

A Monographic Revision of the Neotropical Genus *Macrocarpaea* (Gentianaceae) in Ecuador

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Abstract The genus *Macrocarpaea* is a group of woody Gentianaceae that occurs in mountainous regions of the Neotropics. The majority of species occur in the Andes, with a high percentage in the Amotape–Huancabamba zone that straddles southern Ecuador and northern Peru. Rapid diversification in several species groups in this area has led to the formation of numerous isolated and sometimes cryptic species. Here, a revision of the species that occur in Ecuador is presented, where 35 taxa (34 species, one natural hybrid) are recognized, including 28 published taxa *M. angelliae* J.R. Grant & Struwe, *M. apparata* J.R. Grant & Struwe, *M. arborescens* Gilg, *M. bubops* J.R. Grant & Struwe, *M. claireae* J.R. Grant, *M. dies-viridis* J.R. Grant, *M. elix* J.R. Grant, *M. ericii* J.R. Grant, *M. gattaca* J.R. Grant, *M. gondoloides* J.R. Grant, *M. harlingii* J.S. Pringle, *M. innarrabilis* J.R. Grant, *M. jactans* J.R. Grant, *M. jensii* J.R. Grant & Struwe, *M. lenae* J.R. Grant, *M. luna-gentiana* J.R. Grant & Struwe, *M. × mattii* J.R. Grant (*M. noctiluca* × *M. subsessilis*), *M. micrantha* Gilg, *M. neillii* J.R. Grant, *M. noctiluca* J.R. Grant & Struwe, *M. opulenta* J.R. Grant, *M. pringleana* J.R. Grant, *M. quizhpei* J.R. Grant, *M. sodiroana* Gilg, *M. subsessilis* Weaver & J.R. Grant, *M. voluptuosa* J.R. Grant, *M. xerantifulva* J.R. Grant, and *M. ypsilocaule* J.R. Grant. An additional seven species have yet to be described formally, but are included here for complete coverage, these being *M. “catherineae,”* *M. “cortinae,”* *M. “illuminata,”* *M. “lilliputiana,”* *M. “pacifica,”* *M. “umbellata,”* and *M. “zumbae”*. Description, illustration, documented distribution, and discussion of each species is included.

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3.1 Introduction

Macrocarpaea, the most species-rich genus of the gentian tribe Helieae, is composed of shrubs or small trees with yellow to green funnel-shaped flowers that attracts diurnal visitors such as hummingbirds, ants, butterflies, and many other insects, but is perhaps most effectively pollinated nocturnally by bats and moths. The seeds are small (0.2–2.2 mm) and numerous (at least 10,000 per fruit), with taxonomically informative characters at both the species and sectional rank. It is a genus of 120 species restricted to mountainous regions of the Neotropics. *Macrocarpaea* attains its greatest diversity in the Andes (from Venezuela through Colombia, Ecuador, Peru, to Bolivia), where some 98 taxa occur. Smaller groups occur in southern Mesoamerica (five species and one natural hybrid), the Greater Antilles of the Caribbean (three species), the tepuis of the Guayana Highlands (six species), and the coastal montane Atlantic forests of Brazil (eight species).

This study is part of a series of regional taxonomic monographs within the framework of a full revision of the genus. Revisions for Cuba (Thiv and Grant 2002), Bolivia (Grant 2011), and Brazil (Grant and Trunz 2011) have already been published. In Ecuador, 35 taxa are recognized, including 1 natural hybrid and 34 species. This is a synthesis of extensive field work and herbarium studies that have led to a series of preparatory papers (Grant and Struwe 2001, 2003; Grant 2003, 2004, 2005, 2007, 2008, 2011; Grant and Trunz 2011; Grant and Weaver 2003).

3.2 Sources of Scientific Data

The aim of this project was to revise the genus *Macrocarpaea* in Ecuador through fieldwork, studies of herbarium specimens, seed micromorphology, and biogeography. In order to understand species concepts in the genus, extensive fieldwork was carried out over a period of ten years.

Eight expeditions to Ecuador took place between 2001 and 2013 with numerous colleagues, students, and friends including in 2001 Lena Struwe, February 2002 Joseph-Marie Torres, October 2002 Albert Roguenant, and Aline Raynal-Roques 2006 Meilin Cheung, Fabienne Luisier, and Neil Villard, 2008 Camille Agier, Claire Arnold, and Meilin Cheung, 2009 botanical illustrator Bobbi Angell, Wyan Grant, and Vincent Trunz, 2011 Julien Vieu, and in 2013 Jimmy Cortina.

Material for this monograph was examined during multiple visits to seven herbaria in Ecuador, namely Universidad Nacional de Loja (LOJA), Herbario del Instituto de Ciencias Naturales del Universidad Central (Q), Herbario Alfredo Paredes del Universidad Central (QAP), Pontificia Universidad Católica del Ecuador (QCA), Museo Ecuatoriano de Ciencias Naturales (QCNE), Herbario Luis Sodiro, Biblioteca Ecuatoriana Aurelio Espinosa Pólit (QPLS), and the Universidad San Francisco de Quito (QUSF). The herbaria LOJA, QCA, and QCNE were visited on numerous occasions to examine their rich collections.

Additionally, the most important neotropical collections of Gentianaceae are located at the New York Botanical Garden (NY) and the Missouri Botanical Garden (MO). Numerous visits and exchange of specimens with these institutions have been invaluable for this research. Specimens have been examined in situ or on loan from the following herbaria (acronyms according to Index Herbariorum, Thiers 2008), these being AAU, AFP, ALA, B, BM, BP, BR, BRIT, BSB, C, CAS, CAUP, CEPEC, CESJ, CHOCO, CHRB, COAH, COL, CONN, CR, CUV, CUZ, DAV, DUKE, E, EHH, F, FAUC, FI, FLAS, FMB, FR, FTG, G, GB, GH, GOET, HAC, HAL, HAM, HAO, HB, HUA, HUCP, HUEFS, HUQ, HUT, IAN, INB, INPA, JAUM, JBSD, JE, K, L, LD, LINN, LPB, LS, m, MA, MANCH, MARY, MBM, MBML, MEDEL, MER, MG, MICH, MIN, MOL, MSB, MU, MY, NA, NEU, NO, NSW, OXF, P, PH, PORT, PR, PRC, R, RB, RNG, S, SBBG, SEL, SP, SPF, TEX, U, UC, UCWL, UDBC, UCB, UPS, UPTC, US, USM, VALLE, VEN, W, WIS, WU, YU, and Z.

3.3 Results and Discussion

3.3.1 Morphology

3.3.1.1 Habit

Species of *Macrocarpaea* in Ecuador range from nearly herbaceous/woody herbs from 1 to 3 m (e.g., *M. claireae*, *M. xerantifulva*), to 1–4 m woody bushes with thickened leaves (e.g., *M. arborescens*, *M. harlingii*, *M. subsessilis*), to standard 2–4 m tall bushes or small trees (e.g., *M. dies-viridis*, *M. lenae*, *M. micrantha*), to trees growing to 10 m in height (e.g., *M. apparata*, *M. bubops*, *M. elix*, *M. noctiluca*), to high elevation paramo shrubs (*M. angelliae*, *M. luna-gentiana*).

3.3.1.2 Leaves

The leaves of *Macrocarpaea* have a broad range of morphological variation (Fig. 3.1). They are always entire, yet vary from sessile to petiolate, glabrous to pubescent, thick and coriaceous to thin and papery, and in shape from linear-lanceolate, lanceolate, oblong, ovate, oval, elliptic, oblanceolate, to obovate. The leaf base is aequilateral, oblique, attenuate, cuneate, to rounded; the leaf apex is acuminate, acute, mucronulate, obtuse to rounded. The leaves are generally glabrous, but hairs have evolved independently in a few species, although none of these occur in Ecuador. The interpetiolar ridge has taxonomically useful characters, and is defined as the area between paired opposite leaves where the petioles are fused. Petioles range from unvaginated to having a long scooped out groove or vagination on the upper surface.

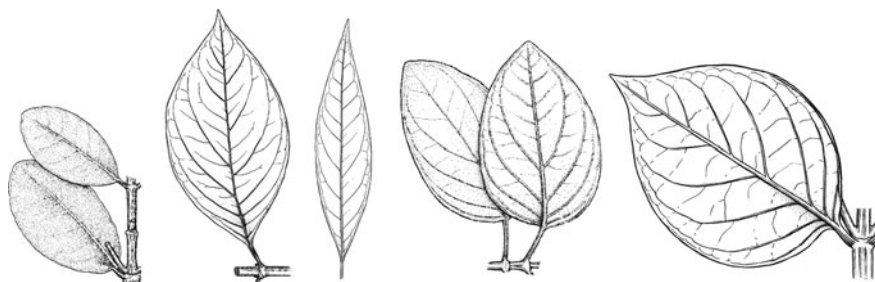


Fig. 3.1 Morphological variation in the leaves of *Macrocarpaea*. Illustrations by Bobbi Angell

3.3.1.3 Flowers and Pollen

Flowers have many important taxonomically rich characters in *Macrocarpaea* (Figs. 3.2, 3.3). A flower consists of a pedicel, bracteoles, calyx, and corolla, as well as the androecium/stamens (filaments and anthers), and gynoecium (ovary, style, and stigma). Comparison of these discrete characters provides a suite from which taxonomic decisions are based. The flowers of *Macrocarapea* display protandry, where the anthers mature first. Only once they have finished does the stigma open and become receptive to pollen (Fig. 3.3).

Calyx. The single-most important morphological feature in terms of taxonomic utility that is readily visible on all specimens regardless of phenological state (flowering to fruiting) is the calyx formed of five sepals. Calyces vary considerably in length and width, in shape from narrowly to broadly campanulate, ecarinate to strongly carinate, and glabrous, spiculate to pubescent in vestiture. Calyx lobes vary from scarcely present to dividing the calyx to nearly the base. The lobes range in shape from ovate, oblong, rotund, elliptic, lunate, to small and triangular, with apices that vary from acuminate, acute, obtuse, to rounded.

Corolla. The corollas of *Macrocarpaea* also display a wide range of morphological diversity. In one species, perhaps the basal-most species in the genus, *M. rubra* of Brazil, the corolla is urceolate in shape. All remaining species of the genus including all species in Ecuador have variations on a funnel-shaped corolla. Useful characters include length and width, and shape of the corolla lobes. Lobes vary from ovate, elliptic, lanceolate, to lunate, with apices that vary from acute, obtuse, retuse, to rounded. Corolla lobes range in shape from ovate, elliptic, lanceolate, large and lunate, to small and triangular, with apices that vary from acute, obtuse, retuse to rounded.

Pollen. Two morphological types of pollen grains occur in *Macrocarpaea* (Nilsson 1968; Grant 2006). The *Glabra*-type pollen (Fig. 3.4a–d) is present in most species of the genus and has been described as “3-colporate, rarely porate, 23–44 × 26–42 μm, spheroidal to subspheroidal, with a reticulate to verrucose-gemmate exine, and usually relatively wide muri” (Nilsson 1968, 2002).

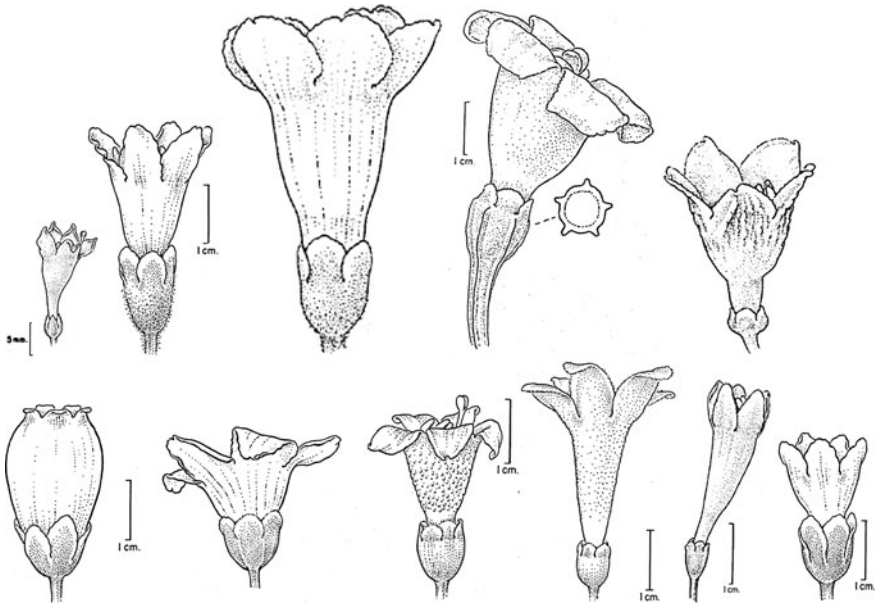


Fig. 3.2 Morphological variation in the calyx and corolla of *Macrocarpaea*. Illustrations by Bobbi Angell

Fig. 3.3 Protandry in *Macrocarpaea*. In the flower on the *right* the anthers are open, but the stigma is closed. In the flower on the *left*, the anthers are finished and recoiled backward, and the stigma has opened. *Macrocarpaea apparata* J.R. Grant & Struwe. Photo Neil Villard



Corymbosa-type pollen (Fig. 3.4e–h) is “3-colporate to colporate, $28\text{--}35 \times 28\text{--}39 \mu\text{m}$, subspheroidal to spheroidal, and with warty exine (verrucae, gemmae, pila, and clavae are present)” (Nilsson 1968, 2002). The *Corymbosa*-type conforms to section *Magnolifoliae*, and provides an important character to define the section. It has been identified in 13 species, with two species in Ecuador, namely *M. harlingii* and *M. jactans*.

3.3.1.4 Fruit and Seeds

The capsules of *Macrocarpaea* are bilocular and filled with upwards of 10,000 wind-dispersed seeds (Grant 2006). The seeds are minute in size, ranging from 0.2–2.2 × 0.2–1.0 (–2.2) mm, yet have a great amount of morphological diversity useful for taxonomic purposes. The four seed types recognized in Grant (2005) are:

1. *Flattened-type seeds* (Fig. 3.5a–b) correspond to section *Tabacifoliae*. The seeds are generally triangular in outline, flattened to polygonal, and lack wings. Some species have extended chalazal and micropylar ends while it either falls off before seed maturity or is lost during seed development in other species.
2. *Perimetrically winged-type seeds* (Fig. 3.5c–h) correspond to the section *Choriophylla*. The seeds are flattened with wings surrounding the perimeter of the seed. They are typically very light in weight, likely an adaptation for wind dispersal.
3. *Rimmed-type seeds* (Fig. 3.6a–f) correspond to the section *Macrocarpaea*. The seeds are polygonal to slightly flattened, and rimmed (typically without, yet sometimes with, very short wings).
4. *Winged-type seeds* (Fig. 3.6g–h) correspond to the section *Magnolifoliae*. The seeds are flattened and prominently winged at their chalazal and micropylar ends, or rarely all around. This seed type is an important character used to define the section *Magnolifoliae*.

3.3.1.5 Wood Anatomy

The Gentianaceae is a largely herbaceous plant family, yet several genera are composed almost entirely of shrubs and trees, including *Anthocleista*, *Fagraea*, *Potalia*, *Symbolanthus*, and *Macrocarpaea*. The general rarity of gentian trees has led to a broad characterization of the family as composed of herbs and shrubs, and few dendrologists have ever studied the gentian wood. Therefore, a collection of *Macrocarpaea* wood from 17 species was made for the purpose of a study of its anatomy, including *M. angelliae*, *M. apparata*, *M. arborescens*, *M. bubops*, *M. gattaca*, *M. harlingii*, *M. jensii*, *M. lenae*, *M. luna-gentiana*, *M. micrantha*, *M. noctiluca*, *M. pachystyla*, *M. rubra*, *M. sodiroana*, *M. subsessilis*, *M. wallnoe-feri*, and *M. wurdackii*. This study resulted in a paper entitled “Wood anatomy of Gentianaceae, tribe Helieae, in relation to ecology, habit, systematics, and sample diameter” (Carlquist and Grant 2005). Perhaps the most notable result was the identification of juvenile characteristics in the rays and pseudoscalariform lateral wall pitting of vessels that suggest paedomorphosis (retention of juvenile characters in adults) (Figs. 3.7, 3.8). This suggests that the evolution of *Macrocarpaea* into trees, and perhaps the entire family, is derived from perennials that have at least a somewhat woody base.

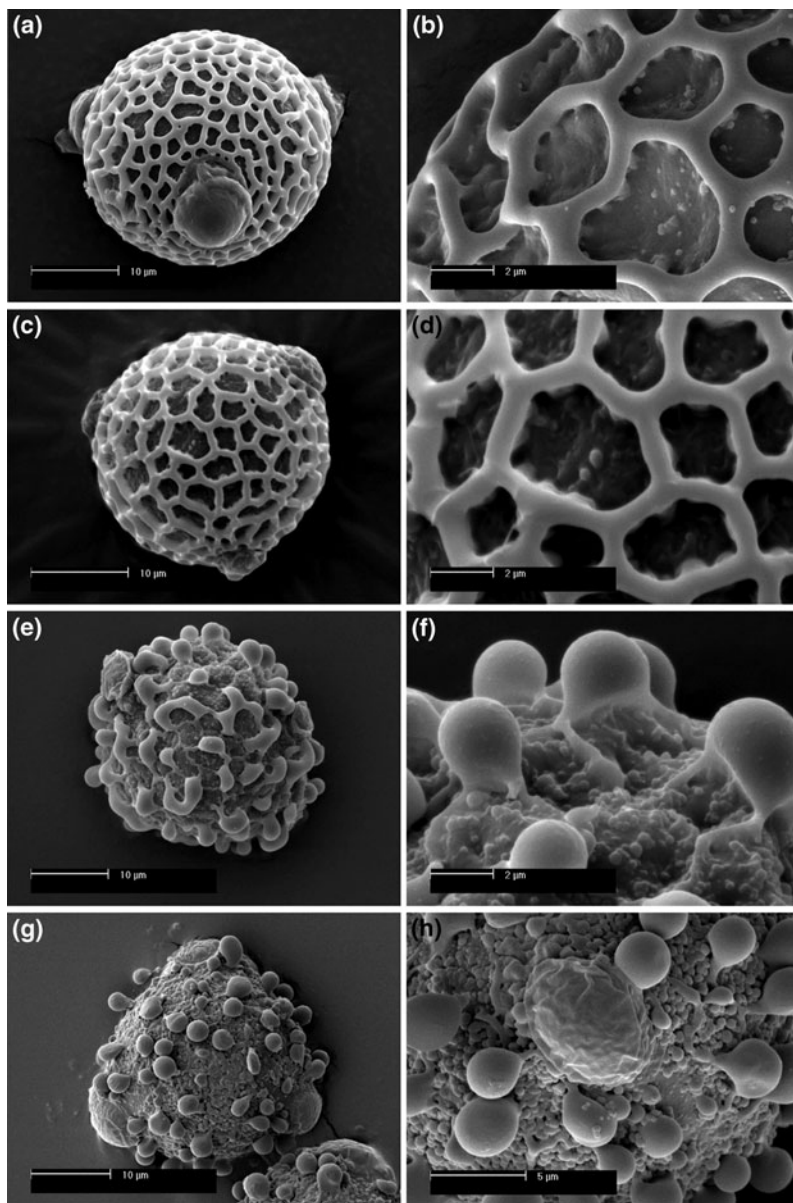


Fig. 3.4 Pollen grains of *Macrocarpaea*. **a–d** Glabra type; **e–h** Corymbosa type. **a** equatorial view of 3-colporate reticulate pollen of *M. subcaudata* from Luteyn 3918 (NY); **b** detail of reticulate exine in pollen of *M. kuepferiana*, from Vargas 18928 (CUZ); **c** polar view of 3-colporate reticulate pollen of *M. wurdackii*, from Smith 4793 (NEU); **d** detail of reticulate exine in pollen of *M. wurdackii*, from Smith 4793 (NEU); **e** polar view of 3-colporate verrucose pollen of *M. revoluta*, from Smith 2748 (NY); **f** detail of intergrading reticulate to verrucose warty exine in pollen of *M. revoluta*, from Smith 2748 (NY); **g** polar view of 3-colporate verrucose pollen of *M. canoëfolia*, from Woytkowski 35417 F **h** detail of verrucose warty exine in pollen of *M. canoëfolia*, from Woytkowski 35417 F. Reprinted from Grant (2005)

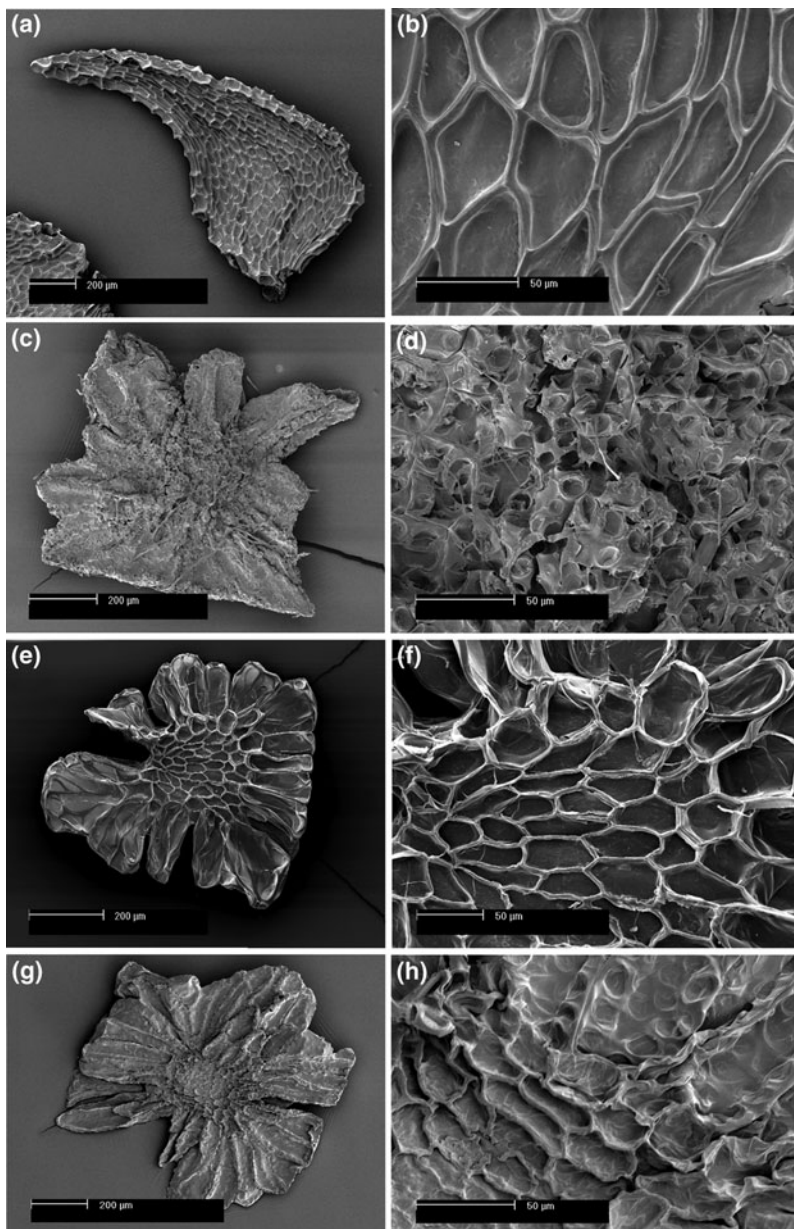


Fig. 3.5 Seed morphology in *Macrocarpaea*. **a–b** “flattened seeds,” *M. illecebrosa*, from Grillo & Conceição 217 (SPF); **c–d** “perimetrically winged seeds,” *M. xerantifulva*, from Campos & Garcia 3960 (MO); **e–f** “perimetrically winged seeds,” *M. gulosa*, from Ramos 1477A (MO); **g–h** “perimetrically winged reversal to rimmed seeds,” *M. umbellata*, from Rubio 1636 (MO). Reprinted from Grant (2005)

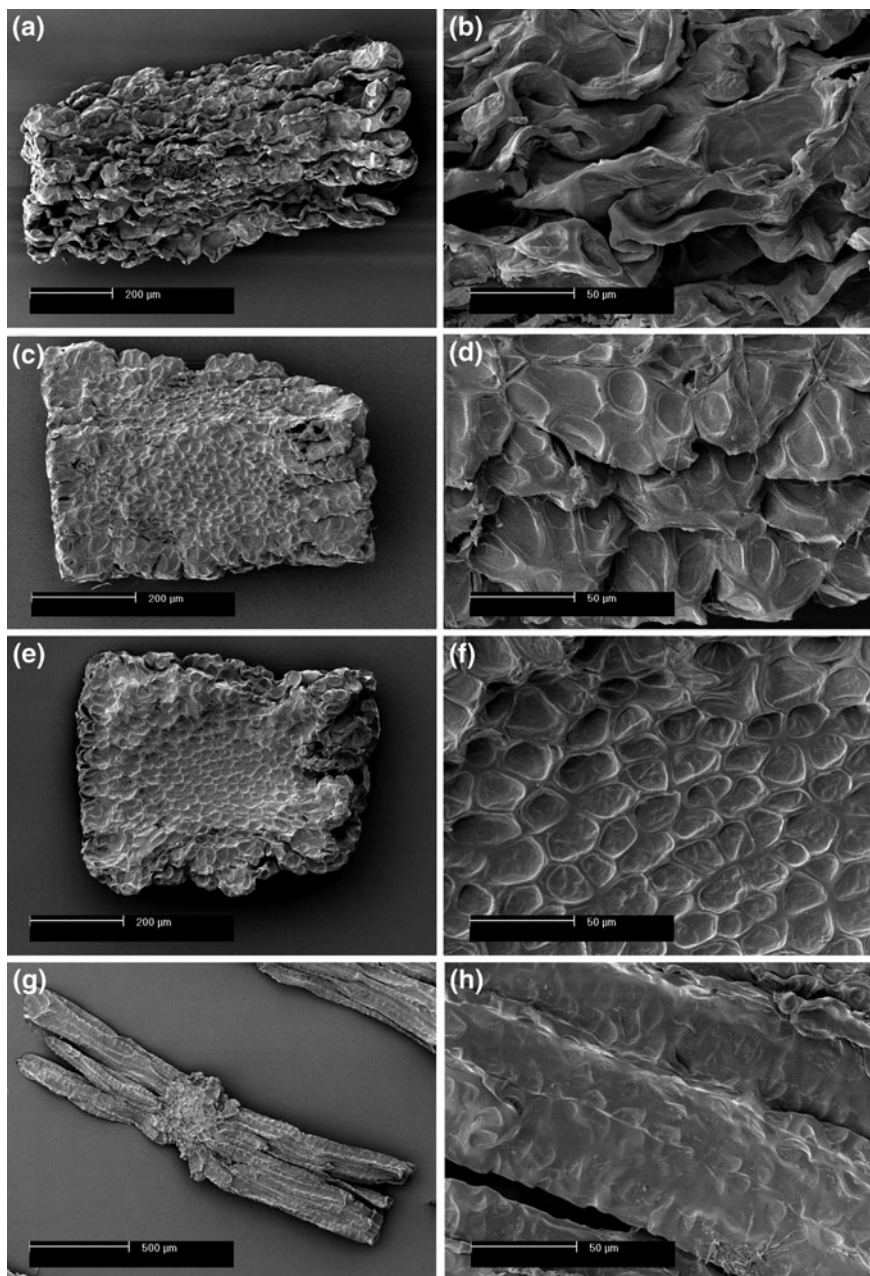


Fig. 3.6 a–b “rimmed seeds,” *Macrocarpaea laudabilis*, from Garcia Barriga & Hawkes 12884 (COL); c–d “rimmed seeds,” *M. gaudialis*, from Schultes 10415 (NY); e–f “winged seeds,” *M. cinchonifolia*, from Solomon 7492 (U); g–h “winged seeds,” *M. jactans*, from Vasquez 20219 (MO). Reprinted from Grant (2005)

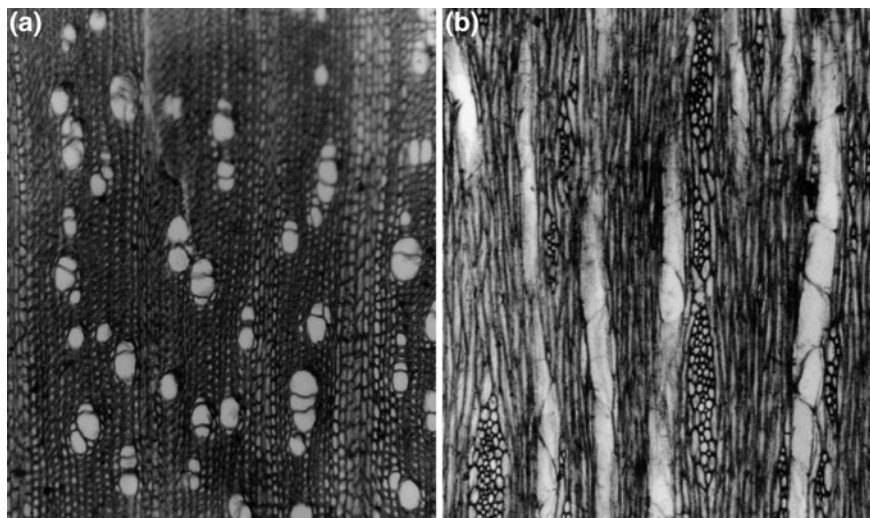


Fig. 3.7 Wood sections of *Macrocarpaea bubops*. **a** Transection, vessels are mostly grouped. **b** Tangential section, several wide multiseriate rays with procumbent cells in wider portions present. Reprinted from Carlquist and Grant (2005)

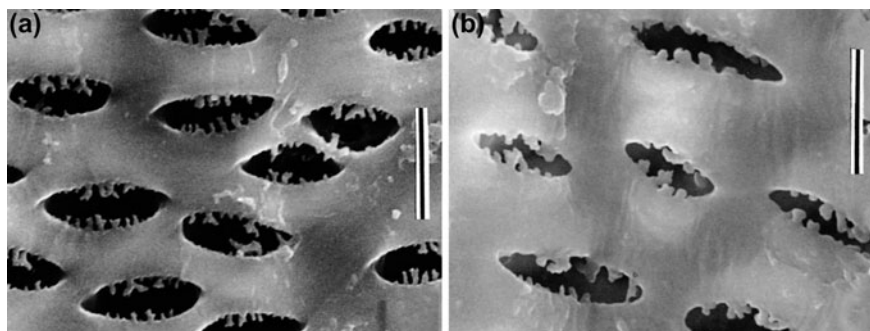


Fig. 3.8 SEM photographs of tangential wood sections of *Macrocarpaea bubops* (**a**) and *M. gattaca* (**b**) showing vestured pits. Reprinted from Carlquist and Grant (2005)

3.3.2 Phylogeny and Evolution

A recent molecular phylogeny of the gentian tribe Helieae indicates that *Macrocarpaea* has the greatest number of species in the tribe (Struwe et al. 2009a, b). The first phylogeny (Fig. 3.9) of *Macrocarpaea* itself was prepared in the framework of a newly designed software program entitled *Spatial Evolutionary and Ecological Vicariance Analysis* (SEEVA) to determine environmental characteristics between clades and sister species (Struwe et al. 2009a, b). A new phylogeny is currently being prepared with multiple accessions per species with a

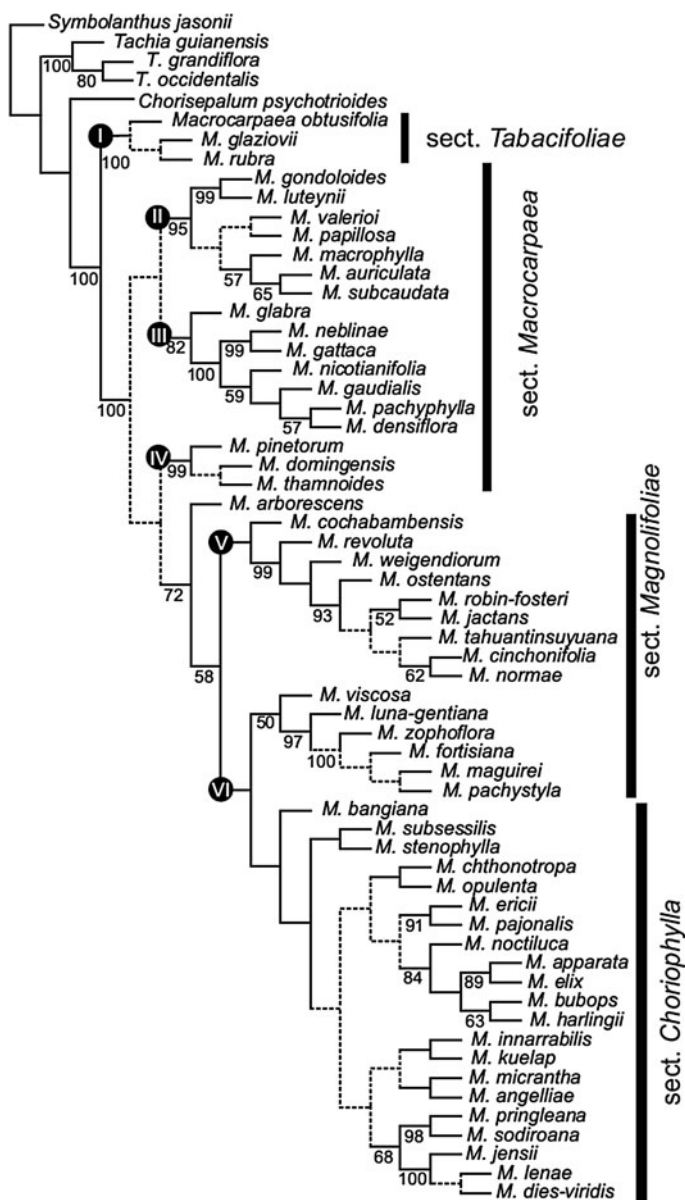


Fig. 3.9 Phylogeny of *Macrocarpaea* from based on combined nuclear ITS and 5 s-TS sequences with outgroups of *Symbolanthus*, *Tachia*, and *Chorisepalum*. Reprinted from Struwe et al. (2009a)

high percentage of representatively in species (Grant, Vieu et al. in preparation) *Macrocarpaea* has been divided into four taxonomic sections based on pollen and seed characters by Grant (2005). The phylogenies indicate that as currently defined, section *Tabacifoliae* of Brazil (Grant and Trunz 2011), section *Macrocarpaea* largely of the northern Andes, and section *Choriophylla* largely of the Amotape–Huancabamba zone of Ecuador and Peru, are monophyletic. However, the section *Magnolifoliae* is paraphyletic and requires further investigation.

Section *Macrocarpaea*. Four species in Ecuador belong to this section, these being *M. gattaca* (endemic), *M. gondoloides*, *M. voluptuosa* (endemic), and *M. ypsilocaule*. Two of these species are endemic to Ecuador, while the remaining two also occur in adjacent regions of Colombia. All of these species occur generally north of Quito, which make sense since the greatest diversity of this section is in Colombia. These species all have pollen with reticulate exine, and rimmed type seeds (except *M. gondoloides* which has a reversal to perimetrically winged seeds).

Section *Magnolifoliae*. This section has its greatest diversity in Peru, yet two species are found in Ecuador, namely *M. jactans* and *M. luna-gentiana*. That belong to different clades in the paraphyletic section. While *M. jactans* has pollen grains with a warty exine pattern, *M. luna-gentiana* has a reticulate exine more characteristic of section *Choriophylla*.

Section *Choriophylla* attains its greatest diversity in the Amotape–Huancabamba zone that straddles the border of Ecuador and Peru. In Ecuador, 28 species occur, 20 of which are endemic, 7 that range into Peru, and one that ranges into Colombia. These species include *M. angelliae* (endemic), *M. apparata* (endemic), *M. bubops* (with Peru), *M. catherineae* (endemic), *M. claireae* (endemic), *M. cortinae* (endemic), *M. dies-viridis* (endemic), *M. elix* (endemic), *M. ericii* (with Peru), *M. harlingii* (with Peru), *M. illuminata* (endemic), *M. innarrabilis* (with Peru), *M. jensii* (endemic), *M. lenae* (endemic), *M. lilliputiana* (endemic), *M. × mattii* (endemic), *M. micrantha* (with Peru), *M. neillii* (endemic), *M. noctiluca* (with Peru), *M. opulenta* (endemic), *M. pacifica* (endemic), *Macrocarpaea pringleana* (endemic), *M. quizhpei* (endemic), *M. sodiroana* (endemic), *M. subsessilis* (endemic), *M. umbellata* (with Colombia), *M. xerantifulva* (with Peru), and *M. zumbae* (endemic). The species of this section have perimetrically winged seeds and pollen with reticulate exine. *Macrocarpaea arborescens* has a unique morphology and is sister to section *Choriophylla*.

3.3.3 Distribution

Macrocarpaea is a genus of 120 species restricted to mountainous regions of the Neotropics. It attains its greatest diversity in the Andes (from Venezuela through Colombia, Ecuador, Peru, to Bolivia) where some 98 taxa (98 species and 1 natural hybrid) occur. Smaller groups occur in southern Mesoamerica (five species and one natural hybrid), the Greater Antilles of the Caribbean (three species), the

Tepuis of the Guayana Highlands (6 species), and the coastal montane Atlantic forests of Brazil (eight species). Three countries harbor the greatest number of species and diversity, these being Ecuador, Peru, and Colombia.

In Ecuador, 35 taxa are recognized including one natural hybrid and 34 species (Figs. 3.10, 3.11, 3.12, 3.13). Twenty-five of these species are endemic to Ecuador, while 11 others range into adjacent countries. Three species of section *Macrocarpaea* occur in both southern Colombia and northern Ecuador (*M. gondoloides*, *M. umbellata*, and *M. ypsilocaule*), while eight species of section *Choriophylla* occur in the Amotape–Huancabamba zone of both southern Ecuador and northern Peru (*M. bubops*, *M. ericii*, *M. harlingii*, *M. innarrabilis*, *M. jactans*, *M. micrantha*, *M. noctiluca*, and *M. xerantifulva*).

Three distinct mountainous biogeographical zones are found in Ecuador; the Cordillera Occidental and Choco have six species of *Macrocarpaea* (Fig. 3.13, region F) [*M. gattaca*, *M. gondoloides*, *M. pacifica*, *M. sodiroana*, *M. umbellata*, and *M. voluptuosa*], The Cordillera Central with two species (Fig. 3.10, region E) [*M. cortinae* and *M. ypsilocaule*], and the Amotape–Huancabamba region (Fig. 3.10, region h) where the remaining 27 taxa occur (Struwe et al. 2009a, b). The Amotape–Huancabamba region of southern Ecuador and northern Peru (Weigend 2002, 2004; Young and Reynel 1997) has the largest number of species and greatest morphological diversity in *Macrocarpaea*. Intense fieldwork in both Ecuador and Peru in recent years has uncovered many species previously unknown to science, and dramatically changed the previously broad circumscriptions of some species.

3.3.4 Pollination and Phylogeny

Macrocarpaea appears to be geared toward nocturnal pollination, yet perhaps functions as a generalist flower. Observations on effective pollination still need to be conducted. The flowers are yellow to green, and begin to blossom in the evening and emit a fragrance. The flowers are funnel-shaped or bell-shaped and produce quantities of nectar, perfect for nocturnal visits by bats and large moths. However, they remain open for several days also attracting diurnal visitors. Many other small insects, including beetles and parasitoids, are found inside some flowers during the night. During the day, ants, butterflies, and hummingbirds, all attracted by the nectar or pollen, visit the flowers.

Joseph Marie Torres of the University of Neuchâtel conducted a study of the pollinators of *Macrocarpaea sodiroana* in the Reserva Maquipucuna in northern Ecuador and identified many nocturnal and diurnal pollinators including at least 11 different species of nocturnal moths and sphinx moths (Fig. 3.14). Matt (2001) described the behavior of bats in southern Ecuador and reported on the visits of bats to a series of species of *Macrocarpaea*. Recently, Nathan Muchhala has photographed the bat *Anoura geoffreyi* pollinating *Macrocarpaea sodiroana* in southern Ecuador (Fig. 3.15).

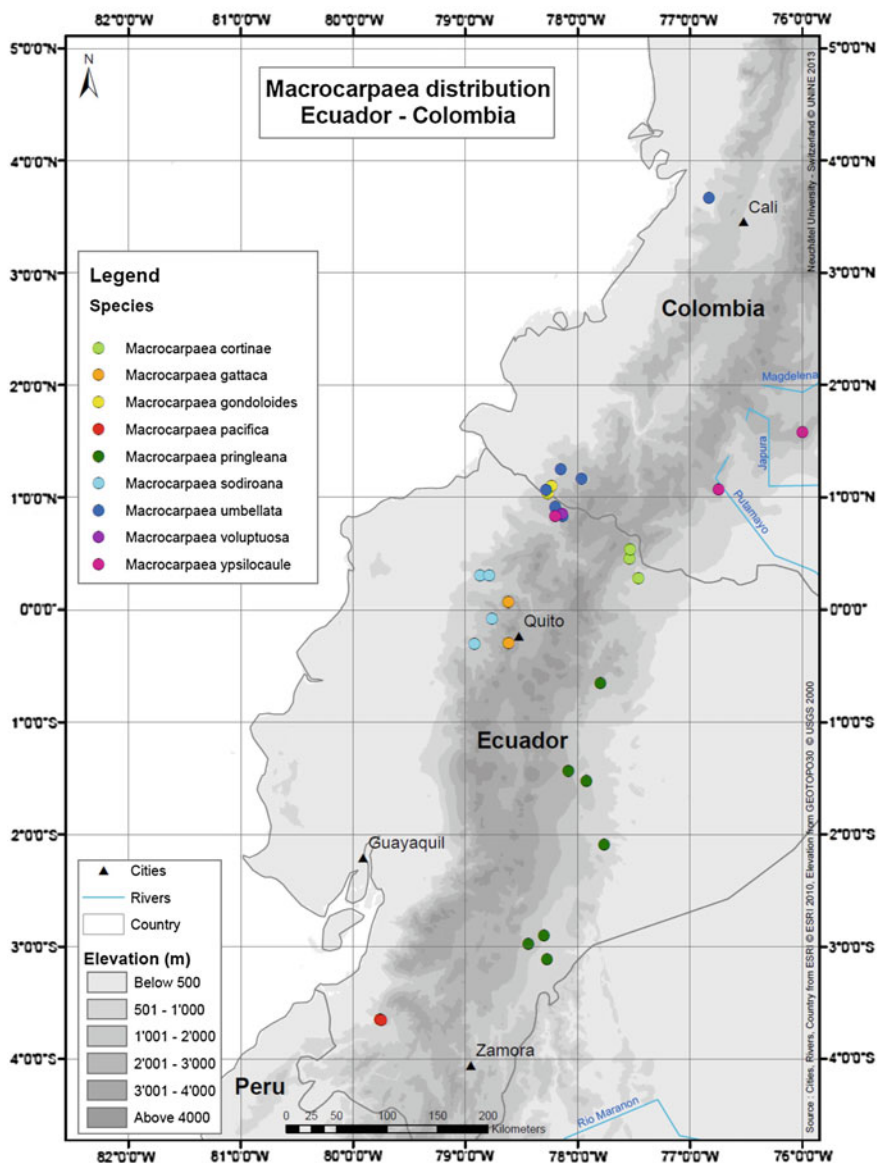


Fig. 3.10 Map of species of *Macrocarpaea* in Ecuador

3.3.5 Taxonomic History

The only revision of *Macrocarpaea* is that of Ewan (1948) who recognized 30 species based on 114 specimens. The specimens used in that revision largely came

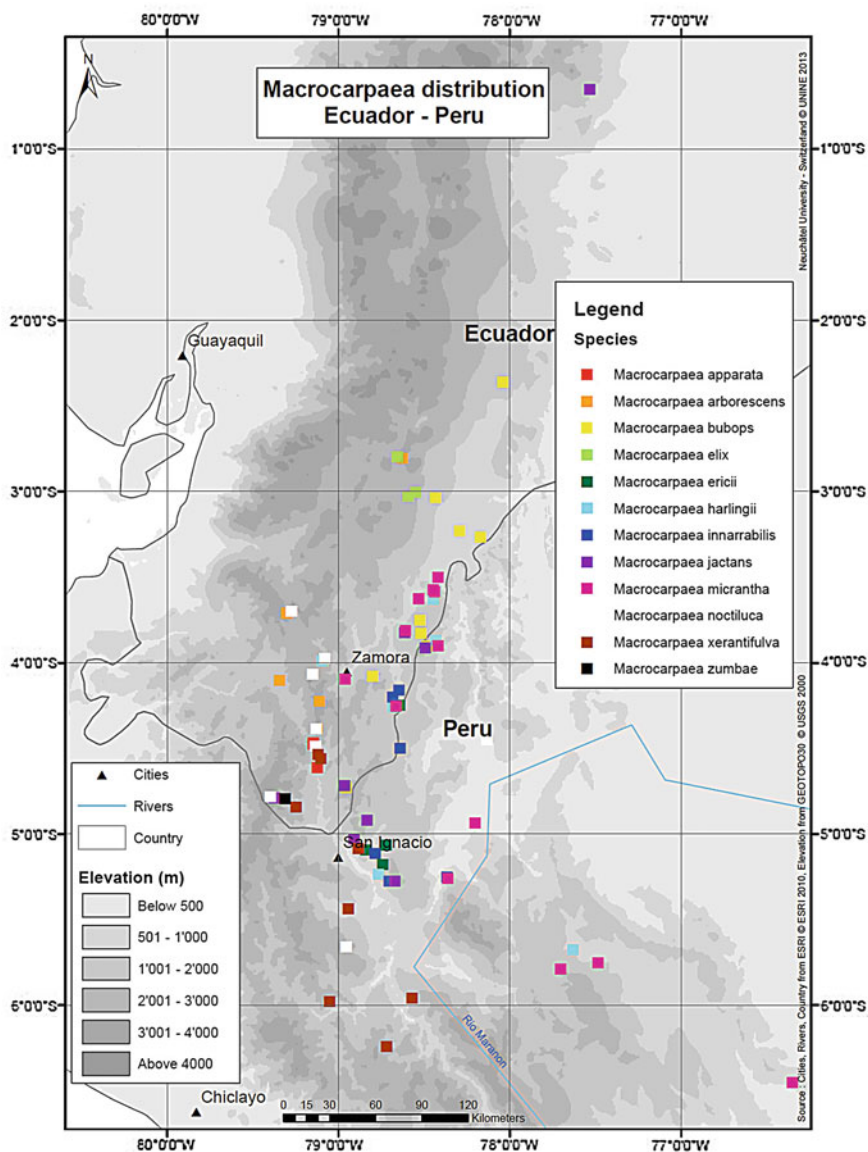


Fig. 3.11 Map of wide-ranging species of *Macrocarpaea* in the Amotape–Huancabamba zone of southern Ecuador and northern Peru

from areas near to major cities such as Bogotá, Quito, or Rio de Janeiro. Since then, vast unexplored regions of South America have opened up that botanists have explored in depth. Researchers from throughout the world, as well as those from their own countries have conducted detailed inventories of previously

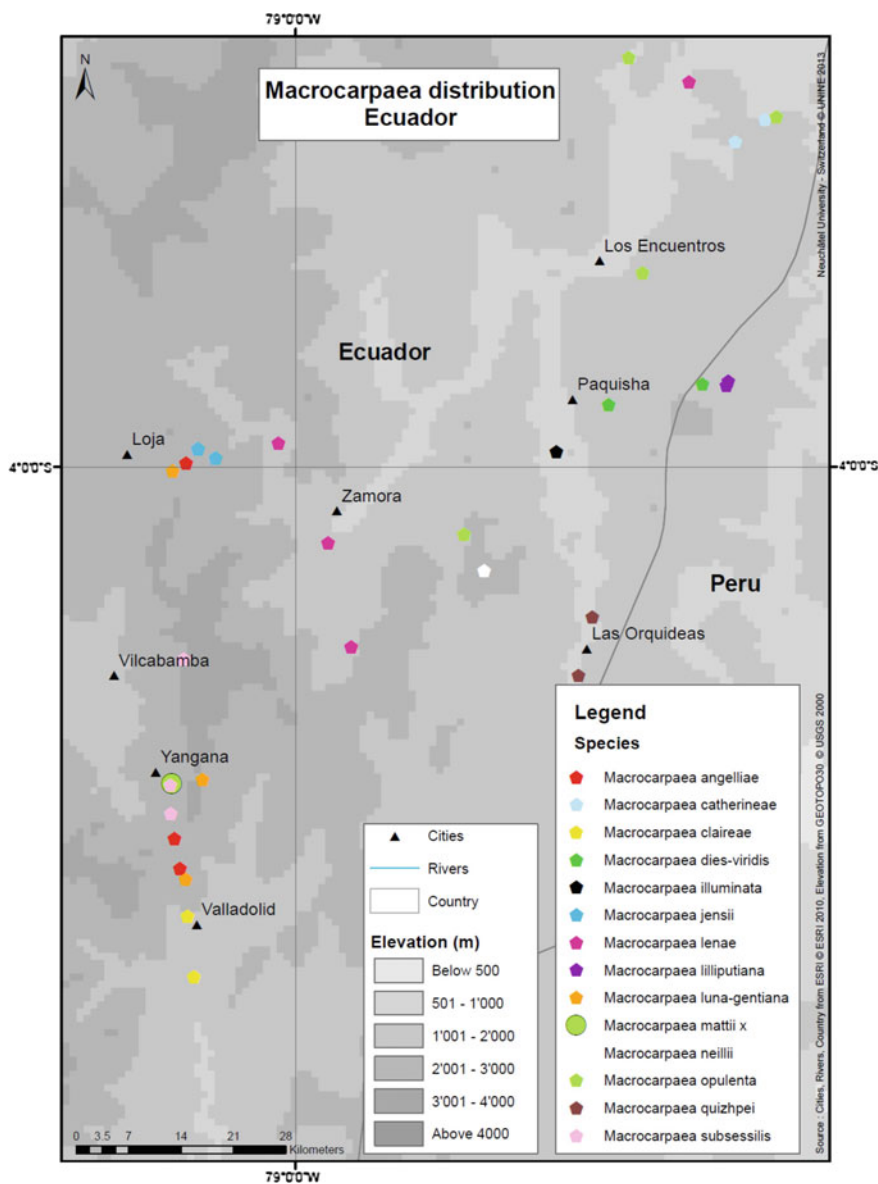


Fig. 3.12 Map of endemic species of *Macrocarpaea* in the Amotape–Huancabamba zone of southern Ecuador and northern Peru

Fig. 3.14 Sphinx moth visiting *Macrocarpaea sodiroana* in Ecuador. Photo Joseph Marie Torres



Fig. 3.15 The bat species *Anoura geoffroyi* visiting *Macrocarpaea harlingii* in Ecuador. Photo Nathan Muchhala



inaccessible regions of the continent. This broad collecting has resulted in a huge backlog in specimens available for study.

Specifically for Ecuador, Ewan (1948) recognized three species to occur there based on 11 specimens made around the cities of Quito and Loja (*M. ovalis* [Lobb s.n., André 4549, Steyermark, J. 54805, Steyermark, J. 54436, Steyermark, J. 54758] *M. pachyphylla* [André 4513], and *M. sodiroana* [Espinosa 198, Mexia 6977, Sodiro 101/1, Steyermark, J. 53548, Steyermark, J. 54812]). The only species that Ewan recognized based on a type from Ecuador is *M. sodiroana*, Sodiro 101/1. However, he also placed here four specimens that actually represent three other species: Mexia 6977 = *M. pringleana*; Steyermark, J. 53548 = *M. elix*; Steyermark, J. 54812 = *M. noctiluca*; and Espinosa 198 = *M. noctiluca*. Additional new determinations among these 11 specimens are: André 4513 = *M. luna-gentiana*; André 4549 = *M. arborescens*; and four specimens Lobb s.n., Steyermark, J. 54805, Steyermark, J. 54436, and Steyermark, J. 54758 = *M. subsessilis*.

In the only regional revision of Ecaudorian Gentianaceae, Pringle (1995) provided a revision of *Macrocarpaea* recognizing eight species, *M. cinchonifolia*,

M. harlingii, *M. micrantha*, *M. ovalis*, *M. pachyphylla*, *M. revoluta*, *M. sodiroana*, and *M. stenophylla*. This revision increased both the number of species recognized and specimens on which the species were characterized. A single new species was described, *M. harlingii* J.S. Pringle. Here, *M. cinchonifolia* is recognized to be endemic to Bolivia, *M. pachyphylla* endemic to Colombia, and both *M. revoluta* and *M. stenophylla* as endemic to Peru. The name *M. ovalis* has been suppressed (Grant 2004). Therefore, the only names used the same as in Pringle (1995) are *M. harlingii*, *M. micrantha*, and *M. sodiroana*, yet each has a much narrower circumscription here than that of Pringle.

From 1998 to 2003, this author revised the genus *Macrocarpaea* for his Ph.D. dissertation. What seemed like an easy task at the beginning resulted in a daunting realization that numerous new species needed to be described, and previously broad species concepts neither made taxonomic nor biogeographical sense. Thousands of specimens were studied on loan from abroad, and numerous institutions in Europe, North America, and South America were visited. I have data-based some 4,000 specimens, an exponential increase in material from the 114 specimens of Ewan. The 35 taxa currently recognized in Ecuador are based on a sizeable of these specimens, especially due to fieldwork from 2001 to 2013.

3.3.6 Species Concept

Species concepts vary considerably between author and taxonomic group. In *Macrocarpaea*, I define a species as a group/population of interbreeding individuals that are morphologically identifiable by discrete characteristics. These species must originate from the same biogeographical area and habitat and have also been identified as distinct by DNA sequences (DNA barcoding). A suite of characters has been used to circumscribe species, species groups, and to formulate an infrageneric classification.

The most important characters are those of gross plant morphology [especially leaf morphology, the architecture of the inflorescence (a thyse, where the primary branching is racemose, and the secondary is cymose), the position of the flowers before and after anthesis (erect, spreading, horizontal, nodding), calyx size, shape (lobes acute, acuminate, cuspidate, obtuse, rounded), and vestiture (glabrous, scabrous, hairy), and leaf size and shape (linear, lanceolate, ovate, elliptical, obovate)]. Additional sources of taxonomically useful information come from seed anatomy, pollen morphology, and molecular data.

It is true that I have described most of the species currently recognized in Ecuador. This is due to the great number of specimens available for study to which previous authors did not have access. Ecuador is also one of the most biodiversity rich countries in the world and, therefore, the discovery of numerous new species has not been surprising. A few additional new species will probably be found in remote unexplored areas.

3.3.7 Key to the Species of *Macrocarpaea* in Ecuador

To simplify identification, this key is based on dried herbarium specimens alone. However, most species can also be identified from fresh material with this key.

- 1a. Secondary leaf veins absent or scarcely visible on a smooth upper leaf surface ...2
 - 2a. Leaves lanceolate, apex acute to acuminate ...3
 - 3a. Plants generally single-stemmed or sparsely branched; calyx rugose, calyx lobes drying light brown, and unlobed portion dark brown...*M. harlingii*
 - 3b. Plants much branched; calyx strongly rugose, drying dark brown throughout ...*M. zumbae*
 - 2b. Leaves obovate, orbicular to elliptical, apex rounded to obtuse ...4
 - 4a. Bracteoles small and inconspicuous (2–5 mm long), positioned remotely about halfway along the pedicel; flowers spreading to pendent ...*M. arborescens*
 - 4b. Bracteoles conspicuous (10–20 mm long), positioned just below the calyx, and exceeding the calyx in length; flowers erect to rarely spreading, but never pendent ...5
 - 5a. Inflorescences paniculate; bracteoles linear to lanceolate ...*M. ericii*
 - 5b. Inflorescences short to nearly sessile within the upper leaves; bracteoles spatulate ...6
 - 6a. Plants robust; leaves 2.5–9 cm long; capsules 12–20 mm long ...*M. subsessilis*
 - 6b. Plants slender; leaves 2.0–3.5 cm long; capsules 10–12 mm long ...*M. lilliputiana*
- 1b. Secondary (and sometimes tertiary) leaf veins prominent, usually several pairs of secondary veins arch toward the leaf apex (readily visible on the upper leaf surface) ...7
 - 7a. Leaves brittle coriaceous, plants of high elevation (2,700–3,100 m)
 - 8a. Corolla green, 41–62 mm long; leaves with strong prominent rugose venation, veins strongly impressed on upper surface ...*M. luna-gentiana*
 - 8b. Corolla white to yellow–green, 35–55 mm long; leaves with prominent venation, but not so much impressed on the upper surface ...9
 - 9a. Leaves long-petiolate (petioles 10–35 mm long) ...*M. bubops*
 - 9b. Leaves sessile to short-petiolate (petioles 0–10 mm long) ...10

- 10a. Leaves lanceolate to elliptic, apex acute to acuminate ...11
 - 11a. Bracts large and broadly ovate, exceeding the length of the cymes; cymes nodding; calyx 6–8 mm long ...*M. angelliae*
 - 11b. Bracts smaller and not exceeding the length of the cymes; cymes not nodding; calyx 15–22 mm long ...*M. ypsilocaule*
- 10b. Leaves broadly ovate to oval, apex obtuse to acute ...12
 - 12a. Calyces 8–11 × 5–6 mm; corolla lobes undulate ...*M. gattaca*
 - 12b. Calyces 9–13 × 8–10 mm; corolla lobes not undulate ...*M. voluptuosa*
- 7b. Leaves tender smooth, plants of generally lower elevations (less than 2,700 m) ...13
 - 13a. Secondary veins pinnate and nearly parallel to another; corolla broadly flared open, funnelform ...*M. jactans*
 - 13b. Secondary veins arching, often with several prominent pairs that arch toward the leaf apex ...14
- 14a. Calyces puberulent hairy ...15
 - 15a. Shrubs 2–3 m; veins on lower leaf surface glabrous; calyx scabrous ...*M. dies-viridis*
 - 15b. Robust trees 2–5 m; veins on lower leaf surface hirsute to hispid; calyx scabrous, hirsute to hispid ...16
 - 16a. Calyx lobes rounded to obtuse ...*M. apparata*
 - 16b. Calyx lobes ovate ...*M. elix*
- 14b. Calyces glabrous and smooth ...17
 - 17a. Corolla broadly flared open, funnelform 40–45 mm wide at broadest; corolla lobes distinctly reflexed; calyx 13–15 × 11–17 mm ...*M. opulenta*
 - 17b. Corolla tubular funnelform (10–25 mm wide at broadest); corolla lobes generally not reflexed ...18
 - 18a. Leaves obovate, generally widest above the middle, leaf apex rounded to obtuse ...19
 - 19a. Pedicels 12–45 mm long ...*M. innarrabilis*
 - 19b. Pedicels 2–15 mm long ...20
 - 20a. Petioles 10–12 mm; bracteoles 1–3 mm ...*M. neillii*
 - 20b. Petioles 0–10 mm; bracteoles 5–18 mm ... *M. × mattii* (*M. noctiluca* × *M. subsessilis*)

- 18b. Leaves ovate, oval, elliptic to obovate, if obovate leaf apex acuminate ...21
- 21a. Cymes simple to compound, rarely subumbelliform; leaves firm, with a pair of “dots” at the base of the lower side of each leaf adjacent to the petiole (easily visualized on living plants, but more difficult on herbarium material) ...22.
- 22a. Leaves coriaceous ...*M. bubops*
- 22b. Leaves smooth ...23
- 23a. Leaves ovate, oblong to elliptic, matte green; bracteoles linear to lanceolate to obovate; common species of southern Ecuador...*M. noctiluca*
- 23b. Leaves elliptic to obovate; shiny green; bracteoles spatulate to oblanceolate; rare hybrid ...*M. × mattii* (*M. noctiluca* × *M. subsessilis*)
- 21b. Cymes umbelliform; leaves smooth, lacking pair of “dots” at the base of the lower side of each leaf adjacent to the petiole ...24
- 24a. Calyx lingulate to oblong, 11–13 mm long; plants of section *Macrocarpaea* ...*M. gondoloides*
- 24b. Calyx ovate, 5–10 mm long; plants of section *Choriophylla* ...25
- 25a. Stem leaves short to long-petiolate; leaves long-decurrent on petiole, narrowing and tapering to the base of the petiole; plants from north of the Amotape–Huancabamba zone (except *M. jensii*), occurring on both Pacific-facing (western) and Amazon-facing (western) slopes of the Andes ...26
- 26a. Leaves obovate to elliptic; calyx urceolate to campanulate; corolla fleshy ...*M. jensii*
- 26b. Leaves lanceolate, ovate, oval to broadly elliptic; calyx campanulate; corolla not fleshy ...27
- 27a. Umbelliform cymes diffuse; plants of Pacific-facing (western) slopes of the Andes ...28
- 28a. Stem leaf petioles 3–7 cm long; plants of El Oro province ...*M. pacifica*
- 28b. Stem leaf petioles 0.5–3.0 cm long; plants largely north of Quito ...29
- 29a. Calyx 5–10 mm long; plants of Pichincha and Imbabura provinces*M. sodiroana*
- 29b. Calyx 8–10 mm long Plants of Carchi province ...*M. umbellata*

- 27b. Umbelliform cymes compact; plants of Amazon-facing (eastern) slopes of the Andes ...30
 - 30a. Calyx lobes green with yellow/orange on dorsal surface; bracts subtending branches elliptic; plants of Sucumbios and Napo ...*M. cortinae*
 - 30b. Calyx lobes green; bracts subtending branches broadly ovate; plants widespread, ranging from about Baeza (Napo) to Limón (Morona-Santiago) ...*M. pringleana*
- 25b. Stem leaves long-petiolate, petiole slender; leaves either not at all decurrent on petiole, or only very shortly decurrent; plants of the Amotape–Huancabamba zone and Cordillera del Condor of southern Ecuador (almost exclusively in Zamora-Chinchipe province) ...31
 - 31a. Calyx scabrous puberulent ...*M. dies-viridis*
 - 31b. Calyx glabrous ...32
 - 32a. Inflorescences large, diffuse; pedicels long (20–52 mm) ...*M. quizhpei*
 - 32b. Inflorescences paniculate, but not diffuse; pedicels shorter (15–25 mm) ...33
 - 33a. Leaves drying thin membranaceous; plants typically much-branched ...*M. micrantha*
 - 33b. Leaves drying papery; plants single stemmed to branched ...34
- 34a. Leaves smooth coriaceous; plants of the Cordillera del Cóndor area ...*M. catherineae*
- 34b. Leaves smooth but not coriaceous; plants of the Andes, but not occurring on the Cordillera del Cóndor ...35
 - 35a. Calyx drying brownish; stems drying yellowish gold in color ...*M. xerantifulva*
 - 35b. Calyx drying black; stems drying green ...36
 - 36a. Calyx not glaucous ...*M. illuminata*
 - 36b. Calyx glaucous ...37
 - 37a. Leaf veins strongly impressed giving a quilted appearance to the leaves; calyx faintly scabrous; plants from the Valladolid region...*M. claireae*
 - 37b. Leaf surface smooth; calyx smooth glabrous; plants from the Zamora region...*M. lenae*

3.3.8 Taxonomic Treatment

3.3.8.1 Genus Description

Macroparpaea (Griseb.) Gilg in Engl. & Prantl, Nat. Pflanzenfam. 4(2): 94. 1895. Based on: *Lisianthus* section *Macroparpaea* Griseb., Gen. Sp. Gent. 173. 1839. T.: *Lisianthus glaber* L.f., Suppl.: 134. 1781. *Macroparpaea glabra* (L.f.) Gilg in Engl. & Prantl, Nat. Pflanzenfam. 4(2): 94. 1895.

= *Rusbyanthus* Gilg in Engl. & Prantl, Nat. Pflanzenfam. 4(2): 95. 1895. T.: *Rusbyanthus cinchonifolius* Gilg, in Engl. & Prantl, Nat. Pflanzenfam. 4(2): 95. 1895. *Macroparpaea cinchonifolia* (Gilg) Weaver, J. Arnold Arbor. 55(2): 300. 1974.

Plants branched to unbranched; 1 m shrubs, treelets, to robust trees to 10 m, facultative epiphytes (*M. browalliioides*, *M. luteynii*, and *M. subcaudata*), and upper páramo shrubs; glabrous to pubescent. **Trunk** 0.5–9.5 cm in diameter, wood hollow (typically narrower in trunk and wider in younger branches) to solid, growth rings faint to prominent, bark papery thin, to thick and pithy to 4 mm wide. **Stems** terete to quadrangular, solid to hollow. **Leaves** entire, petiolate to sessile; glabrous to pubescent; small thick and coriaceous, to large thin and papery; linear-lanceolate, lanceolate, oblong, ovate, oval, elliptic, oblanceolate, to obovate in shape; **leaf base** aequilateral, oblique, attenuate, cuneate, to rounded; **leaf apex** acuminate, acute, mucronulate, obtuse to rounded. **Petioles** short, to long and slender; unvaginated to having a long scooped groove or vagination on the upper surface; **interpetiolar ridge** prominent, exstipulate to stipulate (*M. zophoflora*). **Inflorescence** a thyrse, composed of branches of cymes in a racemose branching pattern. **Bracts** leaf-like and found throughout the inflorescence. **Bracteoles** scarious to bract-like. **Flowers** pedicellate, remaining erect or becoming nodding in maturity. **Calyx** narrowly to broadly campanulate; ecarinate to strongly carinate; glabrous, spiculate to pubescent in vestiture; **calyx lobes** ovate, oblong, rotund, elliptic, to lunate in shape, with apices that vary from acuminate, acute, obtuse, to rounded; persistent in fruit. **Corolla** 5-merous, funnel-shaped and actinomorphic, rarely urceolate (*M. rubra*), yet when androecium and gynoecium are included, the overall flower is zygomorphic; leathery to fleshy; white, cream, yellow to light green in color; **corolla lobes** ovate, elliptic, lanceolate, to lunate, with apices that vary from acute, obtuse, retuse to rounded. **Stamens** of unequal length, originating from about halfway up the corolla tube, displaced such as to aggregate together on the lower part of the corolla mouth; **anthers** linear to elliptical, versatile, sagittate; **pollen** in monads with either *glabra*-type (3-colporate, rarely porate, 23–44 × 26–42 µm, spheroidal to subspheroidal, with reticulate to verrucose-gemmate exine, and usually relatively wide muri), or *corymbosa*-type (3-colporate to colporate, 28–35 × 28–39 µm, subspheroidal to spheroidal, and with warty exine [verrucae, gemmae, pila, and clavae are present]). **Ovary** sessile, bilocular, placentation axile or parietal with strongly inrolled placentas; **style** persistent in fruit; **stigma** bilamellate with broad lobes. **Capsule** dry,

Fig. 3.16 *Macrocarpaea angelliae* J.R. Grant. Photo J.R. Grant



woody, 2-carpetted, bilocular and dehiscing medially; **seeds** flattened, polygonal, rimmed, winged or winged perimetrically, miniscule, ca. $0.2\text{--}1.6 \times 0.2\text{--}0.6$ mm.

3.3.8.2 Species Descriptions

1. *Macrocarpaea angelliae* J.R. Grant & Struwe

Harvard Pap. Bot. 5(2): 490. 2001. TYPE: ECUADOR. Zamora-Chinchipe: Carretera Loja-Zamora, cerca al Paso, 2,800–2,900 m, 15 March 1989, *Romole-roux 804* (Holotype NY; Isotypes AAU, QCA) (Figs. 3.16, 3.17).

Shrubs 1.0–1.5 m tall; stems terete, solid or hollow, up to 8 mm in diameter, glabrous throughout except lower leaf surfaces. Leaves short-petiolate, ovate, elliptical to lanceolate, 55–95 $\times$ 25–40 mm, glabrous, edges strongly revolute (at least when dried), the base rounded to slightly attenuate, the apex acute to acuminate, leathery-coriaceous, the upper side dark green with slightly impressed veins, the lower contrasting light green with raised veins and short brown sessile stellate hairs; ochrea 5–6 mm high; petiole 8–11 mm long. Inflorescences 150–250 mm long, 6–12-flowered; bracts leaf-like, ovate, apex obtuse, 25–41 $\times$ 19–29 mm. Flowers pedicellate, erect, not spreading; pedicel 8–11 mm. Calyx campanulate, 6–8 mm long, yellowish-green, the lobes rounded, 1–2 mm, with hyaline margins, remaining erect in fruit. Corolla yellowish-green, 33–36 mm, funnelform, the lobes ovate to elliptical, 8–12 $\times$ 8–11 mm, lobe apex acute. Stamens reaching the base of the corolla lobes; filaments of unequal length, filiform, straight; anthers linear, 4.5–5.0 mm long, sagittate, versatile. Gynoecium 30 mm long, ovary 5–6 $\times$ 3–4 mm, style 24–25 $\times$ 1.0 mm, stigma 2-lobed, each lobe circular, 2–3 $\times$ 2 mm. Capsules erect to slightly spreading from another, slightly woody, 25–30 mm (excluding the style base), rugose, shiny, with a persistent, elongate style base to 15 mm long. Seeds unknown.

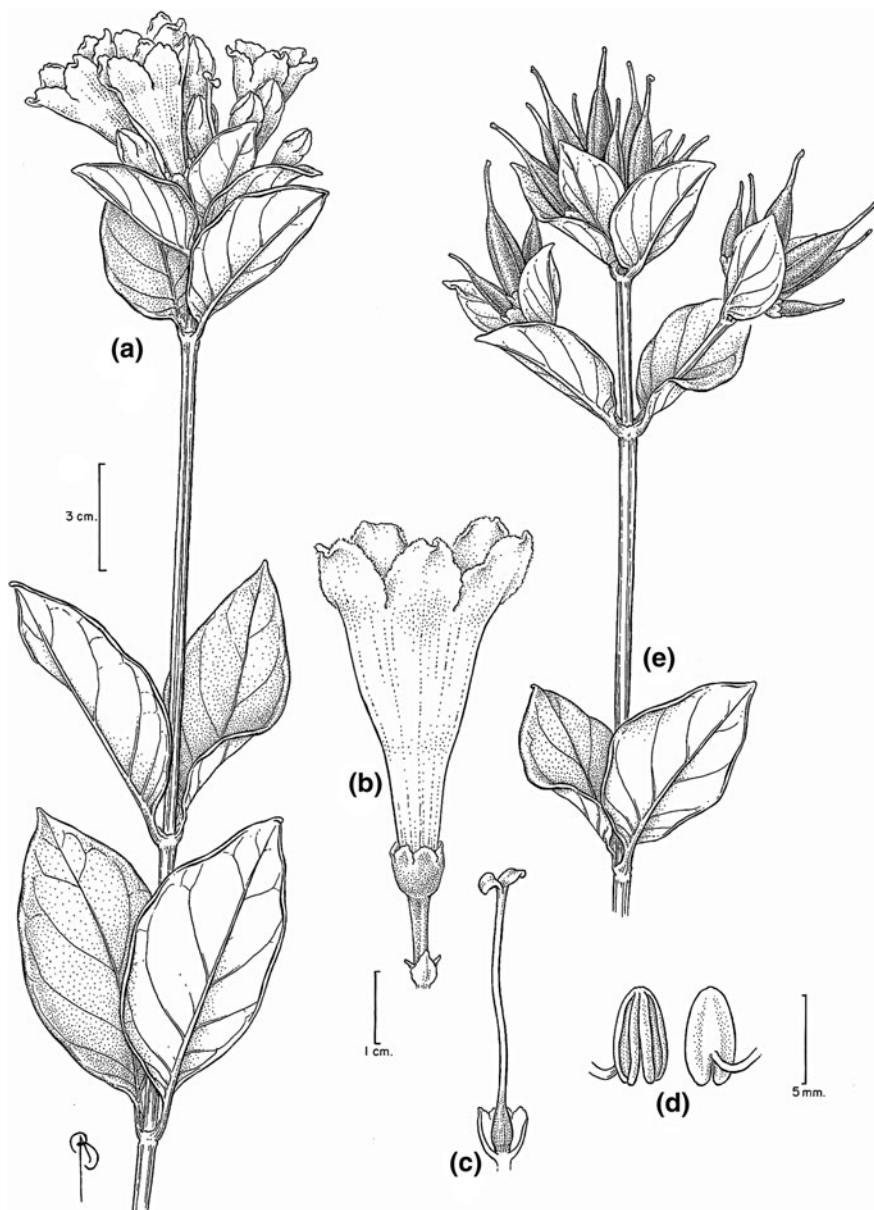


Fig. 3.17 *Macrocarpaea angelliae* J.R. Grant. **a** habit of flowering stem; **b** flower; **c** gynoecium; **d** anthers; **e** fruiting stem. From Øilgaard 91065 (AAU)

Macrocarpaea angelliae belongs to *Macrocarpaea* section *Choriophylla* and occurs from 2,500 to 3,000 m in the Amotape–Huancabamba region of southern Ecuador. It is characterized by large bracts $\frac{1}{2}$ to $\frac{3}{4}$ the length of the cymes they subtend. The inflorescences are generally nodding. The leaves are also rather leathery, typical of high elevation species.

Etymology. Named for Bobbi Angell (1955–), Marlboro, Vermont, USA, who has prepared the scientific illustrations for all the new species of *Macrocarpaea*.

Specimens examined: ECUADOR. **Loja:** Carr. Yangana-Valladolid, antes del refugio de Quebrada Honda, 04° 28' 59" S, 079° 8' 20" W, 2,720 m, 8 October 1995, *Garmendia, A. & G. Paredes* 678 (QCNE); *Garmendia, A. & G. Paredes* 684 (LOJA, QCA, QCNE); 21.3 km past Yangana toward Valladolid; 5 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques* 02-4289 (MO, NEU, NY, US); Carr. Loja-Zamora, collecciones en el km 15, 2500 m, 16 Aug 1983, *Jaramillo & Winnerskjold* 5806 (QCA); P.N. Podocarpus, ca. 1 km along trail toward Numbala at pass on the Yangana-Valladolid road, 4° 28' S, 79° 10' W, 3,000 m, 16 January, 1990, *Knudsen* 8 (LOJA, QCA, S); El Firo Oriental; 03° 59' 43" S, 079° 07' 53" W, 2,800 m, 16 January 2002, *Lozano, P. et al.* E-290 (LOJA); Nudo de Sabanilla, Sendero a Achupallas, 2,900 m, 21 February 2002, *Lozano, P. et al.* E-933 (LOJA); Yangana-Valladolid Rd., 2,500–3,000 m, 10 December 1989, *Madsen* 86683 (AAU, LOJA, QCNE); **Zamora-Chinchipe:** Summit of Nudo de Cajanuma, 04° 27' 019" S, 079° 08' 904" W, 2,745 m, 29 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz* 09-4568 (NY); Summit of Nudo de Sabanilla, 04° 26' 495" S, 079° 08' 44.8" W, 2,877 m, 4 February 2011, *Grant, J.R. & J. Vieu* 11-4664 (NY); Palanda, Podocarpus National Park, crest of the Nudo de Sabanilla at the continental divide, east of the road pass between Yangana and Valladolid, above the microwave antenna; 04° 26' 10" S, 079° 08' 33" W, 2,870 m, 3 December 2006, *Neill, D. & L. Jost* 15345 (LOJA, MO, NY, QCNE); P.N. Podocarpus, road Yangana-Valladolid, just S and E of the pass (Nudo de Sabanilla), muletrack from pass toward Quebrada Honda, 4° 27' S, 78° 08' W, 2,750–2,950 m, 18 February 1989, *Øllgaard* 90630 (AAU, QCA); P.N. Podocarpus, 2,750–2,950 m, 14 March 1989, *Øllgaard* 91065 (AAU, QCA).

2. *Macrocarpaea apparata* J.R. Grant & Struwe

Harvard Pap. Bot. 8(1): 63. 2003. TYPE: ECUADOR. Loja: 28.8 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,450 m, 11 February 2001, *Grant, J.R. & L. Struwe* 01-4002 [Holotype: US (3 sheets); Isotypes: G (2 sheets), LOJA, MO, NEU (2 sheets), NY, QCA, QCNE, S, SBBG] (Figs. 3.3, 3.18, 3.19).

Dichotomously branched tree, overall branching pattern triangular in outline, 4–5 m tall, hyaline hispid with short simple hairs on stems, petioles, leaves, inflorescences, calyces, and corolla lobes. Trunk to 6.5 cm in diameter, wood hollow (pith 3–19 mm, narrower in trunk, and wider in younger branches), growth rings detectable but not prominent; bark papery thin to scarcely measurable (to 0.05 mm), outer surface smooth to rugose, tan-brown. Stems terete to slightly quadrangular, hollow, 8–16 mm in diameter just below inflorescence. Leaves broadly to narrowly

Fig. 3.18 *Macrocarpaea apparata* J.R. Grant & Struwe. Photo J.R. Grant



ovate to elliptic, petiolate, 27–60 cm; blades 24–50 × 14–31 cm, base aequilateral to slightly oblique, apex acute, entire, not revolute, papery thin in texture, dark green, with slightly impressed veins above and slightly raised veins below, glabrous above, hyaline to tan pubescent on lower surfaces and especially veins; interpetiolar ridge 3–10 mm high; petioles robust with strong open vagination nearly equaling the length of the petiole, (30–) 60–100 mm. Branches of the inflorescence 23–40 cm, 14–30 flowered per branch; bracts ovate to lanceolate to linear, 20–165 × 4–100 mm, base aequilateral to oblique, apex acute to acuminate, petiolate; bract petioles 1–20 mm. Flowers pedicellate, erect to horizontal to oriented in all directions in the inflorescence; pedicels 2–26 mm; bracteoles linear to lanceolate to ovate, 3–25 × 1–8 mm. Calyx narrowly campanulate, 7–10 × 6–8 mm, hyaline puberulent, smooth, medium to dark green, ecarinate, no ridges extend down from calyx lobes; calyx lobes dividing calyx to one-third, rounded to obtuse, 2–3 × 3–4 mm. Corolla funnel-shaped, 39–53 mm, 18–22 mm wide at corolla lobe sinuses, whitish-green, rugose to smooth; corolla lobes ovate, apex obtuse to

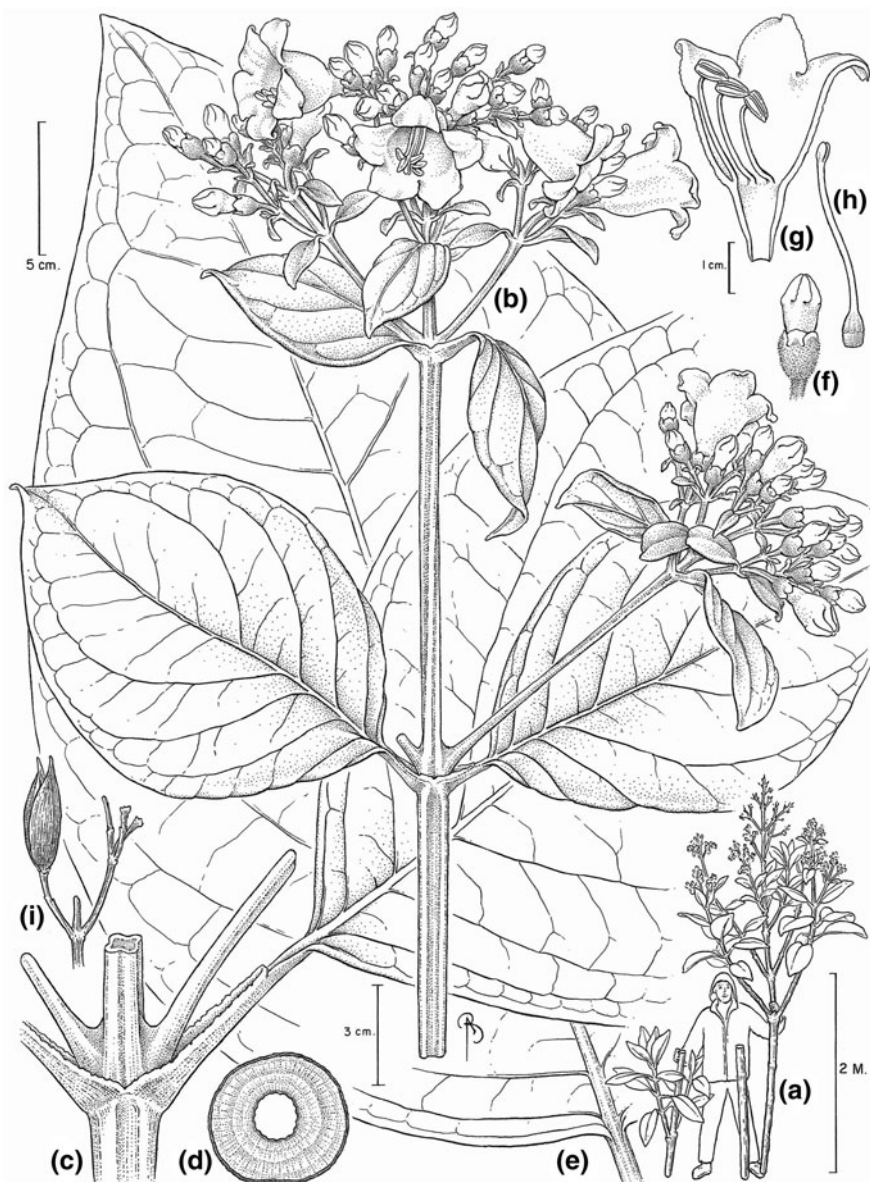


Fig. 3.19 *Macroparpaea apparata* J.R. Grant & Struwe. **a** habit of tree in the field, trunk cut into three segments from the base; **b** habit of flowering stem; **c** interpetiolar ridge; **d** wood anatomy of cross-section of main trunk; **e** leaf; **f** floral bud; **g** cross-section of corolla; **h** pistil; **i** mature dehiscent capsule. **a, d, f, h** from pickles, *photos* and pressed specimens of Grant, J.R & L. Struwe 01-4002; **b, c** from Grant, J.R & L. Struwe 01-3999 and *photos* of Grant, J.R & L. Struwe 01-4002; **e** from Grant, J.R & L. Struwe 3998; **i** from Grant, J.R & L. Struwe 4001

rounded to retuse, 7–14 × 8–12 mm. Stamens 27–33 mm; filaments 20–26 mm, filiform, terete; anthers linear to linear-elliptic, 5.5–7.0 × 2.0–2.5 mm, sagittate, versatile. Pistil 35–39 mm; ovary 7–8 × 3.0–3.5 mm; style 22–26 × 1.0–1.5 mm; stigma 2-lobed, lobes 4–5 × 2.0–2.5 mm, rounded to spatulate. Capsules and seeds unknown.

Macrocarpaea apparata belongs to *Macrocarpaea* section *Choriophylla* and occurs from 2,400 to 1,600 m in the Amotape–Huancabamba region of southern Ecuador. It is a robust treelet to tree to 4–5 m tall with some of the largest leaves known to date within the genus. It is mostly closely related to *M. elix* with which it shares hairy leaves and calyces. This species is part of a distinctive monophyletic group including *M. apparata*, *M. bubops*, *M. elix*, *M. jensii*, *M. × mattii*, and *M. noctiluca*.

Etymology. From the English verb “to apparate.”

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Nudo de Sabanilla, ca. 24 km S of Yangana, at border of P.N. Podocarpus, roadside right after stream that crosses the road, 2,550 m, 11 February 2001, *Grant, J.R. & L. Struwe 01-3995* [LOJA, QCNE, NEU, NY, US (2 sheets)]; 28.8 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,560 m, 11 February 2001, *Grant, J.R. & L. Struwe 01-3997* [LOJA, QCNE, US (2 sheets)]; 29.6 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,450 m, 11 February 2001, *Grant, J.R. & L. Struwe 01-3998* [LOJA, QCNE, NEU, NY, US (2 sheets)]; 29.6 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,450 m, 11 February 2001, *Grant, J.R. & L. Struwe 01-3999* [LOJA, QCNE, NEU, NY, US (2 sheets)]; 30.9 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,450 m, 11 February 2001, *Grant, J.R. & L. Struwe 01-4001* [LOJA, QCNE, NEU (4 sheets), NY, US (4 sheets)]; 30.1 km past Yangana toward Valladolid, 5 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques 02-4292* (NEU, NY, US). Nudo de Sabanilla, ca. 24 km S of Yangana toward Valladolid, at border of P.N. Podocarpus, Tapichalaca Reserve, 2,450 m, 17 February 2006, *Grant, J.R., M.L. Cheung, F. F. Luisier, & N. Villard 06-4340* (CHRB, G, LOJA, MO, NY, QCA, QCNE); Around 30 km south of Yangana toward Valladolid, south of the continental divide at Nudo de Sabanillas, 04° 28' 26.4" S, 079° 08' 50.4" W, 2,601 m, 4 February 2011, *Grant, J.R. & J. Vieu 11-4665* (NY); Región del Río Chinchipe, por la carretera entre Palanda y Valladolid, 04° 36' 47" S, 079° 07' 20" W, 1,300 m, 11 March 2007, *Quizhpe, W. & A. Wisum 2653* (LOJA, MO, NY).

3. *Macrocarpaea arborescens* Gilg

Bot. Jahrb. Syst. Beibl. 111: 50. 1913. TYPE: Colombia. Cauca: W Andes of Popayan, 1,800–2,500 m, 1 January 1882, *Lehmann 5450* [lectotype GH; isolecotypes F, K, US, selected by Grant (2003)] (Fig. 3.20).

Shrub or small tree, 0.5–6.0 m, woody throughout, often much branched, glabrous. Stems quadrangular, sometimes less sharply angles or terete distally; internodes much shorter than to about equaling leaves, 0.5–12.0 cm long. Leaves coriaceous; secondary veins slender, branching from midrib mostly at 50–80 degrees, nearly straight, becoming indistinct toward margin, not or imperfectly

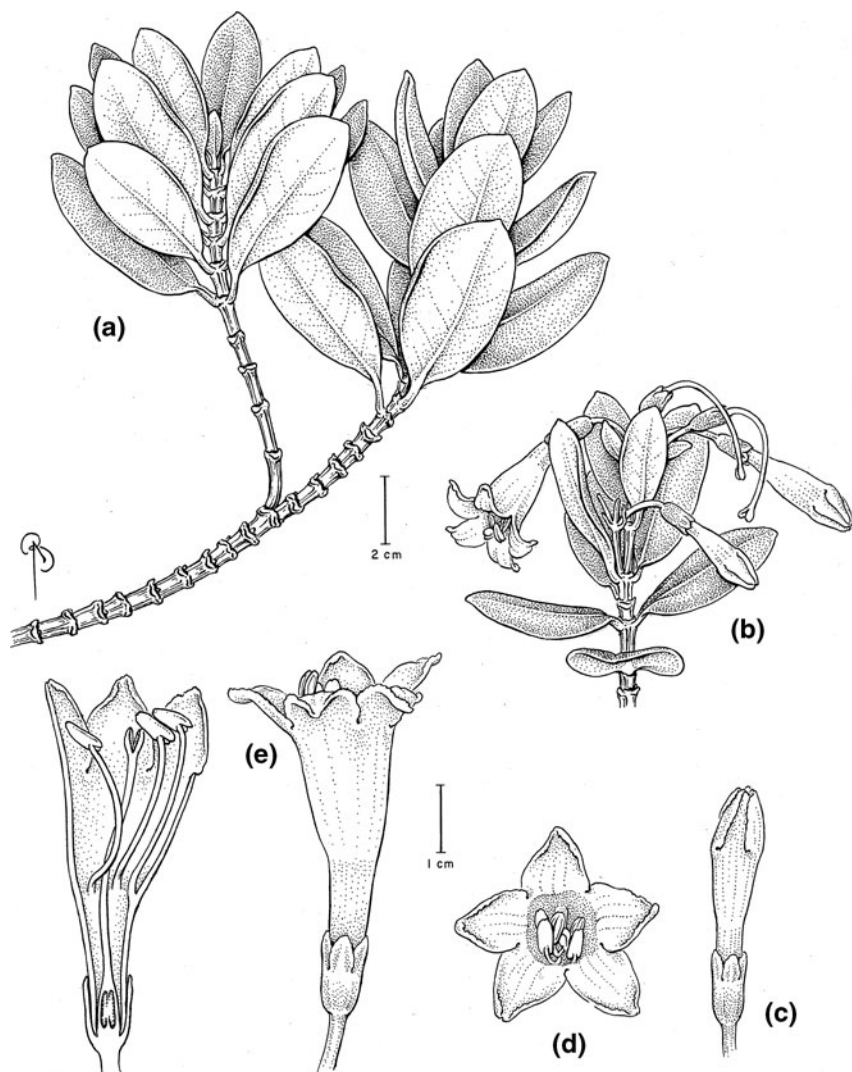


Fig. 3.20 A-C *Macrocarpaea arborescens*; **A** leaves; **B** habit of flowering stem; **C** bud; **D** corolla; **E** flower with cross-section. A drawn from Grant 11-4659 (NY). B-E drawn from Grant 01-4084

brochidodromous. Blades of lower and middle cauline leaves elliptic to obovate, 3–12 cm long, 2–7.5 cm wide; base rounded or abruptly tapering to a clasping petiole 2–10 mm apex rounded to obtuse, more or less mucronulate; margin narrowly cartilaginous, revolute. Upper cauline leaves similar or gradually smaller, subsessile or sessile. Inflorescence a more or less compact cyme, 1–5 times divided, leafy throughout or on larger plants with lower divisions subtended by reduced

leaves, upper by minute bractlets; flowers 3–35. Pedicels erect or arcuate, 2–20 mm, sometimes appearing longer because uppermost bractlets often subtend a single flower. Calyx 7–14 mm; lobes semicircular to ovate-triangular, 0.5–1 times as long as tube, obtuse to subacute, margins narrowly hyaline distally, erose-fimbriate. Corolla 25–75 mm, pale greenish yellow, funnel-form to campanulate; tube nearly straight or moderately curved, usually scarcely widening for one-third to nearly half its length, then flaring widely; lobes 7–18 mm, ovate-triangular, obtuse to subacute. Capsule ovoid, 15–25 mm. This description is largely from Pringle (1995).

M. arborescens occurs from 2,400 to 3,300 m in the Amotape–Huancabamba region of southern Ecuador and has no known close relatives. It is a characteristic species in being a much-branched shrub with distinctive flowers that are always spreading to pendent. This species is part of a group of species with smooth leathery leaves where the secondary leaf veins absent or scarcely visible including *M. arborescens*, *M. ericii*, *M. harlingii*, *M. lilliputiana*, *M. subsessilis*, and *M. zumbae*.

Specimens examined: ECUADOR. 1 January 1840, *Lobb* 22 (F, K, W); **Azuay:** Páramo de Castillo, 2,745–3,355 m, 18 August 1945, *Camp* 4795 (NO, NY, S); Sevilla de Oro, en el Camino Sevilla de Oro-Mendez, llegando al Páramo del Castillo, 3,300 m, 29 August 1996, *Garmendia & Cisneros* 1113 (LOJA, QCNE); Sevilla de Oro, en el Camino Sevilla de Oro-Mendez, llegando al Páramo del Castillo, 3,300 m, 31 August 1996, *Garmendia & Cisneros* 1171 (LOJA, QCNE); Road in construction Sigsig-Gualaquiza, Campamento Molón, ca. 1 km below Molón, 2,800–3,000 m, 11 December 1968, *Harling, G.* et al. 8236 (GB, MO, QCA); Canton Oña, Vía Urdaneta Yacuambi km 15, 3136 m, 7 December 2008, *Jadán, P. & P. Pesantes* 55 (LOJA); Pica Sevilla de Oro-Méndez “colecciones entre Sevilla de Oro-Páramo del Castillo,” 2,800–3,250 m, 7 August 1983, *Jaramillo* 5588 (MO, QCA); Carr. Zigzig-Molón-Gualaquiza, 2,810 m, 6 August 1986, *Jaramillo* et al. 8856 (AAU, HUA, NY, QCA); Km 74 de Cuenca, Carr. Zigzig-Molón-Gualaquiza, 2,790 m, 6 August 1986, *Jaramillo* et al. 8866A (QCA). **Cañar:** At pass on road Pindilig-Rivera (“La Virgen”), 3,200 m, 9 March 1985, *Harling, G. & Andersson* 22989 (GB, MO, QCA). **Loja:** Loja, 3,000 m, 1 Dec 1876, *André* 4549 (F, GH, K, NY); Loma de Oro, 10 km S of Saraguro, 3,300 m, 2 January 1981, *Balslev* 1385 (AAU, NY); Road Loja-Saraguro, 3,000 m, 15 February 1987, *Bohlin* et al. 1357 (GB, QCA); Nudo de Cajanuma, 3,000 m, 2 July 2000, *Chassot* 00-15 (NEU); 5 km S of Saraguro, 2,600–2,700 m, 7 October 1988, *Ellemann* 66594 (AAU, LOJA, QCA, QCNE); Hac. Horta-Naque, 3,100 m, 7 November 1946, *Espinosa, R.* 897 (K, LOJA); Cajanuma Field Station, and trail to Mirador, 2,950 m, 17 February 2001, *Grant, J.R. & L. Struwe* 01-4066 (G, LOJA, NEU, NY, QCA, QCNE, US); From Loja-Saraguro road, then 2.2 km on road toward Fierro Urco, 2,900 m, 18 February 2001, *Grant, J.R. & L. Struwe* 01-4075 (G, LOJA, NEU, NY, QCA, QCNE); From Loja-Saraguro road, then 3 km on road toward Fierro Urco, 2,900 m, 18 February 2001, *Grant, J.R. & L. Struwe* 01-4084 (G, LOJA, NEU, NY, QCNE); 21.3 km past Yangana toward Valladolid, 5 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques* 02-4290 (NEU, NY); Km 8.9 on road from Yangana-Cerro Toledo, 2,450 m, 29

December 2007, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 07-4506* (LOJA, MO, NY); Between km 10–20 on road from Yangana up Cerro Toledo, 04° 23' 05.2" S, 079° 07' 29.4" W, 2,892 m, 3 February 2011, *Grant, J.R. & J. Vieu 11-4659* (NY); Loma de Loro, 3,200 m, 11 February 1985, *Harling, G. & Andersson 21918* (GB); Parque Nacional Podocarpus, Cajanuma entrance, upper montane forest and elfin forest, 04° 07' W, 079° 10' W, 2,980 m, 25 September 2007 *Homeier, J. 2637* (LOJA, QCNE); Saraguro, area de Inka Pirca, colectado en la parcela 1, 2,800 m, 26 November 2003, *Jadán & Veintimilla 15* (LOJA); Mountains below Saraguro and San Lucas, 8 Sep 1865, *Jameson 67* (K); Loma del Oro, 2,800–3,200 m, 4 August 1986, *Jaramillo et al. 8816* (MO, QCA); Saraguro-Loja, km 12.4, turnoff toward Fierro Urco, 3,120–3,390 m, 7 December 1994, *Jørgensen et al. 1314* (LOJA, MO, NY, QCA, QCNE); P.N. Podocarpus, Cajanuma, 3,000 m, 29 October 1977, *Lewis 3674* (AAU, K, LOJA, MO QCNE); Parque Nacional Podocarpus, “Lagunas de Banderillas,” 04° 13' 26" S, 079° 6' 38" W, 15 December 1994, *Lozano, P. et al. 55* (LOJA); Cajanuma Field Station, 3,000 m, 29 January 2002, *Lozano, P. et al. E-487* (LOJA); Yangana-Cerro Toledo, 04° 23' 04" S, 079° 07' 44" W, 2,900 m, 20 February 2002, *Lozano, P. et al. E-760* (LOJA); Páramos de Saraguro, páramo ca. 7 km S of Saraguro, 3,000 m, 2 January 1979, *Luteyn et al. 6669* (NY, QCA); P.N. Podocarpus, Nudo de Cajanuma, 3,000–3,150 m, 6 September 1988, *Madsen & Elleman 75280* (AAU, LOJA, MO, NY, QCA, QCNE); P.N. Podocarpus, above the refuge of Cajanuma, at the point ‘Mirador’, 2,950 m, 1 November 1997, *Matt, F. 2* (ER); P.N. Podocarpus, above the refuge of Cajanuma, at the point ‘Mirador’, 2,950 m, 1 November 1997, *Matt, F. 3* (ER); Ca. Km 5 rd Fierro Ucu from Pichig, 3,100–3,200 m, 12 February 1989, *Øllgaard & Madsen 90494* (AAU, LOJA, MO, QCA, QCNE); P.N. Podocarpus, S of Loja, 2,950–3,000, 22 February 1985, *Øllgaard et al. 57953* (AAU, LOJA, MO, QCA, QCNE); P.N. Podocarpus, S of Loja, 3,000–3,200 m, 22 February 1985, *Øllgaard et al. 57983* (AAU, LOJA, MO, NY, QCA, QCNE); Páramo de Saraguro, 17 March 1983, *Pipoly 6393* (GB, NY); Hualaseo, 1 January 1805, *Tafalla 540* (MA-RUIZPAVON); Loja, 1 January 1805, *Tafalla 572* (MA-RUIZ PAVON); Hualaseo or Loja, 1 January 1805, *Tafalla 540 or 572* (BM, F, G); Cajanuma, 3,000 m, 23 January 2001, *Wolff, D. & F. Matt 56* (UTB). **Morona-Santiago:** Sigsig-Gualaquiza, 9 April 1968, *Harling, G. et al. 8117* (GB). **Zamora-Chinchipe:** Río Yacuambi, region de Rumetranca, Cooral-Huaico, 2,300–3,000 m, 1 January 1944, *Goetschel, J. 94945* (VEN).

4. *Macrocarpaea bubops* J.R. Grant & Struwe

Harvard Pap. Bot. 8(1): 66. 2003. TYPE: ECUADOR. Zamora-Chinchipe: Along new road Loja-Zamora, 2,500 m, 25 April 1987, *van der Werff, H. & W. Palacios 8986* (Holotype: NY; Isotypes: AAU, G, GB, MO, QCNE) (Figs. 3.21, 3.22. 3.28 and 3.35).

=*Macrocarpaea berryi* J.R. Grant, Harvard Pap. Bot. 9(2): 332. 2005. TYPE: ECUADOR. Zamora-Chinchipe: *Berry, P. & D. Neill 7665* (Holotype QCNE; Isotypes, MO, NY).

Fig. 3.21 *Macrocarpaea
bubops* J.R. Grant & Struwe.
Photo J.R. Grant



Dichotomously branched tree, much branched from about 2 m above the ground; overall branching pattern conical in outline, 1–10 m tall, glabrous throughout except lower leaf surfaces with short papillae. Trunk to 9.5 cm diameter wood always solid without any hollow cavities, growth rings prominent; bark thick, pithy to 4 mm thick, outer surface rugose, brown. Stems terete, solid, 5–12 mm in diameter just below inflorescence. Leaves narrowly ovate to elliptic, petiolate, 8.5–22.0 cm; blades 7.5–19.5 × 4.0–11.5, cuneate to rounded, margin entire, slightly revolute, base aequilateral to slightly oblique, apex acute, thick, leathery-coriaceous, dark green, with no or few impressed veins above, and slightly raised veins below, glabrous above and typically below, yet often with short tuberculate hairs on lower veins, and on most herbarium specimens (and especially visible on living material) on the underside of most leaves, at the base, on either side of the midrib just above the petiole, there are two orange dots; interpetiolar ridge 1–5 mm high; petioles robust with strong open vagination nearly equaling the length of the petiole, 10–35 mm. Branches of the inflorescence 14–36 cm, 5–20 flowered per branch. Bracts narrowly ovate to elliptic to obovate to rounded, 22–60(–170) × 6–32(–80) mm, base aequilateral, apex acute, petiolate; bract petioles 2–14(–30) mm. Flowers pedicellate, erect to horizontal to oriented in all directions in the inflorescence; pedicels 4–20 mm; bracteoles linear to ovate to obovate, 2–20 × 2–9 mm. Calyx narrowly to broadly campanulate, 7–11 × 7–10 mm, glabrous, smooth, green, ecarinate, often with pronounced ridges between calyx lobes extending to the base of the calyx; calyx lobes dividing calyx one-third to one half, rounded to obtuse, 3–4 × 3–5 mm, often with a slightly raised orange keel. Corolla funnel-shaped, 32–51 mm, 13–22 mm wide at corolla lobe sinuses, white to greenish yellow, smooth; corolla lobes ovate to elliptic, apex obtuse to rounded to retuse, 5–10 × 7–11 mm. Stamens 17–23 mm; filaments 12–19 mm, filiform, terete; anthers elliptic to oblong, 4–5 × 2.0–2.5 mm, sagittate, versatile. Pistil 22–29 mm; ovary 5–6 × 2.5–4.0 mm; style 14–19 × 0.5–1.0 mm; stigma 2-lobed, lobes 3–4 × 1–2 mm. Capsules and seeds unknown.

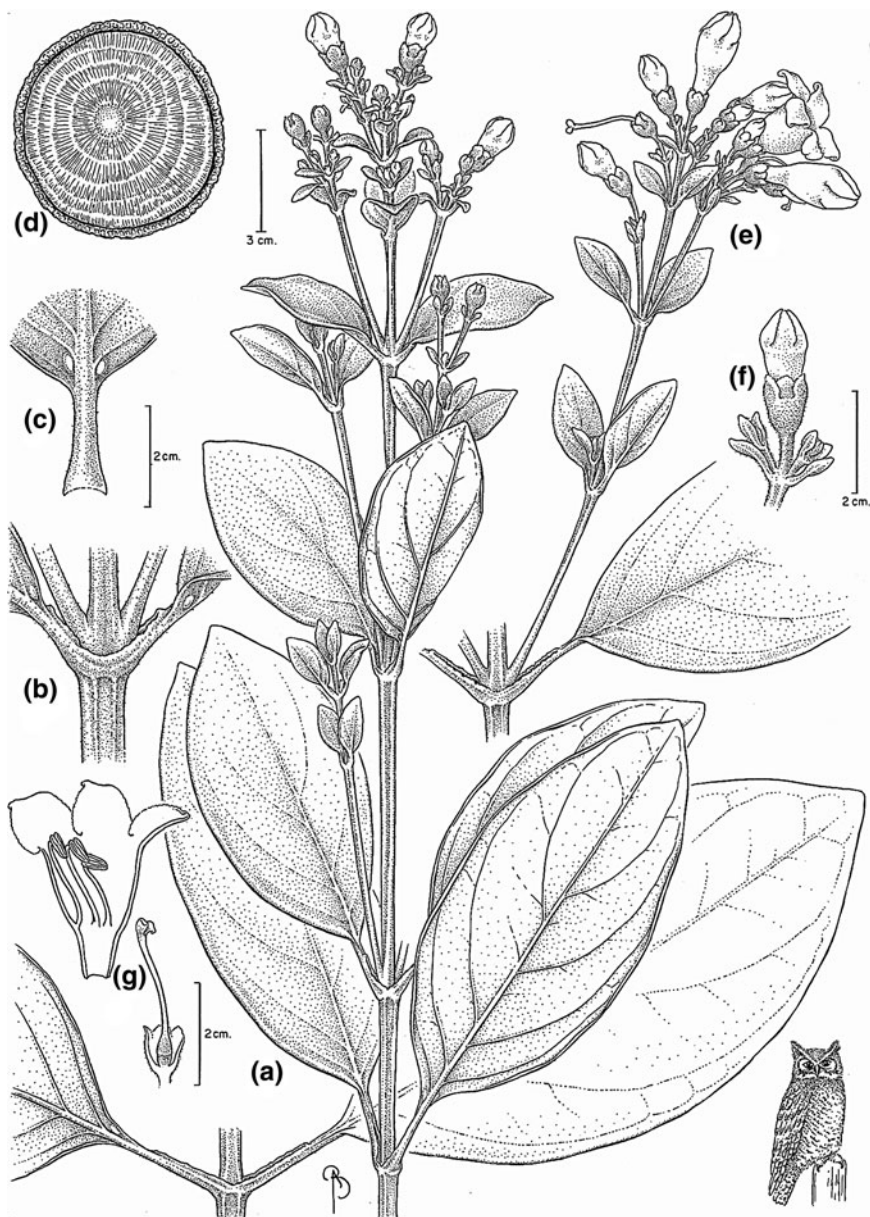


Fig. 3.22 *Macrocarpaea bubops* J.R. Grant & Struwe. **a** habit of flowering stem and leaves; **b** interpetiolar ridge; **c** lower surface of leaf showing two orange dots; **d** wood anatomy of cross-section of main trunk; **e** flowering stem; **f** floral bud; **g** cross-section of corolla and pistil. **a–d**, **f** from pickles, *photos* and *specimens* of Grant, J.R. & L. Struwe 01-4046; **e**, **g** from Madsen 74050 (AAU)

Macrocarpaea bubops belongs to *Macrocarpaea* section *Choriophylla* and occurs from 1,100 to 2,800 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. On the underside of most leaves, at the base, on either side of the midrib just above the petiole, are two, orange dots that become translucent when preserved in alcohol. Similar colored dots also occur on the related species *M. noctiluca* and *M. × matii*. It is part of a distinctive monophyletic group including *M. apparata*, *M. bubops*, *M. elix*, *M. jensii*, *M. × mattii*, and *M. noctiluca*.

Etymology. From the Latin “*Bubo*,” owl, and the Greek “*ops*,” eye, for the orange dots on the underside of most leaves.

Specimens examined: ECUADOR. **Loja:** En una pista que sale de la carretera de Loja a Zamora, 2,600 m, 28 September 1995, *Garmendia & Paredes 311* (LOJA, QCNE); Loja-Zamora rd, km 11, 79° 11' W, 03° 59' S, 2,630 m, 23 February 1988, *Jørgensen 65084* (AAU, QCA); Estación San Francisco, 03° 59' 08" W, 079° 04' 23" W, 2,300 m, 22 January 2002, *Lozano, P. et al. E-337* (LOJA); Loja-Zamora rd., approx. km 15, 79° 08' W, 03° 58' S, 2,400–2,700 m, 23–24 April 1988, *Madsen 74050* (AAU, LOJA, MO, QCA); Zamora Huaycu, 04° 02' 06" S, 079° 09' 42" W, 2,366 m, 7 September 2007, *Rivas, V.M. & E. Guanín A. 21* (LOJA); Zamora Huaycu, 2,600 m, 1983 *Vivar C., F. et al. 2017* (LOJA). **Morona-Santiago:** Elfin forest and semi-open areas along sandstone escarpment above and west of Tikimints, valley of Río Coangas (on topo maps and known locally as “Ijiach Naimt” in Shuar, meaning “Ridge of the Grubs,” 03° 15' 49" S, 078° 10' 12" W, 2,000 m, 20 March 2001, *Berry, P. & D. Neill 7630* (MO, QCNE); *Berry, P. & D. Neill 7640* (MO, QCNE); Elfin forest and semi-open areas along sandstone escarpment above and west of Tikimints, valley of Río Coangas (on topo maps and known locally as “Ijiach Naimt” in Shuar, meaning “Ridge of the Grubs,” 03° 15' 49" S, 078° 10' 12" W, 2,000 m, 20 March 2001, *Berry, P. & D. Neill 7665* (type of *M. berryi*, MO, NY, QCNE); Limón Indanza, Cordillera del Cóndor, Centro Shuar Warints, Recorrido desde la Cumbre del Cerro Chankinias hasta la cumbre de la cordillera, 03° 13' 40" S, 078° 17' 29" W, 2,200 m, 15 October 2002, *Kajekai, C. & Grupo Shuar de Conservación 41* (MO); San Juan Bosco, Cima de la Cordillera del Cóndor, Centro Shuar Numpatkaim. Bosque enano arbustivo y páramo de Bromeliaceae con arbustivos, 03° 16' 08" S, 078° 19' 06" W, 2,700–2,820 m, 22 July 2005, *Katán, T., et al. 367* (LOJA, MO, NY, QCNE); San Juan Bosco, Cima de la Cordillera del Cóndor, Centro Shuar Numpatkaim. Bosque enano arbustivo y páramo de Bromeliaceae con arbustos. Arbolito de 3 m, flores tubulares, 03° 16' 08" S, 078° 19' 06" W, 2,700–2,820 m, 22 July 2005, *Katán, T., et al. 425* (MO, NY, QCNE); San Juan Bosco, Cordillera del Cóndor, Comunidad Shuar Numpatkaim, 03° 15' 23" S, 078° 18' 59" W, 2,490–2,700 m, 24 July 2005, *Morales, C. & Embrey 1413* (MO, NY, QCNE); Limón Indanza Cantón, Cordillera de Huaracayo, east of Cordillera del Cóndor and Río Coangos, Cerro Ijiach Naimt, flat-topped sandstone mountain, east of Shuar village of Tinkimints, low dense montane forest and shrubby vegetation on summit, 03° 15' 49" S, 78° 10' 13" W, 2,000 m, 21 March 2001, *Neill, D. et al. 13102* (MO, QCNE); Cordillera de Cutucu, centro Shuar, Angel Roubi, Pie de la Cordillera, 02° 21' 41" S, 078° 02' 24" W, 1,100 m, 26 March 2002, *Nicolalde, F.*

et al. 1326 (MO, QCNE); Cordillera del Cóndor, recorrido desde la cumbe del Cerro Chankinias a 2,200 m hasta la cumbre de la Cordillera del Condor a 2,700 m, 03° 14' 41" S, 078° 17' 29" W, 2,200 m, 15 October 2002, *Tsuink & Grupos Shuar de Conservación* 37 (MO); **Zamora-Chinchipe:** Canton Zamora, sector el Tambo, Estación Científica "San Francisco," 2,170 m, 17 April 2000, *Cerna* 109 (QCNE); Carretera Loja-Zamora, Cuenca del rio San Francisco, Fundacion Arco Iris, 2,100 m, 03° 59' S, 79° 05' W, bosque de neblina montano, transectos de 50 × 4 M. × 5 (0.1 Ha.), especies de 2.5 cm. de DAP en adelante (modelo radial), arbol de 7 m × 10 cm. de DAP, 27 February 2000, *Cerón et al.* 40136 (QAP); Yantzaza, parroquia las Peñas, Kinross Aurelian, Fruta del Norte, Cordillera del Cóndor, 03° 47' 56" S, 078° 28' 56" W, 1,900 m, 2 November 2011, *Cerón, C. et al.* 70342 (QAP); *Cerón, C. et al.* 70511 (QAP); *Cerón, C. et al.* 70615 (QAP); Estación Científica San Francisco, research station along the highway on the edges of the city of Loja to Zamora at approx. 30 km, 03° 58' 18" S, 079° 04' 44" W, 1,800–3,200 m, 31 January 1999, *Dziedzioch, C.* 163 (LOJA); Parroquia Sabanilla, a 30 km de Loja, Cuesta occidental de la Cordillera del Consuelo, 03° 58' S, 079° 04' W, 2,000 m, 3 February 2003, *Fernández, E. & J. Quesada* 989 (QCNE); Parque Nacional Podocarpus, San Francisco entrance area, between Loja and Zamora, 03° 59' 17.1" S, 079° 05' 35.4" W, 2,169 m, 10 February 2011, *Grant, J.R. & J. Vieu* 11-4681 (NY); Parque Nacional Podocarpus, San Francisco entrance area, between Loja and Zamora, 03° 59' 29.1" S, 079° 05' 46.2" W, 2,103 m, 10 February 2011, *Grant, J.R. & J. Vieu* 11-4686 (NY); P.N. Podocarpus (San Francisco entrance), trail leading west from San Francisco, 03° 59' 24" S, 079° 05' 48" W, 2,100 m, 16 February 2001, *Grant, J.R. & L. Struwe* 01-4046 (G [2 sheets], LOJA, MO, NEU [3 sheets], NY, QCA, QCNE, S, SBBG, US [3 sheets]); Cordillera del Condor, 35 km E of Los Encuentros in direction of Paquisha Alta Military Camp, 1,617 m, 24 February 2006, *Grant, J.R., M.L. Cheung, F. F. Luisier, & N. Villard* 06-4349 (G, LOJA, MO, NY, QCA, QCNE); RBSF [Estacion Cientifica San Francisco], transekt 1, above NUMEX plots, 2,340 m, 11 November 2009, *Hillmann, B.M.* 50 (QCA); Area of the Estación Científica San Francisco, road Loja-Zamora, ca 35 km from Loja, 03° 58' S, 079° 04' W, 2,340 m, 13 March 2000, *Homeier, J.* 328 (LOJA); Reserva Quebrada de Monos, 04° 01' S, 079° 01' W, 2,300 m, 24 January 1998, *Lozano, P. et al.* 920 (LOJA); Estación San Francisco, 03° 59' 08" S, 079° 04' 23" W, 2,400 m, 22 January 2002, *Lozano, P. et al.* E-359 (LOJA); Estación San Francisco, 03° 59' 41" S, 079° 04' 07" W, 2,600 m, 22 January 2002, *Lozano, P. et al.* E-414 (LOJA); Estación San Francisco, 03° 59' 41" S, 079° 04' 07" W, 2,200 m, 22 January 2002, *Lozano, P. et al.* E-445 (LOJA, QCA); Cordillera del Cóndor region, Río Machinaza watershed, east of Los Encuentros, summit area of Hollín sandstone plateau, northwest of "big bend" of Río Machinaza, 03° 45' 06" S, 078° 31' 23" W, 1,720 m, 26 June 2009, *Neill, D. & C. Kajekai* 16974 (MO, QCNE); Cordillera del Cóndor, El Pangui, summit of the Contraduerte de Wawaime, a sandstone butte isolated by about 2 km from the main sandstone plateau of the Cordillera del Cóndor, 03° 35' 12" S, 078° 26' 21" W, 1,660 m, 7 December 2005, *Neill, D. & W. Quizhpe* 15014 (LOJA, MO, NY, QCNE); El Pangui,

Cordillera del Cóndor, summit of the sandstone plateau of Cordillera, southeast headwaters of Río Wawaime, 03° 35' 40" S, 078° 25' 11" S, 1,930 m, 8 December 2005, *Neill, D. & W. Quizhpe 15036* (LOJA, MO, NY, QCNE); El Pangui, Cordillera del Cóndor, summit of sandstone plateau of Cordillera, southeast headwaters of Río Wawaime, 03° 35' 40" S, 078° 25' 11" W, 1,930 m, 19 September 2006, *Neill, D. & W. Quizhpe 15263* (MO, NY); Centinela del Cóndor, Cordillera del Cóndor, Machinaza plateau area, above Paquisha Alto military post, upper watershed of Río Machinaza, 03° 53' 54" S, 078° 28' 49" W, 2,350 m, 16 March 2008, *Neill, D. & W. Quizhpe 16177* (LOJA, MO, NY, QCNE); Yantzaza Cantón, Cordillera del Cóndor region, southeast of Los Encuentros, Valley of Río Suárez, tributary of Río Machinaza, along road to Las Peñas camp of Aurelian mine company, 03° 48' 12" S, 078° 31' 21" W, 1,450 m, 22 March 2008, *Neill, D. & W. Quizhpe 16336* (LOJA, MO, QCNE); Cordillera del Cóndor, carretera desde Los Encuentros hacia el Cerro Machinaza, Parroquia Los Encuentros, Barrio San Antonio, 03° 49' 39" S, 078° 31' 05" W, 1,470 m, 17 July 2005, *Quizhpe, W. 1563* (F, LOJA, MO, NY, QCNE); Cordillera del Cóndor, carretera desde Los Encuentros hacia el Cerro Machinaza, sendero a Las Peñas, 1,400 m, 20 July 2005, *Quizhpe, W. 1630* (LOJA, MO, NY, QCNE); Region de la Cordillera del Cóndor, Parroquia San Carlos de las Minas, Namibija, sendero al Cerro Colorado, 04° 04' 44" S, 078° 47' 58" W, 2,100 m, 26 January 2005, *Quizhpe, W. et al. 751* (LOJA, MO, NY, QCNE); Palanda, Región de la Cordillera del Cóndor, sector sur, Parroquia San Francisco de Vergel, cuenca alta del Río Vergel, sendero a Sol Naciente, 04° 43' 33" S, 078° 57' 18" W, 2,010 m, 11 March 2005, *Quizhpe, W. et al. 962* (LOJA, MO, NY, QCNE); Palanda, Región de la Cordillera del Cóndor, sector sur, Parroquia San Francisco de Vergel, cuenca alta del Río Vergel, 04° 54' 55" S, 078° 58' 07" W, 2,200 m, 12 March 2005, *Quizhpe, W. et al. 974* (LOJA, MO, NY, QCNE); Estación Científica San Francisco, bosque nublado del transecto 1, 03° 58' 59" S, 079° 04' 44" W, 2,200 m, 1 October 1997, *Rbu & SL 2629* (QCA); Cordillera del Condor, destacamento militar Cóndor Mirador (Cóndor Mirador 2), 1 km al sureste del destacamento, 1,962 m, 7 September 2003, *Rodríguez, E.R. et al. 2641* (NY); Along new road Loja-Zamora, 2,500 m, 25 April 1987, *van der Werff, H. & Palacios, W. 8984* (MO).

PERU. Amazonas: Condorcanqui, Cordillera del Condor, la pared del "tepui" Cerro Machinaza, cabeceras del Río Comainas, tributario al oeste del Río Cenepa, arriba de Puesto de Vigilancia Alfonso Ugarte, subiendo atrás y norte del campamento, 03° 52.8 S, 078° 26.0 W, 1,950–2,050 m, 21 July 1994, *Beltrán & R. Foster 1197* (F, USM).

5. *Macrocarpaea claireae* J.R. Grant

Harvard Pap. Bot. 13(2): 253. 2008. TYPE: ECUADOR. Zamora-Chinchipe: 2 km N of Valladolid, 04° 32' 35.4" S, 079° 07' 908" W, 1,767 m, 4 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4528* (Holotype NY; Isotypes G, QCNE) (Figs. 3.23, 3.24).

Fig. 3.23 *Macrocarpaea claireae* J.R. Grant. Photo J.R. Grant



Unbranched shrub to small tree, 1.5–2.0 m, glabrous throughout. Trunk to 2 cm diameter, wood hollow in trunk and in branches, rings scarcely visible; bark papery thin to scarcely measurable, 0.05 mm thick, outer surface smooth to rugose, tan to greenish. Stems terete to quadrangular, hollow, 6–8 mm diameter just below the inflorescence. Leaves oval, elliptic to ovate, petiolate, (17) 26–35 cm long. Petioles (20) 35–50 mm, slender with slight vagination; interpetiolar ridge 1–3 mm high. Blades (15) 22.5–30 × (8.5) 11.5–17.5 cm, entire, not revolute, dark green though yellowing along the margins of all major veins, with slightly impressed veins above, and slightly raised veins below, glabrous above and below, papery thin; base aequilateral to oblique, rounded to cuneate and slightly decurrent on the petiole; apex acuminate to acute. Inflorescence a few branched open thyrses, 75+ cm long; branches 10–24 cm long; 5–9 flowered per branch. Bracts ovate, sessile to short-petiolate, 10–60–(120) × 5–(65) mm; base aequilateral to oblique, cuneate to rounded; apex acute to acuminate; bract petiole 0–6 mm. Flowers pedicellate, erect to slightly spreading; pedicels 10–22 mm long; bracteoles linear to lanceolate, 3–11 × 0.5–3.0 mm. Calyx campanulate to urceolate, 7–8 × 6–8 mm, glabrous to faintly scabrous, green, ecarinate, reniform to ovate; calyx lobes 3–4 × 4.0–5.5 mm, apex rounded to obtuse. Corolla funnel-shaped, 30–33 mm long, 20–23 mm wide at the apex of the tube, light green, smooth; corolla lobes ovate, 10–12 × 8–10 mm; apex obtuse to rounded. Stamens 25.5–28.0 mm long; filaments 22–24 mm long, filiform, flattened; anthers elliptic to oblong, 3.5–4.0 × 1.5–2.0 mm, sagittate, versatile; pollen glabra-type. Pistil 30–32 mm long; ovary 6–8 × 2–3 mm; style 21–22 × 0.5–1.0 mm; stigma lobes spatulate, 2–3 × 1–2 mm. Capsules and seeds unknown.

Macrocarpaea claireae belongs to *Macrocarpaea* section *Choriophylla* and occurs from 2,300 to 1,800 m in the Amotape–Huancabamba region of southern Ecuador. It is closely related to *M. xerantifulva* and even forms mixed stands together along the roadside near Valladolid. This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including

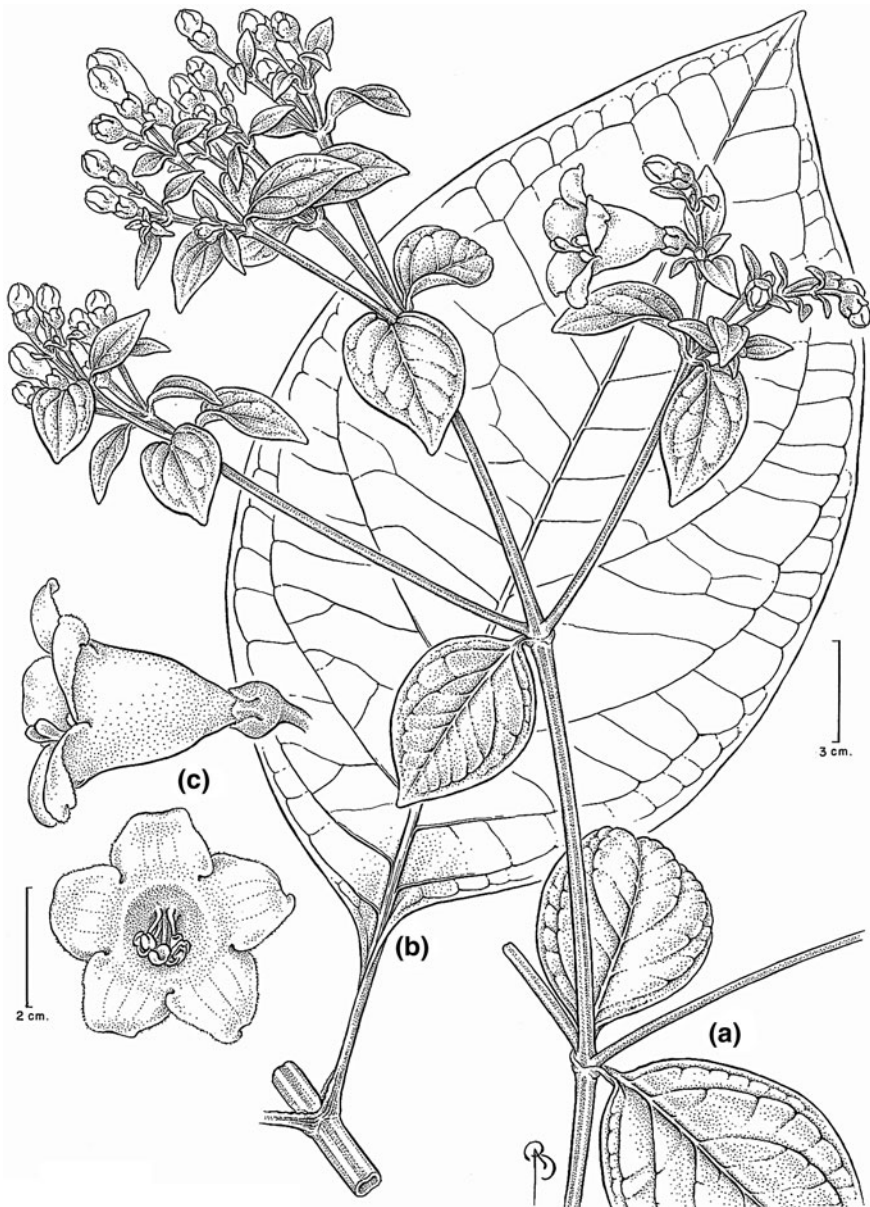


Fig. 3.24 *Macrocarpaea claireae* J.R. Grant. **a** habit of flowering stem; **b** leaf; **c** corolla viewed from front (*below*) and side (*above*). Drawn from Grant et al. 08-4528 by Bobbi Angell

Fig. 3.25 *Macrocarpaea dies-viridis* J.R. Grant. Photo J.R. Grant



M. catherineae, *M. claireae*, *M. dies-viridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*.

Etymology. Named for Dr. Claire Elvire Arnold (1968–), co-collector of the type, Swiss plant population biologist.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** 1.5 km north of Valladolid, 04° 32' 26.9'' S, 079° 07' 48.2'' W, 1,779 m, 6 February 2011, *Grant, J.R. & J. Vieu 11-4666* (NY); Palanda, région del Río Chinchipe, por la carretera entre Palanda y Valladolid, 04° 36' 47'' S, 079° 07' 20'' W, 1,300 m, 11 March 2007, *Quizhpe, W. & A. Wisum 2652* (LOJA, MO, QCNE).

6. *Macrocarpaea dies-viridis* J.R. Grant

Harvard Pap. Bot. 11(2): 129 2007. TYPE: ECUADOR. Zamora-Chinchipe: Cordillera del Cóndor, 8.8 km E of Paquisha, 03° 56' 03'' S, 078° 37' 32'' W, 1,369 m, 27 February 2006, *Grant, J.R., M.L. Cheung, F. Luisier & N. Villard 06- 4352* (Holotype NY; Isotypes G, LOJA, MO, QCA) (Figs. 3.25, 3.26).

Shrub or small tree, 1–4 m, glabrous throughout, though calyces are hyaline scabrous with short simple hairs. Trunk to 3 cm in diameter, wood solid in lower portions to hollow above and in branches, rings scarcely visible; bark papery thin to scarcely measurable, 0.05 mm thick, outer surface smooth to rugose, tan to greenish, blotched with lichens and mosses. Stems terete, hollow, 6–14 mm in diameter just below the inflorescence. Leaves ovate to ovate-elliptic, long-petiole, (17)–44–51 cm long. Petioles (20)–80–100 mm, slender with slight vagination; interpetiolar ridge 2–3 mm high. Blades (15)–33–41 × (7)–18–32 mm, entire, not revolute, dark green, with slightly impressed veins above, and slightly raised veins below, glabrous above and below, papery thin; base aequilateral to oblique, rounded to cuneate and slightly decurrent on the petiole; apex nearly rounded then acuminate, acute to nearly cuspidate. Inflorescence a much branched open thyse, 40+ cm long; branches 5–30 cm long; 9–20 flowered per branch. Bracts ovate to lanceolate, sessile to short-petiolate, 10–95 × 3–60 mm; base

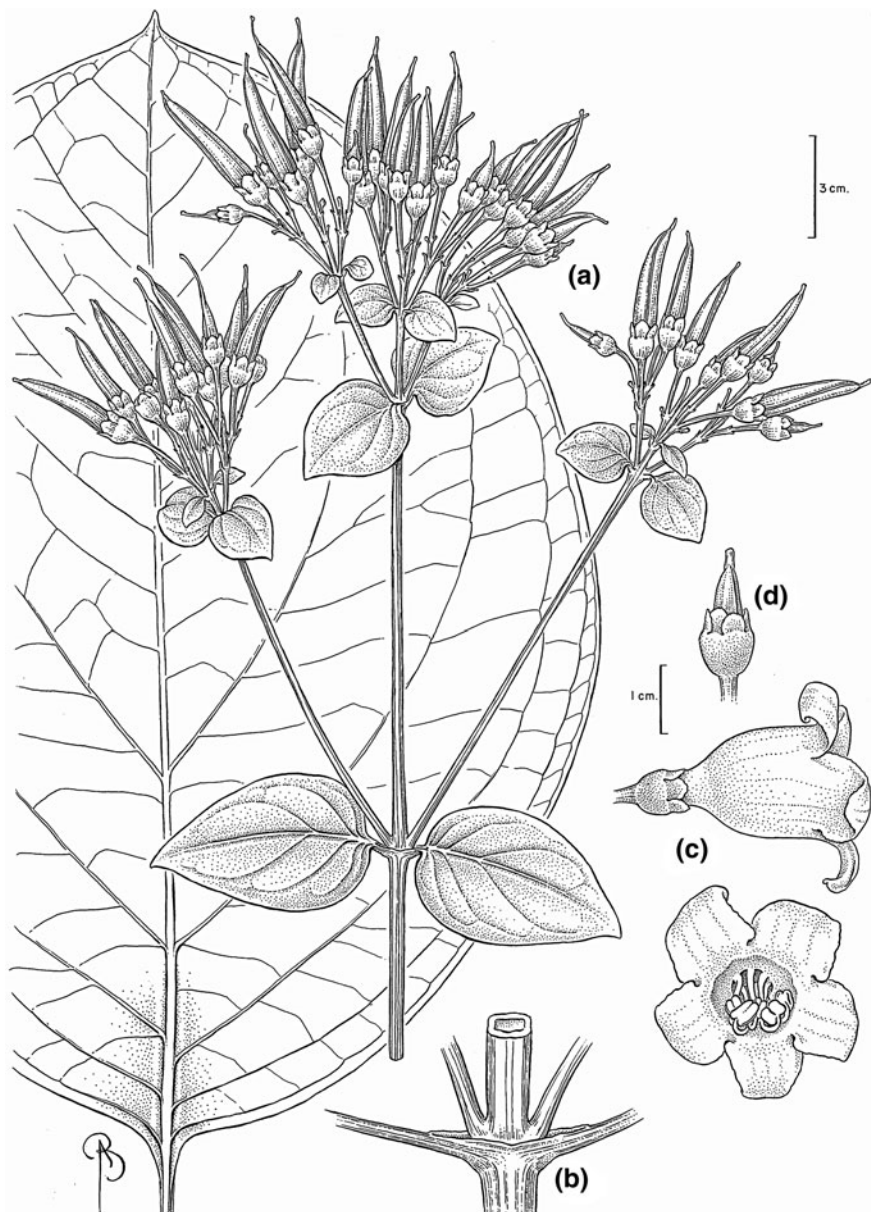


Fig. 3.26 *Macrocarpaea dies-viridis* J.R. Grant. **a-d** *Macrocarpaea dies-viridis*. **a** habit of fruiting stem, and leaf behind; **b** interpetiolar ridge; **c** corolla viewed from front (*below*) and side (*above*); **d** young fruit. **a-d** drawn from Grant et al. 06-4348 and Grant et al. 06-4352

Fig. 3.27 *Macrocarpaea elix* J.R. Grant. Photo J. Cortina



aequilateral to oblique, rounded, cuneate, to slightly cordate; apex acute to acuminate; bract petioles 0–5 mm. Flowers pedicellate, erect to spreading; pedicels 14–25 mm long; bracteoles linear to lanceolate, 2–10 × 1–3 mm. Calyx campanulate, 6–8 × 6–7 mm, glabrous to hyaline scabrous with short simple hairs, green, ecarinate; calyx lobes ovate to rotund, 3–4 × 4–5 mm, apex rounded to obtuse. Corolla funnel-shaped, yet measurements unknown. Capsules ellipsoidal to linear-long, 32–45 × 6–8 mm, smooth to faintly ribbed, greenish brown to tan, erect; style remnant 5–12 mm long. Seeds “perimetrically winged type,” flattened, roughly 3–4 sided in outline, yet appearing as myriads of different puzzle pieces, 0.9–1.3 × 0.9–1.0 mm, bicolored, testa tanish and reticulate, wings straw-colored and ribbed.

Macrocarpaea dies-viridis belongs to *Macrocarpaea* section *Choriophylla* and occurs from 1,369 to 1,558 m in the Amotape–Huancabamba region of southern Ecuador. This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including *M. catherineae*, *M. claireae*, *M. dies-viridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*. It occurs in the Cordillera del Condor region.

Etymology. From the Latin “dies,” day, and “viridis” green, for the American punk rock music group *Green Day*.

Specimen examined: ECUADOR. **Zamora-Chinchi:** Cordillera del Condor, Grant 43.9 km E of Los Encuentros in direction of Paquisha Alta Military Camp, 03° 51' 02" S, 078° 33' 06" W, 1,558 m, 21 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4561* (NY); Cordillera del Condor, 43.9 km E of Los Encuentros in direction of Paquisha Alta Military Camp, 1,558 m, 24 February 2006, *Grant, J.R., M.L. Cheung, F. F. Luisier, & N. Villard 06-4348* (G, LOJA, MO, NY, QCA) Cordillera del Condor, 9.3 km E of Paquisha, 03° 55' 31.1" S, 078° 37' 27.6" W, 1,518 m, 9 February 2011, *Grant, J.R. & J. Vieu 11-4679* (NY); Cordillera del Condor, 44.3 km E of Los Encuentros in direction of Paquisha Alta Military Camp, 03° 54' 02.8" S, 078° 30' 41.9" W, 1,605 m, 13 February 2011, *Grant, J.R. & J. Vieu 11-4693* (NY).

7. *Macrocarpaea elix* J.R. Grant

Harvard Pap. Bot. 9(1): 14. 2004. TYPE: ECUADOR. Azuay: highway Cuenca-Cola de San Pablo, km 88, 2,540 m, 14 February 1977, *J.D. Boeke & H. Loyola* 988 (Holotype: NY; Isotypes: AAU, CONN, MO, QCA) (Figs. 3.27, 3.50). Shrub or small tree to 1–10 m, hyaline hispid to spiculate with short simple hairs on stems, petioles, leaves, inflorescences, bracts, and calyces. Stems terete to slightly quadrangular above, hollow to solid, 5–9 mm in diameter just below inflorescence. Leaves elliptic to ovate, petiolate, (11–) 20–33 cm long. Petioles 10–45 long, robust with strong open vagination or groove nearly equaling the length of the petiole; interpetiolar ridge 2–5 mm high. Blades (10–) 19–28.5 × (5–) 11–18 cm, entire, not revolute, dark green above, lighter below, with slightly impressed veins above, and strongly raised veins below, glabrous above, hyaline hispid on all veins below, papery thin, to thin coriaceous; base aequilateral to oblique, cuneate to rounded; apex acuminate to acute. Inflorescence a much branched open thyrse, often appearing glaucous on dried herbarium specimens due to minute white crystals covering upper stems, petioles and calyces, 37+ cm long (the total inflorescence unknown as has been cut into various segments for separate herbarium sheets); branches 11–22 cm long; 9–15 flowered per branch. Bracts obovate, elliptic, obovate, to oblanceolate, sessile to short-petiolate, 15–120 × 7–68 mm; base aequilateral to oblique, cuneate, rounded to short-attenuate; apex acuminate to acute; bract petioles 2–16 mm long. Flowers pedicellate, erect to slightly spreading; pedicels 9–25 mm long; bracteoles inconspicuous and scabrous, linear, or triangular to ovate, lanceolate to oblanceolate, 1.5–20 × 1–8 mm. Calyx campanulate, 8–10 × 7–8 mm, spiculate to glabrous, smooth, green, ecarinate; calyx lobes ovate, 2–4 × 2.5–4.0, apex rounded to obtuse. Corolla funnel-shaped, (22–35–45 mm long, 10–20 mm wide at the apex of the tube, pale yellow, greenish-yellow, pale greenish, smooth; corolla lobes ovate, 7–12 × 4–9 mm, apex obtuse to rounded. Stamens 24–30 mm long; filaments 20–25 mm long, filiform, terete; anthers linear to linear-elliptic, 4–5 × 1.5–2.0 mm, sagittate, versatile; pollen “glabra-type.” Pistil 35–40 mm long; ovary 5–7 × 2–3 mm; style 28–30 × 0.75–1.0 mm; stigma lobes spatulate to elliptic, 2–3 × 1.0–1.5 mm. Capsules ovoid to ellipsoidal, 21–35 (–

41) × 7–11 mm, smooth to faintly rugose, light to dark brown, erect to nodding; style remnant 15–23 mm; seeds “perimetrically Cwinged,” flattened, roughly 3–4 sided in outline, yet appearing as myriads of different puzzle pieces, 0.8–1.9 × 0.5–1.0 mm, bicolored, testa tan, wings orangish straw-colored, testa reticulate, wings ribbed.

Macrocarpaea elix belongs to *Macrocarpaea* section *Choriophylla* and occurs from 2,100 to 3,100 m in the Amotape–Huancabamba region of southern Ecuador. It is mostly closely related to *M. apparata* with which it shares hairy leaves and calyces. This species is part of a distinctive monophyletic group including *M. apparata*, *M. bubops*, *M. elix*, *M. jensii*, *M. × mattii*, and *M. noctiluca*.

Etymology. From the Latin *elix*, a channel, for the large grooves on the leaf petioles.

Specimens examined: ECUADOR. **Azuay:** The eastern Cordillera, 1–8 km north of the village of Sevilla de Oro, 2,440–2,745 m, 27 July 1945, *Camp 4325* (NO, S, U); Carretera Cuenca-Paute-Sevilla de Oro, colecciones entre Paute-Sevilla de Oro, 2,490 m, 8 August 1986, *Jaramillo 8297* (AAU, QCA); Km 29 Paute-Amaluza road, 02° 41' S, 79° 36' W, 2,550 m, 7 August 1986, *P.M. Jørgensen 61429* (AAU, QCNE). **Cañar:** Above Rivera on road to Pindilig, forest remnants, 2,800 m, 9 March 1985, *Harling, G. & Andersson 23031* (GB, MO, QCA); Pass on road Azogues-Taday, dry “ceja” scrub, 3,100 m, treelet 4–5 m tall, 30 March 1985, *Harling, G. & Andersson 23442* (GB, MO, QCA). **Morona-Santiago:** Along road between Gualaceo and Limón, 42.5 km E of Gualaceo, 17.7 km E of summit, 16.5 km E of Azuay border, 11.4 km W of jct to Indanza, 2,072 m, 22 May 2003, *Croat, T.B. & Menke 89230* (MO, NY, QCNE); SW of military checkpoint in Limón (=General L. Plaza Gutiérrez (02° 58' S, 78° 25' W), 65 km Sw of Mendez (02° 42' S, 78° 18' W), 2,340 m, shrub 1–2 m tall, 27 October 1988, *Dorr, L. & Barnett 5910* (QCA, QCNE, US); Ca 15 km up road from Plan de Milago/Limon to Gualaceo, 03° 00' 07.5" S, 078° 32' 52.7" W, 2,222 m, 12 February 13, *Grant, J.R. & J. Cortina 13-5122* (NY); Road Gualaceo-Limón, Loma del Puerco, mountain forest, 2,500 m, 11 November 1988, *Harling, G. 25814a* (GB); Road Gualaceo-Limón, Loma del Puerco, 2,500 m, ca. 3 m tall, 11 November 1988, *Harling, G. 25814b* (GB); 20 km northwest of Indanza, between Cerro Cruzado and Zapote area, 2,134 m, 2–16 October 1944, *H. Jørgensen 49* (NY); Along Río Tintas below Arenillas, dense forest between Campanas and Arenillas, along Río Tintas, 10 leagues SE of El Pan, 2,195 m, 13 July 1943, *Steyermark, J. 53548* (F [3 sheets], US).

8. *Macrocarpaea ericii* J.R. Grant

Harvard Pap. Bot. 9(1): 23. 2004. TYPE: PERU. Cajamarca: San Ignacio, Huarango, Localidad Romerillo, Cordillera entre Romerillo y Nuevo Mundo, vegetación primaria con predominancia de árboles enanos, 05° 14' S, 78° 46' W, 2,300 m, 27 July 1997, *J. Campos, E. Rodríguez, & S. Núñez 4296* (Holotype: MO; Isotype: HUT) (Fig. 3.28).

Unbranched shrub, 1–1.6 m, glabrous throughout. Stems terete to slightly quadrangular, solid, 3–8 mm in diameter just below inflorescence. Leaves obovate, varying to slightly elliptic, short-petiolate, (4–)7–15 cm long. Petioles 6–2 mm long, robust with strong open vagination one half the length of the petiole; interpetiolar ridge 2–5 mm high. Blades (3.4–6–13 × (2.5–)4.5–8.5 cm, entire, slightly revolute, dark above and below, lateral veins scarcely visible either above or below, glabrous, thick, leathery-coriaceous; base aequilateral to oblique, cuneate to rounded; apex rounded to obtuse. Inflorescence a few branched open thyrses, 8–44 cm long; branches 3–28 cm long, 1–3 flowered per cyme. Bracts obovate to oblanceolate, petiolate, 25–55 × 13–23 mm; base aequilateral, cuneate; apex rounded to obtuse; bract petioles 5–8 mm long. Flowers pedicellate, erect to spreading; pedicels 3–22 mm long; bracteoles linear to oblanceolate, 5–20 × 2–5 mm. Calyx campanulate, 8–11 × 6–8 mm, glabrous, faintly

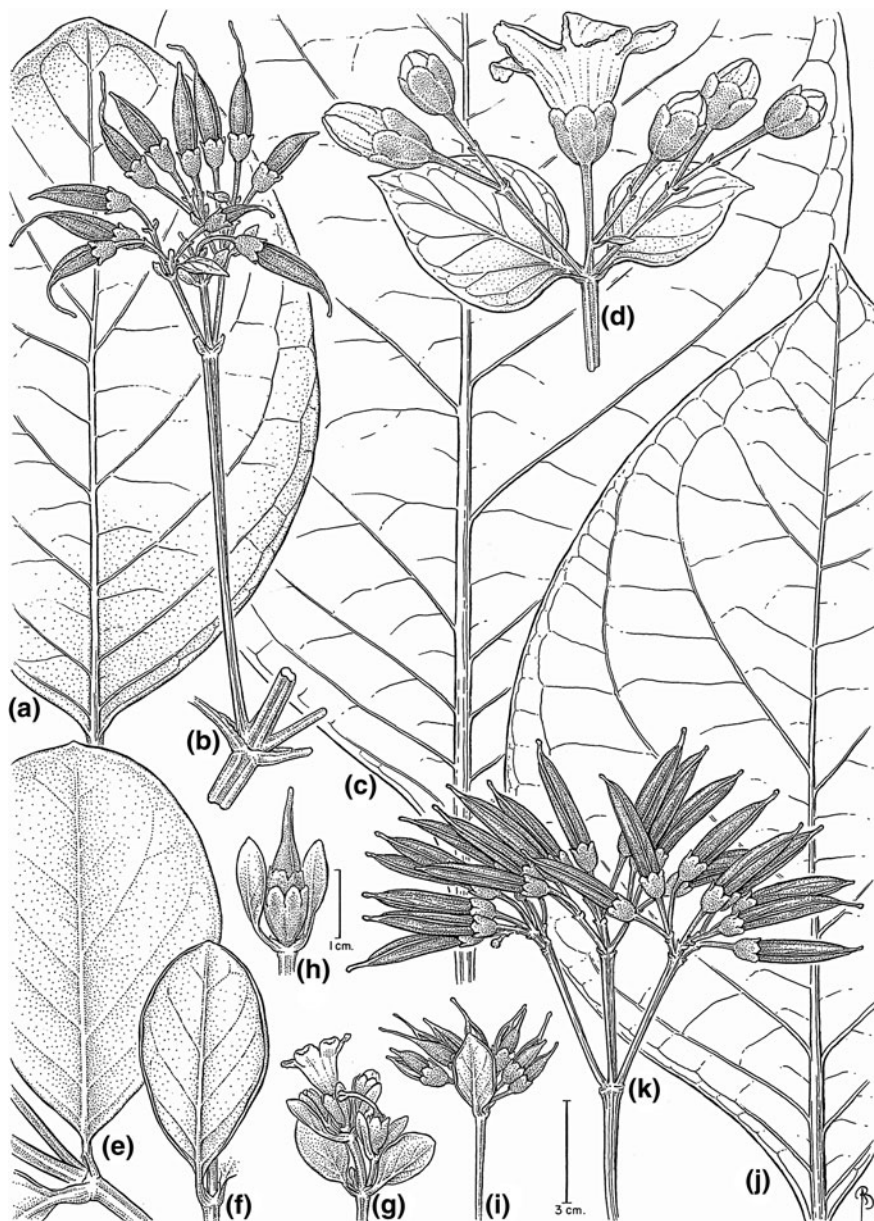


Fig. 3.28 **a–b** *Macrocarpaea bubops*; **a** leaf; **b** branch of flowering stem and interpetiolar ridge; **c–d** *M. ostentans* from Peru; **c** leaf; **d** habit of flowering stem; **e–i** *M. ericii*. **e** mature leaf; **f** smaller mature leaf; **g** habit of flowering stem; **h** detail of fruiting flower, notice two pronounced bracteoles; **i** habit of fruiting stem. **j–k** *M. dillonii* from Peru. **j** leaf; **k** habit of fruiting stem; **a–b** drawn from Beltran & Foster 1197 (USM); **c–d** drawn from Wallnöfer 12-9688 (U); **e** drawn from Campos et al. 4296 (MO); **f–h** drawn from Weigend 98/500 (M); **i** drawn from Campos et al. 5564 (U); **j–k** drawn from Sánchez Vega et al. 9572 (HAO)

verrucose, ecarinate, ovate to elliptic; calyx lobes $4\text{--}5 \times 3.5$ mm, rounded to obtuse. Corolla funnel-shaped, 20–30 mm long, 11–14 mm wide at the apex of the tube, yellow to greenish-yellow, smooth; corolla lobes ovate to elliptic, $6\text{--}10 \times 5\text{--}8$ mm, apex obtuse to rounded. Gynoecium, androecium and pollen unknown. Capsules ovoid to ellipsoidal, $16\text{--}20 \times 8\text{--}10$ mm, smooth, faintly verrucose to pustulate, straw-colored, erect to slightly nodding; style remnant 5–10 mm. Seeds “perimetrically winged–reversal to rimmed”, angular to polyhedral to flattened (pyramids, tetrahedrons, rectangular prisms, to multisided prisms), 2–5-sided, not winged, $0.5\text{--}1.0 \times 0.3\text{--}0.5$ mm, straw-colored, rugose-reticulate.

Macrocarpaea ericii belongs to *Macrocarpaea* section *Choriophylla* and occurs from 1,600 to 2,400 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. It is easily recognized by its thick leathery obovate leaves, and flowers that are subtended by a pair of spatulate bracteoles. This species is part of a group of species with smooth leathery leaves where the secondary leaf veins absent or scarcely visible including *M. arborescens*, *M. ericii*, *M. harlingii*, *M. lilliputiana*, *M. subsessilis*, and *M. zumbae*.

Etymology. Named for Eric Frank Rodríguez Rodríguez (1963–), Herbarium Truxillense, Universidad Nacional de Trujillo, Peru.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Nangaritzta, summit of tapeui “Cima de la Reserva San Miguel de Las Orquideas”, property owned by the Association de Trabajadores Autonomos San Miguel de Las Orquideas, near Cabañas Yankuam, $04^{\circ} 14' 54''$ S, $078^{\circ} 38' 34''$ W, 13 May 2009, Clark, J.L. et al. 10779 (NY); Cordillera del Cóndor, Comunidad San Miguel de Las Orquideas, Tepuy 2, vertiente occidental del río Nangaritzta, 1,600 m, 1 April 2009, Jadán, O., et al. 292 (LOJA).

PERU. San Ignacio: San José de Lourdes, Localidad Estrella del Oriente “Cerro del Oso”, vegetación enana, $04^{\circ} 46' S$, $78^{\circ} 59' W$, 1,600–1,700 m, 6 September 1997, Campos & Díaz 4410 (HUT [not seen], MO, NEU, U [2 sheets]); San Ignacio, near San José de Lourdes, llanos, 1,900–2,100 m, 10 June 1998, Weigend et al. 98/500 (M, USM [not seen]). Piura: Cordillera de San José, páramo 1,700 m, flores verdosas, 23 September 1961, Friedberg 692 (USM).

9. *Macrocarpaea gattaca* J.R. Grant

Harvard Pap. Bot. 9(1): 16. 2004. TYPE: ECUADOR. Pichincha: Vía San Juan-Chiriboga-Empalme, 2,550 m, 10 September 1977, J. Jaramillo 22 (Holotype: NY; Isotypes: AAU, MO, QCA) (Fig. 3.29).

Unbranched shrub to tree to 2–5 m, hyaline spiculate to scabrous with short simple hairs on stems, petioles, leaves, inflorescences, bracts, and bracteoles. Stems terete to quadrangular, solid to hollow, 4–10 mm in diameter just below inflorescence. Leaves ovate to nearly deltoid, sessile to short-petiolate, 10.5–18.5 cm long. Petioles 0–5 mm long, usually absent, but rarely a short robust petiole with strong open vagination present; interpetiolar ridge 3–5 mm high. Blades $10\text{--}18 \times 8\text{--}11$ cm, entire, not revolute, dark green, with slightly impressed

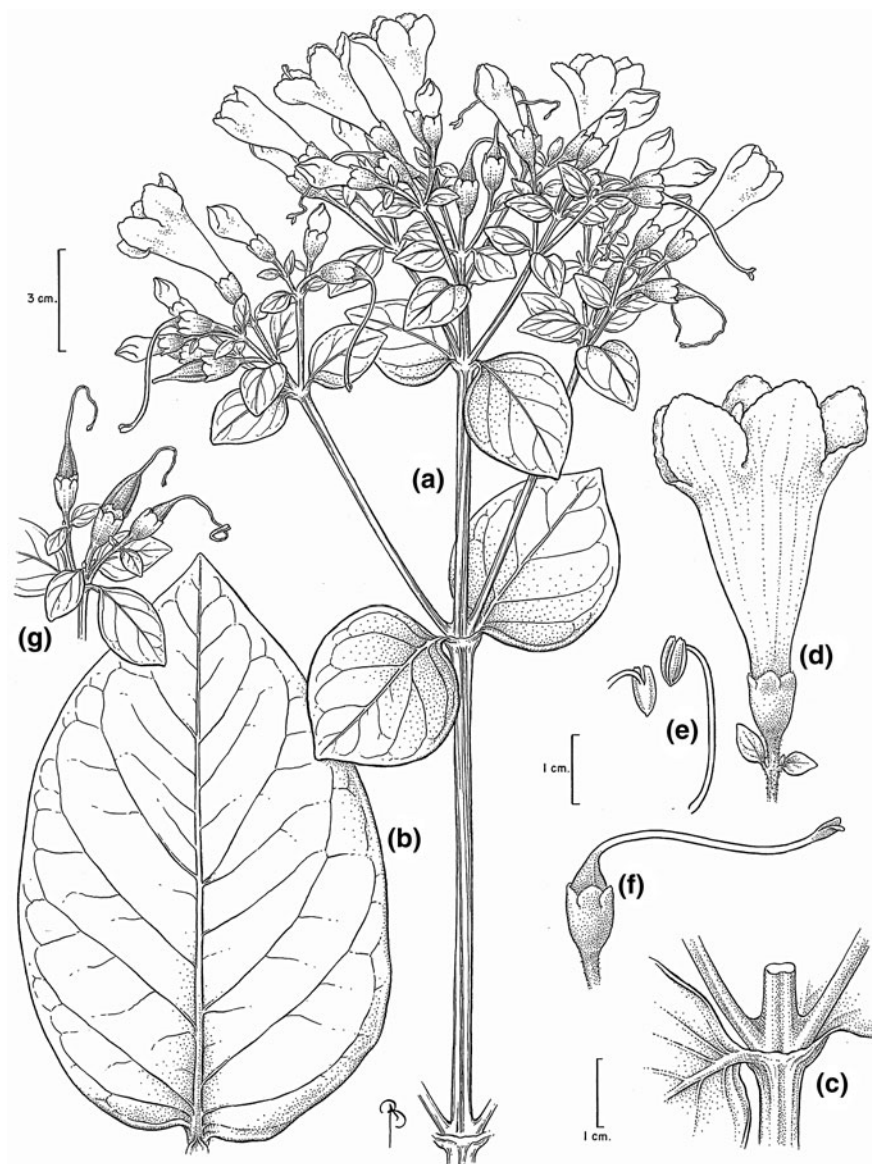


Fig. 3.29 *Macroparpaea gattaca* J.R. Grant. **a** habit of flowering stem; **b** leaf; **c** detail of interpetiolar ridge; **d** flower; **e** anthers; **f** immature fruit; **g** maturing fruits. **a, c–f** drawn from Asplund 18200 (S); **b** drawn from Jaramillo 22 (QCA); **g** drawn from Freire 456 (AAU)

veins above, and slightly raised veins below, hyaline hispid to spiculate on veins on lower surface, papery thin, to thin coriaceous; base aequilateral to oblique, rounded to nearly truncate; apex acute. Inflorescence a much branched open thyrses, 33+ cm long, the total inflorescence unknown as has been cut into various segments for separate herbarium sheets; branches 9–38 cm long; 3–9 flowered per branch. Bracts ovate to nearly deltoid, inaequilateral, suborbicular to elliptic, sessile to petiolate, 12–77 × 6–54 mm; base aequilateral to oblique, rounded to nearly truncate; apex acuminate to acute; bract petioles 0–5 mm long. Flowers pedicellate, erect to spreading; pedicels 7–20 mm long; bracteoles ovate to obovate, 5–18 × 3.5–14.0 mm. Calyx narrowly campanulate, 8–11 × 5–6 mm, glabrous, smooth, green, ecarinate; calyx lobes ovate to reniform, 1.3–2.5 × 3–5, obtuse, acute to rounded. Corolla funnel-shaped, 45–53 mm long, 18–23 mm wide at the apex of the tube, yellow, yellowish-green, to pale green, smooth; corolla lobes ovate, 9–13 × 8–14 mm, obtuse to rounded, often crisped. Stamens 27–37 mm long; filaments 22–30 mm long, filiform; anthers linear to linear-elliptic, 5–7 × 2–3 mm, sagittate, versatile; pollen “glabra-type”. Pistil 47–52 mm long; ovary 10–12 × 2–4; style 34–36 × 1.0; stigma lobes spatulate, 3–4 × 1.0–1.5 mm. Capsules obovoid to ellipsoidal, 25–36 × 7–9 mm, smooth, rugose, to faintly ribbed, greenish to tan, erect to nodding; style remnant 5–17 mm. Seeds “rimmed” type, angular to polyhedral (tetrahedrons, rectangular prisms, to multisided prisms), 2–7-sided, 0.6–1.0 × 0.3–0.7 mm, faint orangish-tan, rugose-reticulate.

Macrocarpaea gattaca belongs to section *Macrocarpaea*, and occurs in the northern Andes, on Pacific slopes on the Cordillera Occidental, the Chocó of Ecuador. It appears to be related to *M. densiflora* (Benth.) Ewan, *M. gaudialis* J.R. Grant, *M. nicotianifolia* Weaver & J.R. Grant, and *M. pachyphylla* Gilg, from southern Colombia. *Macrocarpaea gattaca* is nearly sympatric with *M. sodiroana* yet occur in two distinct elevation bands; 1,000–1,600 m for *M. sodiroana*, and 2,500–2,700 m, for *M. gattaca*.

Etymology: From the DNA nucleotides adenine, cytosine, guanine, and thymine that were used in the identification of this species.

Specimens examined: ECUADOR. **Pichincha:** Parroquia Pacto-Gualea, sector del Río Pishashi, 1,030–1,070 m, 23 July 1994, *Aimacaña & Guzmán 156* (QAP); Salvador, between San Juan and Chiriboga, shrubby slope, 2,600 m, 28 October 1955, *Asplund 18200* (S); Carretera Quito-Las Palmas-Palmeras, 2,800 m, 29 November 1986, *Freire, A. 456* (AAU, QCA); Cerro Guarumos-La Y sendero al Cerro El Castillo, derecho de vía del Oleoducto de Crudos Pesados, 2,600–2,700 m, 7 September 2001, *Freire A. et al. 3170* (MO, NY); 67 km up the old road Santo Domingo-Quito from where it merges with the new Santo Domingo-Quito road, 02° 17' S, 078° 36' W, 26 February 2002, *Grant, J.R. & J.-M. Torres 02-4209* (NEU, NY, US); Via San Juan-Chiriboga, km 33 desde Quito, 2,700 m, 2 April 1976, *Oldeman 3449* (NY, QCA); Canton Quito, Parroquia Nanegal, Montañas de Maquipucuna, Cerro Sosa and ridge adjacent to Cerro Montecristi, 00° 04–05' N, 78° 37' W, 2,100–2,200 m, 9 July 1991, *Webster et al. 28902* (DAV, MICH, MO, QCNE, TEX).

10. *Macrocarpaea gondoloides* J.R. Grant

Harvard Pap. Bot. 9(2): 320. 2005. TYPE: ECUADOR: Carchi: Tulcan, Reserva Indígena Awá, Comunidad San Marcos, 25 km al NW de El Chical, Parroquia Maldonado, bosque pluvial premontano, 01° 06' N, 78° 14' W, 1,500 m, 16–30 November 1990, *D. Rubio, C. Quelal, & J. Pai 1077* (Holotype MO; Isotype NY, QCNE) (Fig. 3.30).

Shrub to liana-like shrub, 0.5–3.0 m, glabrous throughout, cm in diameter. Stems terete, solid, 2–5 mm in diameter just below the inflorescence. Leaves linear-lanceolate, lanceolate, elliptic to ovate, petiolate, (6)10.5–22 cm long. Petioles 2–20 mm long, slender with slight vagination to one quarter the length of the petiole; interpetiolar ridge 1–3 mm high. Blades (5.8)10.3–20 × 3.5–8 cm, entire, not revolute, dark above and below, with slightly impressed veins above, and slightly raised veins below, glabrous, papery thin; base aequilateral to oblique, cuneate to attenuate and decurrent on the petiole; apex acuminate. Inflorescence a few-branched open thyrse, 9–40 cm long; branches 9–22 cm long; 3–9 flowered per branch. Bracts ovate to lanceolate, sessile to short-petiolate, 10–115 × 4–58 mm; base aequilateral to oblique, cuneate to rounded; apex acuminate to acute; bract petioles 0–2 mm long. Flowers pedicellate, erect to slightly spreading, but never nodding; pedicels 8–20 mm long; bracteoles ovate to lanceolate, 5–16 × 1.5–6.0 mm. Calyx campanulate, 11–13 × 5–7 mm, glabrous, vertically striated, straw-colored to tan when dried as herbarium specimen, ecarinate; calyx lobes ligulate to oblong, 6–9 × 3.5–5 mm, apex rounded to obtuse. Corolla greenish-white, greenish-yellow. Stamens and pistil unknown. Capsules ovoid, 9–14 × 5–10 mm, smooth, ribbed along sutures, straw-colored, erect to slightly spreading but not nodding; style remnant 6–8, remaining as a strong lignified tube even when the capsule below deteriorates to release the seeds mm long. Seeds “Rimmed –reversal to Perimetrically winged type,” 0.4–0.9 × 0.3–0.5 mm, bicolored, testa golden-tan, wings translucent golden, testa reticulate, wings ribbed.

Macrocarpaea gondoloides belongs to section *Macrocarpaea*, and occurs in the northern Andes, on the Cordillera Occidental, the Chocó of Colombia and Ecuador. It is closely related to several facultatively epiphytic species: *M. gulosa* J.R. Grant and *M. luteynii* of the Cordillera Occidental of Colombia, and *M. browalliioides* (Ewan) A. Robyns & Nilsson and *M. subcaudata* Ewan of Costa Rica and Panama.

Etymology. For the oblique shape of the leaves, similar to the outline of an Italian *gondola*, a type of boat.

Specimens examined: ECUADOR. **Carchi:** Tulcan, Reserva Étnica Awá, Parroquia El Chical, Centro Gualpi Medio, 01° 02' N, 78° 16' W, 900 m, 18 February 1993, *Aulestia & Grijalva 1122* (MO, QCNE); Tulcan, Reserva Étnica Awá, Parroquia El Chical, Centro San Marcos, bosque muy húmedo premontano, 01° 06' N, 78° 14' W, 750 m, 20–30 April 1990, *Méndez et al. 231* (AAU, MO, QCNE); Tulcan Canton, Chical, Reserva Étnica Awá-Camumbí, 78° 16' W, 00° 53' N, 1,700–1,900 m, 20–29 July 1991, *Quelal et al. 276* (MO, QCNE); Tulcan Cantón, Parroquia Chical, Sector Gualpi medio, Reserva Indígena Awá, Sendero a

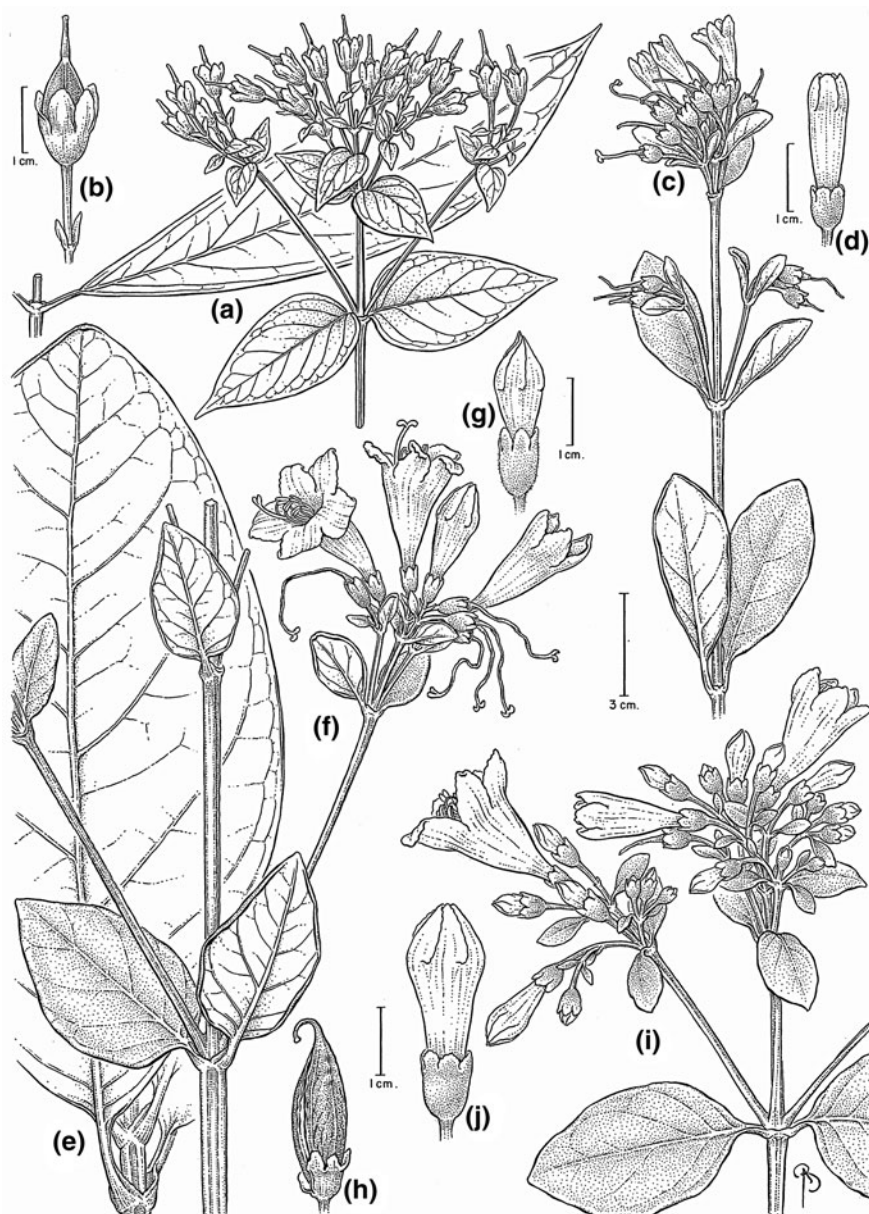


Fig. 3.30 a–b *Macrocarpaea gondoloides*. a habit of fruiting stem, leaf; b fruit. c–d *M. neillii*. c habit of flowering stem; d flower. e–h *M. betancuriana*. e leaves; f habit of flowering stem; g bud; h fruit. i–j *M. voluptuosa*. i habit of flowering stem; j bud. a–b drawn from Méndez et al. 231 (QCNE), c–d drawn from Neill, D. et al. 13758 (LOJA, QCNE), e–h drawn from Weaver 2644 (GH, NY)

Fig. 3.31 *Macrocarpaea harlingii* J.S. Pringle. Photo J.R. Grant



San Marcos al norte de la casa communal, 01° 02' N, 78° 16' W, 3,200 m, 23–17 May 1992, *Tipaz et al. 1051* (MO [2 sheets]). COLOMBIA. Nariño: Mpio. de Ricaurte, Resguardo Indígena Nulpe Medio, Andalucía, camino a Piguantís, 01° 4' N, 78° 15' W, 780 m, 13 January 1996, *González, m.S. & Ramírez P. 1688* (QCA).

11. *Macrocarpaea harlingii* J.S. Pringle

Fl. Ecuador 53(159A): 101. 1995. TYPE: ECUADOR. Loja: N slope of Nudo de Sabanilla, ca. 8 km above Yangana on road to Valladolid, 2,300–2,500 m (Holotype GB; Isotype QCA) (Figs. 3.31, 3.50).

Small tree or large shrub 3–5 m tall, glabrous. Stems quadrangular (older woody portions obscurely so). Internodes mostly much shorter than leaves. Leaves subcoriaceous; venation inconspicuous except for thick midrib, secondary veins branching from midrib at diverse angles, stronger ones mostly at 40–50 (–80) degrees, distally somewhat upcurved, obscure near margins, not brochidodromous. Blades elliptic to broadly oblanceolate, 10–20 cm long, 3–6 cm wide, base gradually tapering to a petiole 1.5–3.0 cm, apex abruptly acute to short-acuminate; margin narrowly cartilaginous, revolute. Inflorescence a large, diffuse dichasium or thyse, several times divided, with elongate, arcuately spreading lower

branches; lower divisions subtended by reduced leaves, upper by minute bractlets; flowers ca. 30–60. Ultimate divisions and pedicels arcuate, tube pedicels 5–15 mm, appearing longer because uppermost bractlets often subtend a single flower. Calyx 9–15 mm, papillose except near margins of lobes; lobes suborbicular, about half to nearly as long as tube, margins broadly hyaline, erose-fimbriate; decurrent ridges extending from sinuses to pedicels (as seen on flowers of the type collection). Corolla 30–52 mm, greenish white, campanulate; tube gradually to rather abruptly flaring above summit of calyx, exterior surface smooth near base, conspicuously papillose above; lobes 7–15 mm, ovate-triangular, obtuse. Casule ellipsoid, 18–25 mm, its papillose surface contrasting with the glossy style base. This description is largely from Pringle (1995).

Macrocarpaea harlingii belongs to *Macrocarpaea* section *Choriophylla* and occurs from 900 to 2,500 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. This species is part of a group of species with smooth leathery leaves where the secondary leaf veins absent or scarcely visible including *M. arborescens*, *M. ericii*, *M. harlingii*, *M. lilliputiana*, *M. subsessilis*, and *M. zumbae*.

Etymology. Named for Swedish botanist, Gunnar Harling (1920–2010), University of Stockholm, Sweden.

Specimens examined: ECUADOR. **Loja:** W slope of Nudo de Sabanilla, 2,300–2,500 m, 2 April 1985, *Harling, G. & Andersson*, 2353 (GB, QCA); San Francisco, 03° 59' 09" S, 079° 05' 38" W, 2,100 m, 15 January 2002, *Lozano, P.* et al. *E-188* (LOJA). **Morona-Santiago:** Gualaquiza Cantón, región de la Corillera del Cóndor, Valle del Río Quimi, 03° 29' 54" S, 078° 25' 13" S, 900 m, 10 May 2007, *Quizhpe, W. & A. Wisum* 2668 (LOJA, MO, QCNE). **Zamora-Chinchipe:** Cordillera del Cóndor, W of Tikimints, valley of Río Coangas, Ijiach Naimt, 2,000 m, 20 March 2001, *Berry, P. & D. Neill* 7651 (MO); Carr. Loja-Zamora, Cuenca del río San Francisco, Fundación Arco Iris, 2,100 m, 27 February 2000, *Cerón et al.* 40105 (QAP); Estación Científica San Francisco, km 30 de la vía Loja-Zamora, 2,100 m, 15 May 2001, *Chimbo & Chambo* 87 (LOJA, MO); El Pangui, Vicinity of Ecu-Corrientes copper mine development, valley of Río Waiwaime, along road to mine site, 03° 34' 44" S, 078° 26' 08" W, 1,312 m, 4 April 2006, *Croat, T.B. et al.* 96578 (LOJA, MO, NY, QCNE); N bank of the Río Zamora, 25 km E of Loja, 2,092–2,125 m, 11 July 1989, *Dorr, L. & Valdespino* 6616 (NY, QCA, QCNE); Parroquia Sabanilla, a 30 km de Loja, Cuesta occidental de la Cordillera del Consuelo, 03° 58' 49" S, 079° 04' 18" W, 2,000 m, 24 September 2003, *Fernández, D. et al.* 1449 (QCNE); P.N. Podocarpus (San Francisco entrance); trail leading west from San Francisco, 2,100 m, 16 February 2001, *Grant, J.R. & L. Struwe* 01-4048 (G, LOJA, NY, QCNE, SBBG); P.N. Podocarpus (San Francisco entrance); trail leading west from San Francisco, 2,100 m, 16 February 2001, *Grant, J.R. & L. Struwe* 01-4049 (LOJA, NEU, NY, QCA, QCNE, US); Parque Nacional Podocarpus, San Francisco entrance area, between Loja and Zamora, 03° 59' 22.8" S, 079° 05' 43.6" W, 2,140 m, 10 February 2011, *Grant, J.R. & J. Vieu* 11-4682 (NY); Cordillera del Cóndor, Comunidad San Miguel de Las Orquideas, Tepuy 2, vertiente occidental del río

Nangaritzta, 1,780 m, 1 April 2009, *Jadán, O.*, et al. 250 (LOJA); Loja-San Francisco, 2,160 m, 17 November 2002, *Merino & Delgado E-1349* (LOJA); Estacion Científico San Francisco, Antennae Trail, 03° 58.4892 S, 079° 3.9518 W, 1,910 m, 5 April 2010, *Muchhala, N.* 433 (QCA, QCNE); El Pangui, western slopes of Cordillera del Cóndor, Río Wawaime watershed, tributary of Río Quimi, 03° 34' 43" S, 078° 26' 07" W, 1,320 m, 2 April 2007, *Neill, D. & NSF Dendrology course 15518* (LOJA, MO, NY, QCNE); Cordillera del Cóndor, El Pangui, sandstone plateau of Contrafuerte Tres Patines, west of main Cóndor ridge, above "Jardin Botánico" of Ecuacorriente copper company, south of km 15 of Cóndor Mirador military road, 1,685 m, 9 December 2005, *Neill, D. & W. Quizhpe 15059* (LOJA, MO, QCNE); El Pangui, Cordillera del Cóndor, western slopes, Upper Río Wawaime watershed, tributary of río Quimi, 1,320 m, 4 April 2006, *Neill, D.* et al. 15123 (F, LOJA, MO, NY, QCNE); P.N. Podocarpus, La Esmeralda (Cooperativo San Francisco de Numbala Alto), bosque primario "achaparrado" con dosel de 6 m de altura en cresta de colina, 04° 22' S, 079° 03' W, 2,300 m, 1 January 1995, *Palacios, W. & Tirado 13098* (MO, QCNE, U); Trail from the Loja-Zamora road to Río Santiago in P.N. Podocarpus, Sitio San Francisco, 2,000 m, 4 May 1995, *Pedersen et al. 104170* (LOJA, QCA); Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi, 1,180–1,400 m, 5 April 2006, *W. Quizhpe 2115* (LOJA, MO, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Tundayme, Vale del Río Wawaime, afluyente del Río Quimi-Tundayme, 1,250 m, 10 April 2006, *Quizhpe, W. & T. Croat 2225* (LOJA, MO, NY, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi, zona de la futura mina de cobre, 1,400–1,670 m, 19 March 2006, *Quizhpe, W. & F. Luisier 1968* (LOJA, MO, NY, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi, zona de la futura mina de cobre, 1,400–1,670 m, 19 March 2006, *Quizhpe, W. & F. Luisier 1977* (F, LOJA, MO, NY, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi, zona de la futura mina de cobre, de la compañía Ecuacorriente, 1,630 m, 20 March 2006, *Quizhpe, W. & F. Luisier 1995* (LOJA, MO, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Tundayme, carretera hacia el destacamento militar Cóndor Mirador 1,690–2,000 m, 21 March 2006, *Quizhpe, W. & F. Luisier 2016* (LOJA, MO, NY, QCNE); Nangaritzta Cantón, Región de la Cordillera del Cóndor, Parrioquia San Francisco del Vergel, Playones, 1,800–2,100 m, 13 March 2005, *Quizhpe, W.* et al. 1040 (LOJA, MO, NY, QCNE); Cordillera del Cóndor, zona del alto Río Nangaritzta, reserva "Los Tepuyes," San Miguel de Las Orquídeas, 04° 15' 32" S, 078° 41' 04" W, 1,620 m, 24 April 2008, *Quizhpe, W.* et al. 3053 (MO); Cordillera del Cóndor, zona del alto Río Nangaritzta, reserva "Los Tepuyes," San Miguel de Las Orquídeas, 04° 15' 32" S, 078° 41' 04" W, 1,620 m, 24 April 2008, *Quizhpe, W.* et al. 3069 (MO); Cordillera del Condor, Destacamento militar Cóndor Mirador (Cóndor Mirador 2), 1 km al norte del destacamento, 03° 37' 41" S, 078° 23' 42" W, 1,975 m, 6 September 2003, *Rodríguez, E.* et al. 2616 (HUT, LOJA, MO, NY, QCNE, USM); Cordillera del Condor, campamento Militar Pachicutza, 1,849 m, 22 February 1994, *Tirado & Gray 903* (MO, NEU, QCNE, U); P.N. Podocarpus, Via Loja-

Zamora, San Francisco, Apr-May 1992, *Vivar C. et al.* 3968 (LOJA); P.N. Podocarpus, Via Loja-Zamora, San Francisco, Apr-May 1992, *Vivar C. et al.* 3980 (LOJA); Area of ECSF (Estación Científica San Francisco), 2,200 m, 7 November 2001, *Wolff, D. & F. Matt, F.* 118 (LOJA).

PERU. **Amazonas:** Condorcanqui, Cordillera del Condor, la pared del “tepui” Cerro Machinaza, 1,950–2,050 m, 21 July 1994, *Beltrán & R. Foster* 1204 (F, USM); Bongará, 4 km N of Pomacochas on road to Rioja, 2,150–2,200 m, 2 June 1986, *Knapp et al.* 7467 (MO, USM); Bongará, Bosque de Protección Alto Mayo, 2,550 m, 19 March 2002, *Vásquez* 27655 (NEU, MO). **Cajamarca:** San Ignacio, Huarango, Localidad Romerillo, Cordillera entre Romerillo y Nuevo Mundo, 2,300 m, 27 July 1997, *Campos et al.* 4284 (MO, U); San Ignacio, Distrito Huarango, Cordillera Huarango, El Romerillo, 05° 16' 26'' S, 078° 41' 55'' W, 2,035 m, 19 July 2005, *Rodríguez, E. et al.* 2929 (HUT, LOJA, MO, QCNE, USM); San Ignacio, Distrito Huarango, Cordillera Huarango (El Romerillo), 05° 16' 26.4 S, 078° 41' 31.8'' W, 1,885–2,168 m, 2 May 2006, *Rodríguez, E. et al.* 3096 (HUT, LOJA, MO, QCNE, USM). **San Martín:** Along road Rioja-Pedro Ruis, ceja de la montaña, El Mirador, 1,850 m, 25 March 1998, *van der Werff et al.* 15702 (MO).

12. *Macrocarpaea innarrabilis* J.R. Grant

Harvard Pap. Bot. 9(1): 27. 2004. TYPE: PERU. Amazonas: Bagua District, Imaza, Tayu Majaji, Comunidad Nativa de Wawas, 05° 15' S, 078° 22' W, 1,100 m, 7 February 1999, *R. Vásquez, C. Vargas, J. Yactayo, & E. Palomino* 26057 (Holotype NEU; Isotypes: F, MO, U) (Fig. 3.32).

Shrub or small tree to 1.5, glabrous throughout. Stems terete to slightly quadrangular, solid to hollow, 5–8 mm in diameter just below inflorescence. Leaves obovate to elliptic, petiolate, 6.5–15.5 cm long. Petioles 13–30 mm long, robust with slight vagination one-eighth the length of the petiole; interpetiolar ridge 2–3 mm high. Blades 5.2–12.5 × 3.5–7.5 cm, entire, not revolute, dark above and conspicuously lighter below, with slightly impressed veins above, and slightly raised veins below, leathery-coriaceous to papery thin when dried; base aequilateral to oblique, cuneate to rounded; apex rounded, obtuse, to slightly mucronulate. Inflorescence a much branched open thyrs, 16–32 cm long; branches 9–29 cm long; 1–7 flowered per branch. Bracts obovate to elliptic, petiolate, 25–80 × 14–32 mm; base aequilateral to oblique, cuneate; apex rounded, obtuse, to slightly mucronulate; bract petioles 3–15 mm long. Flowers pedicellate, erect to spreading; pedicels 12–45 mm long; bracteoles varying from inconspicuous and linear to spatulate, 0.5–9.0 × 0.5–3.0. Calyx campanulate, 6–11 × 4–7 mm, glabrous, smooth, ecarinate; calyx lobes ovate, 2–3 × 2.5–4.5 mm, rounded to obtuse. Corolla funnel-shaped, 32–43 mm long, 13–17 mm wide at the apex of the tube, whitish, yellow, smooth; corolla lobes ovate to elliptic, 7–12 × 5–7 mm; corolla lobe apex obtuse to rounded. Stamens 26–31 mm long; filaments 22–26 mm long, filiform, flattened; anthers elliptic to oblong, 4–5 × 1.5–2.0 mm, sagittate, versatile; pollen “glabrate-type”. Pistil 32–35 mm long; ovary 5–6 × 2–3 mm; style 26–27 × 0.75–1.0; stigma lobes spatulate, 3 × 1.5–2.5 mm. Capsules ellipsoidal to ovoid,

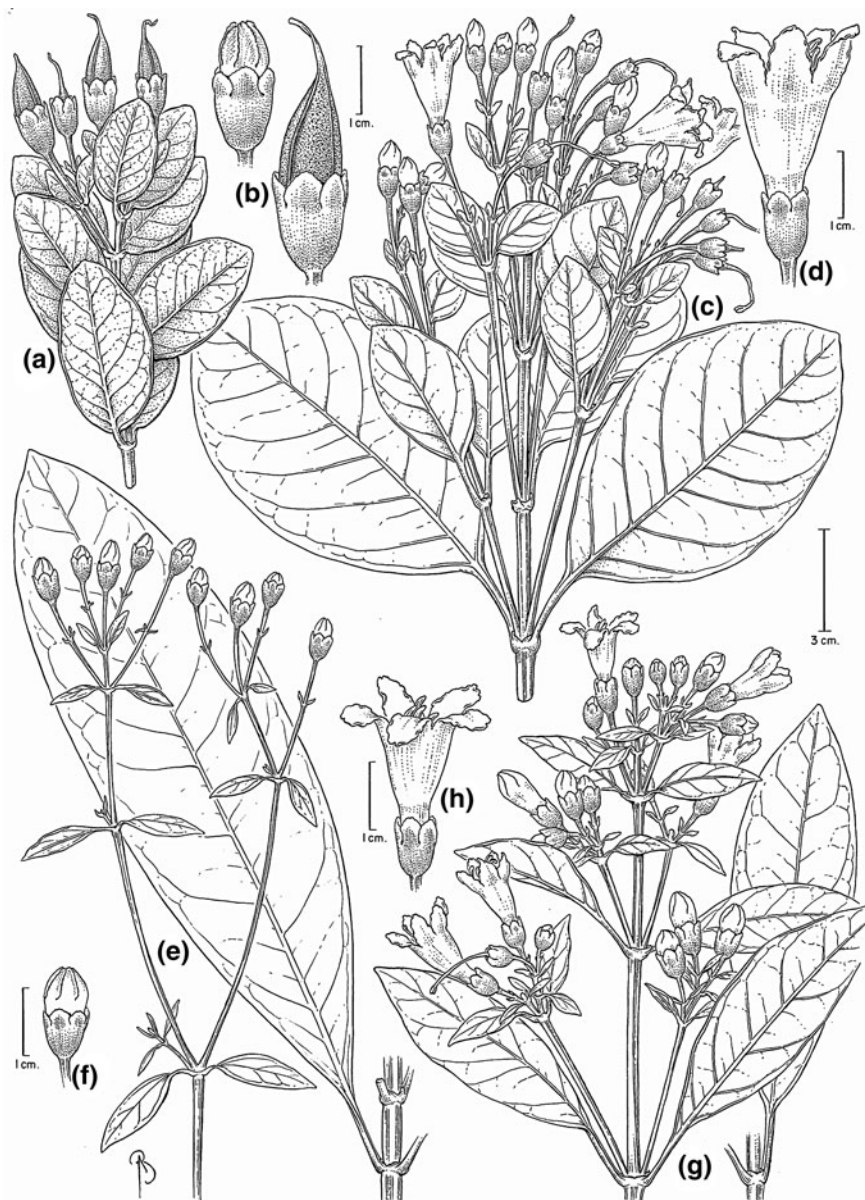


Fig. 3.32 a–b *Macrocarpaea luya* from Peru. a habit of flowering stem; b bud and fruit; c–d *M. innarrabilis*. c habit of flowering stem; d flower; e–f *M. tabula-fluctivagifolia* from Peru. e habit of flowering stem, leaf, and inter-petiolar ridge; f bud; g–h *M. revoluta*. g habit of flowering stem, leaf, and interpetiolar ridge; h flower. a–b drawn from Díaz & Campos 3786 (USM); c–d drawn from Matthews 1314 (K); e–f drawn from Wolfe 12333 (F); g–h drawn from Smith 2748 (NY)

20–21 × 7–8 mm, smooth to pusticulate, shiny, chestnut to brown, spreading to nodding; style remnant 8–9 mm. Seeds “perimetrically winged,” flattened with wings all around, 0.4–1.0 × 0.6–1.0, faint orangish-tan, rugose-reticulate.

Macroparpaea innarrabilis belongs to *Macroparpaea* section *Choriophylla* and occurs from 1,000 to 2,500 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. It is a 1.5 m shrub with obovate to elliptic leaves, and ecarinate calyx lobes. It belongs to a group of closely related species including *M. innarrabilis*, *M. jalca*, and *M. kuelap*. They all occur in northern Peru in Amazonas and Cajamarca provinces, and are related to *M. noctiluca* of southern Ecuador.

Etymology. From the Latin *innarrabilis*, indescribable.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Nangaritza Cantón, Cordillera del Cóndor, comunidad San Miguel de Las Orquídeas, Tepuy 1 vertiente oriental del Río Nangaritza, 1,299 m, 1 April 2009, *Jadán, O.*, et al. 214 (LOJA); *Luisier, F. & W. Quizhpe* 2 (LOJA, QCNE); Nangaritza Cantón, Región de la Cordillera del Cóndor, cuenca alta del Río Nangaritza, La Wantza, 1,050 m, 13 February 2006, *Quizhpe, W. & F. Luisier* 1958 (LOJA, MO, NY, QCNE); Nangaritza Cantón, Región de la Cordillera del Cóndor, cuenca alta del Río Nangaritza, Sector Las Orquídeas, 1,500 m, 23 February 2003, *Quizhpe, W.* et al. 575 (LOJA, MO, NY, QCNE); Nangaritza Cantón, Región de la Cordillera del Cóndor, Parroquia Surmi, Comunidad Yawi, 1,600 m, 14 June 2005, *Quizhpe, W.* et al. 1416 (LOJA, MO, NY, QCNE).

PERU. Amazonas: Yambasbamba, August, *Matthews* 1314 (K); Bagua, Imaza, Cerro Tayu-Muyaji, Comunidad Aguaruna Wawas, trocha desde Puente Almenro, cumber, 1,000 m, 16 February 2004, *Rodríguez, E.R.*, et al. 2680 (HUT, NY); upper slopes and summit of Cerro Teyu, 05° 15' S, 078° 22' W, 1,030 m, shrub 1.5 m, flower yellow, 22 March 2001, *van der Werff* et al. 16315 (F, MO, NEU); Bagua District, Imaza, Tayu Majaji, 05° 15' S, 078° 22' W, 900–1,030 m, 17 February 2002, *Vásquez* 27601 (MO). Without locality, “Voyage à l'Équateur et au Pérou,” 1876–1877, *Vidal-Sénèze s.n.* (P); Rodrigues de Mendoza, low forests of the eastern slopes of the Andes, 1,400–2,500 m, July–August 1963, *Woytkowski* 8018 (MO, U). Cajamarca: San Ignacio, Dist. Huarango, alrededores del Caserio Palma, 1,810 m, 26 April 2006, *Ortiz, E.*, et al. 1398 (MO, NY); San Ignacio, Distrito Huarango, Caserio el Porvenir, 05° 06' 38" S, 078° 47' 07" W, 1,200 m, *Perea, J. & V. Flores* 2370 (MO, NY, QCNE); San Ignacio, Distrito Huarango, Poblado Huarandoza, Caserio el Eden, 05° 09' 38" S, 078° 44' 19" W, 1,598 m, *Perea J. & V. Flores* 3534 (MO, NY).

13. *Macroparpaea jactans* J.R. Grant

Harvard Pap. Bot. 9(2): 334. 2005. TYPE: ECUADOR. Napo: P.N. Napo-Galeras, Cordillera de Galeras, Sendero hacia el Río Pucuno, 00° 39' S, 077° 32' W, 1,550–1,650 m, 20 March 1997, *A. Alvarez, P. Cerda, & B. Shiguango* 1726 (Holotype MO; Isotypes NY, QCNE) (Figs. 3.33, 3.34, 3.35).

Fig. 3.33 *Macrocarpaea jactans* J.R. Grant. Photo J.R. Grant



Fig. 3.34 *Macrocarpaea jactans* J.R. Grant. Photo J.R. Grant



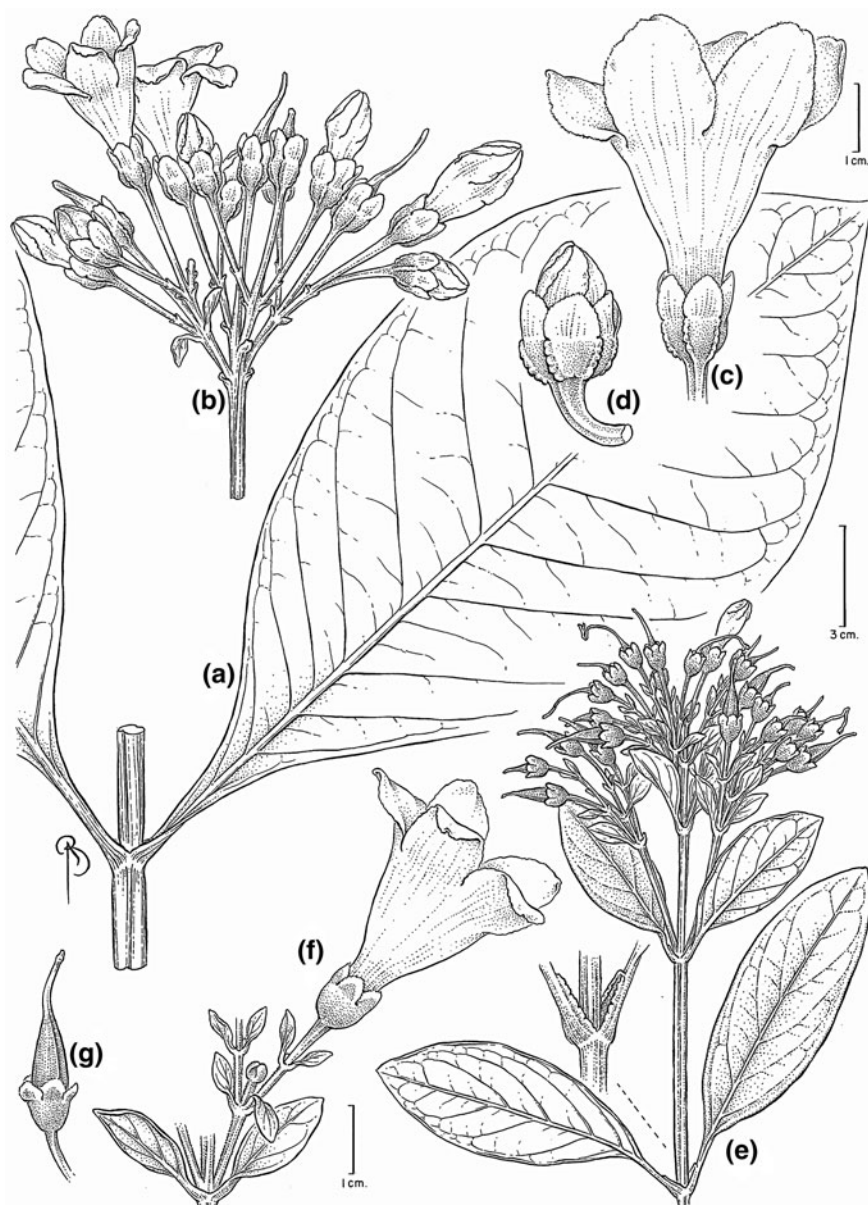


Fig. 3.35 *Macrocarpaea jactans* J.R. Grant. **a–d** *M. jactans*. **a** leaves; **b** inflorescence; **c** flower; **d** bud. **e–g** *Macrocarpaea berryi* (= *M. bubops*) **e** habit of flowering stem; **f** flower; **g** fruit. **a–c** drawn from Alvarez 1726 (MO), **d** drawn from Harling, G. & Andersson 21370 (GB), **e–g** drawn from Berry, P. & D. Neill 7665 (NY)

Shrub or small tree, 1.5–5.0 m, glabrous throughout, cm in diameter. Stems terete to slightly quadrangular, solid to hollow, 10–15 mm in diameter just below the inflorescence. Leaves oval, elliptic to ovate, sessile to short-petiolate, 20.5–35.5 cm long. Petioles 0–25 mm long, robust with strong open vagination one quarter to one-third the length of the petiole; interpetiolar ridge 5–8 mm high. Blades 20.5–33.5 × 12–16.5 cm, entire, not revolute, dark above and conspicuously lighter below, with slightly impressed veins above, and slightly raised veins below, papery thin, to thin coriaceous; base aequilateral to attenuate and decurrent on the petiole; apex rounded, obtuse to acute. Inflorescence a much branched open thyrs, 24–38+ cm long; branches 5–38 cm long; 2–5 flowered per branch. Bracts ovate to elliptic, sessile to short-petiolate, 45–96 × 32–50 mm; base aequilateral to oblique, cuneate, rounded to short-attenuate; apex acute to obtuse; bract petioles 0–3 mm long. Flowers pedicellate, erect to spreading; pedicels 10–34 mm long; bracteoles inconspicuous and scabrous, linear to triangular, 1–13 × 0.5–6.0 mm. Calyx campanulate, 12–16 × 10–16 mm, glabrous, smooth, faintly rugose to pustulate, ecarinate, yet with pronounced ridges between calyx lobes from their bases and extending to the base of the calyx; calyx lobes rotund, ovate to elliptic, 5–9 × 7–10 mm, apex rounded, obtuse to acute. Corolla funnel-shaped, 45–55 mm long, 20–30 mm wide at the apex of the tube, crema-verdosa, yellow, smooth; corolla lobes ovate, 14–22 × 14–19 mm, obtuse to rounded. Stamens 18–30 mm long; filaments 13–25 mm long, filiform, flattened; anthers elliptic to oblong, 5–9 × 2–4 mm, sagittate, versatile; pollen *Corymbosa*-type. Pistil 40–43 mm long; ovary 7–10 × 2–4 mm; style 33–37 × 1.0 mm; stigma lobes spatulate, 3–7 × 2–4 mm. Capsules ellipsoidal to oblong, 30–45 × 12–16 mm, shiny smooth to pustulate, tan to light brown, spreading to slightly nodding; style remnant 7–14 mm long. Seeds “Winged type,” 1.2–2.2 × 0.3–0.5 mm, straw-colored, testa reticulate, wings ribbed.

Macrocarpaea jactans belongs to section *Magnolifoliae* and occurs from 1,500 to 2,300 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. It is unique in Ecuador in having bright true yellow colored flowers that are broadly flared open, and leaves with pinnate venation. It is related to *M. ostentans* J.R. Grant, *M. robin-fosteri* J.R. Grant, and *M. tahuantinsuyuana* J.R. Grant of the Cordillera Central of Peru, and *M. cinchonifolia* (Gilg) Weaver of the Cordillera Oriental of Peru and Bolivia. The unique characters that particularly unite these species are *Corymbosa*-type pollen morphology and Winged-type seeds. Despite belonging to two different species groups both *M. jactans* and *M. opulenta* occur in the same geographic region of the Cordillera del Cóndor, and have similar shaped corollas indicating that they may have a common pollinator.

Etymology. From the Latin *jactans*, boastful, for its large showy inflorescences.

Specimens examined: ECUADOR. **Zamora-Chinchi:** Chinchipe Cantón, Parroquia Zumba, Finca de Sandy León, forest near Río Tarrangami, 2,100–2,300 m, 29 March 2005, Clark, J.L. 8927 (NY, QCNE, US); Approx. 50 km S Amaluza on road to Zumba that nearly parallels the Ecuador–Peru border, 2,224 m, 1 January 2008, Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4520 (LOJA, NY); Along road between Zumba and Amaluza that parallels the Ecuador–Peru

Fig. 3.36 *Macrocarpaea jensii* J.R. Grant & Struwe.
Photo J.R. Grant



border, 04° 47' 58.6'' S, 079° 18' 18.4'' W, 2,030 m, 7 February 2011, *Grant, J.R. & J. Vieu 11-4668* (NY); Cordillera del Condor, 32 km from Los Encuentros in direction of Paquisha Alta Military Camp, north for 1–3 km north on road toward a mine, 03° 50' 54.3'' S, 078° 31' 45.6'' W, 1,500 m, 9 February 2011, *Grant, J.R. & J. Vieu 11-4677* (NY); Cordillera del Condor, 15 km E of Los Encuentros in direction of Paquisha Alta Military Camp, 03° 49' 18.2'' S, 078° 36' 47.2'' W, 1,458 m, 9 February 2011, *Grant, J.R. & J. Vieu 11-4678* (NY); Cordillera del Condor, 46.8 km E of Los Encuentros, entrance to Paquisha Alta Military Camp, 03° 54' 49.1'' S, 078° 29' 36.9'' W, 1,834 m, 13 February 2011, *Grant, J.R. & J. Vieu 11-4694* (NY); Above Valladolid on road to Yangana, 2,300 m, 1 February 1985, *Harling, G. & Andersson 21370* (GB); Yantzaza Cantón, Cordillera del Cóndor region, broad ridge on Hollín sandstone substrate, one km north of Las Peñas, above bend of Río Machinaza, “Fruto del Norte” site of Aurelian mine company, 03° 46' 17'' S, 078° 29' 28'' W, 1,610 m, 22 March 2008, *Neill, D. & W. Quizhpe 16323* (LOJA, QCNE, MO); Región de la Cordillera del Cóndor, sector sur, Parroquia San Francisco de Vergel, Playones, Cuenca alta del Río Vergel, 04° 43' 01'' S, 078° 57' 47'' W, 1,900 m, 10 March 2005, *Quizhpe, W. et al. 903* (LOJA, QCNE, MO; Cordillera del Condor, campamento Militar Pachicutza, 1,849 m, 22 February 1994, *Tirado, M. & B. Gray 887* (QCNE, MO, U).

14. *Macrocarpaea jensii* J.R. Grant & Struwe

Harvard Pap. Bot. 8(1): 68. 2003. TYPE. ECUADOR. Zamora-Chinchipe: P.N. Podocarpus (San Francisco entrance), trail leading west from San Francisco, 03° 59' 24'' S, 079° 05' 48'' W, 2,100 m, 16 February 2001, *Grant, J.R. & L. Struwe 01-4047* (Holotype: US [3 sheets]; Isotypes: G [2 sheets], LOJA, NEU, NY, QCNE, SBBG) (Figs. 3.36, 3.37).

Unbranched tree, overall inflorescence triangular in outline, 1–5 m tall, glabrous throughout; trunk to 1.5 cm diameter wood solid to hollow (pith to 3 mm), growth rings scarcely visible; bark papery thin to scarcely measurable, 0.05 mm thick, outer

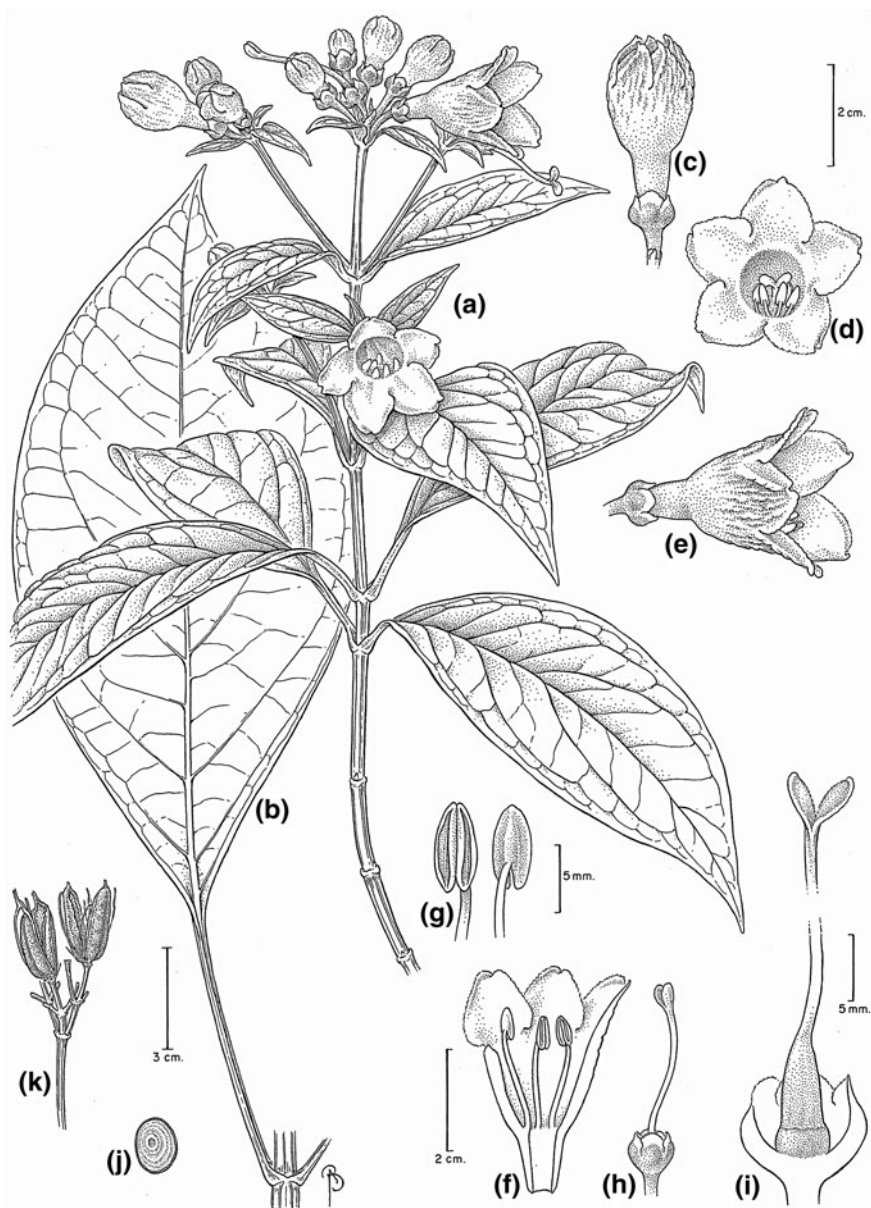


Fig. 3.37 *Macrocarpaea jensii* J.R. Grant & Struwe. **a** habit of flowering stem; **b** leaf; **c** floral bud; **d** corolla viewed from front; **e** side-view of flower at anthesis; **f** cross-section of corolla; **g** anthers; **h** pistil; **i** pistil with sepals removed to show the ovary; **j** wood anatomy of cross-section of main trunk; **k** mature dehiscent capsules. **a–k** from pickles, photos and specimens of Grant, J.R. & L. Struwe 01-4047

surface smooth to rugose, tan. Stems terete, solid to hollow, 4–6 mm in diameter just below inflorescence. Leaves obovate, elliptic-rhomboid to oval, slightly asymmetric, petiolate, 12–32 cm; blades 14–23 × 4.5–11.5 cm, long attenuate and decurrent on the petiole, entire, not revolute, base aequilateral, apex acute to acuminate, membranaceous, thin, flexible, dark green, with slightly impressed veins above, and slightly raised veins below, glabrous above and typically below, yet often with short tuberculate hairs on lower veins; interpetiolar ridge 1–5 mm high; petioles slender with very slight vagination, 30–90 mm. Branches of the inflorescence 6–23 cm, 3–12 flowered per branch. Bracts elliptic-rhomboid to oval, slightly asymmetric, 18–80(–140) × 9–35(–50) mm, base aequilateral to attenuate, apex acute to acuminate, sessile to petiolate; bract petioles 0–10 mm. Flowers pedicellate, erect to horizontal to oriented in all directions in the inflorescence; pedicels 6–17 mm; bracteoles lanceolate to ovate, 1–12 × 1–9 mm. Calyx urceolate to campanulate, 7–9 × 7–9 mm, glabrous, smooth, green, ecarinate, no ridges extend down from calyx lobes; calyx lobes dividing calyx one-third to one half, apex rounded, obtuse to acute, 2–4 × 3–4 mm. Corolla funnel-shaped, 29–41 mm, 17–25 mm wide at corolla lobe sinuses, yellowish-green, smooth to spongy, fleshy, warty and uneven; corolla lobes ovate, apex obtuse to rounded, 7–14 × 6–13 mm. Stamens 19–21 mm; filaments 16–18 mm, filiform, terete; anthers elliptic to oblong, 3–4 × 2–3 mm, sagittate, versatile. Pistil 26–32 mm; ovary 7–10 × 2.5–3.0 mm; style 17–18 × 0.5–1.0 mm, 2-lobed; stigma 2-lobed, lobes 2–4 × 1–2 mm, spatulate. Capsules dry, bilocular, medially dehiscent, ellipsoidal, 20–26 × 6–11 mm, smooth to very faintly ribbed, faint-orangish tan, erect to slightly nodding, style remnant 2–6 mm. Seeds flattened, angular, roughly triangular in outline, winged, 0.3–1.0 × 0.2–0.5 mm, faint orangish-tan, rugose-reticulate.

Macrocarpaea jensii belongs to section *Choriophylla* and occurs from 1,850 to 2,600 m in the Amotape–Huancabamba region of southern Ecuador. It is unique in having a thick spongy corolla and obovate, elliptic-rhomboid leaves. This species is part of a distinctive monophyletic group including *M. apparata*, *M. bubops*, *M. elix*, *M. jensii*, *M. × mattii*, and *M. noctiluca*.

Etymology. Named for Danish botanist Jens Madsen, 1959–, of the University of Aarhus, prolific collector of southern Ecuadorian plants.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Parque Nacional Podocarpus, San Francisco entrance area, between Loja and Zamora, 03° 59' 22.8" S, 079° 05' 47.1" W, 2,126 m, 10 February 2011, *Grant, J.R. & J. Vieu 11-4683* (NY); Loja-Zamora rd., E of the pass, disturbed forest, 2,600 m, slender treelet, 4–5 m, 15 February 1985, *Harling, G. & Andersson 22118* (GB, MO, QCA); At 25 km from Loja (road to Zamora), in the forest of the 'Estación Científica San Francisco', south of the river San Francisco, beside the path connecting the hydroelectric station and the entrance of the water channel, 1,850 m, January 1998, *Matt, F. 16* (ER); At 25 km from Loja (road to Zamora), in the forest of the 'Estación Científica San Francisco', south of the river San Francisco, beside the path connecting the hydroelectric station and the entrance of the water channel, 1,850 m, January 1998, *Matt, F. 17* (ER); Km 17 de la Via Loja-Zamora, Quebrada Navidad, 03° 58' 42.5" S, 079° 7' 3" W, 1,950 m, 30 January 1996, *Merino,*

Fig. 3.38 *Macrocarpaea lenae* J.R. Grant. Photo J.R. Grant



B. et al. 4764 (LOJA); P.N. Podocarpus, La Esmeralda (Cooperativa San Francisco de Numbala Alto), bosque primario alto, 04° 22' S, 79° 03' W, 2,250 m, January 1995, *Palacios, W. & Tirado* 13033 (MO, QCNE, U); Area of ECSF (Estación Científica San Francisco), 03° 58' 18'' S, 079° 04' 44'' W, 2,300 m, 21 January 2001, *Wolff, D.* 49 (LOJA).

15. *Macrocarpaea lenae* J.R. Grant

Harvard Pap. Bot. 8(1): 70. 2003. TYPE: ECUADOR. Zamora-Chinchi: 5 km S of Zamora toward P.N. Podocarpus (Bombuscaro entrance), 04° 06' 31'' S, 078° 57' 49'' W, 1,030 m, 13 February 2001, *Grant, J.R. & L. Struwe* 01-4013 (Holotype: US [3 sheets]; Isotypes: G, LOJA, MO, NEU [2 sheets], NY, QCA, QCNE, S, SBBG) (Figs. 3.38, 3.39).

Unbranched tree, overall inflorescence triangular in outline, 2–3 m tall, glabrous throughout; trunk to 2.7 cm diameter wood always hollow (pith 5–9 mm), growth rings scarcely visible, bark papery thin to scarcely measurable (to 0.05 mm), outer surface smooth to rugose, tan. Stems terete to slightly quadrangular, hollow, 4–6 mm in diameter just below inflorescence. Leaves elliptic, oblong to oval, petiolate, 12–45 cm; blades 10.5–37 × (4.5–) 11.5–19 cm, cuneate to rounded, entire, not revolute, base aequilateral to oblique, apex acute to acuminate, papery thin, dark green, with slightly impressed veins above, and slightly raised veins below, glabrous above and below; interpetiolar ridge 2–8 mm high; petioles slender with very slight vagination, 15–70 mm. Branches of the inflorescence 11–26 cm, 6–20 flowered per branch. Bracts ovate to elliptic, 9–70 × 5–32 mm, base aequilateral, apex acute to acuminate, short-petiolate; bract petioles 1–5 mm. Flowers pedicellate, erect to horizontal to oriented in all directions in the inflorescence; pedicels 7–25 mm; bracteoles linear to ovate, 1–15 × 1–9 mm. Calyx urceolate to campanulate, 8–10 × 6–8 mm, glabrous, smooth, glaucous green, ecarinate; no ridges extend down from calyx lobes; calyx lobes dividing calyx one-third to one half, rounded to obtuse, 3–4 × 3.0–4.5 mm.

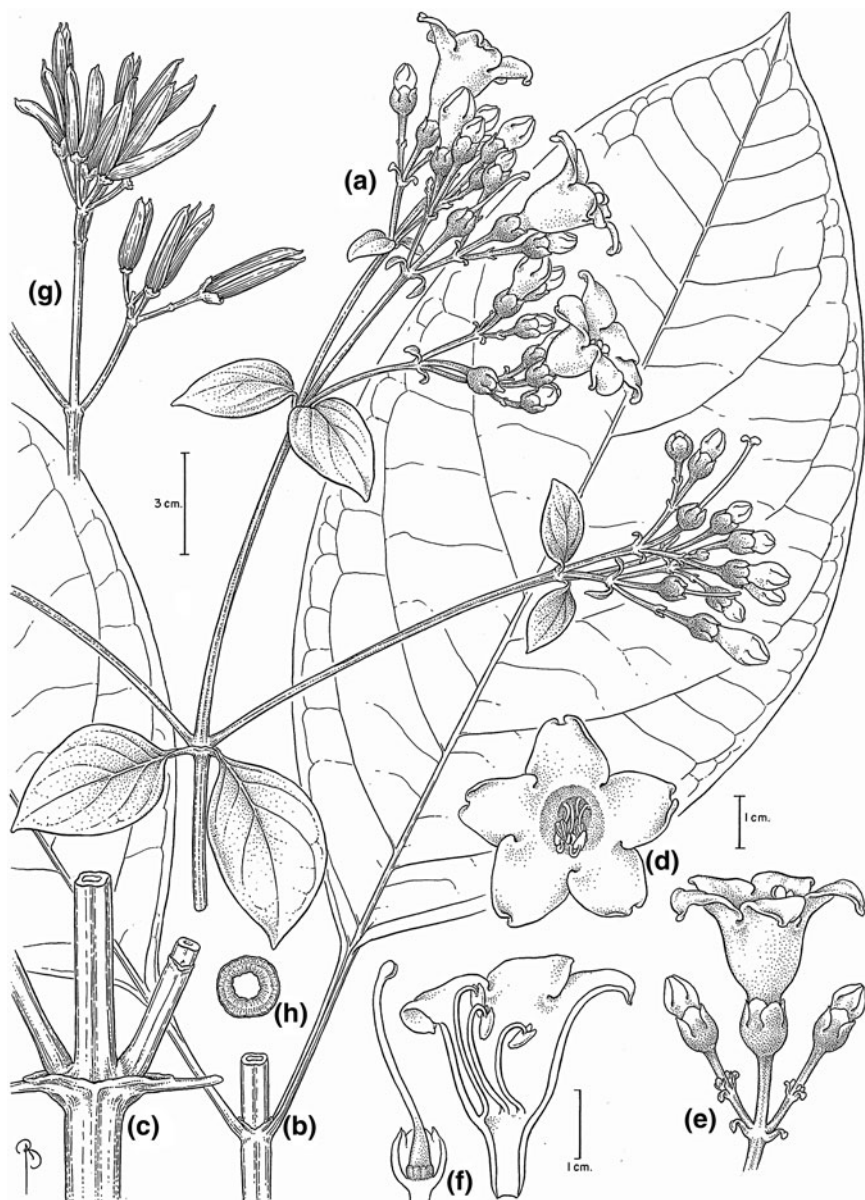


Fig. 3.39 *Macroparpaea lenae* J.R. Grant. **a** habit of flowering stem; **b** leaves; **c** interpetiolar ridge; **d** corolla viewed from front; **e** flower and floral buds; **f** cross-section of corolla; **g** mature dehiscent capsules; **h** wood anatomy of cross-section of main trunk. **a–h** from pickles, photos and specimens of Grant, J.R. & L. Struwe 01-4013

Corolla funnel-shaped, 30–37 mm, 12–21 mm wide at corolla lobe sinuses, light green, smooth; corolla lobes ovate, apex obtuse to retuse, 9–12 × 4–9 mm. Stamens 24–28 mm; filaments 20–24 mm, filiform, terete; anthers elliptic to oblong, 3–4 × 2–3 mm, sagittate, versatile. Pistil 25–31 mm; ovary 5–7 × 2.5–3.5 mm; style 17–20 × 0.5–1.5 mm; stigma 2-lobed, lobes 3–4 × 2.0–2.5 mm, rounded to spathulate. Capsules dry, bilocular, medially dehiscent, ellipsoidal, 24–29 × 8–11 mm, smooth, faint orangish-tan, erect to slightly nodding, style remnant 1–2 mm. Seeds flattened, angular, roughly triangular in outline, winged, 0.3–1.1 × 0.4–0.6, faint orangish-tan, rugose-reticulate.

Macroparpaea lenae belongs to section *Choriophylla* and occurs from 800 to 1,700 m in the Amotape–Huancabamba region of southern Ecuador. It is best known as a lowland species around Zamora, ranging northwards to Chuchumbezta. At the Bombuscaro entrance to the P.N. Podocarpus and it is sympatric with *M. micrantha*. This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including *M. catherineae*, *M. claireae*, *M. dies-viridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*.

Etymology. Named for Swedish botanist Karin Lena Elisabet Struwe, 1967–, Gentianaceae specialist, Rutgers University–New Brunswick, NJ, USA.

Specimens examined: ECUADOR. **Loja:** Chaguarpamba Cantón, Alrededores de Buenavista, 1,220 m, Oct–Nov 2004, *Sanchez, O. & Gonzaga 193* (LOJA); 3 km S of Zamora toward the Bombuscaro entrance of P.N. Podocarpus, 1,019 m, 12 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4546* (NY, LOJA, MO); **Zamora-Chinchipe:** 5 km S of Zamora toward P.N. Podocarpus (Bombuscaro entrance), 04° 06' 31" S, 078° 57' 49" W, 1,030 m, 1 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques 02-4250* (MO, NEU, NY, SEL, US); P.N. Podocarpus (Bombuscaro entrance), 5.7 km S of Zamora, 1,030 m, 22-Feb-2006, *Grant, J.R., M. Cheung, F. F. Luisier, & N. Villard 4346* (CHRB, LOJA, NY); Property of Cabañas Ecológicas Copalinga, between Zamora and the Bombuscaro entrance to P.N. Podocarpus, 04° 05' 30.1" S, 078° 57' 39.4" W, 994 m, 8 February 2011, *Grant, J.R. & J. Vieu 11-4675* (NY); 1 km south of Chuchumbezta on road toward the River Zamora, 03° 32' 12.4" S, 078° 31' 39.9" W, 786 m, 15 February 2011, *Grant, J.R. & J. Vieu 11-4700* (NY); 1 km from Zamora along main road to Loja, 03° 58' 17.7" S, 079° 01' 15.9" W, 1,578 m, 16 February 2011, *Grant, J.R. & J. Vieu 11-4703* (NY); P.N. Podocarpus, Romerillo, trail at limit of P.N. Podocarpus, mountain rainforest, 78° 56' W, 04° 13' S, 1,650–1,700 m, 14 February 1990, *Madsen & Knudsen 86854* (AAU, LOJA); hills and pasture and disturbed forest immediately S and SE of Zamora, 78° 57' W, 04° 04' S, 1,000–1,250 m, 14 June 1988, *Øllgaard et al. 74846* (AAU, LOJA, QCA); P.N. Podocarpus, Guardería Río Bombuscaro, Sendero al Mirador, bosque primario alto, 1,100 m, January 1995, *Palacios, W. & Tirado 13301* (MO, QCNE, U); Zamora, Región de la Cordillera del Cóndor, Parroquia San Carlos de Las Minas, Namibija, Sendero al Cerro Colorado, 2,100 m, 27 January 2005, *Quizhpe, W. et al. 786* (LOJA, MO, NY, QCNE); Región de la Cordillera del Cóndor, Parroquia San Carlos de Las Minas, Namibija, Sendero al Cerro Colorado, 1,520–1,700 m, 29 January 2005, *Quizhpe, W. et al. 834* (LOJA, MO, NY, QCNE).

Fig. 3.40 *Macrocarpaea luna-gentiana* J.R. Grant & Struwe. Photo J.R. Grant



16. *Macrocarpaea luna-gentiana* J.R. Grant & Struwe

Harvard Pap. Bot. 8(1): 72. 2003. TYPE: ECUADOR. Loja: Km 21 on road from Yangana to Cerro Toledo, then trail from Cerro Toledo (ca. 300 m below antennas) toward Numbala, (to 1 km down the trail), cool, very rainy, windy páramo, 04° 24' 01" S, 079° 06' 42" W, 3,350 m, 14 February 2001, *Grant, J.R. & L. Struwe 01-4028* (Holotype: US [2 sheets]; Isotypes: G, LOJA, NEU, NY, QCA, QCNE) (Figs. 3.40, 3.41).

Dichotomously branched to unbranched tree, overall branching pattern obtrian-gular and flat-topped in outline, 2–3 m tall, glabrous to hyaline puberulent with short simple hairs on stems, petioles, leaves, inflorescences, calyces, and corolla lobes; trunk to 7.7 cm diameter wood solid in trunk, hollow in younger branches (to 0.5), growth rings prominent; bark thin to thick, (to 0.5–4.0 mm), brown background, mottled with distinctive tan rippling and furrowing patterns. Stems terete to slightly quadrangular, solid to hollow, 5–10 mm in diameter just below inflorescence. Leaves broadly ovate, sessile to short-petiolate, 3–12 cm; blades 10–11.5 × 2.5–8.0 cm, entire, slightly revolute, base aequilateral to slightly oblique to cuneate, apex acute, thick, leathery-coriaceous, light to dark glossy green, bullate, with few to strongly impressed veins above, and strongly raised veins below, glabrous above and typically below yet often with long pubescent hairs on the veins of young leaves; interpetiolar ridge 1–5 mm high; petioles flattened to concave, 3–5 mm. Branches of the inflorescence 5–23 cm, 1–10 flowered per branch. Bracts ovate to lanceolate, 33–82 × 10–42 mm, base aequilateral to slightly oblique or rounded, apex acute, sessile to short-petiolate; bract petioles 0–3 mm. Flowers pedicellate, erect to horizontal to oriented in all directions in the inflorescence; pedicels 3–30 mm; bracteoles ovate, 5–18 × 3–7 mm. Calyx broadly campanulate, 9–18 × 13–14 mm, hyaline puberulent to glabrous, rugose, green, ecarinate, no ridges extend down from calyx lobes; calyx lobes dividing calyx one-third to one half, rounded, 7–9 × 6–12 mm. Corolla funnel-shaped, 341–62 mm, 15–40 mm

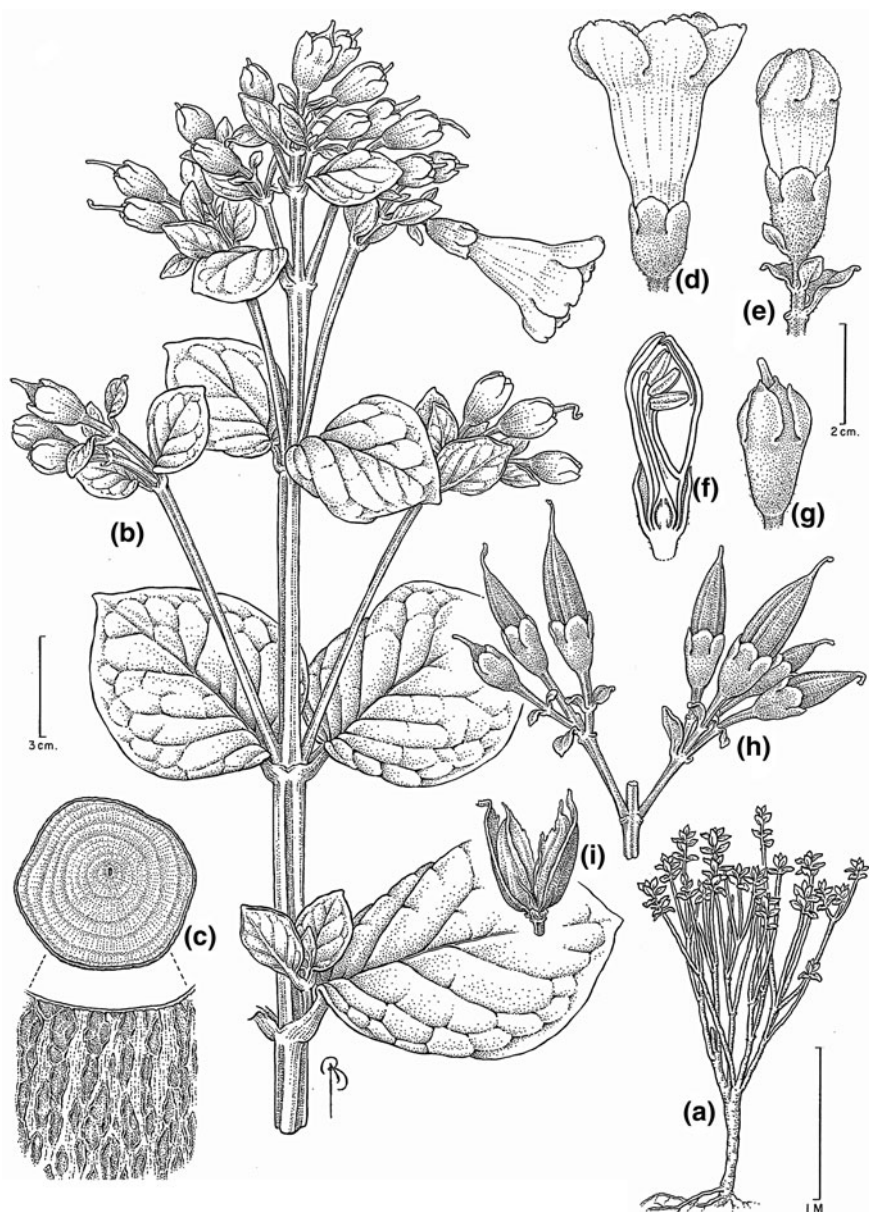


Fig. 3.41 *Macrocarpaea luna-gentiana* J.R. Grant & Stuwe. **a** habit of tree in the field; **b** habit of flowering stem; **c** wood anatomy of cross-section of main trunk, and bark; **d** flower; **e** floral bud; **f** cross-section of floral bud; **g** flower just after anthesis; **h** immature capsules; **i** mature dehiscent capsule. **a** from a photo of Grant, J.R. & L. Struwe 01-4027; **b** from Matt, F. 1 (ER); **c** from Grant, J.R. & L. Struwe 01-4027; **d**–**i** from Grant, J.R. & L. Struwe 01-4028

wide at corolla lobe sinuses, light green, smooth; corolla lobes half moon-shaped to broadly ovate, apex rounded, $5\text{--}21 \times 9\text{--}24$ mm. Stamens $23\text{--}35$ mm; filaments $18\text{--}29$ mm, filiform, flattened; anthers elliptic to oblong, $5\text{--}6 \times 2.5\text{--}3.5$ mm, sagittate, versatile. Pistil $41\text{--}42$ mm; ovary $7\text{--}8 \times 3\text{--}4$ mm; style $29\text{--}30 \times 1.0\text{--}1.5$ mm; stigma 2-lobed, lobes $4\text{--}5 \times 2.0\text{--}2.5$ mm, spatulate. Capsules dry, bilocular, medially dehiscent, ellipsoidal to ovoid, $30\text{--}49 \times 13\text{--}19$ mm, wrinkled to ribbed, dark brown, erect to slightly nodding; style remnant $4\text{--}15$ mm. Seeds unknown.

Macrocarpaea luna-gentiana belongs to section *Magnolifoliae* and occurs from 2,500 to 3,800 m in the Amotape–Huancabamba region of southern Ecuador. Its probable sister species *M. pachyphylla* is restricted to Nariño and Putumayo provinces of Colombia at similar elevations of 3,000–3,400 m. *Macrocarpaea luna-gentiana* It has a generally robust, stout appearance, a few-flowered inflorescence, broad campanulate calyx, rounded calyx lobes, and a broad funnel-shaped corolla with broad rounded to half-moon-shaped corolla lobes.

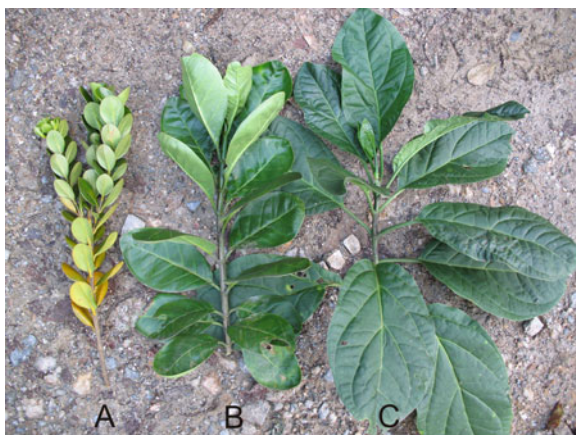
Etymology: From the Latin “*luna*,” moon, and “*gentiana*,” gentian, for the half-moon shaped petal lobes.

Specimens examined: ECUADOR. **Loja:** Loja-Zamora, 3,800 m, 1 December 1876, *André 4513* (F, K, NY); Loja-Zamora, 3,500 m, 1 December 1876, *André 4536* (K, NY); El Tiro, en el límite entre las provincias de Loja y Zamora, a 12 km de Loja, Parque Nacional Podocarpus, $04^{\circ} 00' 17''$ S, $079^{\circ} 08' 51''$ W, 2,980 m, 9 June 1999, *Cabrera, O. et al. 379* (LOJA); P.N. Podocarpus, Sendero a Cajanuma-Laguna del Compadre-Mirador-Cajanuma, 2,750–3,200 m, $04^{\circ} 04'$ S, $79^{\circ} 09'$ W, Bo25 February 2000, *Cerón & Curso de Dendrologia 40077* (QAP); Km 21 on road from Yangana to Cerro Toledo, then trail from Cerro Toledo (ca. 300 m below antennas) toward Numbala, (to 1 km down the trail), cool, very rainy, windy páramo, $04^{\circ} 24' 01''$ S, $079^{\circ} 06' 42''$ W, 3,350 m, 14 February 2001, *Grant, J.R. & L. Struwe 01-4027* (LOJA, NEU, QCNE, US); Km 21 on road from Yangana to Cerro Toledo, 2 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques 02-4274* (NEU, NY, US); Km 21 on road from Yangana-Cerro Toledo, 3,350 m, 19 February 2006, *Grant, J.R., M.L. Cheung, F. F. Luisier, & N. Villard 06-4341* (G, LOJA, NY); Around km 21 on road from Yangana up Cerro Toledo, near the summit of Cerro Toledo, $04^{\circ} 22' 32.9''$ S, $079^{\circ} 06' 43.3''$ W, 3,122 m, 3 February 2011, *Grant, J.R. & J. Vieu 11-4658* (NY); P.N. Podocarpus, Cerro Toledo, $79^{\circ} 07'$ W, $04^{\circ} 23'$ W, 2,500–3,400 m, 30 October 1989, *Madsen 86290* (AAU [2 sheets], LOJA); Parque Nacional Podocarpus, vicinity of Lagunas de Compadre, $04^{\circ} 10'$ S, $079^{\circ} 07'$ W, 3,000–3,400 m, 21 November 1989, *Madsen, J. 86430* (LOJA); P.N. Podocarpus, above the refuge of Cajanuma, beside the trail from ‘Mirador’ on the ridge eastward to the cordillera, 3,200 m, November 1997, *Matt, F. 1* (ER); Cerro Toledo, km 15, Cerretera Yangana-Antenas, $04^{\circ} 23'$ S, $079^{\circ} 7'$ W, 2,920 m, 12 December 1995, *Merino, B. et al. 4695* (LOJA); P.N. Podocarpus, S of Loja, above “Centro de información,” E of Nudo de Cajanuma, $79^{\circ} 10'$ W, $04^{\circ} 05'$ S, 3,050–3,420 m, 3 m tall shrub, flowers green, 24 February 1985, *Øllgaard et al. 58114* (AAU, MO, NY); P.N. Podocarpus, Yangana-Cerro Toledo, at entrance to crest, subpáramo scrub and bogs in the pass, $70^{\circ} 06'$ W, $04^{\circ} 23'$ S, 3,100 m, 26 February 1985, *Øllgaard et al.*

Fig. 3.42 The hybrid *Macrocarpaea* $\times$ *mattii* and its parents.

Macrocarpaea subsessilis (left), *M.* $\times$ *mattii* (middle), and *M. noctiluca* (right).

Photo J.R. Grant



58258 (AAU, LOJA, MO, QCA). **Zamora-Chinchipe:** Palanda, Valladolid, Reserva Biologica Tapichalaca (Fundación de Conservación Jocotoco), Sendero El Paramo (toward plane wreckage), 04° 29' 45'' S, 079° 7' 55'' W, 2,469 m, 1 June 2011, Clark, J.L. et al. 12423 (NY).

17. *Macrocarpaea* $\times$ *mattii* J.R. Grant

(*Macrocarpaea noctiluca* J.R. Grant & Struwe $\times$ *M. subsessilis* Weaver & J.R. Grant), Harvard Pap. Bot. 11(2): 138. 2007. TYPE: ECUADOR. Loja: Beside the road from Yangana to 'Cerro Toledo', 04° 22' 6.94'' S, 079° 08' 0.35'' W, 2,500 m, 1 January 1998, F.G. Matt 14 (Holotype ER) (Fig. 3.42).

Shrub, likely between 1 and 2 m, glabrous throughout. Stems terete, solid, 5–6 mm in diameter just below the inflorescence. Leaves broadly elliptic, petiolate, 9.5–10.5 cm long. Petioles 10–12 mm long, slender with slight vagination; interpetiolar ridge 2–3 mm high. Blades 8.5–9.5 $\times$ 5.5–6.5 cm, entire, not revolute, dark above and conspicuously lighter below, with slightly impressed veins above, and slightly raised veins below, glabrous above and below, thin coriaceous; base aequilateral to oblique, cuneate; apex rounded to obtuse. Inflorescence a much branched open thyse to 15 cm long; branches 5–14 cm long; 3–12 flowered per branch. Bracts obovate to oblanceolate, petiolate, 18–60 $\times$ 10–32 mm; base aequilateral to oblique, cuneate; apex obtuse, acute to rounded; bract petioles 4–7 mm long. Flowers pedicellate, erect to slightly spreading; pedicels 2–15 mm long; bracteoles spatulate to oblanceolate, 5–18 $\times$ 1–7 mm. Calyx narrowly campanulate, 9–11 $\times$ 4.5–6.0 mm, glabrous, smooth, green, ecarinate; calyx lobes ovate to reniform, 3–4 $\times$ 4–5 mm, rounded. Corolla funnel-shaped, 28–32 mm long, 12–14 wide at the apex of the tube, yellow, smooth; corolla lobes ovate to elliptic, 7–12 $\times$ 4–7 mm, apex obtuse to rounded. Stamens 22–25 mm long; filaments 18–20 mm long, filiform, flattened; anthers linear to linear-elliptic, 4–5 $\times$ 1.5–2.0 mm, sagittate, versatile. Pollen glabra-type. Pistil 27–28 mm long;

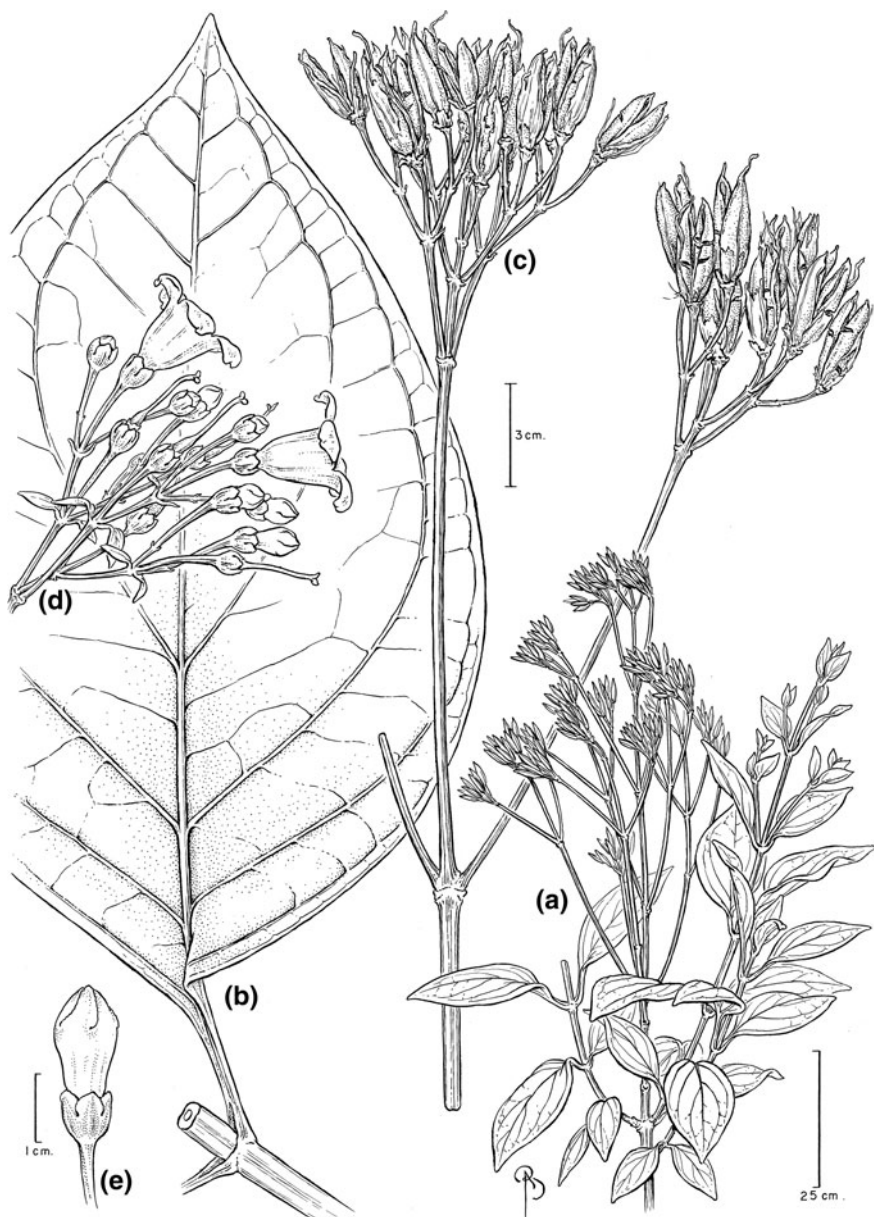


Fig. 3.43 A-C *Macrocarpaea micrantha*. **A** leaves; **B** habit of flowering stem; **C** details of flowers; **A** drawn from Grant 11-4691 (NY). **B-C** drawn from Quizhpe & Wisum 2673 (MO)

ovary $4\text{--}5 \times 2\text{--}3$ mm; style $20\text{--}22 \times 0.75\text{--}1.0$ mm; stigma lobes spatulate, $2\text{--}3 \times 1\text{--}2$ mm. Capsules and seeds unknown.

Macrocarpaea $\times$ *mattii* belongs to section *Choriophylla* and occurs from 2,450 to 2,500 m in the Amotape–Huancabamba region of southern Ecuador. It is a natural hybrid between sympatric *M. noctiluca* and *M. subsessilis*, and is intermediate in its morphological characters between its parents. While *M. subsessilis* has small rounded thick leathery-coriaceous leaves, *M. noctiluca* has much larger broad and papery thin leaves. The leaves of *Macrocarpaea* $\times$ *mattii* are intermediate, being elliptic to slightly obovate in shape. It also has the “dots” on the lower backside of leaves as in *M. noctiluca* and *M. bubops*. This species is part of a distinctive monophyletic group including *M. apparata*, *M. bubops*, *M. elix*, *M. jensii*, *M. \times mattii*, and *M. noctiluca*.

Etymology. Named for German biologist Felix G. Matt, researcher of bats in Ecuador and their pollination of *Macrocarpaea*.

Specimens examined: ECUADOR. **Loja:** Around km 9 on road from Yangana up Cerro Toledo, $04^{\circ} 22' 50.5''$ S, $079^{\circ} 08' 58.1''$ W, 2,450 m, 3 February 2011, Grant, J.R. & J. Vieu 11-4662 (NY); Beside the road from Yangana to ‘Cerro Toledo’, 2,530 m, January 1998, Matt, F. 15 (ER).

18. *Macrocarpaea micrantha* Gilg

Bot. Jahrb. Syst. 22: 338. 1896. TYPE: PERU. San Martín: Propre Tarapoto, 1855–1856, *Spruce 4618* (lectotype NY; isolectotypes BM, BR, C, E, G [3 sheets, G, G-BOISS, G-DC], GH, GOET, K, LD, OXF, P, W, designated by Grant 2004) (Fig. 3.43).

Shrub 1–4 m tall, glabrous. Stem terete or nearly so; internodes various, generally shorter than leaves, usually 1.5–5.0 cm. Leaves membranous; venation slender but conspicuous below, larger (lower) secondary veins mostly branching from midrib at $35\text{--}50$ degrees, strongly upcurved, brochidodromous. Blades of lower and middle cauline leaves elliptic, 12–25 cm long, 4–9 cm wide, base tapering rather abruptly to a distinctively slender petiole 2–4 cm, apex strongly acuminate. Uppermost cauline leaves rather abruptly smaller, often more ovate, all petiolate. Inflorescence a compact dichasium, often small and only 2–4 times divided, or occasionally larger with elongated primary branches; first 1 or 2 divisions subtended by leaves 2.0–6.5 cm long, further divisions my minute or rudimentary bractlets; flowers usually 7–25, occasionally more numerous. Pedicels erect, 15–25 mm. Calyx 7–10 mm; lobes semicircular, 0.4–0.8 times as long as tube, hyaline-margined, erose. Corolla 20–30 mm, pale greenish yellow, narrowly campanulate; lobes 6–8 mm, ovate-triangular, obtuse. Capsule narrowly conic-ovoid, 16–35 mm. This description is largely from Pringle (1995).

Macrocarpaea micrantha belongs to section *Choriophylla* and occurs from 550 to 1,700 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. It is perhaps the most widespread species in lowlands of the Huancabamba region of southern Ecuador and northern Peru. It is often found growing with other species, such as *M. harlingii*, *M. lenae*, *M. noctiluca* and *M.*

quizhpei. Often its presence may indicate the occurrence of other more rare species of *Macrocarpaea*.

Specimens examined: ECUADOR. **Morona-Santiago:** Cantón Tiwintza, Cordillera del Cóndor, Centro Shuar Kaputna, laderas del Cerro kampa Naint, 550 m, 3 July 2003, *Kajekai, C. & Grupo Shuar de Conservación 68* (LOJA, MO); Gualaquiza Cantón, región de la Corillera del Cóndor, vertiente occidental, Valle del Río Quimi, 03° 29'54" S, 078° 25' 13" S, 900 m, 10 May 2007, *Quizhpe, W. & A. Wisum 2673* (LOJA, MO QCNE); Cordillera del Cóndor, Cerro Maka Naint, 6 km al suroeste del Centro Shuar Warints, 1,700 m, 7 October 2002, *Wisum & Grupo Shuar de Conservación-1 18* (MO, NY, QCNE). **Zamora-Chinchipe:** Estación Padmi, 4 km de Los Encuentros en la carretera Zamora-Gualaquiza, 880 m, 12 June 1997, *Aguirre et al. 71* (LOJA); El Panqui, Tundayme, Cordillera del Cóndor region, Río Wawaime watershed, tributary of Río Quimi, below site of proposed Ecuacorriente coppermine, on ridge near 1-ha forest inventory "Wawaime" plot, 03° 34' 18" S, 078° 26' 46" W, 15 May 09, *Clark, J.L. et al. 10819* (NY); Along road from Zamora to Romerillos, 13.3 km N of bridge over Río Bombuscaro at Zamora, 0.4 km N or Pituca along river, 975 m, 30 May 2003, *Croat, T. & Menke 89733* (MO, NEU, NY, QCNE); P.N. Podocarpus, Guardería Bombuscaro, ca. 6 km S de Zamora, camino que va desde el final del Carretero Zamora-P.N. Podocarpus hasta la Guardería Bombuscaro, 1,050 m, 11 July 1992, *Freire-Fierro et al. 2284* (QCA, QCNE, U); Miazí, Río Nangaritzá, hillside behind camp, 930 m, 27 July 1993, *Gentry 80502* (MO, QCNE); Miazí, Río Nangaritzá, hillside behind camp, 930 m, 27 July 1993, *Gentry, A. 80502* (MO, QCNE); Región de la Cordillera del Cóndor, cuneca del alto Río Nangaritzá, Las Orquídeas, 877 m, 8 January 2008, *Grant, J.R. & C. Arnold 4538* (LOJA, MO, NY); 3 km S of Zamora toward the Bombuscaro entrance of P.N. Podocarpus, 1,019 m, 12 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4547* (G, LOJA, MO, NY); Nangaritzá Valley, south of Guayzimi, Cordillera del Condor region, Las Orquídeas, 04° 15' 31.4" S, 078° 40' 08.7" W, 1,180 m, 24 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4556* (NY); Property of Cabañas Ecológicas Copalinga, between Zamora and the Bombuscaro entrance to P.N. Podocarpus, 04° 05' 30.1" S, 078° 57' 39.4" W, 994 m, 8 February 2011, *Grant, J.R. & J. Vieu 11-4674* (NY); Forest trail west of Cabañas Yankuam, south of Las Orquídeas, 04° 14' 58.8" S, 078° 39' 46.6" W, 966 m, 11 February 2011, *Grant, J.R. & J. Vieu 11-4691* (NY); Road from Chuchumbleza, Quimi and Tundayme toward the Condor Mirador, 14 km from end of road at Military camp 'Condor Mirador', 03° 37' 23.5" S, 078° 27' 32.7" W, 1,210 m, 15 February 2011, *Grant, J.R. & J. Vieu 11-4696* (NY); Road from Chuchumbleza, Quimi and Tundayme toward the Condor Mirador, 14 km from end of road at Military camp 'Condor Mirador', 03° 37' 23.5" S, 078° 27' 32.8" W, 1,212 M, 15 February 2011, *Grant, J.R. & J. Vieu 11-4697* (NY); Parque Nacional Podocarpus, bosque subtropical-nublado-andino, 03° 09' S, 079° 01' W, 1,100–2,560 m, 21 July 2002, *Jaramillo, J. 23479* (QCA); Nangaritzá, Parroquia Pachicutza, colecciones en el sector noreste del Campamento military, 900 m, 6 December 1990, *Jaramillo & Grijalva 13411* (NY, QCA); Yacuambi, Parroquia La Paz, Centro Shuar Kurints, en ladera arriba del Río Yacuambi, 03° 46' S, 078° 54' W, 920 m, 7 September 2006,

Kajekai, C. & A. *Wisum* 746 (MO, NY); El Padmi, 6 June 1995, *Merino et al.* 4526 (LOJA); Nangaritzta, lower slopes of Cordillera del Condor, above Río Nangaritzta at Pachicutza, tropical premontane wet forest, 04° 07' S, 78° 37' W, 950 m, ere4 December 1990, *Neill, D. & W. Palacios* 9496 (MO, QCNE); El Pangui, Cordillera del Cóndor region, Río Wawaime watershed, tributary of Río Quimi, 03° 34' 18'' S, 078° 26' 46'' W, 1,130 m, 22 September 2007, *Neill, D. et al.* 15919 (MO, NY, QCNE); P.N. Podocarpus, Guardería Bombuscara, 1 January 2000, *Piguet s.n.* (NEU); Cordillera del Cóndor, vertiente occidental, Cuenca del Río Quimi, 03° 34' 45'' S, 078° 25' 20'' W, 1,180–1,400 m, 5 April 2006, *Quizhpe, W.* 2117 (LOJA, QCNE); Nangaritzta Cantón, Región de la Cordillera del Cóndor, cuenca alta del Río Nangaritzta, Sector Las Orquídeas, 920 m, 11 May 2006, *Quizhpe, W.* 2266 (LOJA, MO, NY, QCNE); Cordillera del Cóndor, vertiente occidental, Cuenca alta del Río Wawaime, afluyente del Río Quimi, 03° 35' 06'' S, 078° 26' 18'' W, 1,500 m, 28 September 2006, *Quizhpe, W. & A. Wisum* 2320 (LOJA, MO, NY, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Machinaza, Comunidad Machinaza, 1,050 m, 22 March 2006, *Quizhpe, W. & F. Luisier* 2056 (LOJA, MO, NY, QCNE); Yantzaza Cantón, Cordillera del Cóndor, vertiente occidental, carretera de Los Encuentros a La Zarza, 3 km al noroeste de Jardén del Cóndor, 03° 48' 40'' S, 078° 36' 28'' W, 1,400 m, 27 March 2008, *Quizhpe, W. & O. Jaramillo* 2968 (LOJA, MO, QCNE); El Pangui, Cordillera del Cóndor region, vertiente occidental, Cantón El Pangui, Parroquia Tundayme, Valle del Río Quimi, 03° 33' 59'' S, 078° 26' 29'' W, 900 m, 17 May 2008, *Quizhpe, W. & R. Steeves* 3078 (MO); Región de la Cordillera del Cóndor, cuenca alta del Río Nangaritzta, destacamento militar de Miazzi, río abajo de la confluencia del Río Cumbiriatza y el Río Nangaritzta, 900 m, 1 January 2002, *Quizhpe, W. et al.* 702 (MO, NY, QCNE); P.N. Podocarpus, near park refugeio, southwest of Zamora, 1,100 m, 10 July 1990, *Rome, A. et al.* 1003 (MO, QCNE); Parroquia La Paz, Centro Shuar Kiim, Terraza aluvial del Río Kiim, 03° 47' 02'' S, 078° 54' 15'' W, 900 m, 18-Jun-2006, *Wisum, A. et al.* 598 (MO, NY, QCNE).

PERU. Amazonas: Bagua, Imaza, Imazita, Wawiko, primary forest trail from Wawiko to Achu community, 04° 56' 7'' S, 078° 12' 11'' W, 400 m, 21 November 1996, *Albán, J. et al.* 9313 (MO); Bagua, Sukutim, annex of Wawas; Aguaruna name: uchi tsuwim, 21 July 1998, *Apanú & E. Chávez* 19262 (MO); Condorcanqui, Cordillera del Condor, Puesto de Vigilancia Alfonso Ugarte (PV3), 1,300–1,500 m, 16 July 1994, *Beltrán, H. & R. Foster* 845 (F, USM); Bagua, Imaza, Aguaruna Putuim (anexo Yamayakat), 760 m, 24 September 1994, *Díaz, C. et al.* 7227 (MO, U); Bagua, Imaza, Comunidad Aguaruna de Wanas (Km 92 Carretera Bagua-Imazita) 700–800 m, 29 August 1996, *Díaz, C. et al.* 8040 (MO, U, USM); Bagua, Imaza, Reg. Nororiental del Marañon, Kampaenza, 320 m, 23 September 1994, *Jaramillo et al.* 468 (MO, NY); Bagua, Imaza, Aguaruna de Putuim, 780 m, 13 June 1996, *Rodríguez, E. et al.* 1000 (AMAZ, HUT, MO, U, USM); Bagua, Imaza, Tayu Mujaji, Comunidad de Wawas, 800 m, 23 October 1997, *Rojas, R., et al.* 443 (MO, U); Quebrado El Almendro, 430 m, 8 March 1998, *van der Werff et al.* 14518 (MO, U); Bagua, Imaza, Tayu Mujaji, Comunidad de Wawas, 600 m, 25 October 1997, *Vásquez et al.* 24690 (MO, U). Loreto: Loreto, 1 September 1904, *Ule* 6392 (G,

Fig. 3.44 *Macrocarpaea noctiluca* J.R. Grant & Struwe. Photo J.R. Grant



MG). San Martín: Pedro Ruíz-Moyobamba road, km 399, 1,410 m, 29 January 2001, *Grant, J.R. & Rodríguez 01-3966* (G, HUT, NEU, NY, US); Pumayacu, between Balsapuerto and Moyobamba, 600–1,200 m, 1 August 1933, *Klug, G. 3138* (F, G, GH, K, MO, NY, S, US, WIS); San Martín, trail to television antenna, km 17.5 of Tarapoto-Yurimaguas road (2.5 km N of Cataratas de Ahuashiyacu), 850–1,200 m, 7 August 1986, *Knapp, S. 7911* (MO, NEU, U, USM); Km 399 of Carretera Marginal, trail to Quebrada Venceremos and Río Serranoyacu, 67 km E of Pomacochas, 8 km W of bridge over Río Serranoyacu, 1,400–1,500 m, 13 June 1986, *Knapp, S. & P. Alcorn 7743* (MO, NY, USM); San Martín, Dtto Tarapoto, Carretera de Tarapoto a Yurimaguas, from km 12 to km 14, 3 December 1979, *Rimachi Y., M. 4751* (MO); Dtto Banda de Silcayo, Carretera de Tarapoto-Yurimaguas km 16, altura de las cataratas del Ahuashiyacu, 800 m, 10 September 1992, *Rimachi Y., M. 10316* (US); Tarapoto, 1 November 1982, *Rios T., J. 1010* (MO); Rioja, salida a Mashoyacu-Schacucaqui, Bosque de Protección Alto Mayo, Toma de Agua, Quebrada Cuchachi, 1,000 m, 15 July 1995, *Sánchez Vega, I. & m.O. Dillon 8048* (F); Rioja, Pardo Miguel, El Afluente y la Marginal, 1,450 m, 25 June 1997, *Sánchez Vega, I. & M.O. Dillon 9038* (F, U); Rioja, Pardo Miguel, Centro Poblado Aguas Verdes, fila entre La Perla y Nuevo Edén, 1,350 m, 25 June 1998, *Sánchez Vega, I. et al. 9520* (F, U); Between Balsafuerte & Mayobamba, 1 August 1938, *Sandeman s.n.* (BM).

19. *Macrocarpaea neillii* J.R. Grant

Harvard Pap. Bot. 9(2): 336. 2005. TYPE: ECUADOR. Zamora-Chinchipe: Nangaritzta Cantón, Cordillera de Nanguipa, Cerro Colorado, about 8 km SSE of Nambija, 20 km ESE of Zamora, montane forest and dense shrubby vegetation on exposed ridges, 04° 07' 29" S, 78° 46' 25" W, 2,700 m, 18 February 2002, *D. Neill, W. Quizhpe, J. Manzanares, A. Hirtz, T. DeLinks, & C. Cole 13758* (Holotype QCNE; Isotypes LOJA, MO, NY) (Fig 3.30).

Unbranched shrub, 2 m, glabrous throughout, cm in diameter. Stems terete, solid, 3–4 mm in diameter just below the inflorescence. Leaves obovate varying to elliptic, petiolate to nearly sessile in upper leaves, 4–8 cm long. Petioles 0–10 mm long, slender with very slight vagination; interpetiolar ridge 1–4 mm high. Blades 4–7 × 2.0–3.5 cm, entire, slightly revolute, dark above and conspicuously lighter below, with slightly impressed veins above, and slightly raised veins below, leathery-coriaceous; base aequilateral to oblique, cuneate to attenuate and decurrent on the petiole; apex acute, obtuse to rounded. Inflorescence a few-branched open thyrse, 4–10 cm long; branches 3–4 cm long; 3–9 flowered per branch. Bracts obovate nearing on spatulate, sessile, 11–21 × 4–17 mm; base aequilateral to oblique, cuneate; apex acute to obtuse; bract petioles 0 mm long. Flowers pedicellate, erect to slightly spreading, but never nodding; pedicels 9–15 mm long; bracteoles inconspicuous and scabrous, to ovate to obovate, 1–3 × 0.5–1.0 mm. Calyx campanulate, 7–8 × 5–6 mm, glabrous, faintly rugose to pustulate, ecarinate; calyx lobes ovate to rotund, 2–3 × 2.5–3.0 mm, apex rounded to obtuse. Corolla funnel-shaped, 21–27 mm long, 7–10 mm wide at the apex of the tube, greenish-yellow (Neill, D. et al. 13758), smooth; corolla lobes ovate, 5–6 × 4–5 mm, obtuse to rounded. Stamens 13.0–15.5 mm long; filaments 10–12 mm long, filiform, flattened; anthers elliptic to oblong, 3.0–3.5 × 1.5–2.0 mm, sagittate, versatile; pollen *Glabra*-type. Pistil 22–29 mm long; ovary 5–6 × 2.0–2.5 mm; style 15.0–20.5 × 0.5 mm; stigma lobes spatulate, 2.0–2.5 × 1.0–1.5 mm. Capsules and seeds unknown.

Macrocarpaea neillii belongs to section *Choriophylla* and occurs at 2,700 m in the Amotape–Huancabamba region of southern Ecuador. It is related to *M. wurdackii* Weaver & J.R. Grant and *M. stenophylla* Gilg, both of the Huancabamba region of Peru.

Etymology. Named for David A. Neill (1953–), collector of the type, specialist of the flora of Ecuador.

20. *Macrocarpaea noctiluca* J.R. Grant & Struwe

Harvard Pap. Bot. 8(1): 76. 2003. TYPE: ECUADOR. Loja: Nudo de Sabanilla, 15 km S of Yangana, 04° 25' 22" S, 079° 09' 04" W, 2,486 m, 10 February 2001, Grant, J.R. & L. Struwe 01-3977 (Holotype: US [2 sheets]; Isotypes: LOJA, QCA, QCNE, NY) (Figs. 3.44, 3.45).

Dichotomously branched to unbranched tree, overall branching pattern triangular in outline, 1–6 m tall, glabrous throughout; trunk to 4.0 cm diameter wood solid to hollow (pith to 5 mm), growth rings prominent, bark thin 0.005–0.1, outer surface rugose, brown. Stems terete, solid to hollow, 6–12 mm in diameter just below inflorescence. Leaves broadly ovate, oblong to elliptic, sessile to short-petiolate, 8–43 cm; blades 7–35 × 4.5–16.0 cm, entire, slightly revolute, base aequilateral to slightly oblique or rounded, apex acute, papery thin, shiny to opaque, light green to dark green, with slightly impressed veins above, and slightly raised veins below, glabrous above and below; interpetiolar ridge 3–6 mm high; petioles slender with very slight vagination, 10–90 mm. Branches of the

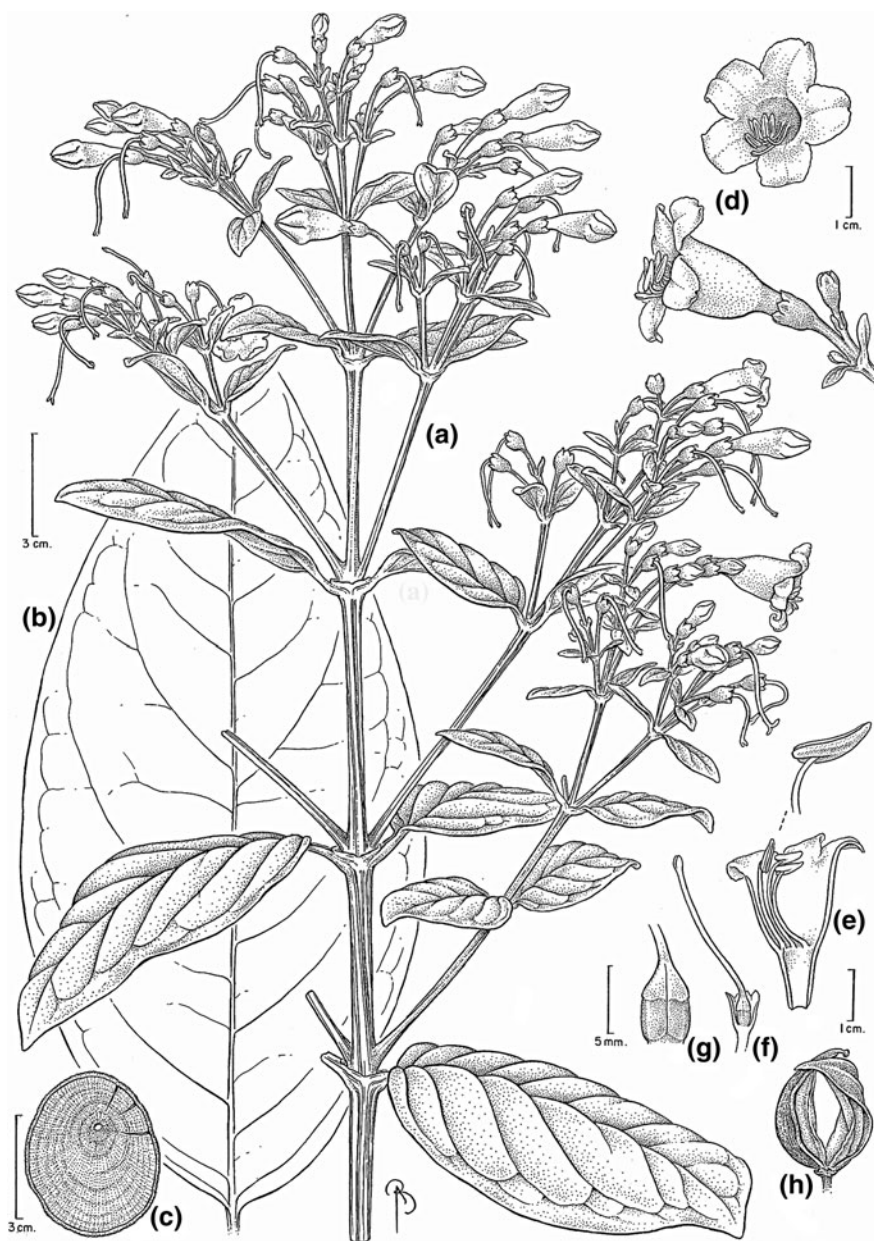


Fig. 3.45 *Macrocarpaea noctiluca* J.R. Grant & Struwe. **a** habit of flowering stem; **b** leaf; **c** wood anatomy of cross-section of main trunk; **d** corolla viewed from front, and side-view of flower; **e** cross-section of corolla, and anther; **f** pistil; **g** ovary; **h** mature dehiscent capsule. **a** from field photo Grant, J.R. & L. Struwe 01-4021; **b**, **g** from Grant, J.R. & L. Struwe 01-4074; **c** from Grant, J.R. & L. Struwe 01-3994; **d**–**f** from pickles of Grant, J.R. & L. Struwe 01-3979

inflorescence 17–34 cm, 3–18 flowered per branch. Bracts ovate to lanceolate to oblong to elliptic, 9–135 × 5–75 mm, base aequilateral to attenuate, apex acute to obtuse, sessile to short-petiolate; bract petioles 1–7 mm. Flowers pedicellate, erect to horizontal to oriented in all directions in the inflorescence; pedicels 3–31 mm; bracteoles linear to lanceolate to obovate, 1–13 × 1–8 mm. Calyx narrowly to broadly campanulate, 7–10 × 5–9 mm, glabrous, smooth, green, ecarinate, to sometimes a small keel on the back of calyx lobe, often with pronounced ridges between calyx lobes extending to the base of the calyx; calyx lobes dividing calyx to one-third, obtuse, rounded to acute, 2–4 × 2.5–3.0. Corolla funnel-shaped, 30–50 mm, 11–24 mm wide at corolla lobe sinuses, creamy white to yellow to yellowish-green, smooth; corolla lobes ovate to elliptic, apex obtuse to rounded, 7–15 × 4–13 mm. Stamens 22–34 mm; filaments 18–28 mm, filiform, terete; anthers linear to linear elliptic, 4–6 × 2.0–2.5 mm, sagittate, versatile. Pistil 25–43 mm; ovary 4–7 × 2.5–3.0 mm; style 18–31 × 1.0–1.5 mm; stigma 2-lobed, lobes 3–5 × 2–3 mm, rounded to spatulate. Capsules dry, bilocular, medially dehiscent, ellipsoidal to ovoid, 29–34 × 10–14 mm, smooth to rugose, dark brown, erect to slightly nodding; style remnant 3–6 mm. Seeds unknown.

Macroparpaea noctiluca belongs to section *Choriophylla* and occurs from 2,100 to 3,200 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. It is the most common species of the genus in Ecuador, occurring in Azuay, Loja, Morona-Santiago, and Zamora-Chinchipe, and subsequently, the mostly frequently collected. It is mostly commonly observed as a primary colonizer in roadside secondary vegetation. It occurs at different sites with *M. angelliae*, *M. apparata*, *M. arborescens*, *M. bubops*, *M. harlingii*, and *M. jensii*. Often its presence may indicate the occurrence of other more rare species of *Macroparpaea*.

This species is part of a distinctive monophyletic group including *M. apparata*, *M. bubops*, *M. elix*, *M. jensii*, *M. × mattii*, and *M. noctiluca*.

Etymology. From the Latin “*noctis*”, night, and “*lucis*,” light, or glowing for flowers that look like small glowing lights.

Specimens examined: ECUADOR. **Azuay:** Km 74 de Cuenca, carretera Zigzag-Molón-Gualaquiza, 2,790 m, 6 August 1986, Jaramillo et al. 8866B (AAU, GB, HUA, QCA); Road Sigsig-Gualaquiza, km 25.6, at the pass on military post road, 3,200–3,330 m, 11 January 2000, Jørgensen et al. 1832 (CHRB, MO, NY, QCNE). **Loja:** 15 km S of Yangana on the road Loja-Zumba (under construction), 04° 30' S, 79° 8' W, 2,500 m, 24 September 1983, Brandbyge 42299 (AAU, MO, NY, Q); Nudo de Guagrauma, slopes of the Lora de Oro (about 6 km south of Saraguro), 3,000 m, 2 August 1944, Camp 275 (NY); P.N. Podocarpus, Sendero a Cajanuma, 2,550–2,700 m, 04° 04' S, 79° 09' W, 23 February 2000, Cerón & Curso de Dendrologia 40065 (QAP); Cerro Villonaco, remanente del bosque Andino en el lado sur oriental de la cumbre 03° 58' S, 079° 16' W, 2,900 m, 12 September 1997, Cerón, C. & L.E. Ocampo 35126 (QAP); Saraguro Canton, along road between Cuenca and Loja, 58.6 km N of Loja (first roundabout after entering the main entrance road), ca. 5 km S of Saraguro, 03° 39' S, 79° 15' W, 2,875 m, 4 March 1992, Croat, T. 72660 (MO, QCNE); Loja-Zamora, 12 km from Loja, on the finca of

Dr. David Espinosa, 03° 55' S, 79° 09' W, 2,600 m, 1 October 1988, *Ellemann* 66529 (AAU, LOJA, QCA); Loja-Zamora, 12 km from Loja, on the finca of Dr. David Espinosa, 03° 55' S, 79° 09' W, 2,400–2,600 m, shrub, flowers yellow, 17–18 November 1988, *Ellemann* 75387 (AAU, LOJA); 12 km NW of Saraguro on Loma Paredones, 03° 36' S, 79° 10' W, 2,800 m, shrub 2 m high, 9 March 1989, *Ellemann* 91665 (AAU, LOJA, QCA); Namandu, S. Loja, 2,400–2,500 m, 18 April 1946, *Espinosa, R.* 198 (LOJA, US); Quedrada Honda, en la carretera Yangana-Valladolid, 2,470 m, 9 October 1995, *Garmendia & Paredes* 639 (QCNE); De la carretera Yangana-Valladolid, antes del refugio de Quebrada Honda, sale un camino de herradura que va a unos potreros, 04° 28' 59" S, 79° 9' 20" W, 2,720 m, 9 October 1995, *Garmendia* and *Paredes* 688 (QCNE); Quebrada Honda, cuesta carrizal, 04° 28' 55" S, 079° 7' 36" W, 2,520 m, 26 September 1996, *Garmendia, A. & M. Igual* 1464 (QCA); 8 km E of Loja on Loja-Zamora road, 31 October 2002, *J.R. Grant* 02-4245 (NEU, NY, US); Km 8.9 on road from Yangana-Cerro Toledo, 2,450 m, 29 December 2007, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung* 07-4508 (LOJA, MO, NY); Km 8.9 on road from Yangana-Cerro Toledo, 2,450 m, 19 February 2006, *Grant, J.R., M.L. Cheung, F. F. Luisier, & N. Villard* 06-4342 (CHRB, G, LOJA, MO, NY); Km 10 on road from Yangana-Cerro Toledo, 2 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques* 02-4275 (MO, NEU, NY, SEL, US); Km 10 on road from Yangana-Cerro Toledo, 2 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques* 02-4276 (MO, NEU, NY, SEL, US); 30.1 km past Yangana toward Valladolid, 5 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques* 02-4295 (NEU, NY, US); Nudo de Sabanilla, 20 km S of Yangana, 04° 27' 12" S, 079° 09' 11" W, 2,485 m, 10 February 2001, *Grant, J.R. & L. Struwe* 01-3979 (LOJA, QCA, QCNE, NEU, NY, S, US); Nudo de Sabanilla, between 20 and 28.8 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,550 m, 11 February 2001, *Grant, J.R. & L. Struwe* 01-3992 (LOJA, QCA, QCNE, NEU, NY, MO, S, US); Nudo de Sabanilla, between 20 and 28.8 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,550 m, 11 February 2001, *Grant, J.R. & L. Struwe* 01-3993 (LOJA, NEU, QCNE); Nudo de Sabanilla, between 20 and 28.8 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,550 m, 11 February 2001, *Grant, J.R. & L. Struwe* 01-3994 (LOJA, NEU, QCNE, US [2 sheets]); 28.8 km S of Yangana, 04° 27' 59" S, 079° 08' 44" W, 2,560 m, 11 February 2001, *Grant, J.R. & L. Struwe* 01-3996 (LOJA, QCNE, US); 10 km from Loja on road to Zamora, 03° 59' 28" S, 079° 09' 57" W, 2,550 m, 13 February 2001, *Grant, J.R. & L. Struwe* 01-4003 (LOJA, NEU, NY, QCA, QCNE); Km 8.9 on road from Yangana to Cerro Toledo, 04° 23' 08" S, 079° 09' 03" W, 2,450 m, 14 February 2001, *Grant, J.R. & L. Struwe* 01-4021 (LOJA, NEU, NY, QCA, QCNE.); From Loja-Saraguro road, then 200 m on road toward Fierro Urco, 03° 40' 58" S, 079° 16' 22" W, 2,900 m, 17 February 2001, *Grant, J.R. & L. Struwe* 01-4074 (G, LOJA, NEU [3 sheets], NY, QCA, QCNE, US [2 sheets]); Around km 9 on road from Yangana up Cerro Toledo, 04° 22' 59.6" S, 079° 07' 41.0" W, 2,826 m, 3 February 2011, *Grant, J.R. & J. Vieu* 11-4660 (NY); Around km 9 on road from Yangana up Cerro Toledo, 04° 22' 59.6" S, 079° 07' 41.0" W, 2826, 3 February 2011, *Grant, J.R. & J. Vieu* 11-4660-6 (NY); Around km 9 on road from Yangana up Cerro Toledo, 04° 22' 59.6" S, 079° 07' 41.0" W, 2,826 m, 3 February 2011, *Grant,*

J.R. & J. Vieu 11-4660-58 (NY); Km 8.9 on road from Yangana–Cerro Toledo, 2 November 2002, *J.R. Grant et al. 02-4269* (NEU); Road between Loja and Zamora, 2,600–2,700 m, 20 March 1972, *Harling, G. 11322* (GB, MO); Loma de Loro, 6 km S of Saraguro on road to Loja, 3,200 m, 11 February 1985, *Harling, G. & Andersson 21910* (GB, MO, QCA); W slope of Nudo de Sabanilla, ca. 10 km above Yangana on road to Valladolid, 2,500 m, shrub 2.0–2.5 m tall, 3 April 1985, *Harling, G. & Andersson 23,594* (GB, QCA); Loja–Zamora rd, 2,700–2,900 m, 8 February 1982, *Harling, G. et al. 20386* (GB); Nudo de Sabanilla, N part, 2,400–2,600 m, 10 February 1982, *Harling, G. et al. 20558* (GB); Carretera Loja–La Palma, bosque húmedo, suelo cascajosa, 2,850 m, 27 December 1988, *Jaramillo 10514* (QCA); Carretera Saraguro–Loja, Loma del Oro, 03° 31' 38" S, 079° 43' 41" W, 2,525 M, 24 June 2008, *Jaramillo, J. et al. 26788* (QCA); Km 10–15 Yangana–Toledo road, subpáramo, 04° 24' S, 79° 6' W, 3,000–3,300 m, 1 August 1986 *Jørgensen 61374B* (AAU, MO, NY, QCA, QCNE); Loja–Saraguro, km 58, turnoff toward Fierro Urco, km 1–2, 03° 41' 49" S, 79° 16' 22" W, 3,000 m, 21 April 1994, *Jørgensen et al. 499* (LOJA, MO, QCA, QCNE); Cerro Uritusinga, Loja–La Palma, km 18–20, 04° 05' 03" S, 79° 13' 40" W, 2,910–3,000 m, 30 November 1994, *Jørgensen et al. 1050* (LOJA, MO, NEU, QCA, QCNE); 4 km S of Loja, 04° 0' 40" S, 79° 2' 15" W, 2,600 m, 17 April 1966, *Knight 494* (WIS); Slopes of Cerro Villonaco, ca. 10 km west of Loja, 03° 11' 80" S, 79° 3' 10" W, 2,850 m, small tree 4 m tall, with yellow flowers, 6 March 1966, *Knight 517* (WIS); Road Loja–Zamora, km 10, 03° 58' S, 79° 08' W, 2,600 m, 24 October 1996, *Lewis 2709* (K, LOJA, MO, NY, QCNE); Road Loja–Saraguro, km 26, bosque Cofragia, 03° 49' 437" S, 79° 17' 592" W, 2,750 m, 17 January 1997, *Lewis et al. 2930* (K, LOJA, MO, QCNE); Road between Loja and Zamora ca. Km 9, 2,500–2,750 m, 31 December 1978, *Luteyn et al. 6542* (AAU, CAS, GH, MO, NY, QCA); Cordillera de Sabanilla, ca. 15 km S of Yangana, 2,480 m, 30 December 1980, *Madison & Besse 7498* (QCA, SEL); Rd. Loja–Zamora km 18 (El Tiro), 03° 58' S, 079° 08' W, 2,650–2,800 m, 21 February 2001, *Madsen, J. 7724* (LOJA, NY, QCNE); Rd. Universidad Nacional de Loja - Las Achira (Uritusinga), km 10, 2,800 m, 25 October 2001, *Madsen, J. and Chimbo 8610* (AAU); P.N. Podocarpus, about 6.5 km from the park entrance to the refuge Cajanuma, 2,500 m, November 1998, *Matt, F. 4* (ER); *Matt, F. 5* (ER); *Matt, F. 6* (ER); Beside the road from Loja to Zamora, still on the eastern slope of the cordillera, 2 km before the former rubbish dump of Loja, 2,550 m, January 1998, *Matt, F. 7* (ER); *Matt, F. 8* (ER); *Matt, F. 9* (ER); *Matt, F. 10* (ER); *Matt, F. 11* (ER); Amaluza, 5–10 km ENE of the village (Pasaje del Romerillo), 2,400–2,700 m, tree 3 m high, 79° 23' W, 04° 34' S, 23 September 1976, *Øllgaard and Balslev 9740* (AAU, NY); La Palma, bosque alto andino, 2,850 m, 27 December 1988, *Rios, M. et al. 209* (AAU, QCA); Carretera Valladolid–Loja, km 4–21, 04° 20' S, 79° 15' W, 1,900–2,700 m, 18 February 1993, *Romoleroux et al. 1536* (QCA, QCNE); Cerro Uritusinga (north of Loja), 2,920 m, 14 January 2003, *Smith, S.D. & O. Jadan 229* (MO); western slopes of Cordillera de Condor and northwest slopes of Nudo de Sabanillas, around Tambo Cachiyacu, along Río Cachiyacu, about 2 leagues southeast of Yangana, 2,000–3,000 m, 19 October 1943, *Steyermark, J. 54812* (F); Canton Loja, Hoya de Loja, Cordillera Oriental, Sitio via a Zamora, 2,646 m, 14

Fig. 3.46 *Macrocarpaea opulenta* J.R. Grant. Photo J.R. Grant



Fig. 3.47 *Macrocarpaea opulenta* J.R. Grant. Photo J.R. Grant



July 2008, *Villa, N. 93* (LOJA); Canton Loja, Hoya de Loja, Cordillera Occidental, sitio Villonaco, 2,818 m, 15 July 2008, *Villa, N. 130* (LOJA); Canton Loja, Hoya de Loja, Cordillera Oriental, Sitio Z. Huayco Alto, 2,363 m, 22 July 2008, *Villa, N. 155* (LOJA); Canton Loja, Hoya de Loja, Cordillera Sur-Oriental, sitio Q. Monica, 2,547 m, 25 August 2008, *Villa, N. 240* (LOJA); Canton Loja, Hoya de Loja, Cordillera Oriental, Sitio Q. Volcan, 2,622 m, 26 August 2008, *Villa, N. 277* (LOJA). **Morona-Santiago:** Path Campamento San Miguel (on road in construction Sigsig-Gualaquiza)–Gualaquiza, 9 April 1968, *Harling, G. et al. 8115* (GB). **Zamora-Chinchipe:** Palanda Cantón, Parroquia Vallodolid, southern slopes of the Cordillera de Sabanilla (headwaters of Río Chinchipe), Tapichalaca Reserve (Fundación Jocotoco), 2,500–2,700 m, 3 April 2005, *Clark, J.L. 9022* (NY, QCNE, US); Quebrada Honda, cuesta carrizal, 2,520 m, 26 September 1996, *Garmedia & Igual 1464* (QCNE); Approx. 40 km S Amaluza on road to Zumba that nearly parallels the Ecuador–Peru border, 3,016 m, 1 January 2008, *Grant, J.R., C. Agier,*

C. Arnold & M.L. Cheung 08-4515 (LOJA, NY); P.N. Podocarpus (San Francisco entrance), trail leading west from San Francisco, 03° 59' 24'' S, 079° 05' 48'' W, 2,100 m, 16 February 2001, *Grant, J.R. & L. Struwe 01-4062* (LOJA, QCNE); Along road between Zumba and Amaluza that parallels the Ecuador–Peru border, 04° 47' 18.1'' S, 079° 22' 16.6'' W, 2,507 m, 7 February 2011, *Grant, J.R. & J. Vieu 11-4671* (NY); Along road between Zumba and Amaluza that parallels the Ecuador–Peru border, 04° 46' 47.0'' S, 079° 23' 50.0'' W, 2,988 m, 7 February 2011, *Grant, J.R. & J. Vieu 11-4672* (NY); Above Valladolid on rd to Yangana, montane rain forest, 2,700 m, 2 February 1985, *Harling, G. & Andersson 21462* (GB); Nudo de Sabanilla–Valladolid, horse trail to Caserío Quebrada Honda, montane rainforest, 2,400–2,600 m, ca. 2.0–2.5 m, 12 February 1993, *Harling, G. & Ståhl 26325* (GB, MO, S); P.N. Podocarpus, road Yangana–Valladolid, km 26, montane forest along ravine, 04° 29' S, 79° 09' W, 2,550 m, 2 December 1988, *Madsen et al. 75753* (AAU, LOJA, QCA, QCNE); Palanda, Tapichalaca Reserve, south of Podocarpus National Park, in upper Río Chinchipe watershed, east of the Yangana–Valladolid road, at the head of the mule trail to Quebrada Honda, 04° 29' 04'' S, 079° 07' 59'' W, 2,570 m, 4 December 2006, *Neill, D. 15368* (NY, QCNE); Palanda, Tapichalaca Reserve, south of Podocarpus National Park, east of road between Yangana and Valladolid, upper Río Chinchipe watershed, near beginning of mule trail to Quebrada Honda, 04° 29' 23'' S, 079° 08' 11'' W, 2,550 m, 25 September 2007, *Neill, D. et al. 16001* (LOJA, MO); P.N. Podocarpus, road Yangana–Valladolid, just S of the pass (Nudo de Sabanilla), quebrada with wet montane forest, and low dense scrub on ridgetop, 04° 27' S, 78° 08' W, 2,640–2,770 m, 16 February 1989, *Øllgaard et al. 90616* (AAU, LOJA, QCA); Valladolid, cruz del soldado, 04° 28' S, 079° 05' W, 9 December 2000, *Sánchez, O. 17* (LOJA); Palanda, Reserva Tapichalaca, near road between Yangana and Valladolid, south of Podocarpus National Park, trails in Tapichalaca Reserve, Upper Río Chinchipe watershed, 04° 29' 44'' S, 079° 07' 55'' W, 2,700 m, 30 October 2006, *van der Werff, H. et al. 21810* (MO); Area of ECSF (Estación Científica San Francisco), 03° 58' 18'' S, 079° 04' 44'' W, 2,200–2,600 m, 24 January 2001, *Wolff, D. 98* (LOJA).

21. *Macrocarpaea opulenta* J.R. Grant

Harvard Pap. Bot. 11(2): 135. 2007. TYPE: ECUADOR. Zamora-Chinchipe: Cordillera del Cóndor, 28.1 km E of Los Encuentros (as measured from the bridge crossing the Rio Nangaritzta E of the city center) in direction of the Paquisha Alta military camp, 1,441 m, 24 February 2006, *Grant, J.R., M.L. Cheung, F. Luisier & N. Villard 06-4347* (Holotype NY!; Isotypes G, LOJA, MO, QCA, QCNE) (Figs. 3.46, 3.47, 3.48).

Shrub 2–4 m, glabrous throughout. Trunk to 2 cm diameter, wood hollow, rings absent; bark papery thin to scarcely measurable, 0.05 mm thick, outer surface smooth to rugose, tan to greenish, blotched with lichens and mosses. Stems terete, hollow, 8–11 mm in diameter just below the inflorescence. Leaves elliptic, oval to ovate, long-petiolate, (20)–37–47 cm long. Petioles (20)–65–85 mm, slender with slight vagination; interpetiolar ridge 2–3 mm high. Blades (18)–29–40 × (8.5)–

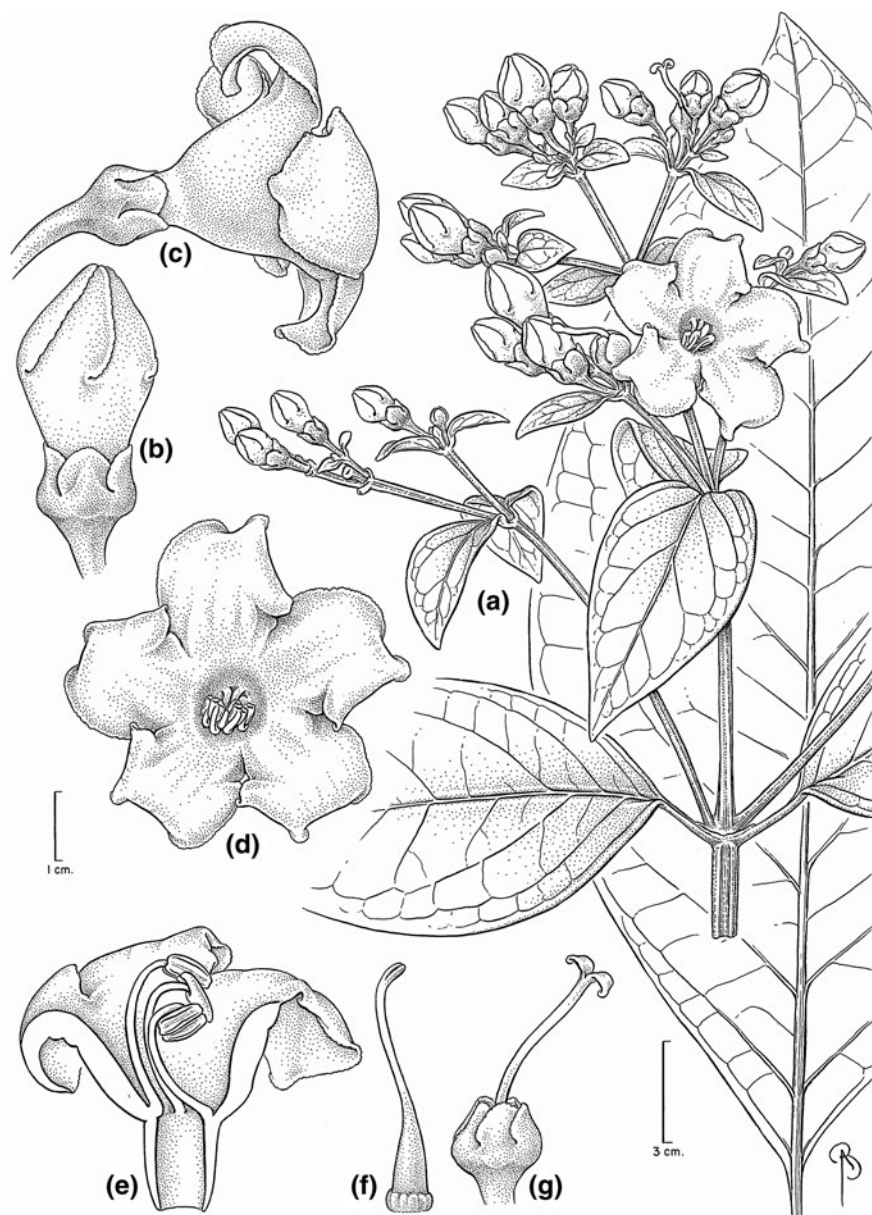


Fig. 3.48 *Macrocarpaea opulenta* J.R. Grant. **a** habit of flowering stem; **b** bud; **c** corolla viewed from side; **d** corolla viewed from front; **e** dissected corolla, noticed thickened petals; **f** young pistil; **g** calyx and pistil once corolla has dropped. **a–g** drawn from Grant et al. 06-4347

14–19 cm, entire, not revolute, dark green, with slightly impressed veins above, and slightly raised veins below, glabrous above and below, membranaceous, thin, flexible; base aequilateral to oblique, cuneate to attenuate; apex acuminate to acute. Inflorescence much branched open thyrses, 29–35+ cm long; branches 5–35 cm long, 3–12 flowered per branch. Bracts ovate, elliptic, to lanceolate, petiolate, 17–130 × 9–65 mm; base aequilateral to oblique, cuneate; apex acuminate to acute; bract petioles 0–5 mm. Flowers pedicellate, erect to slightly spreading; pedicels 7–30 mm long; bracteoles inconspicuous and scabrous, linear, triangular to ovate, 1–5 × 1–2 mm. Calyx campanulate, 13–15 × 11–17 mm, glabrous, smooth, green, ecarinate, ovate, reniform to rotund; calyx lobes 4–9 × 6–10 mm, apex obtuse to rounded. Corolla broadly funnel-shaped with petal lobes slightly spiraled to the right such as to give the impression of a pinwheel, 47–59 mm, 40–45 mm wide at the apex of the tube, greenish-yellow, smooth, spongy, significantly thickened and fleshy; corolla lobes ovate, slightly imbricate (lobes spiraling, curving and overlapping to the right), an additional curling of the right side of the petal lobe gives each petal the shape of a horse's head; corolla lobes 28–32 × 22–30 mm, obtuse to rounded. Stamens 27–33 mm long; filaments 22–27 mm long, filiform, terete; anthers elliptic to oblong, 5–6 × 3.0–3.5 mm, sagittate, versatile; pollen glabra-type. Pistil 38–40 mm long; ovary 11–13 × 3–4 mm; style 23–25 × 1.5–2.0; stigma lobes oblong to spatulate, 3–4 × 2–3 mm. Capsules and seeds unknown.

Macrocarpaea opulenta belongs to section *Choriophylla* and occurs from 1,100 to 1,700 m in the Amotape–Huancabamba region of southern Ecuador. Its flowers are green and broadly flared, having a broad mouth, petals that have a flattened face before curling backwards. The petals that are significantly thickened and fleshy, a slight turn in the angle of the petal lobes so they appear as curving toward the right, and unique curving of the right side of the petal lobes that give each petal the shape of a horse's head. Despite belonging to two different species groups both *M. jactans* and *M. opulenta* occur in the same geographic region of the Cordillera del Cóndor, and have similar shaped corollas indicating that they may have a common pollinator.

Etymology. From the Latin “opulentus,” splendid or opulent.

Specimens examined: ECUADOR. **Zamora–Chinchipe:** 13 km E of Los Encuentros (as measured from the bridge crossing the Rio Nangaritza E of the city center) in direction of the Paquisha Alta military camp, 1,444 m, 9 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4539* (NY, LOJA); 13 km E of Los Encuentros (as measured from the bridge crossing the Rio Nangaritza E of the city center) in direction of the Paquisha Alta military camp, 1,444 m, 9-Jan-2008, *Grant, J.R., C. Agier, C. Arnold & M. Cheung, 08-4540* (NY, LOJA); Cordillera del Condor, 18.4 km E of Los Encuentros in direction of Paquisha Alta Military Camp, 03° 30' 28" S, 078° 35' 59" W, 1,433 m, 21 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4551* (NY); Cordillera del Condor, 32 km from Los Encuentros in direction of Paquisha Alta Military Camp, north for 1–3 km north on road toward a mine, 03° 50' 56.2" S, 078° 31' 49.8" W, 1,506 m, 9 February 2011, *Grant, J.R. & J. Vieu 11-4676* (NY); Road from Chuchumbleza, Quimi and Tundayme toward the Condor Mirador, 12 km from end of road at

Military camp 'Condor Mirador', 03° 37' 07.0'' S, 078° 26' 41.7'' W, 1,427 m, 15 February 2011, *Grant, J.R. & J. Vieu 11-4698* (NY); Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi 03° 34' 45'' W, 078° 25' 20'' W, 1,180–1,400 m, 5 April 2006, *Quizhpe, W. 2141* (LOJA, MO, NY, QCNE); Yantzaza Cantón, Cordillera del Cóndor, vertiente occidental, carretera de Los Encuentros a La Zarza, 03° 48' 40'' S, 078° 36' 28'' W, 1,400 m, 27 March 2008, *Quizhpe, W. & O. Jaramillo 2990* (LOJA, MO, QCNE); Yantzaza Cantón, Cordillera del Cóndor, vertiente occidental, Vía Pindal, al noreste de Los Encuentros, 03° 46' S, 078° 35' W, 1,100 m, 30 March 2008, *Quizhpe, W. & O. Jaramillo 3011* (MO, QCNE); Yantzaza Cantón, Cordillera del Cóndor, vertiente occidental, Vía Pindal, al noreste de Los Encuentros, 03° 46' S, 078° 35' W, 1,100 m, 30 March 2008, *Quizhpe, W. & O. Jaramillo 3016* (MO, QCNE); Región de la Cordillera del Cóndor, Parroquia San Carlos de Las Minas, Namibija, sendero al Cerro Colorado, bosque muy húmedo montano bajo, 04° 04' 52'' S, 078° 47' 51'' W, 1,520–1,700 m, 29 January 2005, *Quizhpe, W. et al. 830* (LOJA, MO, QCNE); Cordillera del Condor, Destacamento militar Cóndor Mirador, ruta hacia el hito límite Perú–Ecuador, 1,770 m, 8 September 2003, *Rodríguez, E.R. et al. 2669* (NY).

22. *Macrocarpaea pringleana* J.R. Grant

Harvard Pap. Bot. 9(1): 18. 2004. TYPE: ECUADOR. Pastaza: Puyo–Puerto Napo Road, 14–18 km N of Puyo, heavily cut over forest, now pasture with remnant trees, 1,000–1,025 m, 25 April 1978, *J.L. Luteyn & M. Lebron–Luteyn 5830* (Holotype: NY; Isotype: GH [2 sheets]) (Figs. 3.49, 3.50).

Unbranched shrub to tree, 1–5 m, glabrous throughout. Stems terete to slightly quadrangular, hollow, 5–9 mm in diameter just below inflorescence. Leaves ovate to ovate-elliptic, petiolate, 12–29(–38) cm long. Petioles 5–50 mm long, slender with slight vagination to one quarter the length of the petiole; interpetiolar ridge 2–5 mm high. Blades 11.5–26.5(–33) × 6–14.5(–18), entire, not revolute, bright green above, lighter below, with slightly impressed veins above, and slightly raised veins below, glabrous above and below, papery thin; base aequilateral to slightly oblique, cuneate, rounded to attenuate and decurrent on the petiole; apex acute to long acuminate (sometimes nearly apiculate). Inflorescence a much branched open thyrses, 46 + cm long, as the inflorescence of the single plant has been cut into multiple lengths for separate herbarium sheets; branches 6–40 cm long; 3–18 flowers per branch. Bracts ovate, elliptic, to lanceolate, sessile to short-petiolate, 12–113 × 4–63 mm; base aequilateral to oblique, cuneate to rounded; apex acuminate; bract petioles 0–4 mm long. Flowers pedicellate, erect; pedicels 11–17 mm long; bracteoles linear to lanceolate to ovate, 0.5–10 × 0.5–3.0 mm. Calyx campanulate, 6–10 × 6–8 mm, glabrous, smooth, ecarinate; calyx lobes ovate to elliptic, 2–4 × 2–4; apex rounded, obtuse to acute. Corolla funnel-shaped, 30–40 mm long, 15–25 mm wide at the apex of the tube, yellowish-green, greenish yellow to green, smooth; corolla lobes ovate to elliptic, 9–12 × 7–12, apex obtuse to rounded. Stamens 21–28 mm long; filaments 17–22 long, filiform, flattened; anthers elliptic to oblong, 4–6 × 2–3, sagittate, versatile; pollen

Fig. 3.49 *Macrocarpaea pringleana*. Photo J. Cortina



“glabra-type”. Pistil 29–34 mm long; ovary $8-9 \times 2-3$ mm; style $19-22 \times 0.5-1.5$ mm; stigma lobes spatulate, $2-3 \times 1.0-1.5$ mm. Capsules ellipsoidal to oblong, $23-32 \times 6-9$, smooth to ribbed, chestnut-tan, erect to slightly spreading; style remnant 2–9 mm. Seeds “perimetrically winged,” flattened, roughly 4 sided in outline, yet appearing as myriads of different puzzle pieces, $0.8-1.1 \times 0.5-0.9$, bicolored, testa brown, wings straw-colored, testa reticulate, wings ribbed.

Macrocarpaea pringleana belongs to section *Choriophylla* and occurs from 500 to 2,200 m in the Amotape–Huancabamba region of southern Ecuador. It occurs exclusively on Amazon-facing slopes of Ecuador, ranging from about Baeza (Napo) to Limón (Morona–Santiago). This species belongs to a closely related group of species with leaves that are long-decurrent on the petiole including *M. cortinae*, *M. pringleana*, *M. sodiroana*, and *M. umbellata*.

Etymology. Named for James S. Pringle (1937–), Royal Botanic Gardens, Hamilton, Ontario, Canada, specialist of North and South American Gentianaceae, and author of the treatment of the family in the *Flora of Ecuador* (1995).

Vernacular name: tabaquillo, *Vargas* 3634.

Specimens examined: **Morona–Santiago:** El Partidero, between the ríos Paute and Negro, eastern slope of the cordillera, valley of the ríos Negro and Chupianza (on the trail from Sevilla de Oro to Mendez), 640–945 m, 14 December 1944, *Camp* 1533 (NO, NY, S); Carretera Macas–Riobamba, Parroquia 9 de octubre,



Fig. 3.50 *Macrocarpaea pringleana* J.R. Grant, *M. harlingii* J.R. Grant, and *M. elix* J.R. Grant. **a–b** *Macrocarpaea pringleana*. **a** bud, habit of flowering stem; **b** fruit. **c–d** *M. harlingii*. **c** habit of flowering stem; **d** flower. **e–k** *M. elix*. **e** habit of flowering stem; **f** leaf; **g** flower, **h** habit of flowering stem; **i** flower; **j** interpetiolar ridge and leaves; **k** fruit. A drawn from Luteyn 5830 (NY); **b** drawn from Clark et al. 5480 (QCNE); **c–d** drawn from Knapp et al. 7467; **e** drawn from Harling, G. & Andersson 23442; **f–g** drawn from Harling, G. & Andersson 23031; **h–i** drawn from Boeke & Loyala 988; **j–k** drawn from Camp 4325

vegetación aledaña del río Salado, entrada al P.N. Sangay, 1,665 m, 23 August 2002, *Caranqui* et al. 790 (MO, NY, QCNE); Loma San José Grande-Sendero San José-Río Bomboiza, bosque húmedo premontano, vegetación de potreros y bosques secundarios, 02° 38' S, 78° 27' W, 1,300–1,600 m, 21 April 1991, *Cerón* 14358 (MO, QAP, QCNE); Along road between Limón (Gen. Plaza Gutiérrez) and Gualaceo, 1.2 km N of Limón disturbed roadside banks, 02° 58' 36" S, 078° 26' 24" W, 1,211 m, 11 August 2002, *Croat, T.B.* et al. 86472 (LOJA, MO, NY); Just north of Limon along highway, 02° 57' 20.0" S, 078° 25' 25.6" W, 1,059 m, 12 February 2013, *Grant, J.R. & J. Cortina* 13-5121 (NY); environs of Santa Susana de Chiviaza, rastros, 1,200 m, 1 March 1993, *Harling, G. & Ståhl* 26808 (GB, S); Environs of Pan de Azúcar, along road Indanza–Don Bosco, 1,000–1,100 m, 2 March 1993, *Harling, G. & Ståhl* 26853 (S); Limón Indanza, Región de la Cordillera del Cóndor, Centro Shuar Maikuant, Cerro Wishiwishi Naint, 03° 06' 49" S, 078° 16' 26" W, 1,140 m, 17 March 2005, *Kajekai, C.* et al. 323 (LOJA, MO, NY, QCNE); Limón Indanza, Región de la Cordillera del Cóndor, Centro Shuar Maikuant, Cerro Wishiwishi Naint, 03° 06' 49" S, 078° 16' 26" W, 1,140 m, 17 March 2005, *Kajekai, C.* et al. 325 (LOJA, MO, NY, QCNE); 2–4 km N of Arapicos, 800–900 m, 4 April 1981, *Lugo S.* 5980 (GB, K, MO, NY); 2–6 km S of Arapicos, 800–900 m, 6 April 1982, *Lugo S.* 6003 (GB, K, MO, NY); Macas–Alshi, forest of small trees nearby a small brook, 1,360 m, 6 February 2006, *Luisier, F., D. Neill & W. Quizhpe* 1 (CHRB, G, LOJA, MO, NEU, NY, QCA, QCNE); Limón Indanza, Región de la Cordillera del Cóndor, al oeste del Río Zamora, Parroquia Santa Susana de Chiviaza, en la trocha hacia el poblado de Las Orquídeas, 02° 53' 50" S, 078° 18' 42" W, 1,200 m, 22 February 2006, *Morales, C. & D. Reyes* 1628 (MO, QCNE); Limón Indanza, Región de la Cordillera del Cóndor, al oeste del Río Zamora, cerca a la población de Santa Susana de Chiviaza, 1,560 m, 24 February 2006, *Morales, C. & D. Reyes* 1672 (MO, QCNE); Taisha, Centro Shuar Wisui, summit area of Cerro Wisui, east of Río Macuma, the northeasternmost summit of the Cordillera de Cutucú, 02° 05' 25" S, 077° 45' 57" W, 1,360 m, 24 June 2007, *Neill, D. & U. Politec.* *Salesiana students* 15664 (MO, NY, QCNE); Río Cuyes y vía Bomboiza–Gualaquiza, 03° 25' S, 78° 35' W, 800 m, 1 November 1986, *Palacios, W.* 1430 (MO, QCNE, U); Limón Indanza, Región de la Cordillera del Cóndor, Santa Susana de Chiviaza, al oeste del Río Zamora, Cerro Chiviaza, 1,150 m, 24 March 2006, *Reyes & C. Morales* 1075 (QCNE); Parque Nacional Sangay, Bosque Sardnayu, 1,500 m, 7 February 1999, *Toasa* et al. 5290 (QCNE). **Napo:** Tena-Pano road, 550 m, 18 July 1982, *Besse* et al. 1668 (SEL); Reserva Ecológica Antisana, comunidad Shamato, entrada por km 21 –Shamata, 1,700 m, 23 April 1998, *Clark, J.L.* et al. 5029 (MO, QCNE); Reserva Ecológica Antisana, Sector Guacamayos, Sendero Jumandy–La Virgen (km 30), path follows potential oil pipeline, ends near Río Urcusiqui, 00° 38' S, 77° 49' W, 1,700–1,800 m, 1 May 1998, *Clark, J.L.* et al. 5480 (COL, MO, QCNE); Narupa to Coca Road, 4.5 km E of man Baeza–Archidona, 1,189 m, 19 April 2003, *Croat, T.B.* et al. 87811 (QCNE); P.N. Sumaco, ca. km 239 E 45 Baeza–Tena road, ca. 20 km north of Narupo (turnoff to Hollín-Coca), 00° 38' 57" S, 077° 47' 57.9" W, 1,866 m, 8 February 2013, *Grant, J.R. & J. Cortina* 13-5118

(NY); new road to Loreto (56 km S of Baeza), 28 km E of junction with Baeza–Tena road, 100° 50' S, 77° 33' W, 1,100 m, 21 December 1988, *Hammel, B. & Wilder 17267* (MO, QCNE); Carretera Hollín-Loreto, km 40–50, alrededores de la comunidad Huamaní y del Río Pucuno, 1,200 m, 10 October 1988, *Hurtado 674* (MO, QCNE); Carretera Hollín-Loreto, km 25, Centro Challuayacu, 1,230 m, 10 November 1988, *Hurtado & Alvarado 955* (AAU, MO, QCNE); Crescit in silvis, Cuyuyua Baeza, 1 February 1905, *Sodiño s.n.* (QPLS [2 sheets]); Carretera Tena-Baeza, Cordillera de Guacamayos, Reserva Ecológica Antisana, 16 km al norte del desvío a Loreto, bosque pluvial premontano, 00° 40' S, 77° 50' W, 1,800 m, 18 June 1995, *Tirado & Murillo 1563* (MO). **Pastaza:** Mera, forest on precipitous bank of Río Pastaza, 1,050 m, 21 December 1955, *Asplund 18939* (S [2 sheets]); Hacienda San Antonio de Baron von Humboldt, 2 km al NE de Mera, 1,300 m, 5 March 1985, *Baker et al. 5509* (QCNE); Road N from Mera known as the “via Anzu,” 01° 20' S, 78° 10' W, 1,100 m, National Cancer Institute voucher specimen, 1 January 1988, *Boom et al. 7884* (MO, NY, QCA, QCNE); Along road from Mera to Río Anzu, 7 km N of Río Alpayacu, 01° 25' 56" S, 078° 04' 53" W, 1,267 m, 8 May 2003, *Croat, T.B. et al. 88765* (QCNE); Along road from Mera to Río Anzu, 7 km N of Río Alpayacu, 01° 25' 56" S, 078° 04' 53" W, 1,267 m, 8 May 2003, *Croat, T.B. et al. 88795* (QCNE); Just south of Puyo along highway, 01° 31' 14.5" S, 077° 55' 18.8" W, 992 m, 12 February 2013, *Grant, J.R. & J. Cortina 13-5120* (NY); El Topo, 1,250 m, 28 November 1959, *Harling, G. 3413* (S); Mera, along Río Alpayacu, riverside thickets, 1,000 m, 6 March 1980, *Harling, G. & Andersson 16984* (GB [2 sheets], MO); Mera, 1,100 m, 25 May 1968, *Harling, G. et al. 10208* (GB, MO); Mera, trail to Pindo, 1,000 m, 16 January 1982, *Harling, G. et al. 19621* (GB); Cabeceras on the Río Bobonaza, ca. 12 km E of Puyo, 16 November 1974, *Lugo S. 4618* (GB, NY, U); Veracruz (Indillama), 22 November 1974, *Lugo S. 4656* (GB, MO); Between Mera and Río Negro, 27 km from Puyo on road to Baños, 1 km N of the road, primary mountain rainforest, 01° 25' S, 78° 11' W, 1,300–1,400 m, 14 January 1988, *Molau et al. 2469* (AAU, GB, HAM, QCA, QCNE); Hacienda San Antonio de Baron von Humboldt, 2 km al NE de Mera, 01° 27' S, 78° 06' W, 1,100 m, 27 February –19 March 1985, *Neill, D. et al. 5809* (MO, QCNE); Munic. Puyo, Canton Puyo, Los Vencedores, Estación Experimental E.S.P.O.C.H., 01° 30' S, 77° 56' W, 800–1,000 m, 4 October 1995, *Pinus RBS-0023* (MO); Munic. Puyo, Canton Puyo, Los Vencedores, Estación Experimental E.S.P.O.C.H., 01° 30' S, 77° 56' W, 800–1,040 m, 14 December 1995, *Soejarto et al. 9424* (F [2 sheets], HUA, QCNE); Puyo, Los Vencedores, km 32 Puyo-Macas, Estación Experimental E.S.P.O.C.H., trail from Field Station to river leading to waterfall, 8 June 1996, *Soejarto et al. 9645* (F); Río Cayabe, between Mera and Río Topo, 1,100 m, 17 July 1967, *Sparre 17619* (S). **Tungurahua:** Parque central de la Parroquia de Río Negro via al Puyo, 18 January 2003, *Alcocer, V. 17* (QCNE); Río Topo, 1,220 m, 12 November 1955, *Asplund 18364* (S); Baños, Parroquia Río Verde, sector Machay, collections made on forested trail starting from Machay (Baños-Puyo road) to Río Verde, 01° 23' 05" W, 78° 16' 50" W, 1,800–2,200 m, tropical montane wet forest, 24 December 2000, *Clark, J.L. et al. 5724* (QCA, QCNE, US);



Fig. 3.51 *Macrocarpaea quizhpei* J.R. Grant. Photo J.R. Grant

Between Ambato and Baños, 10 January 1981, *D'Arcy 14014* (MO, NY); Baños, Río Negro, 1,500 m, 18 January 2003, *Guamán, N. 12* (QCNE); Cashurco, near Río Negro, northern side of Río Pastaza, ca. 1.0–1.5 m high, 18 March 1969, *Lugo S. 813* (GB,MO); Trail between Baños and Mera, near Río Negro, in border low woods, 400–500 m, 23 February 1935, *Mexia 6977* (NA, UC, US); Baños, Zona de amortiguamiento del P.N. Llanganates, Río Verde, canon a las cascadas de Machay, bosque húmedo montaño bajo, 01° 23' S, 78° 17' W, 1,630 m, 29 July 1999, *Vargas, H. 3634* (MO, QCA, QCNE).

23. *Macrocarpaea quizhpei* J.R. Grant

Harvard Pap. Bot. 13(2): 256. 2008. TYPE: ECUADOR. Zamora-Chinchipe: Nangaritza, Región de la Cordillera del Cóndor, cuenca del alto Río Nangaritza, Las Orquídeas, bosque muy húmedo, en colina, selo arcilloso, 04° 13' 15'' S, 078° 40' 54'' W, 1,100 m, 11 February 2006, *W. Quizhpe & F. Luisier 1913* (Holotype LOJA; Isotypes MO, NY, QCNE) (Figs. 3.51, 3.52).

Unbranched shrub to small tree, 1–3 m, glabrous throughout. Trunk to 2 cm diameter, wood hollow in trunk and in branches, rings scarcely visible; bark papery thin to scarcely measurable, 0.05 mm thick, outer surface smooth to rugose, tan to greenish; stems terete to quadrangular, hollow, 6–13 mm diameter just below the inflorescence. Leaves broadly ovate to elliptic, long-petiolate, (16)–39–46 cm long. Petioles 50–110 mm, slender with slight vagination; interpetiolar

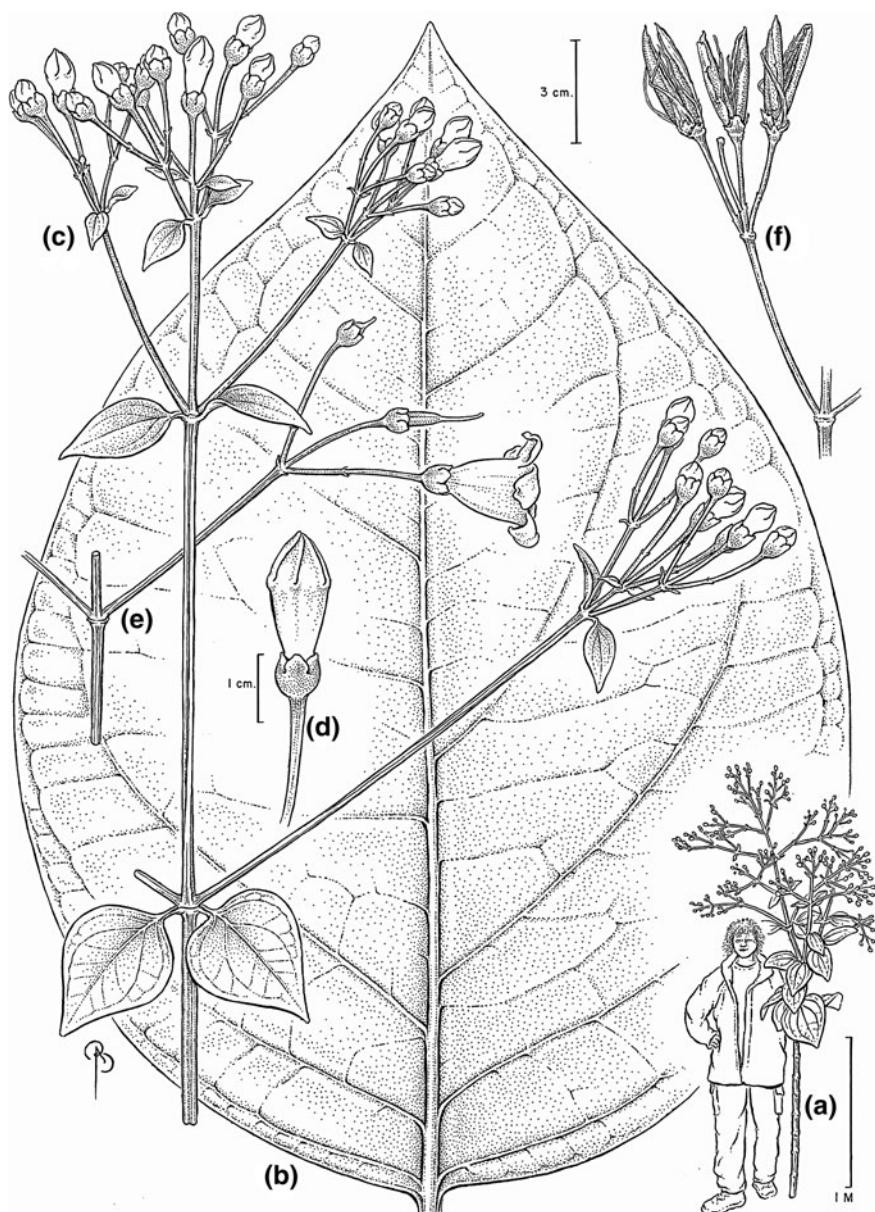


Fig. 3.52 *Macrocarpaea quizhpei* J.R. Grant. **a** habit of tree in the field (Claire Arnold holding plant); **b** leaf; **c** habit of flowering stem; **d** bud; **e** flowering stem; **f** fruits. **a–d, f** drawn from Grant et al. 08-4537, **e** drawn from Quizhpe & Luisier 1913 by Bobbi Angell

ridge 2–3 mm high. Blades (14)–30–36 × (9)–23–26.5 cm, entire, not revolute dark green, with slightly impressed veins above, and slightly raised veins below, glabrous above and below, papery thin; base aequilateral to oblique, rounded to nearly truncate; apex acute to acuminate. Inflorescence a much diffusely branched open thyrse to 1.3 m; branches 10–60+ cm long, 3–9 flowered per branch. Bracts broadly ovate, ovate, to lanceolate, short-petiolate, 18–62–(160) × 5–45–(90) mm; base aequilateral to oblique, rounded to nearly truncate; apex acuminate to acute; bract petioles 1–5 mm. Flowers pedicellate, erect to slightly spreading; pedicels 20–52 mm, long; bracteoles linear to lanceolate, 1–10 × 0.5–2.0 mm. Calyx campanulate, 7–9 × 7–8 mm, glabrous, smooth, green, ecarinate, ovate; calyx lobes 2.5–5.0 × 3.5–4.0 mm, apex rounded to obtuse. Corolla funnel-shaped, 38–40 mm long, 18–20 mm wide at the apex of the tube, light green, smooth; corolla lobes ovate, 10–12 × 8–12 mm, obtuse to rounded. Stamens 30.0–32.5 mm long; filaments 28–30 mm long, filiform, flattened; anthers elliptic to oblong, 5–6 × 2.0–2.5 mm, sagittate, versatile; pollen glabra-type. Pistil 31–33 mm long; ovary 8–11 × 3–4 mm; styel 19–21 × 1.0–1.5; stigma lobes spathulate, 2–3 × 1–2 mm. Capsules ellipsoidal to linear-long, 35–38 × 6–8 mm, smooth to faintly ribbed, faint-orangish tan, erect to slightly nodding; style remnant 1–2 mm long. Seeds “perimetrically winged type,” flattened, roughly 3–4 sided in outline, yet appearing as a myriads of different puzzle pieces, 0.8–1.2 × 0.8–1.0 mm, bicolored, testa brown, wings straw-colored, testa reticulate, wings ribbed.

Macrocarpaea quizhpei belongs to section *Choriophylla* and occurs from 863 to 1,500 m in the Amotape–Huancabamba region of southern Ecuador. It has a large diffuse inflorescence with long pedicels (20–52 mm). This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including *M. catherineae*, *M. claireae*, *M. dies-viridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*.

Etymology. Named for Wilson Quizhpe (1970–), Ecuadorian botanist of the Herbario Loja, Universidad Nacional de Loja, Ecuador.

Specimen examined: ECUADOR. **Zamora-Chinchipe:** Nangaritza Valley, south of Guayzimi, Cordillera del Condor region, Las Orquídeas, 04° 15' 314'' S, 078° 40' 087'' W, 1,180 m, 24 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4555* (NY); Nangaritza, Región de la Cordillera del Cóndor, cuenca del alto Río Nangaritza, Las Orquídeas, 04° 09' 222'' S, 078° 38' 555'' W, 877 m, 8 January 2008, *Grant, J.R. & Claire Arnold 08-4537* (G, LOJA, MO, NY); Between Wants and Las Orquídeas, 04° 10' 51.1'' S, 078° 38' 38.6'' W, 863 m, 11 February 2011, *Grant, J.R. & J. Vieu 11-4688* (NY); Forest trail west of Cabañas Yankuam, south of Las Orquídeas, 04° 15' 03.1'' S, 078° 39' 37.7'' W, 925 m, 11 February 2011, *Grant, J.R. & J. Vieu 11-4689* (NY).

24. *Macrocarpaea sodiroana* Gilg

Bot. Jahrb. Syst. 25: 724. 1898. TYPE: ECUADOR. Pichincha. In regione temperate secus fluv. Pilatón, 800–1,600 m, August flor., *Sodiro 101/1* (Type: B?



Fig. 3.53 *Macrocarpaea sodiroana* Gilg. Photo J.R. Grant

[destroyed]; Lectotype: QPLS; isoelectotypes: QPLS [2 sheets], designated by Grant (2003a, 2003b) (Fig. 3.53).

Shrub, sometimes largely herbaceous but at least basally woody, usually 1–5 m tall, sometimes up to 10 m and arborescent, glabrous or inflorescence branches and calyx tubes occasionally sparsely pubescent. Stem terete or nearly so; internodes various, often exceeding leaves. Leaves membranous; venation conspicuous below, larger (lower) secondary veins mostly branching from midrib at 30–50 degree, strongly upcurved, distinctly brochidodromous. Blades of lower and middle cauline leaves elliptic, mostly 20–40 cm long, 9–22 cm wide, base tapering gradually or rather abruptly to a petiole 2–5 cm, apex acuminate. Upper cauline leaves gradually smaller, more ovate, subsessile or sessile. Inflorescence a dichasium, 3–6 times divided, primary branches often much elongated; first 2–3 divisions subtended by leaves 1.5–12 cm long, ultimate divisions by minute bractlets; flowers 16–100. Pedicels erect or arcuate, 7–30 mm. Calyx 6–12 mm; lobes semicircular, 0.5–0.8 times as long as tube, hyaline-margined, erose. Corolla 24(30–50 mm, pale green to greenish yellow, funnellform to campanulate; lobes 7–12 mm, ovate-triangular, obtuse. Capsule narrowly ovoid-cylindric, 28–50 mm. This description is largely from Pringle (1995).

Macrocarpaea sodiroana belongs to section *Choriophylla*, and occurs in the northern Andes, on Pacific slopes on the Cordillera Occidental, the Chocó of Ecuador. *Macrocarpaea sodiroana* is nearly sympatric with *M. gattaca* yet occur in two distinct elevation bands; 1,000–1,600 m for *M. sodiroana*, and 2,500–2,700 m, for *M. gattaca*. This species belongs to a closely related group of species with

leaves that are long-decurrent on the petiole including *M. cortinae*, *M. pringleana*, *M. sodiroana*, and *M. umbellata*.

Specimens examined. ECUADOR. **Imbabura:** Cotacachi, Parroquia García Moreno, Reserva Biológica Los Cedros, sendera Y de la Cascada-Estación, 00° 18' 13" N, 078° 47' 21" W, 1,550 m, 2 November 2005, *Vargas, H.* et al. 6495 (MO, NY). **Pichincha:** Vía a Mindo, 1,400 m, 17 May 1997, *Avila, M.E.* 11 (QCA); On road La Palma-Chiriboga (old road to Quito), 1,200 m, 21 December 1981, *Berg, C.C.* 1285 (QCA); Carr. Calacalí –Los Bancos, en Mindo, 1,500 m, 17 May 1997, *Carrera 23* (QCA); Quito, trek from Lloa to Mindo Mature Forest, between Hacienda Pacay and main bridge to Mindo, 1,400 m, 8 February 1998, *Clark, J.L.* 4521 (MO, QCNE); Ayapi Pachijal, 18 November 2010, *Cornejo, X. & T. Montenegro* 8349 (QCA); Along road from La Unión de Toachi to Quito via Chiriboga, 2.2 km up road to Chiriboga from the bridge over the Río Toachia, 10.9 km W of Allurgin, 00° 18' 57" S, 078° 55' 29" W, 984 m, 24 February 2005, *Croat, T.* 95277 (MO, QCNE); Maquipucuna Reserve, vicinity of Nanegal 6.7 km NE of Nanegalito-Nanegal Road (turnoff ca. 3 km S of Nanegal), 19 km N of Nanegalito, 1,331 m, 11 March 2006, *Croat, T.* et al. 95730 (MO, QCNE); Along old road from Santo Domingo de los Colorados to Quito via Chiriboga and San Juan, 10.9 km NE of La Unión and Río Pilaton, 00° 18' 21" S, 078° 53' 03" W, 1,233 m, 17 March 2006, *Croat, T.B.* et al. 96020 (MO, NY); Along road from Santo Domingo de Los Colorados via Chiriboga and San Juan, 14.3 m NE of La Unión and Río Pilaton, 1,432 m, 23 March 2006, *Croat, T.* et al. 96289 (MO, NY, QCNE); Bosque Protector Mindo, 1,325–1,400 m, 15 July 1992, *Delprete* et al. 6100 (TEX); Km 87–84 old road Quito-Santo-Domingo, 1,200–1,300 m, 21 March 1980, *Dodson, C.H. & Gentry* 9725 (QCNE, SEL); Dos Rios, km 90 old road Quito-Santo Domingo, 1,100 m, 7 April 1984, *Dodson, C.H. & Thurston* 14162 (MO, QCNE); Km 87–84 old road Quito-Santo-Domingo, 1,200–1,300 m, 21 March 1980, *Dodson, C.H., C.H. & Gentry* 9725 (MO); 27 km from Chiriboga, *Fagerlind & Wibom* 1925a (S); 27 km from Chiriboga, *Fagerlind & Wibom* 1925b (S); Maquipucuna, 5 km E of Nanegal, 1,630 m, 9 May 1990, *Gentry* et al. 69921 (MO, QCNE); 15 km up road toward Chiriboga from the intersection of the new highway, on the old Quito-Sto. Domingo Road, 00° 18' 11.8" W, 078° 52' 08.2" W, 1,450 m, 27 January 13, *Grant, J.R.* 13-5103 (NY); Mindo, Cordillera San Lorenzo, 00° 04' 35.4" S, 078° 45' 49.2" W, 1,456 m, 5 February 13, *Grant, J.R. & J. Cortina* 13-5106 (NY); 15 km up the old road Santo Domingo-Quito from where it merges with the new Santo Domingo-Quito road, 1,461 m, 26 February 2002, *Grant, J.R. & J.-M. Torres* 02-4210 (G, NEU, NY, US); Road Nanegal-Nanegalito, 1,200–1,550 m, 24 January 1974, *Harling, G. & Andersson* 11575 (GB); Old road Santo Domingo-Quito, 1,500 m, 8 May 1968, *Harling, G.* et al. 9221 (GB); Old road Quito-Santo Domingo, 2–9 km NE of turn off to old road out of Alluriquin, 1,100–1,230 m, 2 February 1982, *Luteyn* et al. 8733 (QCA, QCNE); Km 96 Carr. Quito-Santo Domingo, 1 February 1975, *Ortíz* 20 (MO, QCA); Carretera Cotacollao-Tandayapa-Nanegalito-Palmito-Pamba, 1,500 m, 26 January 1984, *Rodríguez, J. & C. Ulloa* 154 (QCA); Mindo, camino a Mindo Gardens, vegetación secundaria cerca de las orillas del río Mindo, 078° 46' 21" W, 00° 2'

54'' W, 1,500 m, 17 October 1999, *Romero-Saltos, H. 1507* (QCA); Vía a Mindo, 1,400 m, 17 May 1997, Sáenz, F. 6 QCA); Camino de Quito a Santo Domingo de Los Colorados, entre Chiriboga y Dos Rios, 951–1,863 m, 4 February 1944, *Scolnik 1616* (PH); Nanegal, Res. Biol. Maquipucuna, 1,200–1,700 m, 20 May 1991, *Tipaz & Quelal 154* (MO, QCNE); Reserva Maquipucuna, secondary rainforest along Río Tulambi W of Hacienda El Carmen, 1,250 m, 18 September 1989, *Webster et al. 27733* (DAV, MO); Parroquia Nanegal, Bosque Protectora Maquipucuna, disturbed riparian woods on N bank of Río Umachaca, NE of Hacienda El Camen, 1,250 m, 7 July 1992, *Webster et al. 29065* (DAV); Ridge between Río Mindo and Río Bagasal, 1,325–1,450 m, 14 July 1992, *Webster et al. 29399* (DAV); Parroquia Nanegal, Reserva Maquipucuna, secondary riparian forest along Río Umachaca across from Hacienda El Carmen, 1,250 m, 15 January 1995, *Webster et al. 31346* (DAV); Parroquia Nanegal, Bosque Protector Maquipucuna, steep slope in secondary rainforest along Río Umachaca, 1,250 m, 17 June 1996, *Webster et al. 31550* (DAV, QCNE); 13.5 km by road W of Pacto, 1,400 m, 17 November 1998, *Webster 32889* (QCNE); Carr. Quito-Chiriboga-Empalme, km 92, desvío a Mulaulte, en borde del carretero y en quebrado de Mulaulte, 1,200–1,300 m, 13 December 1987, *Zak & Jaramillo 3169* (MO); Carretera Quito-Aloag-Santo Domingo, 1,100–1,400 m, 15 April 1988, *Zak & Jaramillo 3458* (AAU, G, GB, K, MO, NY, US).

25. *Macrocarpaea subsessilis* Weaver & J.R. Grant

Harvard Pap. Bot. 8(1): 91. 2003. TYPE: ECUADOR. Loja: Between Tambo Cachiyacu, La Entrada, and Nudo de Sabanilla, 2,500–3,500 m, 7 October 1943, *J. Steyermark, J. 54436* [Holotype: US; Isotypes: F, NY (2 sheets)] (Figs. 3.54, 3.55). Shrub much branching from the base, the middle or above, 0.5–1.5(–3.0) m, glabrous throughout. Trunk to 1.5 cm in diameter, wood always solid. Stems terete to slightly quadrangular, solid, 2–5 mm in diameter just below inflorescence. Leaves obovate varying to elliptic, petiolate, 2.5–9.0 cm long; blades 2.0–8.5 × (1.5–)2.5–5.0 cm, not revolute, thick, leathery-coriaceous, dark green above, light green below, drying yellowish-green in herbarium material, midrib yellow to orange, lateral veins scarcely visible either above or below, glabrous; base aequilateral to oblique, rounded, apex obtuse to rounded, to rarely slightly mucronulate. Petioles 3–9 mm long, robust with short open vagination one quarter to one-third the length of the petiole; interpetiolar ridge 1–3 mm high. Inflorescence a few-branched nearly sessile thyrses, 3–11 cm long; branches 1–7 cm long, 2–8 flowered per branch. Bracts obovate, elliptic to rotund, petiolate, 12–30 × 6–19 mm; base aequilateral to oblique, rounded, apex obtuse to rounded, to rarely slightly mucronulate; bract petioles 2–4 mm long. Flowers pedicellate, erect to slightly spreading, but never nodding; pedicels 1–6 mm long; bracteoles spatulate, 10–22 × 4–11 mm. Calyx narrowly campanulate, 8–13 × 4–7 mm, glabrous, smooth, green, ecarinate; calyx lobes elliptic, 3–6 × 3–4 mm, apex rounded. Corolla funnel-shaped, 21–35 mm long, 11–25 mm wide at the apex of the tube, pale yellow, yellowish-green, greenish-yellow, cream to white, smooth;

Fig. 3.54 *Macrocarpaea subsessilis* Weaver & J.R. Grant. Photo J.R. Grant



corolla lobes ovate to elliptic, $7\text{--}12 \times 4\text{--}10$ mm, apex obtuse, rounded to retuse. Stamens $9\text{--}24$ mm long; filaments $11\text{--}21$ mm long, filiform, flattened; anthers linear to linear-elliptic, $3\text{--}4 \times 1.5\text{--}2.0$ mm. Pistil $13\text{--}23$ mm long; ovary $4\text{--}6 \times 1\text{--}3$ mm; style $14\text{--}16 \times 0.75\text{--}1.0$ mm; stigma lobes spathulate to elliptic $2\text{--}3 \times 1\text{--}2$ mm. Capsules ovoid to ellipsoidal, $11\text{--}15 \times 6\text{--}10$ mm, smooth, pustulate to rugose, straw-colored, erect to nodding; style remnant $3\text{--}9$ mm long. Seeds angular to polyhedral to flattened (pyramids, tetrahedrons, rectangular prisms, to multisided prisms), $2\text{--}5$ -sided, not winged, $0.3\text{--}1.3 \times 0.3\text{--}0.6$ mm, dark orangish-tan, rugose-reticulate to wrinkled.

Macrocarpaea subsessilis belongs to section *Choriophylla* and occurs from 2,350 to 3,000 m in the Amotape–Huancabamba region of southern Ecuador. Its most frequently collected site, the hillside road from Yangana to Cerro Toledo has been seriously degraded by recent successive years of burning. It can be easily identified by its short, subsessile inflorescence, short-pedicellate flowers, large spathulate bracteoles, and leaves that become light-greenish yellow with yellow to orange midribs when dried as herbarium specimens. This species is part of a group of species with smooth leathery leaves where the secondary leaf veins absent or scarcely visible including *M. arborescens*, *M. ericii*, *M. harlingii*, *M. lilliputiana*, *M. subsessilis*, and *M. zumbae*.

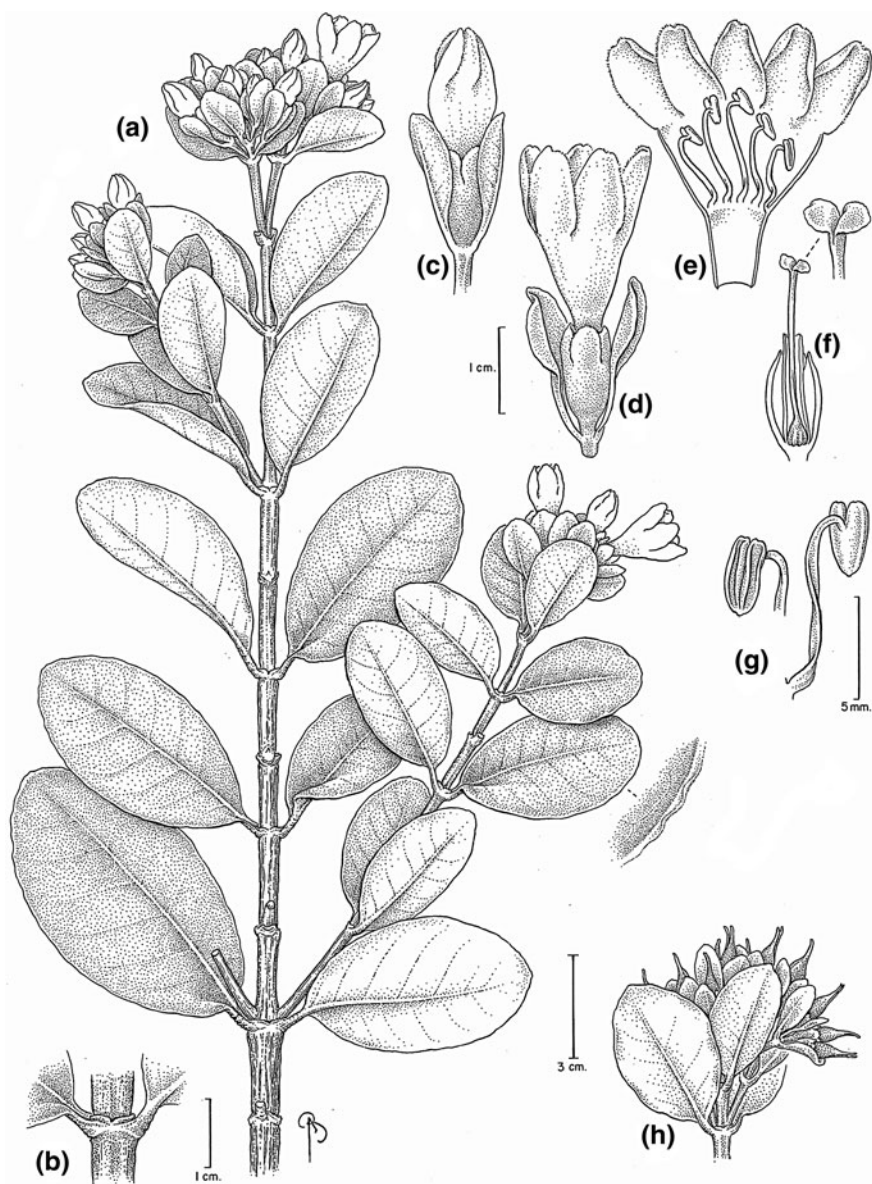


Fig. 3.55 *Macrocarpaea subsessilis* Weaver & J.R. Grant. **a** habit of flowering stem; **b** interpetiolar ridge; **c** flower in bud with distinctive bracteoles; **d** flower; **e** internal cross-section of corolla; **f** gynoecium; **g** anthers, **h** habit of fruiting stem. **a–c** drawn from Luteyn & Clements 7978 (NY); **d–g** drawn from Balslev 1288 (NY); **h** drawn from Steyermark, J. 54436 (NY)

Etymology. Named for its nearly sessile inflorescences.

Specimens examined: ECUADOR. **Loja:** Yangana-Zumba road, km 15–20, N slopes of Cordillera de Sabanilla, 2,550 m, 31 December 1980, *Balslev 1288* (AAU, NY); Río Catamayo Drainage, ridge between Quebrada Amarilla and Quebrada Agua Corra, eastern slope of Cordillera de Santa Rosa, Hacienda Guaycopamba, 21 km S of Vilcabamba, open brushy rocky ridge, 04° 27' S, 079° 13' W, low 16 February 1945, *Fosberg & Giler 23097* (NO, US); Nudo de Sabanilla, 21.5 km S of Yangana, 04° 25' S, 079° 09' W, 10 February 2001, *Grant, J.R. & L. Struwe 3982* (LOJA, NEU, QCNE); Km 8.9 on road from Yangana to Cerro Toledo, 04° 23' S, 079° 09' W, 14 February 2001, *Grant, J.R. & L. Struwe 4020* (G, LOJA, MO, NEU, NY, QCA, QCNE, S, SBBG, US [2 sheets]); Km 9.5 on road from Yangana to Cerro Toledo, 04° 22' S, 079° 09' W, 14 February 2001, *Grant, J.R. & L. Struwe 4025* (LOJA, NEU, NY QCNE); Km 8.9 on road from Yangana to Cerro Toledo, 04° 23' S, 079° 09' W, 2 November 2002, *Grant, J.R., A. Roguenant & A. Raynal-Roques 02-4267* (MO, NEU, NY, US); Loja Km 8.9 on road from Yangana-Cerro Toledo, 2,450 m, 19-Feb-2006, *Grant, J.R., M. Cheung, F. F. Luisier, & N. Villard 4343* (G, LOJA, MO, NY); Around km 9 on road from Yangana up Cerro Toledo, 04° 22' 58.7'' S, 079° 09' 01.6'' W, 2,507 m, 3 February 2011, *Grant, J.R. & J. Vieu 11-4661* (NY); Cerro Bangala, ca. 10 km east of Yangana, 2,500–2,700 m, 18 October 1988, *Harling, G. 25318* (GB, MO); Nudo de Sabanilla, western slope on road to Yangana, 2,600 m, 6 February 1985, *Harling, G. & Andersson 21731* (GB, MO, QCA); Nudo de Sabanilla, western slope ca. 10 km above Yangana on road to Valladolid, 2,500 m, 3 April 1985, *Harling, G. & Andersson 23593* (GB, QCA); Cerro Toledo, road to “La Torre,” ca. 7 km southeast of Yangana, 2,500 m, 7 April 1985, *Harling, G. & Andersson 23848* (GB, QCA); Yangana-Nudo de Sabanilla, dry and low mountain forest, 2,500–2,600 m, 16 October 1988, *Harling, G. & E. Madsen 25261* (AAU, MO, GB); Yangana-Nudo de Sabanilla, dense shrub forest and open scrub, 2,200–2,400 m, 13 February 1993, *Harling, G. & Ståhl 26373* (GB, MO, QCA, S); Yangana-Cerro Toledo, burned area, pastures and shrubby vegetation, 04° 23' S, 079° 08' W, 2,750–2,850 m, 28 December 1988, *Jørgensen & J. Madsen 65728* (AAU, QCA, QCNE); Yangana-Cerro Toledo, burned area with secondary vegetation, 04° 21' S, 079° 07' W, 2,510 m, 14 November 1990, *Jørgensen et al. 92722* (AAU, QCA, QCNE); Road S out of Loja ca. 14 km S of Yangana, lower slopes of Nudo de Sabanilla, 2,460 m, 16 January 1981, *Luteyn & Clements 7978* (NY); Cordillera de Sabanilla, ca. 15 km S of Yangana, wet montane forest, 2,480 m, 31 December 1980, *Madison & Besse 7497* (SEL); Beside the road from Yangana to ‘Cerro Toledo’, 2,500 m, January 1998, *Matt, F. 12* (ER); Beside the road from Yangana to ‘Cerro Toledo’, 2,500 m, January 1998, *Matt, F. 13* (ER); Banderillas, 04° 13' 52.5'' S, 079° 08' 34.2'' W, 2,900 m, 20 March 2002, *Merino, B. et al. E-1066* (LOJA); Límite del P.N. Podocarpus, carretera Yangana–Cerro Toledo, 2,450 m, January 1995, *Palacios, W. 13016* (MO, QCNE); Between Nudo de Sabanilla and Río Cachiyaçu at Tambo Cachiyaçu, in dry sotobosque, 3,000–3,500 m, 17 October 1943, *Steyermark, J. 54758* (F); western slopes of Cordillera de Condor and northwest slopes of Nudo de Sabanilla, around Tambo

Cachiyacu, along Río Cachiyacu, about 2 leagues southeast of Yangana, 2,000–3,000 m, 19 October 1943, *Steyermark, J.* 54805 (F); Sabanilla, 7 February 1986, *Vivar C., F.* 2300 (LOJA). **Zamora-Chinchipe:** Yangana Cantón, ascending road from Yangana to Numbala drainage and antennas on summit of Filo Toledo, 2,400–2,950 m, 27 March 2005, *Clark, J.L.* 8891 (QCNE, US).

26. *Macrocarpaea voluptyuosa* J.R. Grant

Harvard Pap. Bot. 9(2): 336. 2005 TYPE: ECUADOR. Carchi: Cresta del Cerro Golondrinas Hembra, bosque húmedo montaña bajo, vegetación arbustiva en la cresta de la montaña, 00° 51' N, 078° 08' W, 3,000 m, 21 August 1994, *W. Palacios* 12515 (Holotype MO; Isotypes QCNE, U) (Fig. 3.30).

Shrub, 1–3 m, hyaline hispid to spiculate with short simple hairs on stems, petioles, leaves, inflorescences, bracts and calyces, cm in diameter. Stems terete to slightly quadrangular, solid to hollow, 9–15 mm in diameter just below the inflorescence. Leaves ovate to subdeltoid, petiolate, 9.5.0–16.5(–25 according to *Boyle et al.* 3394) cm long. Petioles 5–10 mm long, robust with strong open vagination one half the length of the petiole; interpetiolar ridge 2–3 mm high. Blades 9.0–17.5 × 9.5–11.0 cm, entire, not revolute, dark green, with slightly impressed veins above, and slightly raised veins below, hyaline hispid to spiculate on veins on lower surface, papery thin, to thin coriaceous; base aequilateral to oblique, cuneate to rounded; apex acute, obtuse to rounded. Inflorescence a much branched open thyrses, 36+ cm long; branches 6–36 cm long; 3–15 flowered per branch. Bracts ovate, elliptic, to lanceolate, petiolate, 16–78 × 8–52 mm; base aequilateral to oblique, cuneate; apex acute to acuminate; bract petioles 1–6 mm long. Flowers pedicellate, erect to spreading; pedicels 5–21 mm long; bracteoles ovate, lanceolate to oblanceolate, 6–16 × 2–8 mm. Calyx campanulate, 9–13 × 8–10 mm, glabrous, smooth, green, ecarinate; calyx lobes ovate, suborbicular to reniform, 2–3 × 3–5 mm, apex rounded to obtuse. Corolla funnel-shaped, 41–55 mm long, 18–26 mm wide at the apex of the tube, white, yellow, smooth; corolla lobes ovate to elliptic, 9–17 × 9–14 mm, obtuse to rounded. Stamens 30–35 mm long; filaments 24–28 mm long, filiform, flattened; anthers linear to linear-elliptic, 6–7 × 2–3 mm, sagittate, versatile; pollen *Glabra*-type. Pistil 40–51 mm long; ovary 8–9 × 2–4 mm; style 36–38 × 1.0–1.5 mm; stigma lobes spatulate, 3–4 × 1.5–2.0 mm. Capsules and seeds unknown.

Macrocarpaea voluptyuosa belongs to section *Macrocarpaea*, and occurs in the northern Andes, from 3,000 to 3,060 m on the Cordillera Occidental, the Chocó of Ecuador. It is related to *M. duquei* Gilg-Ben. and *M. callejasii* J.R. Grant of the Cordillera Occidental Colombia, and *M. densiflora* (Benth.) Ewan and *M. pachyphylla* Gilg of the Cordillera Central Colombia.

Etymology. From the Latin *voluptyuosus*, pleasant or delightful.

Specimens examined: ECUADOR. **Carchi:** Cerro Golondrinas, on crest of N ridge, just below peak, low elfin forest—páramo ecotone scrub, 00° 51' 15" N, 78° 08' 21" W, 3,000–3,060 m, 24 July 1994, *Boyle et al.* 3394 (MO, QCNE, U).

27. *Macrocarpaea xerantifulva* J.R. Grant

Harvard Pap. Bot. 9(2): 341. 2005. TYPE: PERU. Cajamarca: San Ignacio, La Coipa, vista Florida—La Laguna, bosque primario, 0526' 00" S, 7856' 30" W, 2,000–2,100 m, 11 June 1997, *J. Campos & Z. García 3960* (Holotype: MO; Isotype: U) (Fig. 3.56).

Shrub or small tree, 1.5–3.0 m, glabrous throughout. Stems terete to slightly quadrangular, hollow, 5–8 mm in diameter just below the inflorescence. Leaves ovate to ovate-elliptic, petiolate, 7.5–32.0 cm long. Petioles 5–40 mm long, robust with strong open vagination 1/2 the length of petiole; interpertiar ridge 1–4 mm high. Blades 7–28 × 5–16 cm, entire, not revolute, green, with slightly impressed veins above and slightly raised veins below, glabrous above and below, papery thin; base equilateral to attenuate and decurrent on the petiole; apex acuminate to apiculate. Inflorescence a much-branched open thyse, 18–31+ cm long; branches 11–31 cm long; 5–15 flowered per branch. Bracts ovate to elliptic, sessile to short-petiolate, 17–62 × 8–32 mm; base equilateral to oblique, cuneate to rounded; apex acuminate; bract petioles 0–5 mm long. Flowers pedicellate, erect; pedicels 13–26 mm long; bracteoles inconspicuous and scabrous, triangular, linear to ovate, 0.5–12.0 × 0.5–3.0 mm. Calyx campanulate, 5–9 × 5–10 mm, typically glabrous to hispid (Sánchez Vega 73–80), ecarinate; calyx lobes ovate to reniform, 2.5–3.5 × 3–4 mm, apex rounded to obtuse. Corolla funnel-shaped, 23–31 mm long, 15–20 mm wide at the apex of the tube, green/yellow (Dostert 98/114), greenish yellow (Sánchez Vega 73–80), greenish (Friedberg 696), smooth; corolla lobes ovate, 6–9 × 7–9 mm, obtuse to rounded. Stamens 12–20 mm long; filaments 9–15 mm long, filaments filiform/flattened; anthers ovate-elliptic, 4–5 × 2.00–2.25 mm, sagittate, versatile; pollen *Glabra* type. Pistil 20–27 mm long; ovary 4–8 × 2–3 mm; style 14.0–16.5 × 1.0 mm; stigma lobes spatulate, 2.0–2.5 × 1.0–1.5 mm. Capsules ellipsoidal to fusiform, 25–35 × 5–7 mm, smooth varying to faintly striated, rugose or ribbed, greenish brown, tan to light brown, erect to slightly nodding; style remnant 2–7 mm long. Seeds “perimetrically winged type,” 0.8–1.0 × 0.4–1.0 mm, bicolored, testa tannish, wings straw-colored, testa reticulate, wings ribbed.

Macrocarpaea xerantifulva belongs to section *Choriophylla* and occurs from 1,500 to 2,250 m in the Amotape–Huancabamba region of southern Ecuador and northern Peru. It is a common roadside species from Valladolid south to the border with Peru, and also in northern Peru. This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including *M. catherineae*, *M. claireae*, *M. dies-viridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*.

Etymology: From the Greek *xeros*, dry, and the Latin *fulvus*, yellowish, for the stems and inflorescence that dry rather yellowish-gold in color.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Valladolid Cantón, road Valladolid-Tapala-El Porvenir del Carmen, 1–2 km E of Valladolid, 04° 33' 27" S, 079° 07' 50" W, 1,600–1,700 m, 1 April 2005, *Clark, J.L. et al. 8983* (NY, QCNE, US); 2 km N of Valladolid, 04° 32' 78" S, 079° 07' 83" W, 1,662 m, 29

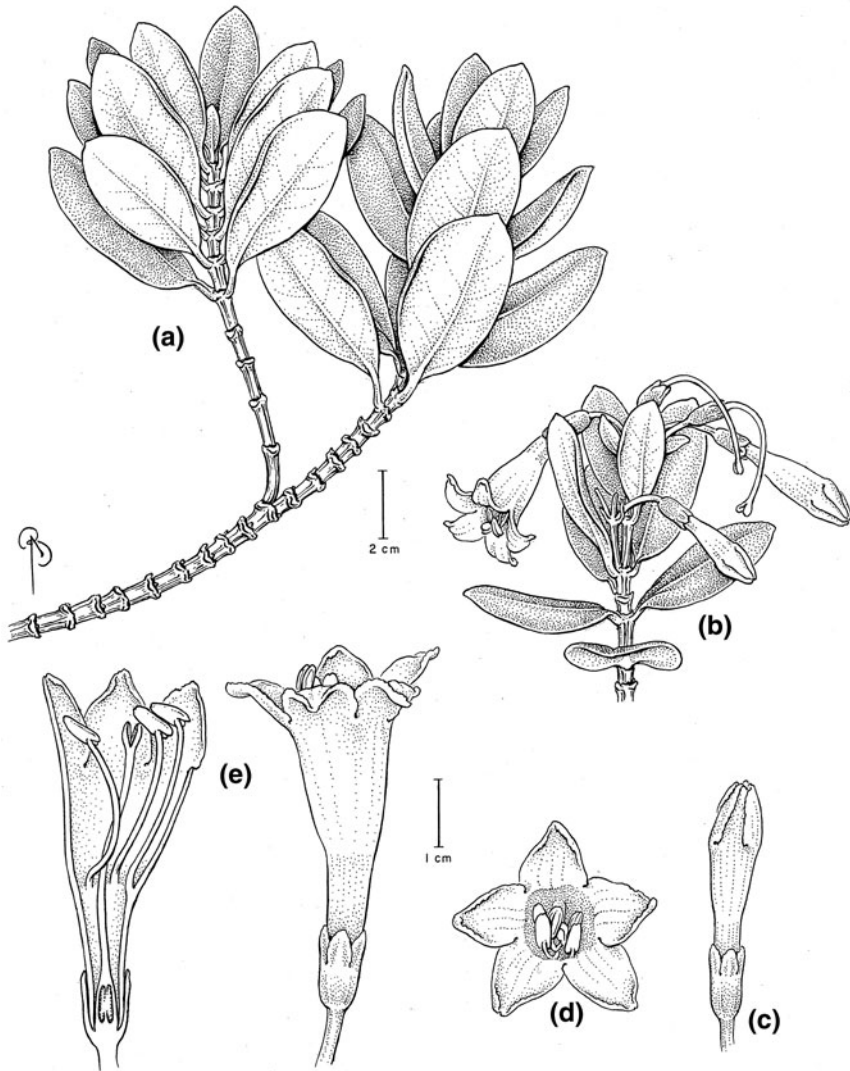


Fig. 3.56 A-E *Macrocarpaea xerantifulva*. **A** habit of fruiting plant; **B** leaf. **C** fruiting stem; **D** flowers; **E** detail of bud

January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4569* (NY); 7 km E from Valladolid toward Tapala, 04° 33' 27.6'' S, 079° 06' 65.5'' W, 1,500 m, 29 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4572* (NY); 7 km E from Valladolid toward Tapala, 1,500 m, 4 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4522* (NY); 1 km south of Valladolid, 04° 33' 32.3'' S, 079° 08' 13.7'' W, 1,571 m, 6 February 2011, *Grant, J.R. & J. Vieu 11-4667* (NY).

PERU. Cajamarca: San Ignacio, La Coipa, vista Florida-La Laguna, 2,000–2,100 m, 11 June 1997, *Campos, J. & García 3960* (MO, U); Jaén, Colosay, above the village, 1,800–2,300 m, 7 March 1998, *Dostert 98/114* (F, MSB); Cutervo, San Andrés, km 1.5 noriente de San Andrés, 2,250 m, 18 June 1980, *Sánchez Vega 73-80* (MO); San Ignacio, mountain slope above San José de Lourdes, 1,300–1,500 m, 10 June 1998, *Weigend, M. et al. 98/519* (F, M). Piura: Huancabamba, Cordillera de San José, 1,700 m, 23 September 1961, *Friedberg 696* (NY).

28. *Macrocarpaea ypsilocaule* J.R. Grant

Harvard Pap. Bot. 9(2): 331. 2005. TYPE: COLOMBIA. Putumayo: Páramo de San Francisco (la Depresión), en el camino carretera de San Francisco a Mocoa, 3,000–3,100 m, January 1942, *P. Fray Miguel 57* (Holotype: F) (Fig. 3.57).

Shrub, 2 m, glabrous throughout except hispid along veins on the lower surface, cm in diameter. Stems terete to slightly quadrangular, solid, 2–5 mm in diameter just below the inflorescence. Leaves elliptic, oval to ovate, petiolate, 5.5–15.5 cm long. Petioles 4–10 mm long, robust with strong open vagination one quarter to one-third the length of the petiole; interpetiolar ridge 1–4 mm high. Blades 5.0–14.5 × 2.5–6.0 cm, entire, not revolute, dark green above, lighter below, with slightly impressed veins above, and strongly raised veins below, glabrous above, hyaline hispid on all veins below, thin to leathery coriaceous; base aequilateral to oblique, cuneate; apex acuminate to acute. Inflorescence a few-branched open thyse, 6–22 cm long; branches 5–15 cm long; 1(–3) flowered per branch. Bracts ovate to lanceolate, sessile to short-petiolate, 20–70 × 7–15 mm; base aequilateral to oblique, cuneate, to short-attenuate; apex acuminate; bract petioles 0–5 mm long. Flowers pedicellate, spreading; pedicels 8–45 mm long; bracteoles linear to lanceolate, 6–14 × 2–3 mm. Calyx campanulate, 15–22 × 8–18 mm, glabrous, faintly rugose to pusticulate, ecarinate; calyx lobes ovate to elliptic, 9–13 × 8–11 mm, apex rounded to obtuse. Corolla funnel-shaped, 42–45 mm long, 15–20 mm wide at the apex of the tube, green, smooth; corolla lobes ovate, 10–12 × 9–11 mm, obtuse to rounded. Stamens 24–30 mm long; filaments 20–24 mm long, filiform, flattened; anthers elliptic to oblong, 4–6 × 2–3 mm, sagittate, versatile; pollen *Glabra*-type. Pistil 40–42 mm long; ovary 8–10 × 2–4 mm; style 29–30 × 0.75–1.0 mm; stigma lobes spatulate, 2–3 × 1.5–2.0 mm. Capsules ovoid, 14–17 × 11–13 mm, smooth, tan, erect to nodding; style remnant 1–3 mm long. Seeds “Rimmed type,” 0.8–0.9 × 0.4–0.5 mm, straw-colored, testa rugose-reticulate.

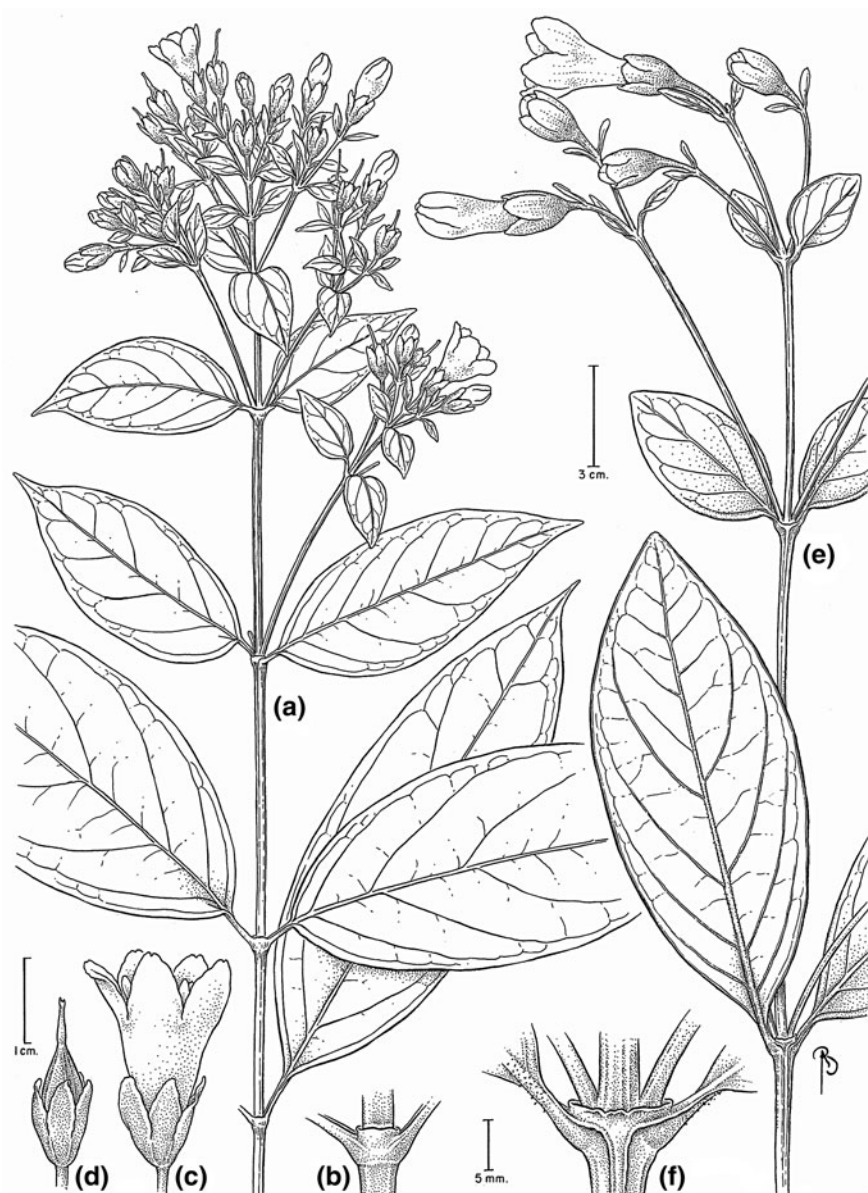


Fig. 3.57 a–d *Macrocarpaea gulosa* from Colombia. a habit of flowering stem; b interpetiolar ridge; c flower; d fruit. e–f *M. ypsilocaule*. e habit of flowering stem; f interpetiolar ridge. a–c drawn from Forero et al. 3158 (MO, COL), d drawn from Forero 3226 (COL), e–f drawn from Miguel 57 (F)

Macrocarpaea ypsilocaule belongs to section *Macrocarpaea*, and occurs in the northern Andes, from 2,000 to 2,750 m on the Cordillera Central of Colombia. It is related to *M. biremis* J.R. Grant of the Cordillera Occidental, the Chocó of Colombia on the basis of few-flowered inflorescences, and flowers with large calyces. Often the basal branches of the inflorescence of *Macrocarpaea ypsilocaule* only have a single flower.

Etymology. From the Greek *ypsilon* (or *upsilon*), and *caulis* (stem) for the “Y-shaped” bifurcated branching pattern of the inflorescence.

Specimens examined: ECUADOR. **Carchi:** Cerro Golondrinas area, access via Chamorro property above El Carmen, which is above Hualchán, flat hilltop before steep ridge crest approach to peak 1840, stunted upper montane forest, heavily festooned with moss, 00° 50' N, 78° 12' W, 2,690 m, shrub, in fruit only, 24 July 1993, *Boyle & Hibbs 2333* (MO, QCNE).

COLOMBIA. Huila: Vía a la quebrada Cascajal del Conudo, P.N. Natural Cueva de Los Guácharos, 01° 35' N, 76° 00' W, 30 August 1993, *Barbosa 15567* (FMB [2 sheets]); Vía a la quebrada Cascajal del Conudo, P.N. Natural Cueva de Los Guácharos, 01° 35' N, 76° 00' W, 30 August 1993, *Barbosa 15592* (FMB); De la Quebrada Negra al primer cerro vía a Cerro Punta, P.N. Natural Cueva de Los Guácharos, 01° 35' N, 76° 00' W, 2 September 1993, *Barbosa 15625* (FMB). Putumayo: Municipio de Mocoa, Carretera entre Sibundoy y Mocoa, localidad el Mirador, 01° 04' 11 N, 76° 44' 41'' W, 2,000 m, 7 September 1998, *Mendoza et al. 6034* (COAH, FMB); Municipio Colon, Reserva Natural “La Rejoya,” 2,750 m, shrub 2 m, 12 March 1999, *Stancik 2807* (COL, PSO [not seen]).

29. *sp. nov.* A “*catherineae*”

This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including *M. catherineae*, *M. claireae*, *M. diesviridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*. It occurs in the Cordillera del Condor region.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Road from Chumbeza, Quimi and Tundayme toward the Condor Mirador, 16 km from end of road at Military camp ‘Condor Mirador’, 03° 36' 32.7'' S, 078° 28' 18.3'' W, 1,059 m, 15 February 2011, *Grant, J.R. & J. Vieu 11-4695* (NY); Région de la Cordillera del Cóndor, vertiente occidental, Cantón El Pangui, parroquia Tundayme, Valle del Río Quimi, Bosque húmedo premontano, arbustivo de 3 m de alto, flores campanulares color blanco-crema, 03° 35' 05'' S, 078° 27' 07'' W, 900 m, 8 July 2007, *Quizhpe, W. 2706* (MO, QCNE); El Pangui, Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi, zona de la futura mina de cobre de la compañía EcuCorriente, Formación rocosa arenisca, suelo arenoso, bosque muy húmedo montano bajo y bosque arbustivo. Arbusto de 304 m, hojas carnosas, flores con pecíolos amarillos, 03° 34' 55'' S, 078° 26' 10'' W, 1,400–1,670 m, 19 March 2006, *Quizhpe, W. & F. Luisier 1977* (QCNE); Cordillera del Cóndor, vertiente occidental, cuenca del Río Quimi, zona de la futura mina de cobre de la



Fig. 3.58 *Macrocarpaea* sp. nov. “cortinae.” Photo J. Cortina

compañía Ecuacorriente, 03° 34' 55" S, 078° 26' 10" W, 1,400–1,670 m, 19 March 2006, *Quizhpe, W. & F. Luisier 1981* (LOJA, QCNE).

30. sp. nov. **B “cortinae”**

This species belongs to a closely related group of species with leaves that are long-decurrent on the petiole including *M. cortinae*, *M. pringleana*, *M. sodiroana*, and *M. umbellata*. It occurs in northern Ecuador on Amazon-facing slopes of the Andes in Sucumbios and Napo (Fig. 3.58).

Specimens examined: ECUADOR. **Napo:** Valle alto del Río Quijos, 5 km al Sur de Cuyuja, Finca Agroecologica Antisana, 00° 28' S, 078° 03' W, 2850, 16 June 1998, *Vargas, H. et al. 1851* (MO, NY, QCNE). **Sucumbios:** Rio Bermejo to Cerro Sur Pax, Cofan community of Alto Bermejo, access from Bermejo oil field of Pozo 1, NW between Lumbaqui and Cascales, vicinity of Vista Camp, 00° 18' 13.8 N, 077° 24' 32.0" W, 100–1,200 m, 29 July 2001, *Aguinda, R. et al. 1204* (F); Sinangoe Station, Rio Cuccono Chico, affluent of Rio Due, SW of Puerto Libre, NW of Lumbaqui, access trail from Rio Sieguayo, vicinity of Ccuccono beach camp, 00° 07' 48.5" N, 077° 33' 19.9" W, 940–1,000 m, 8 August 2001, *Aguinda, R. et al. 1585* (F); Gonzalo Pizarro Canton, Parroquia Reventador, 1,800 m, 23 May 1990, *Cerón, C. & Ayala 9988* (MO, QCNE); 13 km NW of La Bonita on road toward Santa Barbara, 00° 32' 14.7" N, 077° 31' 53.6" W, 2,016 m, 7 February 13, *Grant, J.R & J. Cortina 13-5114* (NY); 6 km south of La Bonita, 00° 27' 27.1" N, 077° 32' 20.8" W, 1,903 m, 7 February 13, *Grant, J.R & J. Cortina 13-5115* (NY); 4 km N of Rio

Chigual ridge at km 44 from Lumbaqui, 00° 16' 46.7'' N, 077° 27' 39.6'' W, 767 m, 7 February 13, *Grant, J.R. & J. Cortina 13-5116* (NY).

31. **sp. nov. C “illuminata”**

This species belongs to a closely related group of species restricted to the Amotape–Huancabamba zone including *M. catherineae*, *M. claireae*, *M. dies-viridis*, *M. illuminata*, *M. lenae*, *M. quizhpei*, and *M. xerantifulva*.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Cordillera del Condor, 9.3 km E of Paquisha (measured from the church in the central square), 1,394 m, 7 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4529* (LOJA, MO, NY); Cordillera del Condor region, from the road from Zumbi to Paquisha, 8 km south on the road toward Guayzimi, (just W of Paquisha), 03° 58' 055'' S, 078° 41' 133'' W, 1,022 m, 25 January 2009, *Grant, J.R., B. Angell, W. Grant & V. Trunz 09-4560* (NY); Cordillera del Condor region, from the road from Zumbi to Paquisha, 8 km south on the road toward Guayzimi, (just W of Paquisha), 03° 58' 02.1'' S, 079° 41' 09.9'' W, 910 m, 11-Feb-2011, *Grant, J.R. & J. Vieu 11-4687* (NY).

32. **sp. nov. D “lilliputiana”**

This is an easily identifiable species with small rounded leaves a very short inflorescence, similar to that of *M. subsessilis*. It occurs in the Cordillera del Condor region. This species is part of a group of species with smooth leathery leaves where the secondary leaf veins absent or scarcely visible including *M. arborescens*, *M. ericii*, *M. harlingii*, *M. lilliputiana*, *M. subsessilis*, and *M. zumbae*.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Paquisha Cantón, Cordillera del Cóndor, the Machinaza plateau, one of the highest-elevation Hollín sandstone plateaus in the Condór region, about 500 m west of the Ecuador–Peru international border, near end of trail from Paquisha Alto military post. Bare sandstone substrate, or quartzite sand derived therefrom, very nutrient poor. Dwarf scrub vegetation, dominated by shrubs to about 1.5 m tall, with occasional small tree to 4 m tall. Vegetation recovering slowly from an extensive burn about 20 years previously, with charred woody stems in abundance on ground, 03° 54' 06'' S, 078° 28' 57'' W, 2,315 m, 23 June 2009, *Neill, D. & C. Kjekai 16910* (LOJA, MO, QCNE); Machinaza plateau summit area, upper Paquisha military post on Ecuador–Peru border, 03° 53' 50'' S, 078° 28' 49'' W, 2,420 m, 15 March 2008, *Neill, D. & W. Quizhpe 16113* (MO, NY).

33. **sp. nov. E “pacific”**

This species is the only species of *Macrocarpaea* known from El Oro province, and is also the southernmost species on the Pacific side of the Andes in *Macrocarpaea* (Fig. 3.59).

Specimens examined: ECUADOR. **El Oro:** Piñas, Moromoro, Reserva Biológica Buenaventura (Fundación de Conservación Jocotoco), bosque Moscos,

Fig. 3.59 *Macrocarpaea* sp. nov. “pacifica.” Photo J. Grant



Quebrada obscura, 03° 39' 17" S, 079° 44' 32" W, 940–1,050 m, 28 May 2011, *Clark, J.L.* et al. 12283 (NY); Piñas, Bosque Protector Buenaventura, Fundación de Conservación Jocotoco, 03° 39' 02.4" S, 079° 44' 53.0" W, 925 m, 16 February 2011, *Grant, J.R.* & *J. Vieu* 11-4704 (NY); Parroquia El Placer, Reserva Buenaventura, propiedad de la Fundación Jocotoco, recorrido por el sendero desde la estación hasta el bosque Puma, bosque secundario con relictos de bosque primario, bosque humedo pre-montano, 03° 38' 41" S, 079° 45' 46" W, 1,000 m, 4 April 2005, *Vargas, H.* et al. 5191 (MO); Piñas, Parroquia El Placer, Reserva Ecológica Buenaventura, propiedad de la Fundación Jocotoco, sendero al Jardín Botánico, entrada por la Cripta de la Virgen, bosque primario, bosque humedo pre-montano, 03° 39' 33" S, 079° 44' 25" W, 1,220 m, 8 April 2005, *Vargas, H.* et al. 5344 (MO, NY).

34. **sp. nov. F “umbellata”**

This species belongs to a closely related group of species with leaves that are long-decurrent on the petiole including *M. cortinae*, *M. pringleana*, *M. sodiroana*, and *M. umbellata*. It occurs on Pacific-facing slopes of southern Colombia and adjacent Carchi, Ecuador (Fig. 3.60).

Fig. 3.60 *Macrocarpaea* sp. nov. “umbellata.” Photo J. Cortina



Specimens examined: ECUADOR. Between Rio Verde and Rio Blanco, 7 January 1962, *Dodson, C.H. & L.B. Thien* 1925 (AAU, MO, NY); *Verleysen* s.n. (QPLS). **Carchi:** Camaña El Corazón y alrededores Carchi, 2,200 m, 11 February 1997, *Anton* 320 (QCA, QCNE); Tulcán-Maldonado highway, Chical Trail, 1,500 m, 26 January 1977, *Boeke, J.D.* 845 (AAU, MO, NY, QCA); Along road from El Chical to Tulcán, 7.4 km E of El Chical, 1,393 m, 19 February 2004, *Croat, T.B.* 94939 (MO, NY, QCNE); Road from La Carolina (between Ibarra and San Lorenzo) northeast toward El Chical, 00° 54' 56.3" N, 078° 12' 04.6" W, 1,497 m, 6 February 13, *Grant, J.R. & J. Cortina* 13-5107 (NY); Vic. of Maldonado, 1,600–1,900 m, 13 April 1977, *Madison, M.T.* 3956 (NY); Environs of Chical, 12 km below Maldonado, 1,200 m, 30 May 1978, *Madison, M.T.* et al. 4795 (F, QCA, SEL); Peñas Blancas, 20 km below Maldonado on the Río San Juan, 900–1,000 m, 27 May 1978, *Madison, M.T.* et al. 4614 (F, QCA, SEL); Environs of Chical, 12 km below Maldonado, 1,200 m, 30 May 1978, *Madison, M.T.* et al. 4795 (F, QCA, SEL); Tulcan, Res. Indígena Awá, 1,800 m, 15 June 1991, *Rubio* et al. 1636 (MO, QCNE); Reserva Golondrinas, recorrido por el sendero de las mulas hasta la casa de la Fundación Golondrinas en Santa Rosa. Bosque muy húmedo montano, bosque primario, arbusto de 2 m, tallos huecos, flores amarillo-verdosas, 00° 50' N, 078° 08' W, 1,790 m, 26 January 2004, *Vargas, H.* et al. 4469 (MO, NY, QCNE).

COLOMBIA. *Mutis* 334 (US). Cauca: Mun. Santa Rosa, Corregimiento Descanse, Vereda Génova, en cercanía de la quebrada La Isla, Finca La Isla, 1,100 m, 8 April 1995, *Rubiano, L.J. & Moreno* O. 644 (COL); Santa Martha, Bota Cauca, en la via Mocoa-Pitalito, ca. 5 km del puente del Rio Caquetá, 1,100 m, 25 January 1990, *Ramos, J.E.* et al. 2501 (CUVC, MO, U). Nariño: Ricárte, 1,300 m, 7 April 1941, *von Sneidern* 512 (S); Mpio. de Ricaurte, Resguardo Indígena Nulpe Medio, Orillas del río Nulpe, 715 m, 6 January 1996, *González & Ramírez* P. 1554 (QCA); Mpio. de Ricaurte, Trayecto La Planada-San Isidro, 1,500–2,700 m, 16 November 1991, *Ramírez, B.R.* 4270 (MO); Altaquer, 1,000 m, 14 June 1986, *Maas, P.J.M.* et al. 6528 (U); Res. Nat. La Planada, 7 km de Chucunes, 1,800 m, 15 November 1987, *Benavides, O.* de 8953 (MO); Trayecto

Fig. 3.61 *Macrocarpaea* sp. nov. “zumbae.” Photo J. Grant



Pialapi-La Planada, 1,300–1,700 m, 23 July 1988, *Benavides, O. de 10122* (MO); 2–8 km E of Junin on Tumaco-Tuquirres rd, 1,100 m, 26 July 1986, *Gentry, A. et al. 55232* (MO, U). Valle: Hoya del Río Digua, Piedra de Moler, 900–1,180 m, 19 August 1943, *Cuatrecasas, J. 14986* (F, US, VALLE); Río Anchicaya near CVC hydroelectric plant, 400–500 m, 15 December 1981, *Gentry, A. 35666* (COL, MO); Cali-Buenaventura hwy, 28 km beyond the junction with the new hwy, 1,400–1,420 m, 28 August 1976, *Croat, T.B. 38605* (MO).

35. sp. nov. *G* “zumbae”

This new species resembles *M. harlingii*, but is actually more closely related to *M. pajonalis* and *M. kuelap* of Peru. It occurs just in the border region of Ecuador with Peru (Fig. 3.61). This species is part of a group of species with smooth leathery leaves where the secondary leaf veins absent or scarcely visible including *M. arborescens*, *M. ericii*, *M. harlingii*, *M. lilliputiana*, *M. subsessilis*, and *M. zumbae*.

Specimens examined: ECUADOR. **Zamora-Chinchipe:** Along road between Zumba and Amaluza that parallels the Ecuador–Peru border, 04° 47' 39.6" S, 079° 18' 39.6" W, 1,989 m, 7 February 2011, *Grant, J.R. & J. Vieu 11-4669* (NY); Approx. 50 km S Amaluza on road to Zumba that nearly parallels the Ecuador–Peru border, 2,224 m, 1 January 2008, *Grant, J.R., C. Agier, C. Arnold & M.L. Cheung 08-4518* (NY); 08-4519 (NY).

3.4 Conclusions

This monograph is the result of ten years of study including eight trips to Ecuador for both fieldwork and herbarium studies on *Macrocarpaea*. Examination of over 4,000 herbarium specimens has resulted in the description of numerous new

species and the major modification of some species concepts. This also represents the first major monographic revision of *Macrocarpaea* in the Andes, while treatments for both Colombia and Peru under current preparation. While additional new species may be found in remote regions in Ecuador, this monograph may serve as a point of reference for future research on this spectacular example of radiation in the Amotape–Huancabamba zone.

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References

- Carlquist S, Grant JR (2005) Wood anatomy of Gentianaceae, tribe Helieae: diversification in relation to ecology, habit, and systematics; the effect of sample diameter. *Brittonia* 57:276–291
- Ewan J (1948) A revision of *Macrocarpaea*, a neotropical genus of shrubby gentians. *Contr US Natl Herb* 29:209–250
- Grant JR (2003) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis II: typification of the Ruiz & Pavon names. *Harvard Pap Bot* 7(2):423–436
- Grant JR (2004) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis V: twenty-three new species largely from Peru, and typification of all species in the genus. *Harvard Pap Bot* 9:11–49
- Grant JR (2005) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis VI: seed morphology, palynology, an infrageneric classification, and another twenty-three new species, largely from Colombia. *Harvard Pap Bot* 9:305–342
- Grant JR (2007) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis VII: four new species and two natural hybrids. *Harvard Pap Bot* 11:129–139
- Grant JR (2008) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis VIII: two new species from Ecuador. *Harvard Pap Bot* 13:253–259
- Grant JR (2011) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis IX: a synopsis of the genus in Bolivia. *Harvard Pap Bot* 16:389–397

- Grant JR, Struwe L (2001) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis I: an introduction to the genus *Macrocarpaea* and three new species from Colombia, Ecuador, and Guyana. *Harvard Pap Bot* 5:489–498
- Grant JR, Struwe L (2003) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis III: six new species of moon-gentians (*Macrocarpaea*, *Gentianaceae*: *Helieae*) from P.N. Podocarpus, Ecuador. *Harvard Pap Bot* 8:61–81
- Grant JR, Trunz V (2011) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis X: a synopsis of the genus in montane Atlantic Forests of Brazil. *Harvard Pap Bot* 16:399–420
- Grant JR, Weaver RE (2003) De *Macrocarpaeae* Grisebach (ex *Gentianaceis*) speciebus novis IV: twelve new species of *Macrocarpaea* (*Gentianaceae*: *Helieae*) from Central and South America, and the first report of the presence of a stipule in the family. *Harvard Pap Bot* 8:83–109
- Matt F (2001) Papel ecológico de los murciélagos y orthópteros en el bosque montañoso del PN Podocarpus. Informe parcial parte I: Murciélagos y relaciones con plantas: Propagación de las semillas y polinización. <http://www.natureandculture.org/GermanResearchGroups/papers/AG%20Helsen/1%20Murci%20E9lagos%20y%20sus%20plantas.pdf>
- Nilsson S (1968) Pollen morphology in the genus *Macrocarpaea* (*Gentianaceae*) and its taxonomical significance. *Svensk Bot Tidskr* 62:338–364
- Nilsson S (2002) *Gentianaceae*: a review of palynology. In: Struwe L, Albert VA (eds) *Gentianaceae: systematics and natural history*. Cambridge University Press, Cambridge, pp 377–497
- Pringle JS (1995) *Gentianaceae*. In: Harling G, Andersson L (eds) *Flora of Ecuador*, vol 53. Göteborg university, Sweden, pp 1–132
- Struwe LS, Haag S, Heiberg E, Grant JR (2009a) Andean speciation and vicariance in Neotropical *Macrocarpaea* (*Gentianaceae*-*Helieae*). *Ann Missouri Bot Gard* 96:450–469
- Struwe L, Albert VA, Calió MF, Frasier C, Lepis KB, Mathews KG, Grant JR (2009b) Evolutionary patterns in neotropical tribe *Helieae* (*Gentianaceae*): evidence from morphology, chloroplast and nuclear DNA sequences. *Taxon* 58:479–499
- Thiers B (2008+) [continuously updated]: Index herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden: published at <http://sweetgum.nybg.org/ih/>
- Thiv M, Grant JR (2002) *Macrocarpaea* (*Gentianaceae*). In: *Flora de la República de Cuba*, Fasc Koeltz Scientific Books, Konigstein, Germany, vol 6. pp 23–26
- Weigend M (2002) Observations on the biogeography of the Amotape–Huancabamba zone in northern Peru. *Bot Rev* 68:38–54
- Weigend M (2004) Additional observations on the biogeography of the Amotape–Huancabamba zone in northern Peru: defining the south-eastern limits. *Rev Peru Biol* 11:127–134
- Young KR, Reynel C (1997) Huancabamba region: Peru and Ecuador. In: Davis SD, Heywood VH, Herrera-MacBryde O, Villa-Lobos J, Hamilton A (eds) *Centres of plant diversity: a guide and strategy for their conservation*, vol 3. The Americas IUCN Publications Unit, Cambridge, pp 465–469