, 1800–2200 m, 13 Jul. 1983, *C. Hamilton & K. Krager 3900* (MO!); Hill E of Audubon Cabin, S of Cerro Punta, 8°52’N, 82°35’W, 1400–1800 m, 12 Jul. 1983, *C. Hamilton & K. Krager 3841* (MO!); Gualaca-Chiriquí Grande, 4.2 mi NW of Los Planes de Hornito, 08°39’N, 82°13’W, 1000 m, 29 Mar. 1993, *T.B. Croat 74915* (MO!); Cerro Colorado, along road to copper mine development N of San Felix, 20.5 mi N of the bridge near San Felix, 8.3 mi beyond Chame and turnoff to Escopeta. 08°32’N, 81°46’W, 1630 m, 30 Mar. 1993, *T.B. Croat 75041* (MO!); Cerro Colorado, along road between Río San Felix and Cerro Colorado mining exploration camp, W of Chamé, 8°35’N, 81°51’W, 1400 m, 8 Jul. 1988, *T.B. Croat 69221* (MO!); Along road from Cerro Punta village towards Boquete, near place called Bajo Grande, 8°50’N, 82°35’W, 2100 m, 5 Jun. 1986, *G. McPherson 9325* (MO!); Cerro Colorado Mine, near higher elevation camp, 1500 m, 30 May. 1980, *T. Antonio 4872* (MO!); Wooded slopes about 1 km north of Las Nubes, east of the mountain of Cerro Punta and about 5 km northwest of the town of Cerro Punta, 2000–3000 m, 24 Dec. 1971, *R. Wilbur et al. 15234* (MO!); Roadsides, pastures and remnants of lower montane wet forest, Bajo Grande, 1–3 km E of town of Cerro Punta, 2000–2200 m, 24 Feb. 1974, *M. Nee 10065* (MO!); 2 mi N of El Hato del Volcán, 30 May 1970, *T.B. Croat 10664* (MO!); Vicinity of Bajo Chorro, 1900 m, 20 Jul. 1940, *R. Woodson & R. Schery 634* (MO!); Palo Alto, just east of Boquete, 5000 f [1524 m], 23 Jul. 1959, *W.L. Stern et al. 1055* (MO!); Cerro Colorado, on road, 31.6 km from Río San Felix bridge, 1690 m, 15 Jul. 1976, *G. Sullivan 323* (MO!); La Fortuna hydroelectric project; in cloud forest on ridge behind camp, 1300–1400 m, 23 Mar. 1978, *B.E. Hammel 2235* (MO!); Primary forest and adjacent cut over areas; Vicinity of Las Nubes; 2.7 mi NW of Río Chiriquí Viejo W of Cerro Punta, 2200 m, 27 Feb. 1973, *T.B. Croat 22385* (MO!); Lower north slope of Barú, east of Bajo Choro region, forest, forest edge and pasture, 6000–6500 f, 7 May 1978, *B.E. Hammel 2970* (MO!); Trail from Paso Respingo to Bajo Chorro, Cerro Punta to Boquete, 7300 f, 13 Apr. 1979, *B.E. Hammel et al. 7027* (MO!), Camino entre Bombito y La Amenaza, 6000 f, 21 Apr. 1969, *M. Correa 1274* (MO!); Forested hill N of Audubon Cabin, 20 Feb. 1971, *T.B. Croat 13631* (MO!); 7 km NW of Cerro Punta, Las Nubes region, 7200 f, 11 Feb. 1978, *B.E. Hammel* 1466 (MO!); Vicinity of Callejón Seco, Volcán de Chiriquí, 1700 m, 17 Jul. 1940, *R. Woodson et al. 501* (MO!); Lower montane wet forest 5.5 km by road NW of Alto Quiel, along road toward Cerro Punta, 8 km NW of Boquete, 1600 m, 23 Feb. 1974, *M. Nee 9943* (MO!); Above San Felix along mining road 18–27 miles off of Pan-American Highway (above Chame or turnoff to Escopeta), 1200–1500 m, 12 Mar. 1976, *T.B. Croat 33093* (F!, MO!); Cerro Colorado, along mining road 31.6 km beyond bridge over Río San Felix (10.6 km beyond turn-off to Escopeta), 1690 m, 15 Jul. 1976, *T.B. Croat 37170A* (MO!); East of Boquete along steep, forested slopes and in wooded pastures on Cerro Azul near Quebrada Jaramillo, 1620–1700 m, 11 Aug. 1974, *T.B. Croat 26844* (MO!); 3.7 km along road through Bajo Grande from bridge NE of Cerro Punta, 08°50’N, 082°32’W, 2250–2400 m, 9 Nov. 1980, *K. Sytsma & W. Stevens 2080* (MO!); Las Cumbres, hogback ridge N of Quebrada Iglesia, near town of Cerro Punta, 22 Jul. 1971, *T.B. Croat 1616*4 (MO!); Roadside south of Cerro Punta, 29 May 1970, *T.B. Croat 10434* (MO!); Volcán Barú, Boquete-Alto Quiel, Along old road from Boquete-Alto Quiel to Cerro Punta; on trail up north slope of Volcán Barú, 8°50’N, 82°30’W, 1750–1900 m, 13 Jan. 1989, *G. McPherson 13519* (MO!); Boquete: Back side of mountain, 20 Mar. 1977, *J. Folsom 2206* (MO!); Bugaba, Cerro Punta, 08°52’N, 82°33’W, 2200 m, 23 Jan. 1984, *H. van der Werff & J. Herrera 6289* (MO!); **Coclé:** La Mesa above El Valle; in forest on both sides of junction with road to Cerro Pilón, 800 m, 21 Jul. 1974, *T.B. Croat 25357* (MO!); La Mesa, above El Valle de Anton, ca 2 km W of Cerro Pilon on slopes of steep knife-like ridge, 900–930 m, 22 Jul. 1976, *T.B. Croat 37502* (MO!); **Veraguas:** Ridge of Cordillera de Tute, along trail to Cerro Tute, ca 3–4 km past Escuela Agrícola Alto de Piedra, just W of Santa Fé, 08°32’N, 081°07’W, 800–1400 m, 20 Mar. 1982, *S. Knapp & J. Kress 4374* (MO!); 5 mi W of Santa Fe on road past Escuela Agrícola Alto Piedra on Pacific side of divide, 800–1200 m, 18–19 Mar. 1973, *R. Liesner 909* (MO!); 5 mi W of Santa Fé on road past Escuela Agrícola Alto Piedra on Pacific side of divide, 800–1200 m, 18–19 Mar. 1973, *R. Liesner 941* (MO!).

48. ***Monstera tarrazuensis*** Croat & M.Cedeño, *Nordic J. Bot.* 38(12): 5. 2020. (Figs. 83, 84)

Type:—COSTA RICA. San José: Cantón Tarrazú, distrito San Lorenzo, Camino de Tarrazú hacia Quepos, 1386 m, 9 July 2019, (fr.), *M. Cedeño 1686* (holotype USJ!).

Nomadic vine, appressed-climbing and pendent habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** light-green with white dots, smooth; **internodes** 3–7 cm long, 3–5 mm diam.; **petiole** distinct, dark or light-green, smooth, 4–10 cm long, sheathed to base of the geniculum or blade; **petiole sheath** persistent; **blades** lanceolate, cordate at base, acuminate at apex, coriaceous, 7–14 × 5–9 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark green with white dots, smooth, cylindrical; **internodes** 4–11 cm long, 1.2–1.7 cm diam., 3.3–6.5 times longer than wide; **anchor roots** and **feeder roots** light-brown; **petiole** light-green with white dots, smooth, 11–14 cm long, sheathed along its entire length; **petiole sheath** persistent or rarely deciduous; geniculum obscure, 0.5–1.0 cm long; **blades** ovate to ovate-elliptic, rounded or asymmetrical at base, short-acuminate at apex, coriaceous, 13–26 × 7.5–13.8 cm, 1.5–2.0 times longer than wide, not decurrent on the geniculum, drying grayish or brown, faintly glossy; **midrib** ribbed adaxially, convex abaxially, drying dark brown; **primary lateral veins** 5–9 per side, departing midrib at 45–60°, slightly sunken adaxially, prominent abaxially, drying dark brown and wavy; **secondary veins** completely parallel to the primary lateral veins and finely wavy; **collective veins** scarcely visible; **fenestrations** absent; **margins** entire. INFLORESCENCES on pendent stems, arranged in the axils of the leaves; **peduncle** smooth, 13–15 cm long; **spathe** long-acuminate, open at apex and overlapping margins at the medial part, light green during development, white internally and greenish-white or creamy white externally at anthesis, 10–15 × 5–7 cm, up to 5 cm longer than the spadix, falling intact after anthesis; **spadix** oval, white during development, white at anthesis, 5–6 cm long, 2–3 cm diam.; **basal sterile flowers** 2.5–4.0 mm long, with a transparent stigmatic secretion; **fertile flowers** 3–4 mm long; stamens 2–4 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, 2–3 × 1.5–2.0 mm; style hexagonal, 1.5–2.0 × 2–3 mm; stigmatophore absent; stigma linear, with a transparent stigmatic secretion; **berries** with a white stylar cap during development, mature stylar cap white-cream; pulp white; **seeds** unknown.

Distribution and ecology:—Endemic to Costa Rica in the central Pacific region, on Cerro Hormiguero, at 1100 to 1200 m elevation, occurring in *Tropical wet forest* and *Premontane rain forest* life zones.

Phenology:—Flowering and fruiting have been recorded in July and September.

Discussion:—The species is a member of sect. *Monstera* and is characterized by its long slender internodes, small narrowly ovate, entire blades which lack perforations and the inflorescences with a stubby spadix which is much shorter than the coriaceous caviform spathe that is yellowish on outside and creamy white inside as well as by the subterete, somewhat caviform styles and subcircular, barely raised stigma.

Mostera tarrazuensis can be confused with *M. luteynii*, which also has hanging stems and leaf blade without perforations. But it differs because *M. lutein* has stems completely covered with pustules, leaf blade with tertiary venation strongly prominent on both surfaces and the terete geniculum.

Additional specimens examined:—COSTA RICA. **San José:** Tarrazu Cantón, San Marcos de Tarrazu between Cerro Toro and Cerro Hormiguruero along the road between Basuera de Tarrazu and Esquipula, vicinity of Cerro Hormiquero, 1100–1200 m, 5 Septiembre 1996, *T.B. Croat 78912* (CR!, MO!); Tarrazu, San Marcos de Tarrazu between Cerro Toro and Cerro Hormiguero along the road between Basuero de Tarrazu and Esquipulas, 1100–1200 m, 5 septiembre 1996, (fr.), *T.B. Croat 78934* (INB, MO).

49. ***Monstera tenuis*** K.Koch in A. Braun & C. Bouché, *Index Seminum Hort. Bot. Berol., Appendix*: 4. 1855. (Fig. 85)

Type:—Cultivated at Potsdam, Wildparkstation, *1855, K. Koch s.n*. (lectotype K-K000434515! [fragm.], designated by Cedeño-Fonseca *et al.* 2022). —COSTA RICA. Cartago: Tucurrique, 635 m, Jan. 1899, *A. Tonduz 13311* (epitype B-B100144968!], isoepitypes P! three sheets [P00748754, P00748755 & P00748756], US! two sheets [00087942 & 01095187], designated by Cedeño-Fonseca *et al.* (2022)).

Marcgravia paradoxa [W.Bull, *Retail list for* 1872: 7. 1872 & *Gard. Chron.* April 6, 1872: 470. 1872 (‘*Marcgraavia paradoxa*’), nom. inval. (provisional)]; W.Bull ex G.W.Johnson & R.Hogg, *J. Hort. Cottage Gard.* n.s. 28: 470. 1875 (Johnson & Hogg 1875). TYPE:—Cultivated Knowle, Warwickshire, UK, 12 April 1889, *E. Tonks s.n.* (neotype K!, three sheets [K000626773, K000626774, K000626775], designated by Cedeño-Fonseca *et al.* (2022)).

Monstera gigantea Engl., *Bot. Jahrb. Syst.* 37: 118. 1905, [*nom. illeg*., non *M. gigantea* (Roxb.) Schott, *Wiener Z. Kunst* 1830(4): 1028. 1830, i.e. *Epipremnum giganteum* (Roxburgh 1820: 455) Schott (1857: 45)]. TYPE:—COSTA RICA. Cartago: Tucurrique, 635 m, Jan. 1899, *A. Tonduz 13311* (holotype B!, isotypes P!, US!).

Robust to massive nomadic vine, appressed-climbing habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** light-brown or green, smooth, flattened or cylindrical; **internodes** 2–10 cm long, 5–10 mm diam.; **petiole** not visible (covered by blade), dark green, smooth, 2–4 cm long; **blades** obovate, subcordate at base, acuminate at apex, coriaceous, 5–15 × 4–10 cm, appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** light-brown or green, cylindrical, warty with pustules; **internodes** 3–8 cm long, 3–14 cm diam., 0.6–1.0 times as long as wide; **anchor roots** light brown; **feeder roots** dark-brown; petiole light-green, smooth, 25–70 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous with fibrous remains; geniculum smooth, flattened adaxially, convex abaxially, 2–5 cm long; **blades** lanceolate to ovate to lanceolate-oblong, obtuse, truncate, sub-cordate or attenuate at base, obtuse to slightly acuminate at apex, coriaceous, drying yellowish, blackish, brownish or reddish, 45–90 × 35–50 cm, 1.5–2.0 times longer than wide, decurrent on the geniculum, decurrent portion 1–2 mm wide; **midrib** ribbed adaxially, convex abaxially, drying black to dark brown on both surfaces; **primary lateral veins** 5–60 per side, slightly sunken adaxially, prominent abaxially, drying blackish or dark brown; **collective veins** not visible; **fenestrations** present only in the transition to adult leaves; **margins** deeply pinnatifid, 5–30 lobes per side, often somewhat drooping, with 3–5 veins per lobe (the middle one the most prominent). INFLORESCENCES on ascending stems, 1–5 simultaneously at flowering time, arranged in the leaf axils; **peduncle** smooth, 4–10 cm long, 3–4(6) cm diam.; **spathe** obtuse to short-acuminate, green-yellowish externally and white-cream externally during development, completely open or tearing in fragments, deciduous after anthesis, 15–40 × 10–20 cm, as long as the spadix; **spadix** white-cream during development, yellow at anthesis, 13–40 cm long, 2–6 cm diam.; **basal sterile flowers** 5–8 mm long, with a yellowish stigmatic secretion; **fertile flowers** 0.9–1.5 cm long; stamens 2–10 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 7–11 × 2–3 mm; style hexagonal, 4–6 × 2–3 mm; stigmatophore semi-columnar; stigma linear, with a yellow stigmatic secretion; **berries** with a pale-green stylar cap during development, mature stylar cap moss-green; pulp gray; **seeds** black with light brown dots, elongated, 6–10 mm long.

Distribution and ecology:—*Monstera tenuis* ranges from Nicaragua to Costa Rica and Panama, at 0–1766 m. It occurs in *Tropical moist* forest, *Tropical wet forest*, *Premontane wet forest* and *Premontane rain forest* life zones; in primary and secondary forest, and open areas.

Phenology: —Flowering has been recorded in February, May, November–December, and fruit in January–March, and May–September.

Discussion:—The species, a member of sect. *Marcgraviopsis*, is characterized by the light green petiole, sheathing to base of the geniculum, with deciduous wings leaving fibrous residues, leaf blades deeply pinnatífid and never fenestrate, inflorescences with the spathe white-cream externally, spadices up to 40 cm long with short peduncles (<10 cm), and the infructescence moss green at maturity. It could be confused with *M. pinnatipartita*, but that species has the petioles speckled, with wings of the leaf sheath persistent and involute, and it lacks the shingling juvenile phase.

Monstera tenuis is among the most robust species of the genus, only rivalled in the size of the leaves by *M. deliciosa* and *M. alfaroi*, and the recently described Panamanian *M. gigas*, the latter with leaves which can reach 3 m long (Cedeño-Fonseca *et al.* 2021b, 2022). *Monstera tenuis* also has the largest spadix of any species, though overall inflorescence size is eclipsed by *M. titanum* also from Panama, whose combined peduncle and spathe length can approach 1 m (Cedeño-Fonseca *et al.* 2021b, 2022).

For more details about the taxonomic comments and nomenclatural note see Cedeño-Fonseca *et al.* (2022).

Additional specimens examined:—NICARAGUA. **Atlántico Sur:** Municipio de Nueva Guinea, Reserva Indio-Maiz, colinas de piedra fina, 11°25'N 084°13'W, 200–300 m, 6 enero 1999, *R.M. Rueda et al. 9897* (MO!); Caño Costa Riquita, ca. 1.8 km SW of Colonia Naciones Unidas, above (S of) road between Colonia Nuevo Léon and Colonia Naciones Unidas, 11°43'N 084°18'W, 150–180 m, 06 November 1977 – 07 November 1977, *W.D. Stevens 5046* (MO!); **Río San Juan:** Near Caño Chontaleño, 20 km NE of El Castillo, 11°08'N 084°12'W, 200 m, 18 April 1978 – 21 April 1978, *D.A. Neill & P.C. Vincelli 3619* (MO!); Los Filos, near Loma Los Filos, Río Santa Cruz; recently logged lowland moist forest on clay soils, 11°08'N 084°19'W, 100–200 m, 6 Sep. 1993, *J. Salick 8113* (MO!). COSTA RICA. **Alajuela:** San Ramón, Peñas Blancas, R.B. Monteverde, Río Peñas blancas, Laguna, 850 m, 27 May 1988, (Fr.), *E. Bello 413* (CR!); Primary forest and perimeter, Finca Los Ensayos ca 11 miles NE of Zarcero, 850 m, 15 August 1977, (Infer.), *T.B. Croat 43594* (CR!, MO!); Along road between Cañas and Upala, 400 m, 24 June 1976, (Infer.), *T.B. Croat 36322* (MO!); San Isidro de San Ramón, 1259 m, 21 Octubre 1986, (Fr.), *G. Herrera 57* (MO!); 3 miles north of San

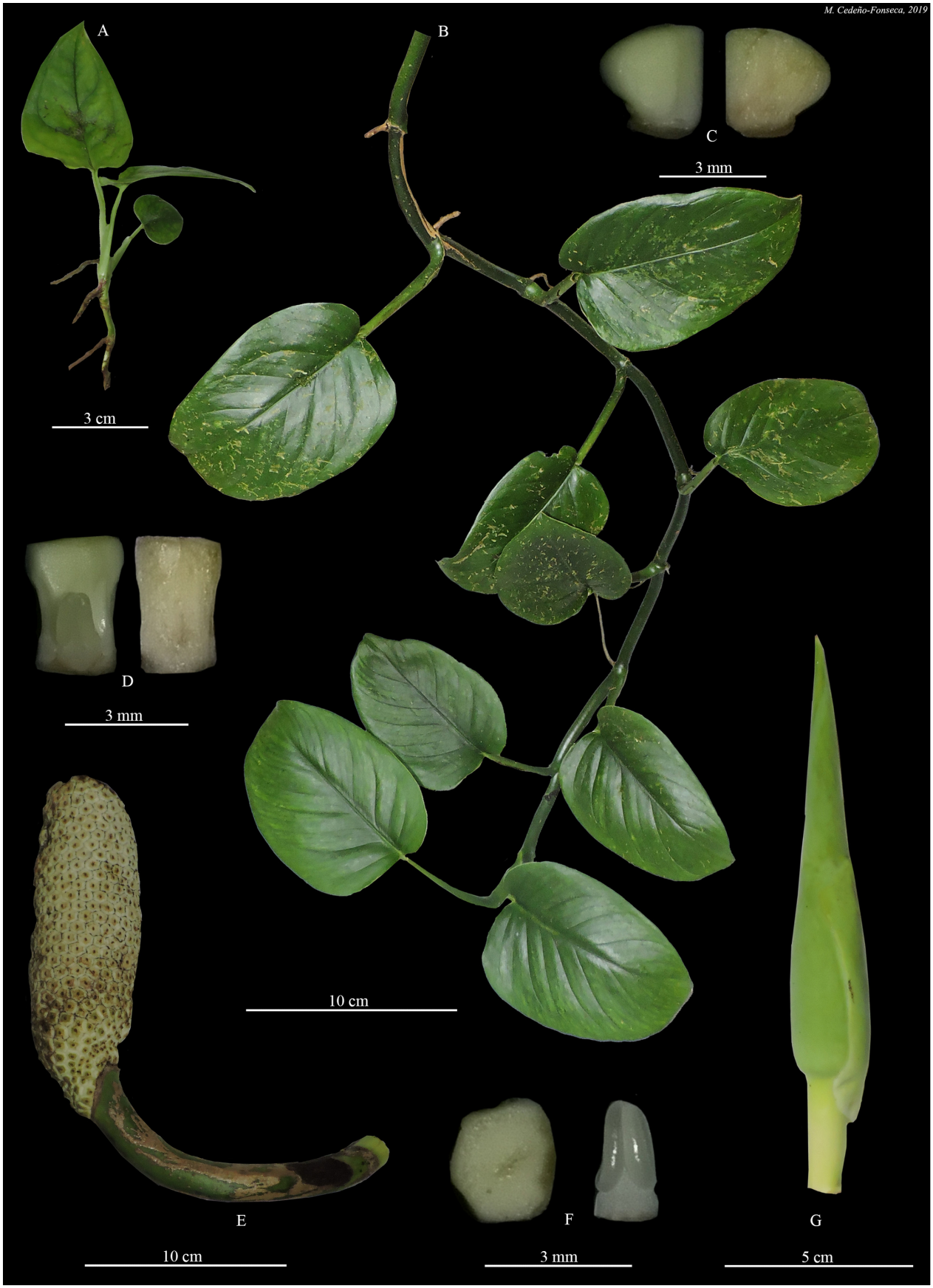

FIGURE 83. *Monstera tarrazuensis* from Tarrazú, Costa Rica. (A) Seedling. (B) Adult plant. (C) Sterile flower; in lateral view (left), and longitudinal section (right). (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Immature infructescence. (F) Stylar plate with stigma (left) and one stamen (right). (G) Developing inflorescence. *M. Cedeño 1686* (USJ). Image from Cedeño-Fonseca *et al.* (2020a).



FIGURE 84. *Monstera tarrazuensis* from Tarrazú, Costa Rica. (A, B) adult plants in their natural habitat, with hanging stems at the edge of the forest. (C) hanging stem with erect inflorescence (arrow). (D) hanging stem with erect infructescence (arrow). *M. Cedeño 1686* (USJ). Image from Cedeño-Fonseca *et al.* (2020a).

Miguel, 380 m, 26 Mayo 1976, (Infer.), *T.B. Croat 35644* (MO!); **Cartago:** Paraíso, Cachí, Remnant trees near Río Naranjo, 3 km E of Cachí, 1300 m, 20 April 1969, (Fr.), *R. Lent 1589* (CR!); Turrialba. Peralta. (Tres Equis), 450 m, 15 April 1935, (Fr.), *F. Solís 237* (CR!); Turrialba, La Suiza, Jardín Botánico Carlos Lankester, 6 km al este de la ciudad de Cartago, 1370 m, 22 October 1994, (Infer.), *A. Quesada 21* (CR!); Turrialba, Santa Cruz, Sobre ríos Guayabo, Lajitas y monumento, Crece a orillas de las quebradas, 1100 m, 27 June 1992, (Fr.), *G. Rivera et al. 1888* (CR!); Turrialba, Turrialba, CATIE, Confluencia del Rìo Tuis y el Rìo Reventazòn, 580 m, 15 June 1994, (Fr.), *G. Herrera 7157* (CR!); Turrialba, Along road between Juan Viñas and Turrialba, 1 July 1976, (Fr.), *T.B. Croat 36838* (MO!); Cartago, Wooded slope along the Río Sombrero just outside of El Muñeco, 1300 m, 25 June 1972, (Fr.), *J. Luteyn 3240* (MO!); Cartago, Dulce Nombre, Jardín Botánico Lankester, 1360 m, 26 September 2015, (Fr.), *M. Cedeño & M. Blanco 835* (USJ!); **Guanacaste:** Liberia, Mayorga, P.N. Guanacaste, Estación Mengo, Sendero al potrero, lado sur, 1100 m, 15 July 1989, (Fr.), *INBio 185* (CR!, MO!); Bagaces, Mogote, P.N. Rincón de la Vieja, Sendero a San Jorge, límite este, Cabecera de Quebrada Tapezco, 770 m, 12 June 1991, (Fr.), *G. Rivera 1365* (CR!); Bagaces, La Fortuna, Z. P. Miravalles, Cuenca del Tempisque, Zona Protectora Volcan Miravalles, 900 m, 24 May 1997, (Fr.), *F. Alvarado et al. 187* (CR!); Liberia, Mayorga, Sector Cacao hacia la Estación 2.5 Km después del río Góngora, en bosque remanente, 900 m, 1 May 2000, (Fl.), *L. Acosta 1100* (CR!); Liberia, Mayorga, Estacion Cacao, Sendero Pedregal, Bosque primario, 1100

m, 10 February 1995, (Fl.), *B. Gamboa 63* (CR!, MO!); Parque Nacional Rincón de la Vieja, 900–1200 m, 27 January 1983, (Fl.), *G. Davidse 23387* (MO!); **Heredia:** Sarapiquí, Near Puerto Viejo along road near the Río Sucio, 20 m, 27 May 1976, (Infer.), *T.B. Croat 35712* (MO!); Sarapiquí, La Selva Field Station, 100 m, 3 January 1978, (Infer.), *T.B. Croat 44229* (MO!); La Selva Biological Station, 100 m, 16 June 1984, (Fr.), *B. Jacobs 2370* (MO!); Along road between San Jose and Puerto Viejo, 100 m, 1 October 1987, (Infer.), *T.B. Croat 68380* (MO!); La Selva Biological Station, 100 m, 9 July 1984, (Fr.), *B. Jacobs 2770* (MO!); **Limón:** Pacuarito, Banana and cacao plantations on level areas between Siquirres and the Río Pacuare, and remnant forest on steep hills south of the railroad bridge over the río Pacuare, 80 m, 20 December 1969, (Fl.), *W. Burger & R. Liesner 6955* (CR!, MO!); Along highway 32 near Río Madre, ca.1 miles southwest of Limón, 10 m, 13 August 1977, (Fr.), *T.B. Croat 43306* (CR!, MO!); Pococí, Colorado, P.N. Tortuguero, Estación Agua Fría, 4 km al Norte siguiendo el cauce del Río Agua Fría hasta la unión con el Río Tortuguero, Bosque perturbado, 40 m, 15 March 1988, (Infer.), *R. Robles 1733* (CR!, MO!); Pococí, Guapiles, Bosque Lluvioso, alrededores de la casa, bordes de bosque, 350 m, 18 August 2005, (Infer.), *L. Acosta 3566* (CR!); Talamanca, 7 km SW of Bribrí, 100–250 m, 4 May 1983, (Fl.), *L. Gómez 20317* (CR!, MO!); 20 mi SE of Limón on road to Punta Cahuita, 0 m, 11 August 1977, (Infer.), *T.B. Croat 43171* (MO!); Siquirres, 2 miles NW of Río Siquirres on Highway 32 from Limón to Turrialba, 200 m, 11 August 1977, (Infer.), *T.B. Croat 43160* (MO!); Along road from Río Frio to Limón, 360 m, 2 October 1987, (Infer.), *T.B. Croat 68425* (MO!); 20 mi SE of Limón on road to Punta Cahuita, 0 m, 11 August 1977, (Infer.), *T.B. Croat 43173* (MO!); **Puntarenas:** Buenos Aires, Biolley, P.I. La Amistad, Cordillera de Talamanca, area around Río Canasta, 9.5 airline km NW of Agua Caliente, between Cerro Frantzius and Cerro Pittier, 1550 m, 6 September 1984, (Fr.), *G. Davidse et al. 28393* (CR!, MO!); Buenos Aires, Biolley, P.I. La Amistad, Estación Altamira, cerro Biollley, Cuenca Térraba-Sierpe, 1766 m, 1 June 1996, (Fr.), *J. Quesada 1623* (CR!, MO!); Coto Brus, Pittier, Pittier, Santa María, Sobre sendero al Río Canasta, 1700 m, 30 July 2000, (Fr.), *L. Acosta 2352* (CR!); Coto Brus, Pittier, Estacion Pittier, Sendero Altamira, 1650 m, 28 January 1995, (Fr.), *M. Chinchilla 7* (CR!); Buenos Aires, Potrero Grande, Buenos Aires, Potrero Grande, La Lucha, Punto 8, Bosque denso 5–25 m DAP 30–90 cm; Predominio de Hampea appendiculata, Cecropia sp, Ruagea glabra, Lauraceae y helechos arborescentes, 1400 m, 20 February 2008, (Fr.), *D. Santamaría 7027* (CR!); Vicinity of San Vito de Java, Disturbed primary forest, 4000 f, 28 February 1976, (Fr.), *T.B. Croat 32902* (MO!); Corredores, En el camino que va desde La Estación Biolgógica Las Cruces hasta el Río Jaba, 1170 m, 16 June 2003, (Infer.), *R. Moran 6481* (MO!); Coto Brus. Finca Las Cruces, 5000 f, 17 March 1969, (Fr.), *W. Stevens 233* (MO!); Coto Brus, San Vito, Estación Biológica Las Cruces, 1200 m, 2 May 2015, (Infer.), *M. Cedeño 781* (USJ!); Comunidad de Monteverde, En arbol en potrero abierto, 1450 m, 26 June 1977, (Fl.), *V. Dryer 1535* (CR!); **San José:** Turrubares, Carara, P.N. Carara, Cuenca del Río Grande de Tárcoles, Ridges W of Río del Sur (E foothills of Montañas Jamaica), bet. Carara and El Sur, 280 m, 3 April 1993, (Infer.), *M.H. Grayum 10446* (CR!, MO!); Perez Zeledon, About 1 mile beyond divide between San Isidro del General and coastal town of Dominical, 900 m, 22 May 1976, (Infr.), *T.B. Croat 35320* (MO!). PANAMA. **Bocas del Toro:** Caribbean slopes of Cerro Fábrega at foot of 'Falso Fábrega' in Palo Seco Reserve, second northernmost tributary (on map) of Culubre river: Pavón Camp, 09°09'54"N 082°40'45"W, 980 m, 20 March 2005, *A. Monro & S. Cafferty 4800* (BM, PMA); Changuinola, Dos Bocas, Unión del Changuinola con el Teribe, 09°22'18"N 082°31'54"W, 21 Feb 1980, *M.D. Correa et al. 3536* (MO!, PMA!); Changuinola, Dos Bocas, Unión del Changuinola con el Teribe, 09°22'18"N 082°31'54"W, 21 Feb 1980, *M.D. Correa et al. 3536* (MO!); Approximately 3 km S of Tiger Key. UTM 1,015,00m N; 363,000m E. Moist tropical forest with Hura crepitans and Theobroma cacao, 09°11'24"N 082°14'24"W - 09°11'25"N 082°14'54"W, 0–30 m, 25 Feb 1989, *P.M. Peterson & C.R. Annable 7127* (US!); Approximately 3 km S of Tiger Key. UTM 1,015,00m N; 363,000m E. Moist tropical forest with Hura crepitans and Theobroma cacao, 09°11'24"N 082°14'24"W - 09°11'25"N 082°14'54"W, 0–30 m, 25 Feb 1989, *P.M. Peterson & C.R. Annable 7127* (MO!); Along road between Almirante and Ojo de Agua 3–6 km W of Almirante. Disturbed vegetation along road, 09°18'24"N 082°26'48"W, 30–300 m, 4 Aug 1976, *T.B. Croat 38209* (MO!); Station Milla 7.5 on Changuinola-Almirante Railroad, along a slender ridge to World War II communications facility, ca. 2 km NW of ruins of U.S. Army Military barracks, 09°21'54"N 082°27'12"W, 0–100 m, 03 August 1976, *T.B. Croat 38090* (MO!); **Chiriquí:** Near Cerro Colorado, c. 3.5 miles along road from Chami [Chame] Camp. [Coordinates on original label: 8º35'N, 81º45W], 08°28'57"N 081°45'56"W, 1350 m, 17 April 1986, *G. McPherson 9004* (MO!); "Ojo de Agua", property of Ratidon Hartmann, vicinity of Santa Clara (between Volcán and Río Sereno), 08°51'N 082°45'W, 1520 m, 17 June 1987, *T.B. Croat 66292* (B, K, MO, NY, US); Along road in vicinity of branch in road to Cerro Colorado and Escopeta, above Río San Félix near town of San Felix (ca. 13 miles N of Río San Félix bridge), 08°27'N 081°47'W, 800–1200 m, 15 March 1976, *T.B. Croat 33460* (MO!); Cerro Colorado, along road above San Félix, 29 km above bridge over Río San Félix (7.9 km above turnoff to Escopeta), 08°32'07"N 081°49'11"W, 1500 m, 14 July 1976, *T.B. Croat 37097* (MO!); Along road from Volcán to Río Serano, ca. 12 km from Escuela San Benito in Volcán, 08°49'48"N 082°42'30"W, 1200 m, 8 Aug



FIGURE 85. *Monstera tenuis* from Turrialba, Costa Rica. (A) Adult individual. (B) Inflorescence in male phase with the spathe opening by longitudinal tearing. (C) Adult plant with inflorescence. (D) Juvenile plant. (E) Abaxial side of lobes of the adult lamina each with a prominent central primary vein and a basally converging secondary vein on each side. Turrialba, Cartago (no collected). Image from Cedeño-Fonseca *et al.* (2022).

1974, *T.B. Croat 26495* (MO!); Cerro Colorado, above San Félix along mining road 18–27 miles off of Pan-American Highway (above Chame or turn-off to Escopeta), 08°32'N 081°49'W, 1200–1500 m, 12 March 1976, *T.B. Croat 33073* (MO!); Fortuna-Chiriqui Grande, 1.8 mi. NW of center of dam, 08°45'N 082°18'W, 1080 m, 27 Jun 1994, *T.B. Croat & G. Zhu 76499A* (MO!); **Coclé:** La Pintada. Alto Calvario above El Copé, ca. 6 km N of El Copé; Atlantic slope, along trail which leads W off old lumber trail which leads down to Las Ricas, Limón and San Juan, 08°40'41"N

080°35’47”W - 08°41’04”N 080°35’50”W, 710–800 m, 22 June 1988, *T.B. Croat 68749* (MO!); **Darién:** Cerro Sapo; ca. 5 km south of Garachiné; along ridge at north approach to cerro, 07°59’N 078°25’W, 600–800 m, 23 March 1986, *B.E. Hammel et al. 14858* (MO!); **Panamá:** Chepo. El Llano-Cartí road, 8.4 mi beyond the highway, 09°16’55”N 078°55’55”W, 500 m, 5 Dec 1979, *T.B. Croat 49133* (MO!).

50. ***Monstera titanum*** Croat, M.Cedeño & O.Ortiz, Webbia 76(2): 275–278. 2021. (Figs. 86, 87)

Type:—PANAMA. Panamá, Antón, El Valle. Valle de Antón, camino a Altos del María, 1030 m, 26 Mar. 2021, M. *Cedeño, O. Ortíz, J.E Jiménez & M. Mittermeier 2385* (holotype PMA!, isotype USJ!, MO!).

Robust to very robust nomadic vine, appressed-climbing habit. SEEDLINGS: bearing foliose leaves. JUVENILE PLANTS: root climbers; **stems** smooth, dark or light green, sometimes with white dots, cylindrical; **internodes** 5–15 cm long, 0.5–1.0 cm diam.; **petiole** distinct, dark or light green, sometimes with white dots, smooth, 10–25 cm long, sheathed to base of the geniculum; **petiole sheath** slightly persistent or completely deciduous; **leaf blades** with collective veins visible, obovate, subcordate to truncate at base, acuminate at apex, thinly coriaceous, 10–20 × 8–13 cm, not appressed to the phorophyte, **fenestrations** absent or present, arranged on both sides of the midrib and in a single row of small ellipsoid perforations, 2.0–2.7 mm long. ADULT PLANTS: root climbers; **stems** light or dark green, white-spotted, smooth or slightly verrucose, cylindrical; **internodes** 1.5–3.0 cm long, 2–10 cm diam., 0.3–0.7 times as long as wide; **anchor roots** black; **feeder roots** black; **petiole** light green, white-spotted, smooth or verrucose at base, 50–95 cm long, sheathed to base of the geniculum or 15 cm before; **petiole sheath** slightly persistent; geniculum smooth, sunken adaxially, convex abaxially, 2.0–4.5 cm long; **leaf blades** narrowly ovate-elliptic, subcordate at base, acuminate at apex, subcoriaceous to coriaceous, drying dark brown and semiglossy adaxially, greenish yellow to brown abaxially, 47–100 × 28–35 cm, 1.6–1.7 times longer than wide, decurrent on geniculum (decurrent portion 1–2 mm wide); **midrib** flattened adaxially, convex abaxially, drying reddish, light brown or black on both surfaces; **primary lateral veins** 20–40 per side, strongly sunken adaxially and prominent abaxially, departing midrib at 75–95°, drying reddish, black or light brown; **secondary veins** parallel and reticulate toward the margin, undulate when dry; **collective veins** prominent; **fenestrations** absent or present in two or three rows, the first row along the midrib, with small perforations of 0.5–5.5 × 0.5–3.5 cm, the second and third rows near the margins, with larger perforations of 9.0–14.5 × 1.7–3.0 cm; **margins** entire. INFLORESCENCES on ascending stems, very large; **peduncle** smooth, 25–48 cm long; **spathe** acuminate, coriaceous, completely open, light green during development, creamy or white externally and white or creamy internally at anthesis, 16.5–47.0 × 10–20 cm, up to 10 cm longer than the spadix; **spadix** cream at anthesis, 18–24 cm long, 2.5–6.0 cm diam., 5.5–7.3 longer than wide; **basal sterile flowers** 4–5 mm long; **fertile flowers** 7–9 mm long; stamens 3–8 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary rectangular in longitudinal section, ribbed, 5–6 × 2–3 mm; style hexagonal, 4–5 × 2.5–3.0 mm; stigmatophore slightly conical, 1.5–2.0 mm long; stigma circular; **berries** with a creamy stylar cap during development, ripe berries color unknown; **seeds** unknown.

Distribution and ecology:—*Monstera titanum* is endemic to Panama, where it is known from the type locality on Altos del Maria, Valle of Anton, and the border of Chiriquí and Bocas del Toro Provinces (Fortuna), at 1450–1480 m elevation in *Premontane rain forest* life zones.

Phenology:—Flowering in January, March and November. Fruiting in March, June and November.

Discussion:—The species, a member of sect. *Monstera*, is characterized by its juvenile plants with narrowly ovate, often perforated leaves and adult plants growing as nomadic vines with an appressed-climbing habit, stems with short internodes, densely speckled, fully sheathed petioles with a sharply sulcate geniculum, large, narrowly ovate-elliptic, subcordate leaf blades with two rows of small elliptic fenestrations on both sides and drying pale greenish yellow-brown on the lower surface. The inflorescence is remarkable for its extraordinary size, with the peduncle and whitish, long acuminate spathe each up to almost half a meter long in very robust individuals. The spadix was often found eaten by beetles but with the spathe still intact. This is unusual as typically the spathes are much more ephemeral than the spadices. *Monstera titanum* is similar to *M. alfaroi* (Cedeño *et al.* 2020e), but differs in having smooth, light green and white-spotted petioles (vs. black-warty, light green and light brown petioles), cordate leaf-blades (vs. rounded at base), and smooth (vs. warty) peduncles (Cedeño-Fonseca *et al.* 2022).

The populations of *M. titanum* from Fortuna need more widespread fieldwork in order to document the inflorescence, spathe and shape of the flowers. Only once has it been possible to collect this species in Fortuna with infructescence. This was during fieldwork in 2018. We never saw the inflorescence in development or anthesis, but the leaves and the stems are very similar to the population from Valle de Antón.

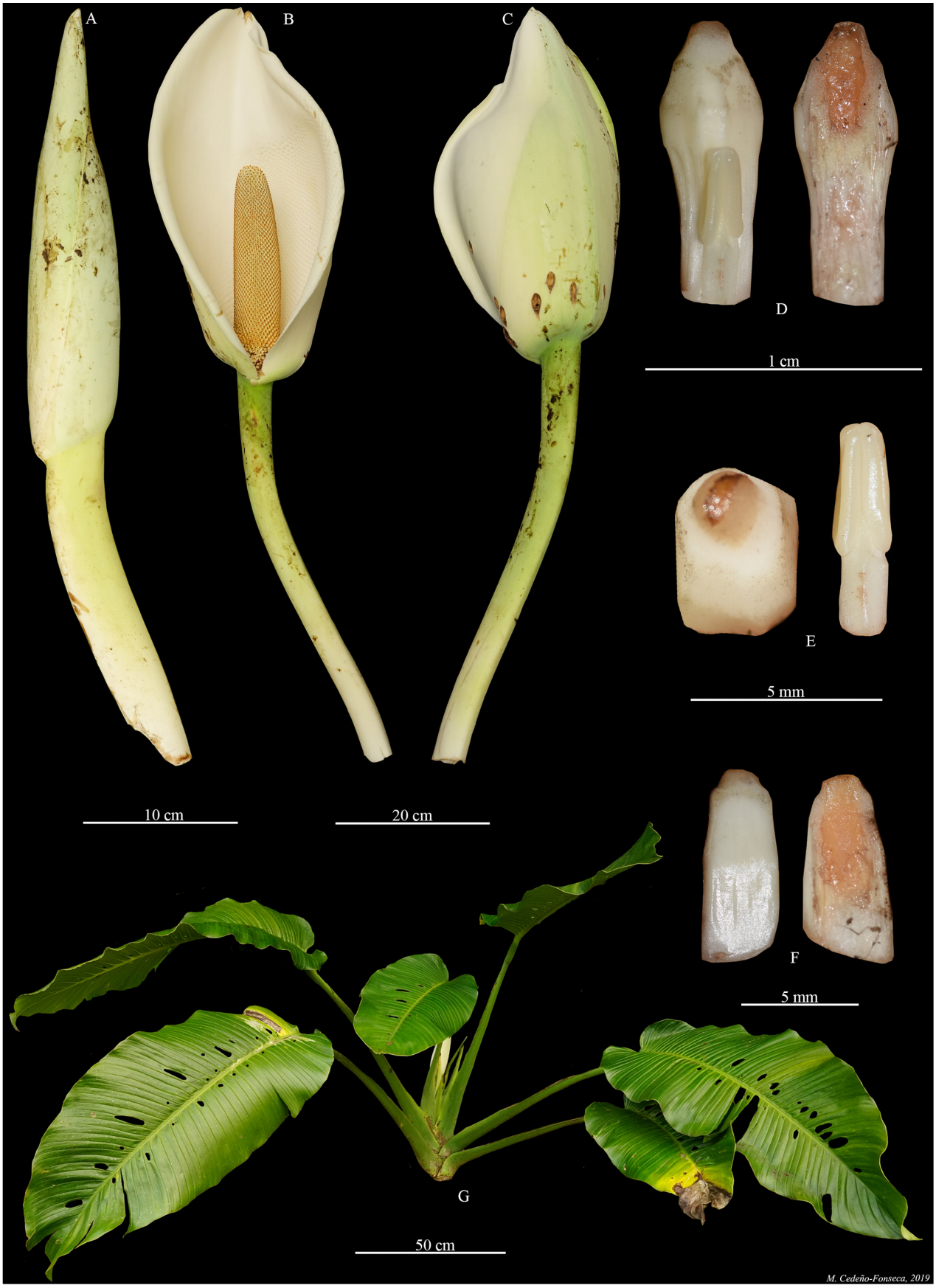

FIGURE 86. *Monstera titanum* from Panama. (A) Developing inflorescence. (B & C) Front and back views of open inflorescence. (D) Fertile flower in lateral view (left) and longitudinal section (right). (E) Stylar plate top view (left), and individual stamen (right). (F) Sterile flower in lateral view (left) and longitudinal section (right). (G) Adult plant. *M. Cedeño et al. 2385* (PMA). Image from Cedeño-Fonseca *et al.* (2020b).



FIGURE 87. *Monstera titanum* from Panama. Adult plant growing in the locality type. *M. Cedeño et al. 2385* (PMA). Image from Cedeño-Fonseca *et al.* (2020b).

Additional specimens examined:—PANAMA. **Bocas del Toro:** Cerro Colorado, 9.2 miles W of Chamé; along trail E of road which leads down to stream, 1450–1480 m, *T.B. Croat 69033* (MO!); Cerro Colorado, along road between Río San Felix and mining exploration camp, 7 mi W of Chamé, along trail through Guaymí village, 1500 m, *T.B. Croat 69190* (MO!); Bocas del Toro–Chiriquí border, Fortuna Dam region, along continental divide trail, 1200 m, *G. McPherson 13548* (G, MO, NY); **Chiriquí:** Cerro Colorado, along mining road, 31.6 km beyond bridge over Río San Félix (10.6 km beyond turnoff to Escopeta), 1690 m, *T.B. Croat 37178* (MO!); Fortuna , Hornito, Along the road to the Fortuna Dam site, N of Gualaca, 22.7 mi beyond the bridge over the Río Estí, 11.8 mi N of Los Planes de Hornito, 10.7 mi N of jct. to tunnel, 1400 m, *T.B. Croat 48691* (MO!); Along road between Fortuna Lake and Chiriquí Grande; 4.5–5 km N of dam over Fortuna Lake, 1100–1135 m, *T.B. Croat 60003* (MO!); Cerro Colorado, along road to old copper mine development N of San Félix, 18.6 mi N of bridge over river near San Félix, 6.6 mi beyond Chamé and road to Escopeta, 1475–1485 m, *T.B. Croat 75008* (MO!); Cerro Colorado, along road to copper mine development N of San Félix, 20.5 mi N of the bridge near San Félix, 8.3 mi beyond Chamé and turnoff to Escopeta, 1630 m, *T.B. Croat 75026* (MO!); Gualaca, Reserva Forestal Fortuna. División Continental, 1154 m, *O. Ortiz et al. 1809* (MO!, PMA!); Gualaca, Corregimiento Hornito, Reserva Forestal Fortuna, senderos cerca al centro de investigaciones Jorge L. Arauz, 1200–1500 m, *A. Zuluaga 914* (PMA!, MO!, WIS!); Ngäbe-Buglé (Bocas del Toro): Cerro Colorado, 9.2 mi W of Chamé, along trail E of road which leads down to a stream, 1450–1480 m, 6 Jul 1988, *T.B. Croat 69012* (MO!, PMA!); Chiriquí, Gualaca, Hornito. Fortuna, camino a Chiriquí Grande, 1230 m, *M. Cedeño et al. 2329* (PAM, USJ).

51. ***Monstera tuberculata*** Lundell, *Lloydia* 2: 78, t. 1. 1939. (Figs. 88, 89)

Type:—BELIZE. El Cayo District, Valentin, June 1936, *C.L. Lundell 6238* (holotype MICH-MICH1115586!, isotype GH!).

Nomadic vine, pendent habit. SEEDLINGS: filiform. JUVENILE PLANTS: root climbers; **stems** light-green to dark, smooth, flattened; **internodes** 3–6 cm long, 3–5 mm diam.; **petiole** not visible, dark green, smooth, 3–6 cm long; **blades** obovate or orbicular, subcordate to truncate at base, acuminate at apex, coriaceous, variegated, 5–10 × 4–9 cm, appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** dark-green to light-green, smooth, cylindrical or dorsoventrally compressed and slightly sulcate on one side, with caducous epidermis; **internodes** 5–15 cm long, 1–2 cm diam., 5.0–7.5 times longer than wide; **anchor roots** dark-brown; **feeder roots** corky; **petiole** light or dark-green, smooth, 2–6 cm long, sheathed to base of the geniculum, the sheath apically prolonged in a free ligule, 3–6 cm long; **petiole sheath** dry-persistent for several days, leaving fibrous residues; geniculum smooth, flattened adaxially, convex abaxially, 5–10 mm long; **blades** ovate, cordulate to cordate at base, obtuse to short-acuminate at apex, coriaceous, drying blackish, yellowish or grayish, 5.5–20.0 × 4–12 cm, 1.4–1.9 times longer than wide, not decurrent on the geniculum; **midrib** convex on both surfaces, drying blackish abaxially, **primary lateral veins** 4–7 per side, obscure adaxially, prominent abaxially, drying yellowish or blackish; **secondary veins** reticulate and prominent, wavy throughout its length when dry; **collective veins** slightly visible; **fenestrations** absent or rarely present; **margins** entire. INFLORESCENCES on pendent stems, 1–10 simultaneously at flowering time, arranged in the leaf axils; **peduncle** smooth, 2–5 cm long, 2–6 mm diam.; **spathe** acuminate to long-acuminate, green externally during development, yellowish green or creamy white externally and white internally at anthesis, marcescent or deciduous after anthesis, 7–10 × 6–8 cm, up to 3 cm longer than the spadix; **spadix** white during development, yellow at anthesis, 4–7 cm long, 1.5–3.5 cm diam.; **basal sterile flowers** 4–6 mm long, with a yellowish stigmatic secretion; **fertile flowers** 5–9 mm long; stamens 1–5 mm long, with laminar filaments; anthers 1.5–2.0 mm long; ovary acute at base, ribbed, 3–5 × 2–3 mm; style pentagonal or hexagonal, 5–6 × 3.5–5.0 mm; stigmaphore thickly conical and recurved, 3–6 mm long; stigma linear, with a rusty red stigmatic secretion; **berries** with a yellowish-green stylar cap during development, mature stylar cap dark-green; pulp white; **seeds** brown with white dots, oblong, 6–9 mm long.

Distribution and ecology:—From México (Oaxaca) to West of Panamá, at 0–1100 m. It lives in *Tropical moist forest* and *Tropical wet forest* life zones; primary and secondary forest.

Phenology:—Flowering has been recorded in February, April, June-July and November. Fruit in May-August.

Discussion:—The species, a member of sect. *Echinospadix*, is characterized by its silvery blotched juvenile leaves, appressed-climbing high growing adult plants with the flowering branches pendent, elongated internodes, short petioles with a ligule that may extend beyond base of the blade, the broadly ovate, usually subcordate acuminate blades with a short peduncle, spathe about as broad as long and white cylindroid spadix.

The two areas have two distinct varieties: *Monstera tuberculata* var. *tuberculata* in Mexico and Guatemala is known from elevations of 50–150 m and *M. tuberculata* var. *brevinoda* in Nicaragua to Panama ranges from 0–150 m. *Monstera tuberculata* var. *tuberculata* in Belize (*Brewer 7635,* MO), have adult leaf blades with abundant impressed

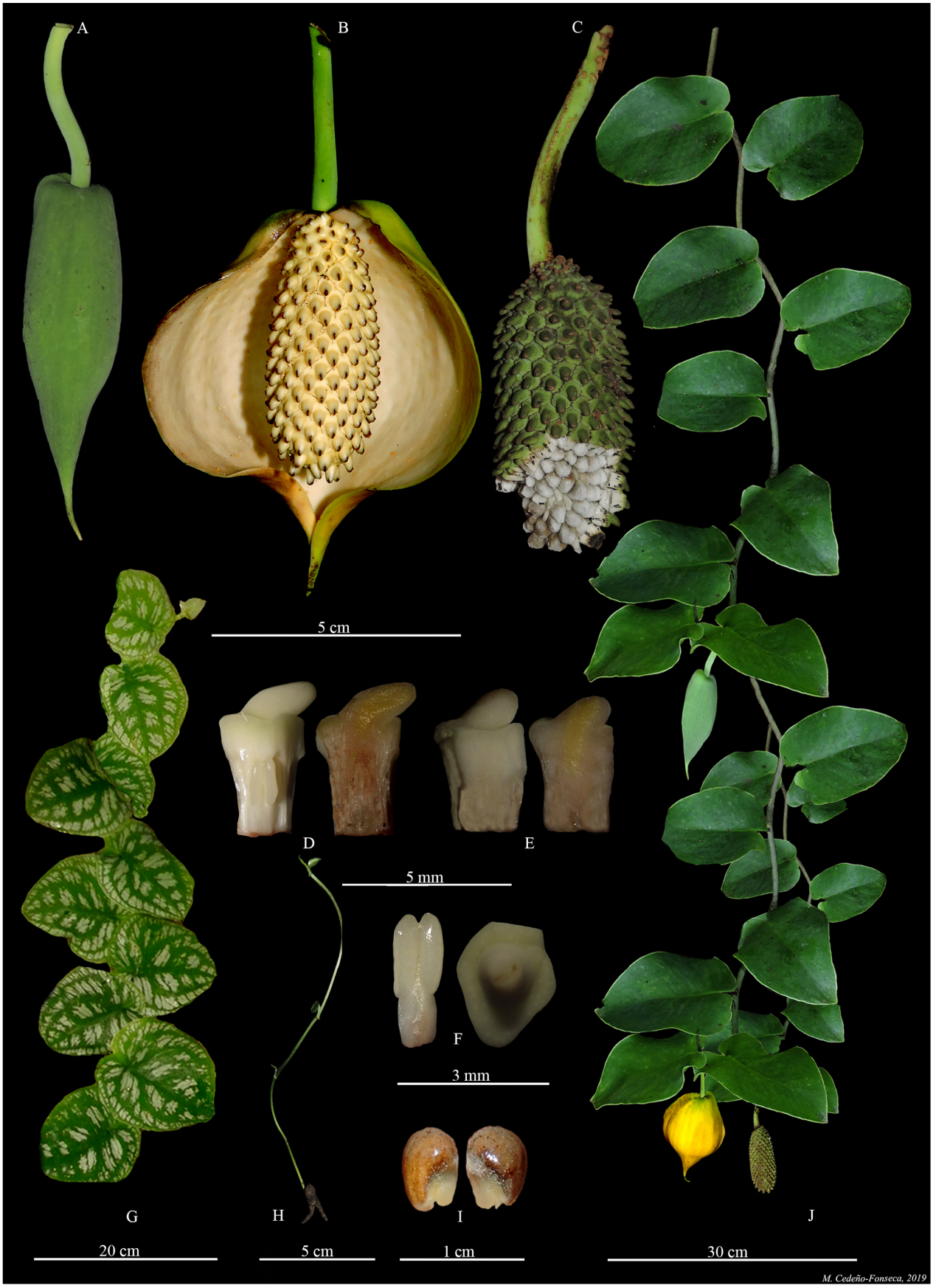

FIGURE 88. *Monstera tuberculata* from Sarapiquí, Costa Rica. (A) Developing inflorescence. (B) Inflorescence with open spathe, front view. (C) Mature infructescence, stylar plates detaching. (D) Fertile flower; in lateral view (left), and longitudinal section (right). (E) Sterile flower; in lateral view (left) and in longitudinal section (right). (F) Stylar plate with stigma (right) and one stamen (left). (G) Juvenile plant. (H) Seedling. (I) Seeds. (J) Adult plant. *M. Cedeño et al. 874* (USJ). Image from Cedeño-Fonseca *et al.* (2022).



FIGURE 89. *Monstera tuberculata* from Veracruz, Mexico. *Monstera tuberculata* var. *tuberculata* in Mexico with fenestrations in the blade. *P. Diaz-Jiménez et al. 1456* (HEM).

glands on the underside, and in Mexico, in the region of Veracruz (*Ceja et al. 1881*, XAL) they present leaves with a few fenestrations, a characteristic never observed in the populations of Costa Rica and Panama (Cedeño-Fonseca *et al.* 2022).

Additional specimens examined:—MEXICO. **Campeche:** Calakmul. A 86 km al S de Ejido Constitución, 17°51'00"N 090°05'26"W, 218 m, 28 mayo 1998, *E.M. Martínez et al. 30976* (MO!); **Chiapas:** Tropical rain forest remnant along Rio Pichucalco, richly hanging with lianas and epipytic bromeliads and orchids, 3 km NE of Pichucalco on road to Villahermosa, 17°32'N 093°04'W, 200 m, 2 Jul 1969, *B. Marcks & C. Marcks 906* (MO!); Ocosingo. Límite entre la comunidad Lacandona y el monumento Bonampak, 16°43'32"N 091°04'38"W, 326 m, 10 agosto 2002, *G. Águilar et al. 2036* (MEXU!, MO!); Zona urbana a 1.46 km del centro de Frontera Corozal al SO, 16°48'12"N 090°53'27"W, 123 m, 02 junio 2004, *G. Águilar et al. 10390* (MEXU!, MO!); Entrada de Velasco Viejo a 4 km de la carretera, 16°58'12"N 091°13'48"W, 449–461 m, 30 marzo 2002, *G. Águilar et al. 399* (MEXU!, MO!); Rapids on Río Santo Domingo at Santo Domingo. Forested river bank, 17°01'58"N 091°24'53"W, 490 m, 13 May 1982, *G. Davidse et al. 20456* (MO!); Ostuacán. Two mi S of Chiapas border along highway 195. Disturbed area beside stream, 17°33'03"N 092°59'47"W, 80 m, 3 Jul 1977, *T.B. Croat 40085* (MO!); Pichucalco. Along stream 10 km NE of Pichucalco, 17°32'56"N 093°03'39"W, 150 m, 10 May 1973, *D.E. Breedlove 35047* (MO!); Along stream 11 km ENE of Pichucalco, 17°33'36"N 093°03'00"W, 100 m, 5 Oct 1980, *D.E. Breedlove 45904* (CAS); **Oaxaca:** Mpio. Sta María Chimalapa: cafetales cerca de Sta. María; cefetales con Vochysia, Andira galeottiana, Termninalia, Enterolobium schomburgkii, Cassia moschata, Hymeneae, Apeiba, Guazuma, Didymopanax, Inga, Mosquitoxylum; suelos profundos, pendientes ligeras o fuertes, 16°55'N 094°40'W, 300 m, 6 May 1985, *H. Hernández 1156* (MO!); Uxpanapa Region, along gravel road E of Sarabia on road to Uxpanapa, 4.2 mi NE of Río Corte. On and around karst limestone formations along road. Veg. type: "selva alta perennifolia", 17°09'N 095°49'W, 90 m, 18 Jan 1987, *T.B. Croat & D.P. Hannon 63189* (MO!); **Tabasco:** Tacotalpa. Cerro del Madrigal, Km 7 (4.2 mi) de la estación Tacotalpa hacia Tapijulapa, 17°30'00"N 092°48'36"W, 90 m, 17 Jun 1983, *C.P. Cowan et al. 3950* (MO!); **Veracruz:** Veracruz: San Andrés Tuxtla, EBT, camino a Laguna escondida, 18°35'02"N 095°04'38"W, 78 m, 06 March 2020, *P. Díaz-Jiménez et al. 1456* (HEM!); Playa Escondida, 28 km NE of Catemaco, 18°34'12"N 095°03'36"W, 50 m, Aug 1972, *M. Madison 631* (SEL!); 4 km NE of Minatitlan, 18°01'12"N 094°32'24"W, 50 m, Aug 1958, *R. King 1114* (MICH, US); Estacion de biologia tropical Los Tuxtlas; selva alta perennifolia; bejuce Herbaceo, sobre Coussapoa purpusii. Inflorescencia verdosa. "Telefono", 18°34'N 095°44'W - 18°36'N 095°09'W, 450 m, 18 July 1985, *S. Sinaca 143* (MO!, UMO); Entrance road to Playa Escondida near jct. with road between Santecomapan and Montepio, 18°33'36"N 095°03'36"W, 10–15 m, 25 Jul 1978, *T. Cochrane et al. 8626* (MO!); Along road between Catemaco and Montepio, 15 km E of junction to Tebanca, Coyame and Nanciyaga, 18°29'50"N 095°02'31"W, 133 m, 6 Mar 2008, *T.B. Croat & P. Díaz Jiménez 100323* (MO!); Catemaco. Vic. of Playa Escondida, 10 km N of Sontecomapan. Selva Alta Perennifolia. Evergreen tropical forest, some cleared for pastures, on slopes around and above Hotel Playa Escondida and the beach on the Gulf of Mexico, 18°35'24"N 095°03'00"W, 0–150 m, 30 Jun 1982, *M. Nee 24740* (F!, MO!, XAL!); Minatitlán. 2 km N of Uxpanapa on road (Pob. 12) en camino al Pob. 13; arroyo pedregoso en selva de Dialium, Terminalia, Brosimum, Cynometra, Lonchocarpus spp, 17°12'36"N 094°12'36"W, 150 m, 7 Jul 1985, *T. Wendt et al. 4886* (MO!); San Andrés Tuxtla. Estación de Biología Tropical "Los Tuxtlas, Cerro Vigía 5, Lote 67. Selva alta perennifolia, 18°34'N 095°04'W, 450 m, 12 Apr 2005, *Thorsten Krömer 1921* (MO!); Balzapote, Parcela Escolar, Ejido Balzapote. Plantación de citricos, 18°36'N 095°04'W, 60 m, 4 Aug 2005, *T. Krömer et al. 2461* (MO!); Soteapan. Mirador Pilapa, *M. Vázquez T. 3448*. BELIZE. **Cayo:** Valentin, 16°45'59"N 089°09'45"W, 2 Jul 1936, *C.L. Lundell 6337* (LL!); Valentin, British Honduras, 16°45'59"N 089°09'45"W, June 1936 - August 1936, *C.L. Lundell 6238* (MO!); **Stann Creek:** Watershed of the Cocoa Branch of the Sittee River. Sittee River Forest Reserve, 16°50'57"N 088°34'14"W, 300 m, 10 March 2016, *S.W. Brewer & M. Paredes 7635* (BRH, MEXU, MO); **Toledo:** Vicinity of San Antonio, 16°14'N 088°59'W, 14 Jan 1946, *P.H. Gentle 5484* (LL!). GUATEMALA. **Alta Verapaz:** Sebol, 15°48'22"N 089°56'44"W, 21 Apr 1964, *E. Contreras 4453* (LL!); **Izabal:** Collected 2.5 mi. N. of Río Dulce on gravel road to Petén, 15°40'39"N 089°02'20"W, 100 ft, 08 August 1975, *D.B. Dunn & D.G. LeDoux 22029* (MO!, UMO); El Estor. La Llorona, 15°39'18"N 089°10'37"W, 500 m, 23 Aug 1998, *M. Véliz 98.6655* (MO!); **Petén:** Remate Road, 36 km from Tikal, 16°54'10"N 089°46'10"W, 25 Feb 1961, *E. Contreras 1998* (LL!); Ca. 5 miles south of entrance to Tikal National Park, mature forest, 17°02'13"N 089°41'10"W, 19 Jun 1973, *T.B. Croat 24747* (MO!); Dolores. Dolores, 16°30'45"N 089°24'57"W, 5 Sep 1961, *E. Contreras 2855* (LL!); San Luis. San Luis, Km 51 of road, 16°11'59"N 089°26'31"W, 400 m, 10 Jul 1959, *C.L. Lundell 16280* (LL!). NICARAGUA. **Atlántico Sur:** Municipio de Nueva Guinea, Reserva Indio-Maiz, Río Pijibaye entre el Caño Bijagua y el Cerro Chiripa, 11°22'N 084°01'W, 200–350 m, 15 enero 1999, *R.M. Rueda et al. 10227* (MO!); **Río San Juan:** La Lupe, ca. 25 km ENE of Boca de Sabalo; primary forest lightly logged with silvicultural treatment, clay soils, hilly, 11°08'N 084°21'W, 80–120 m, 28 June 1997 – 2 July 1997, *J. Salick & E. Stijfhoorn 8358* (MO!); La Palma, Río Santa Cruz, 11°02'N 084°25'W, 50 m, 21 marzo 1985, *P.P. Moreno 25492*

(MO!); Municipio de el Castillo, Reserva Indio-Maíz, zona de amortiguamiento, estación biológica La Lupe, 11°08'N 084°21'W, 100–200 m, 15 Marzo 1999, *R.M. Rueda et al. 10371* (HULE, MO); Reserva Indio-Maíz, Municipio de el Castillo, en los alrededores de la desembocadura del Río Bartola, 10°58'N 084°20'W, 30–50 m, 13 Enero 1997, *R.M. Rueda et al. 5667* (MO!, WU!); Municipio de San Carlos, Reserva Esperanza verde, 11°04'N 084°44'W, 60 m, 16 Septiembre 2001, *R.M. Rueda et al. 16548* (HULE, MO); Between Río Santa Cruz and Caño Santa Crucita, La Palma; tall evergreen forest, 11°02'N 084°24'W - 11°04'N 084°26'W, 40–60 m, 30 Nov 1984 – 2 Dec 1984, *W.D. Stevens et al. 23435* (MO!); Municipio El Castillo, Comunidad Las Maravillas 2 km al Oeste, 11°07'15"N 084°21'04"W, 100 m, 25 Abril 2005, *W. Garrido 3917* (HULE, MO). COSTA RICA. **Alajuela:** San Carlos, Pocosol, Azucena, Concho de Cutris, 80 m, 4 April 1991, (Fl., Fr.), *Q. Jiménez et al. 962* (CR!, MO!); Upala, Aguas Claras, P.N. Rincón de la Vieja, Cordillera de Guanacaste, Colonia Blanca, Finca Los Moras, junto a Quebrada Mora, 770 m, 13 June 1991, (Fr.), *G. Rivera 1393* (CR!, MO!); Upala, San José o Pizote, San José, 4 km al Noroeste del pueblo, Laguna Las Camelias, 20 m, 19 April 1988, (Fl.), *G. Herrera 1848* (CR!, MO!); Upala, Aguas Claras, Sector de Rio Aguas Verdes, 2 Km aguas arriba del puente, falda NE del volcan Santa Maria, 600 m, 12 February 1991, (Fl.), *G. Rivera 1052* (CR!); Upala, Prov, Guanacaste-Alajuela, lower montane rainforest, 1500 m, 1 November 1982, (Infer.), *L. Gómez 19175* (MO!); **Cartago:** Turrialba, Along road from Río Pacuare to Grano de Oro on road from Turrialba to Moravia, 600–1200 m, 30 June 1976, (Fr.), *T.B. Croat 36574* (MO!); **Heredia:** Sarapiquí, Las Horquetas, Along Starkey Road", 50 m, 7 August 1979, (Fr.), *W. Stevens 13475* (CR!, MO!); Sarapiquí, La Virgen, S base of Cerros Sardinal, Chilamate de Sarapiquí (N side of Río Sarapiquí), 90 m, 4 July 1985, (Fr.), *M.H. Grayum & B.E. Hammel 5544* (CR!, MO!); Sarapiquí, La Virgen, E.B. La Selva, Estación Biológico, La Selva, Along road leading to the reserve, 100 m, 16 August 1987, (Fr.), *J.F. Smith 475* (CR!); Sarapiquí, Las Horquetas, La Esperanza, orillas de río San José, Finca propiedad de José Rufino Chaves, 168 m, 31 July 2010, (Fr.), *A. Estrada 4624* (CR!); Sarapiquí, La Virgen, P.N. Braulio Carrillo, Estación Biológica Magsasay, Bosque primario y orillas de potreros, Sotobosque, 200 m, 23 June 1990, (Fr.), *E. Alcázar 102* (CR!); Sarapiquí, La Virgen, Estacion Magsasay, Bosque primario y orillas de potreros, 200 m, 23 June 1990, (Fr.), *E. Alcázar 118* (CR!, MO!); Sarapiquí, Puerto Viejo, Sendero Tres ríos y lindero el Peje, 0 m, 11 July 2003, (Fl., Fr.), *R. Kriebel 3618* (CR!); Sarapiquí, Horquetas, Estación Biológica La Selva, 50 m, 24 Junio 2016, (Fr.), *M. Cedeño & M. Blanco 907* (USJ!); Sarapiquí, La Virgen, Reserva Biológica La Tirimbina, 150 m, 16 April 2016, (Fr.), *M. Cedeño & J. Ley 874* (USJ!); **Limón:** Talamanca, Cocles, 12 June 1981, (Infer.), *R. Alfaro & R. Ocampo 27* (CR!); Pococí, Rita, Cariari de Pococí, Palmitas, El Triángulo, Las Brisas, finca de Guillemo Acosta, 30 m, 18 April 1997, (Fl.), *A. Estrada et al. 743* (CR!); Talamanca, Cahuita, Punta de Riel, 4 June 1985, (Infer.), *R. Soto 2128* (CR!); NW 0982, 5 km rd Cahuita Bribri, Sea level, flat land periodically flooded, pasture with shade tres, 1 February 1984, (Infer.), *T. Pennington 11459* (CR!); Talamanca; R.V.S. Gandoca-Manzanillo, Trail between the town of Manzanillo and Punta Mona, Old secondary growth with old cocoa crops by the coast, 10 m, 3 August 1994, (Fr.), *W. Alverson & V. Stilio 2580* (CR!); Siquirres, Pacuarito, Carretera a Siquirres, Entre Siquirres y río Pacuarito, 100 m, 17 November 1994, (Fl.), *V. Nilsson et al. 572* (CR!); Talamanca, Cocles, 12 June 1981, (Fl.), *R. Alfaro & R. Ocampo 26* (CR!); Limón, Río Blanco, Camino a Veragua Rainforest, entre Río Quito y las Brisas, Árboles en potreros, finca de Sr. Antonio Calderón, 118 m, 26 May 2011, (Fr.), *A. Cascante et al. 2295* (CR!); Talamanca, Cahuita, R.V.S. Gandoca-Manzanillo, Sendero entre Manzanillo y Gandoca, Aprox. 1,4 km de la entrada al sendero por el sector de Manzanillo, 10 m, 10 April 2012, (Fl.), *A. Estrada et al. 5324* (CR!); Pococí, Rita, Finca La Suerte, 50 m, 10 July 1995, (Fl.), *R. Aguilar 4206* (CR!, MO!); Talamanca, Sixaola, Cerro Manzanillo, sobre la fila, 100 m, 5 December 1992, (Infer.), *A. Fernandez 477* (CR!); Talamanca, Sixaola, Punta Uva, peñón innominado adyacente a la Quebrada Ernesto, 0 m, 4 May 2001, (Fr.), *J. Morales 7972* (CR!); Talamanca, Sixaola, Sendero a Punta Mona, 74 m, 4 April 2011, (Fr.), *L. Vargas 4350* (CR!); Talamanca, Along the road S of Limón from the corner at the road to Bomba, 0–50 m, 26 February 1985, (Fr.), *C. Taylor 4442* (MO!); Region between Hone Creek and ca. 4–5 km NW on a trail roughly paralleling the Río Carbon (Río Hone), Collection from Cacao and second growth, 60–100 m, 17 January 1974, (Fr.), *J. Utley 659* (MO!); Talamanca, Road between Cahuita and Punto [Puerto] Vargas, 0–5 m, 7 July 1980, (Fr.), *B.E. Hammel 9152* (MO!); Talamanca, Puerto Viejo, 500 m del cruce de Bribri, 40 m, 5 December 2012, (Fl., Fr.), *J. Gómez et al. 15783* (USJ!); Talamanca, Cahuita, Camino detrás de la carretera, Finca La Montaña, 10 m, 11 July 1999, (Fl.), *M. Blanco et al. 997* (USJ!); Talamanca, Cahuita, Bosques de Manzanillo, 50 m, 9 January 2017, (Fl.), *M. Cedeño et al. 1104* (USJ!); Limón, Talamanca, Bribri, Proyecto ARA, 4 m, 30 September 2018, (Fl.), *M. Cedeño et al. 1480* (USJ!). PANAMA. **Bocas del Toro:** 5 km S of Tiger Key on the mainland near Cacao Boquete just N of Enseñada de Bosquete, 09°10'12"N 082°10'24"W – 09°10'24"N 082°14'48"W, 5–110 m, 24 February 1989, *Paul M. Peterson & Carol R. Annable 7064* (MO!); Distrito de Changuinola. File de la Sierpe, cerca de Quebrada Bonyic, 09°20'01"N 082°35'24"W, 111 m, 27 septiembre 2007, *R. Carranza et al. 208* (MO, PMA, SCZ); Station Milla 7.5 on Changuinola-Almirante Railroad, along a slender ridge to World War II communications facility, ca. 2 km NW of ruins of U.S. Army Military barracks, 09°21'54"N 082°27'12"W, 0 – 100 m, 03 August 1976, *T.B. Croat 38117* (MO!).

52. ***Monstera wilsoniensis*** M. Cedeño & Grayum, *Nordic J. Bot.* 38(12): 1–13. 2020. (Figs. 90, 91).

Type:—COSTA RICA: Puntarenas, Coto Brus, San Vito, Jardín Botánico Wilson, Reserva de bosque primario, 1353 m, 10 Oct 2018 (fr.), *M. Cedeño, M. Blanco, M. Mata & O. Alvarado 1484* (holotype USJ! [two sheets], isotypes MO!, PMA!).

Nomadic vine, pendent habit. SEEDLINGS: bearing foliage leaves. JUVENILE PLANTS: root climbers; **stems** light green with black pustules; **internodes** 3–5 cm long, 4–6 mm diam.; **petiole** distinct, dark or light-green, smooth, 5–10 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous; **blades** ovate, lanceolate, attenuate or truncate at base, acuminate at apex, subcoriaceous, 8–15 × 2–6 cm, not appressed to the phorophyte; **fenestrations** absent. ADULT PLANTS: root climbers; **stems** light-green to dark with black pustules, cylindrical; **internodes** 2–10 cm long, 1.0–1.5 cm diam., usually 3.0–6.6 times longer than wide; **cataphylls** light-green, deciduous but leaving dry fragments on the peduncle; **anchor roots** dark brown; **feeder roots** brown; **petiole** dark green, sometimes white-spotted, smooth, 13–20 cm long, sheathed to base of the geniculum; **petiole sheath** deciduous; geniculum smooth, sunken adaxially, convex abaxially, 1.0–2.5 cm long; **blades** lanceolate or oblique, cordate, subcordate to obtuse at base, acuminate at apex, subcoriaceous, drying greenish, yellowish or blackish, 15–25 × 13–15 cm, slightly decurrent to the medial part of the geniculum; **midrib** ribbed adaxially, convex abaxially, drying yellowish or blackish on both surfaces; **primary lateral veins** 15–25 per side, forked, slightly sunken adaxially, prominent abaxially, departing midrib at 55–65°, drying yellowish or blackish; **secondary veins** reticulate; **collective veins** visible; **fenestrations** absent or infrequently present; **margins** entire. INFLORESCENCES on ascending or pendent stems, 1–3 simultaneously at flowering time, arranged in the axils of the leaves or into cataphylls; **peduncle** smooth, 10–15 cm long; **spathe** long-acuminate or mucronate, light green during development, yellowish green externally and white internally at apex, thin, completely open, deciduous after anthesis, 13–18 × 9–13 cm, up to 4 cm longer than spadix; **spadix** creamy during development, yellowish-cream at anthesis, 7–13 cm long, 1.5–2.0 cm diam.; **basal sterile flowers** 3–5 mm long, with a transparent stigmatic secretion; **fertile flowers** 4–6 mm long; stamens 2–6 mm long, with laminar filaments; anthers 1–2 mm long; ovary quadrangular in longitudinal section, ribbed, 3–4 × 3–4 mm; style hexagonal, 1–2 × 3–4 mm; stigma linear, with a transparent stigmatic secretion; **berries** with a green stylar cap during development, mature stylar cap white-cream; pulp white; **seeds** black, 3–5 mm long.

Distribution and ecology:—Endemic to Costa Rica on the Pacific slope of the Cordillera of Talamanca, as well as the Cerros de La Carpintera, Cerros de Escazú, and Fila Costeña, from 1200 to 2100 m, in *Premontane moist forest* life zones.

Phenology:—Flowering has been recorded in June and September. Fruiting in December, January and March.

Discussion:—The species is a member sect. *Monstera*, and differs from the other species of its genus in Costa Rica by having petioles sheathed along their entire length, petioles sheathed deciduous, leaf blades cordate at base, scarcely fenestrate, and with numerous lateral primary veins, and inflorescences on both ascending and hanging stems. This species has been confused with the lowland morphotype on the Pacific slope of *M. adansonii* but differs from the latter by having shorter petioles 13–20 (vs. 35–55 cm) and smaller leaf blades (15–25 × 13–15 cm, vs. 25–65 × 25–45 cm) that are cordate or subcordate to obtuse (vs. cuneate or attenuate) at base.

Monstera wilsoniensis grows mainly in *Premontane moist forest* life zones of the Las Cruces Biological Station and the Pacific slope of the Cordillera de Talamanca, at elevations of 1200–2100 m, while the *M. adansonii* morphotypes that could be confused with it grow in *Tropical dry forest* and *Tropical moist forest* at elevations of 0–900 m and have fenestrate leaf blades.

Additional specimens examined:—COSTA RICA. **Cartago:** La Unión, San Diego, Z.P. Cerros de La Carpintera, 1800 m, 28 September 2006, (Fr.), *J. Sanchéz 1586* (CR!); Cartago, La Unión, San Diego, Z.P. La Carpintera, Ladera norte con vista a Tres Ríos, entrando por finca de los Tinoco, 1520 m, 26 March 2008, (Fr.), *A. Cascante et al. 1905* (CR!); Cartago, San Nicolás, Z.P. Cerros de La Carpintera, 1689 m, 21 March 2006, (Fr.), *A. Quesada 1604* (CR!); Cartago, La Unión, San Diego, Cerro La Carpintera, bosque sobre ladera hacia Tres Ríos, 1700 m, 28 February 2013, (Fr.), *A. Cascate & C. Trejos 2387* (USJ!); Cartago, Cartago, San Nicolas, Cerros La Carpintera, 1700 m, 22 April 2016, (Fr.), *A. Cascate & C. Trejos 2593* (USJ!); Cartago, Cartago, San Nicolas, Cerros de la Carpintera, Bosques remanentes en la parte alta, 1750 m, 3 September 2013, (Fr.), *A. Cascate & C. Trejos 2409* (USJ!); **Puntarenas:** Coto Brus, San Vito, E.B. Las Cruces, Estación Biológica Las Cruces, Java, Reserva Forestal, 1150 m, 4 July 1994, (Fl.), *W. Kress & S. Martén 94–4360* (CR!); Las Cruces, 1300 m, 11 January 1978, (Fr.), *T.B. Croat 44388* (MO!); Coto Brus, San Vito, E.B. Las Cruces, Las Cruces Tropical Botanical Garden, 6 km W of San Vito de Java, Cultivated and native species, 1200 m, 6 March 1984, (Infer.), *T.B. Croat 57235* (CR!, MO!); Buenos Aires, Biolley, P.I. La Amistad, Cordillera de Talamanca, area around Río Canasta, 9.5 airline km NW of Agua Caliente, between Cerro Frantzius and Cerro Pittier, Lower montane wet forest with a few pasture clearings, 1550 m, 6 September 1984, (Fr.), *G. Davidse*

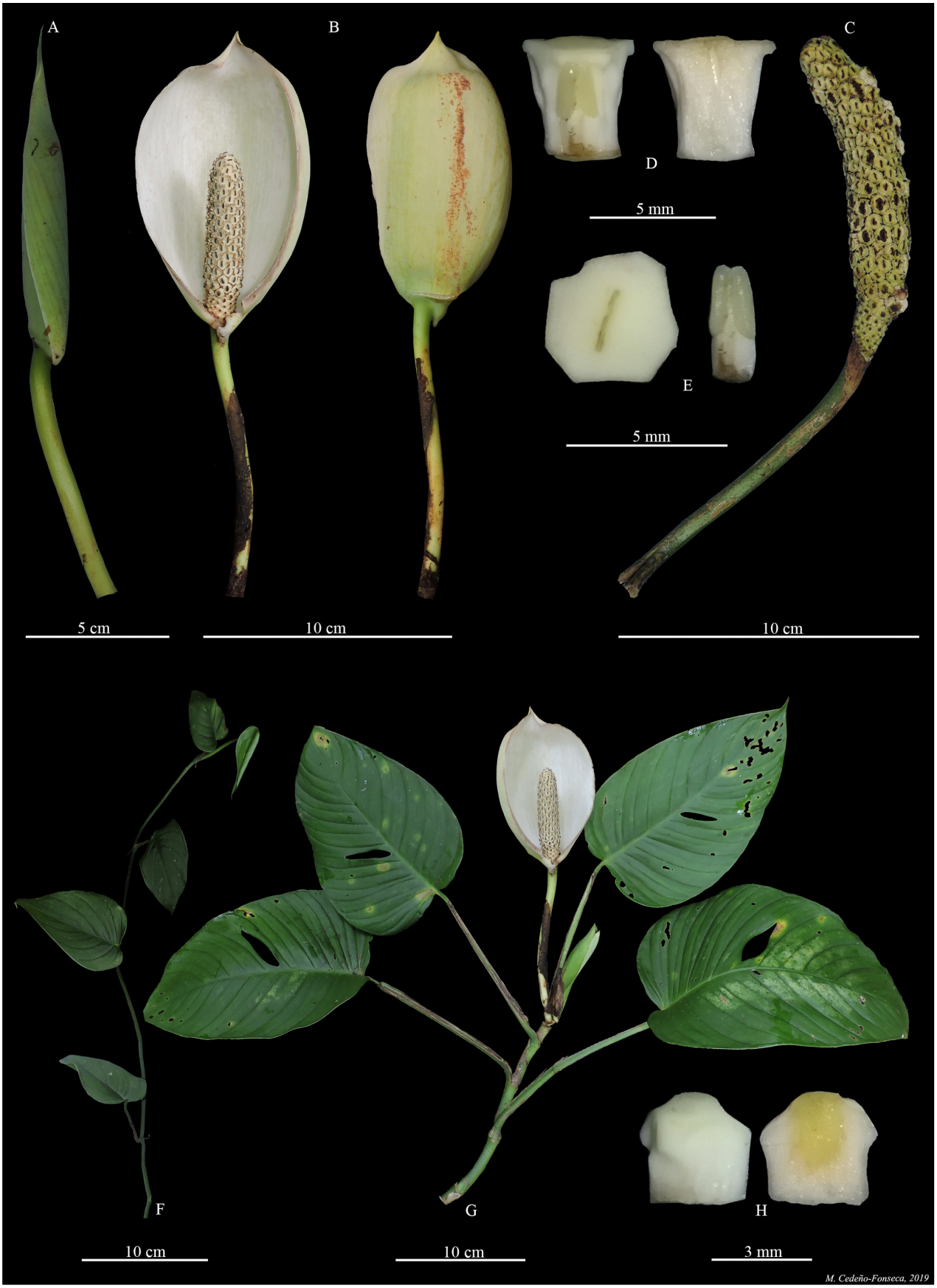

FIGURE 90. *Monstera wilsoniensis* from Coto Brus, Costa Rica. (A) Developing inflorescence. (B) Frontal (left) and back (right) views of opened inflorescence. (C) Infructescence. (D) Fertile flower in lateral view (left), and longitudinal section (right). (E) Stylar plate with stigma (left) and one stamen (right). (F) Portion of juvenile plant. (G) Portion of adult plant. (H) Sterile flower; in lateral view (left), and longitudinal section (right). *M. Cedeño et al. 1484* (USJ). Image from Cedeño-Fonseca *et al.* (2020a).



FIGURE 91. *Monstera wilsoniensis* from Coto Brus, Costa Rica. (A, B) adult plants in their natural habitat. (C) Hanging stems with pendulous or sub-erect infructescences (arrow). *M. Cedeño et al. 1484* (USJ). Image from Cedeño-Fonseca *et al.* (2020a).

et al. 28424 (CR!, MO!); Coto Brus, San Vito, E.B. Las Cruces, Along trail between Las Cruces Botanical Garden and Río Jaba, ca. 3.5 km SE of San Vito de Coto Brus, 1180 m, 12 September 1985, (Fr.), *M.H. Grayum et al. 5974* (CR!, MO!); Coto Brus, San Vito, E.B. Las Cruces, Jardín Botánico Wilson, Las Cruces, San Vito de Coto Brus, Sobre sendero Este hacia Río Java, 1100 m, 3 September 1993, (Fr.), *G. Rivera 2151* (CR!); Coto Brus, San Vito, E.B. Las Cruces, Forest below Las Cruces Biological Station along trail to Rìo Java, San Vito de Java, 1275 m, 29 June 1994, (Fl.), *W. Kress & W. Alverson 94–3773* (CR!); Coto Brus, San Vito, E.B. Las Cruces, Estación Biológica Las Cruces, Java, Reserva Forestal, 1275 m, 8 April 1994, (Fl., Fr.), *W. Kress & J. Runk 94–4654* (USJ!); Coto Brus, Pittier, Colecta en bosque en el límite oeste de la estación, 1700 m, 2 August 2000, (Fr.), *L. Acosta 2425* (CR!); Coto Brus, San Vito, Jardín Botánico Wilson, Las Cruces, Sobre sendero Este hacia Río Java, 1100 m, 30 September 1993, (Fr.), *G. Rivera 2163* (CR!); **San José:** Pérez Zeledón, San Pedro, Las Nubes, Santa Elena, Colecta en bosque secundario y potrero, 1210 m, 4 August 1995, (Fr.), *E. Alfaro 324* (CR!); San José, Dota, Copey, Providencia, Montaña fría, 1850 m, 11 October 2002, (Fr.), *J. Sánchez 1344* (CR!); San José, Acosta, Sabanillas, Bajo Vanegas, por Quebrada Delicias, 1500 m, 17 December 1996, (Fr.), *B.E. Hammel 20604* (CR!); San José, Pérez Zeledón, Páramo, Páramo, Providencia, Cruce sitio Pierdas, 4.7 SO de Providencia, 1854 m, 21 March 2001, (Fl.), *A. Rodríguez 7276* (CR!, MO!); San José, Dota, Manglar on estero between Río Paquita and Río Viejo, 1146 m, 14 August 1936, (Fr.), *C. Dodge 9825* (MO!); San José, Dota, Copey, Dota, Providencia, Zapotal, Finca propiedad de Joyce Zurcher, 1800 m, 20 August 2003, (Fr.), *A. Rodríguez 8262* (CR!, MO!); San José, Pérez Zeledón, El General, Reserva Universidad de York, 1200 m, 28 November 2017, (Fr.), *M. Cedeño & M. Mejía 1138* (USJ!); San José, Mora, Tabarcia, Zona Protectora Cerros de Escazú, cuenca del río Negro, 2 km en línea recta al noreste de la plaza de Palmichal en remanentes de bosque a la orilla del río, 1283 m, 19 August 2010, (Fr.), *J. Sánchez & R. Chacón 2166* (CR!); San José, Alajuelita, San Antonio, Z.P. Cerros de Escazú, Alrededores de Cerro Rabo de Mico, 2200 m, 22 September 1989, (Infer.), *G. Vargas & J. Sanchéz 765* (CR!); San José, Acosta, Palmichal, Z.P. Cerros de Escazú, Cuenca superior del Río Negro, Finca de señor Jericó Vindas, 1825 m, 8 July 2010, (Fl., Fr.), *A. Cascante et al. 2229* (CR!); Desamparados, San Miguel, Camino rural entre pequeños fragmentos de bosque y potreros arbolados a 4.5 km E de Tobosi, siguiendo la carretera 228, 1850 m, 4 August 2015, (Fr.), *A. Cascate & C. Trejos 2546* (USJ!); San José, Perez Zeledón, Páramo, Providencia, Zapotal, Bosque secundario detrás de la casa, 1805 m, 20 August 2003, (Fr.), *A. Ruíz & S. Lobo 743* (CR!); San José. Aserrí. Vuelta de Jorco, Tarbaca; Bajos de Praga; b. secundario en la union de los rios Tarbaca y Cedral, 1475 m, 29 January 1994, (Fr.), *J. Morales 2299* (CR!).

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APENDIX 1. Currently accepted names (bold) and synonyms (without bold) of the genus *Monstera* in Central America.

***Monstera acacoyaguensis* Matuda**

Monstera magnispatha Matuda

***Monstera acuminata* K.Koch**

Monstera karwinskyi Schott

Monstera belizensis Lundell

Monstera grandifolia Standl. & Steyerm.

Monstera chiapensis Matuda

***Monstera adansonii* Schott**

***Monstera adansonii* subsp. *laniata* (Schott) Mayo & I.M. Andrade**

Monstera friedrichsthalli Schott

Monstera seemanii Schott

***Monstera alcirana* Croat, M. Cedeño, Zuluaga & O. Ortiz**

***Monstera alfaroi* Croat & M. Cedeño**

***Monstera anomala* Zuluaga & Croat**

***Monstera bocatorensis* Croat & M. Cedeño**

***Monstera buseyi* Croat & Grayum**

Monstera coclensis Croat

***Monstera croatii* M. Cedeño & A. Hay**

***Monstera costaricensis* (Engl. & K.Krause) Croat & Grayum**

***Monstera deliciosa* Liebm.**

Philodendron pertusum Kunth & C.D.Bouché in Kunth

Philodendron anatomicum [Kunth & C.D.Bouché in Kunth

Tornelia fragrans Gutiérrez ex Schldl.

Monstera borsigiana K.Koch

***Monstera dissecta* (Schott) Croat & Grayum**

Monstera longipedunculata Matuda

***Monstera donosoensis* Croat, M. Cedeño & O. Ortíz**

***Monstera dubia* (Kunth) Engl. & K.Krause**

***Monstera epipremnoides* Engl.**

***Monstera egregia* Schott**

***Monstera filamentosa* Croat & Grayum**

***Monstera florescanoana* Croat, T.Krömer & Acebey**

***Monstera gambensis* M. Cedeño & M.A. Blanco**

***Monstera glaucescens* Croat & Grayum**

***Monstera gentryi* Croat, M. Cedeño & O. Ortiz**

***Monstera gigas* Croat, Zuluaga, M. Cedeño & O. Ortiz**

***Monstera guzman-jacobiae* Díaz-Jiménez, M. Cedeño, Zuluaga & Aguilar-Rodríguez**

***Monstera harrisoniorum* Croat, M. Cedeño & O. Ortíz**

***Monstera integrifolia* Zuluaga & Croat**

***Monstera juliusii* M. Cedeño & Croat**

***Monstera lentii* Croat & Grayum**

***Monstera limitaris* M. Cedeño**

***Monstera luteynii* Madison**

***Monstera maderaverder* Grayum & Karney**

***Monstera membranácea* Madison**

***Monstera mínima* Madison**

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APENDIX 1. (Continued)

***Monstera mittermeieri* M. Cedeño**

***Monstera molinae* Croat & Grayum**

***Monstera monteverdensis* M. Cedeño & Croat**

Monstera ngabensis Croat

***Monstera obliqua* Miq.**

***Monstera oreophila* Madison**

***Monstera pinnatipartita* Schott**

***Monstera pittieri* Engl.**

***Monstera punctulata* (Schott) Schott ex Engl.**

***Monstera siltepecana* Matuda**

***Monstera spruceana* (Schott) Engl.**

***Monstera standleyana* G.S. Bunting**

***Monstera tacanaensis* Matuda**

Monstera tablasensis M.Cedeño

***Monstera tarrazuensis* Croat & M. Cedeño**

***Monstera tenuis* K.Koch**

Monstera gigantea Engl.

***Monstera titanum* Croat, M. Cedeño & O. Ortiz**

***Monstera tuberculata* Lundell**

***Monstera tuberculata* var. tuberculata Madison**

***Monstera tuberculata* var. b*revinoda* (Standl. & L.O.Williams) Madison**

***Monstera wilsoniensis* M. Cedeño & Grayum**