

A Revision of the 3-Segmented Species of *Anthurium* sect. *Dactylophyllum* (Araceae)

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ABSTRACT

Anthurium sect. *Dactylophyllum* have leaf blades palmately divided into segments divided to the base and may have (1–) 3–15 segments. Those species with 3 or fewer segments are revised here.

KEY WORDS

Anthurium, Section *Dactylophyllum*, Araceae, palmate, 3-segmented.

INTRODUCTION

Madison (1978) published a revision of *Anthurium* species with palmately-lobed and palmately-segmented blades which covered all of the neotropics. During our work on the Araceae treatment for the *Flora of Ecuador*, three new species have been discovered and this has caused a reappraisal of most of the species with the blades divided into three segments. Madison

recognized 5 species with trisect blades and since this another new 3-sect *Anthurium*, *A. moonenii* Croat & E. Gonçalves was recently described from French Guiana and Brazil (Croat & Gonçalves, 2005). *Anthurium thrinax* Madison and *A. moonenii* occur only in the Guianas or northern Brazil and *A. trisectum* Sodiro occurs only on the Pacific coast ranging from Costa Rica to Ecuador. The remainder of the species in this group occur on the eastern slopes of the Andes from Colombia to Bolivia and these will be reviewed or redescribed here. Madison (loc. cit.) recognized three species from the eastern slopes of the Ecuadorian Andes, *A. arisaemoides* Madison, *A. cutucuense* Madison and *A. triphyllum* (Willd. ex Schult.) Brongn. ex Schott, but three additional species have been discovered on the eastern slopes of the Andes in Colombia and Ecuador and they are described here. A new key to the group is presented.

KEY TO ANTHURIUM SPECIES WITH PALMATELY DIVIDED LEAVES

- A. Leaf blades divided into three segments (sometimes monophyllous in *A. moonenii*).
- B. Species from eastern South America, Guianas and N.E. Brazil.
 - C. Plants usually terrestrial;; primary lateral veins 10–14 pairs, arising at 45–55° angle; Inflorescence erect; peduncle often longer than petiole (at least sometimes shorter in *A. moonenii*); spadix 5–10 cm long; berries purplish red *A. thrinax* Madison
 - C. Plants appressed-climbing hemiepiphyte; inflorescence pendent; primary lateral veins 20–25 pairs, prominently quilted-sunken, arising at 45–60° angle;

- inflorescence pendent; spadix 28–60 cm long; berries yellowish green
 *A. moonenii* Croat & E. G. Gonçalves
- B. Species from Central America or western South America, either along the western slopes of the Andes or the eastern slopes of the Andes and the western Amazon basin.
- C. Occurring in Central America and along the western slope of the Andes in Colombia and Ecuador; spadix 3–6 cm long, often yellow at anthesis
 *A. trisectum* Sodiro
- D. Occurring on the eastern slopes of the Andes in South America; spadix typically more than 6 cm long and green to cream, pink to purplish at anthesis (Colombia to Bolivia).
- E. Leaf blades averaging twice as long as wide with elongate, narrow, medial lobe and lateral veins at 90° angle to midrib.
- F. Petioles mottled red; peduncle equaling petiole (Ecuador).
 *A. cutucuense* Madison
- F. Petioles green, not mottled with red; petiole twice as long as peduncle (Ecuador). *A. huacamayoense* Croat
- E. Blades shorter than wide to only slightly longer than wide with lateral veins at 30–45° angle to midrib.
- G. Small terrestrial plants *A. arisaemoides* Madison
- G. Large epiphytic plants.
- H. Leaf blades with lateral segments broad, ovate-elliptic, pale yellow-green to dark green; spadix 4.5–26.5 cm long (Bolivia, Ecuador, Peru, Venezuela)
 *A. triphyllum* (Willd. ex Schult.) Brongn. ex Schott
- H. Leaf blades with lateral segments lanceolate, falcate.
- I. Medial lobe acuminate at apex with short apiculum; spadix cream-colored (Ecuador) *A. warintsense* Croat
- I. Medial lobe narrowly long-acuminate and down-turned at apex; spadix lemon-green (Colombia) . . . *A. zuloagae* Croat
- A. Leaf blades not divided into three segments (this is only a portion of the revised treatment of Section *Dactylophyllum*).

Anthurium arisaemoides Madison. *Selbyana* 2(2–3): 249. 1978. Type: ECUADOR: Morona-Santiago: Cordillera de Cutucú, general region of 02°46'S, 78°06'W, 1,700 m, Nov 1976, *M.T. Madison, E.O. Bush & E.W. Davis* 3433 (holotype, SEL). Figures 1a–c.

Terrestrial herb usually low to the ground but sometimes erect to 1.5 m, sometimes an epiphytic creeper to between 30 cm and 1.5 m; **stems** usually moderately short; **internodes** elongate (1–)3–10.5 cm long, 6–18 mm diam., medium to dark green or gray-brown, matte to semiglossy; **cataphylls** 4–7.5 cm long, green tinged purple, uppermost intact, deciduous or persisting as white membra-

naceous fibers at upper nodes. LEAVES evenly spaced along an elongate stem; **petioles** 9–41 cm long, 2–3 mm diam., terete or obtusely D-shaped or flattened, narrowly and shallowly or bluntly sulcate abaxially, slightly paler and rounded abaxially, dark yellow-green to medium green to purple-violet, weakly glossy to semiglossy; **geniculum** 12 mm long, swollen, especially abaxially, narrowly sulcate adaxially; **blades** trisect, 8–29.5 cm long, 10–30 cm wide, broadest at the middle, conspicuously bullate, subcoriaceous, light green to dark green and semiglossy to matte or weakly glossy above, moderately paler, matte to weakly glossy and net-sunken below; **medial segment** 12–21 cm long, 4–9 cm wide; **lateral segment** markedly

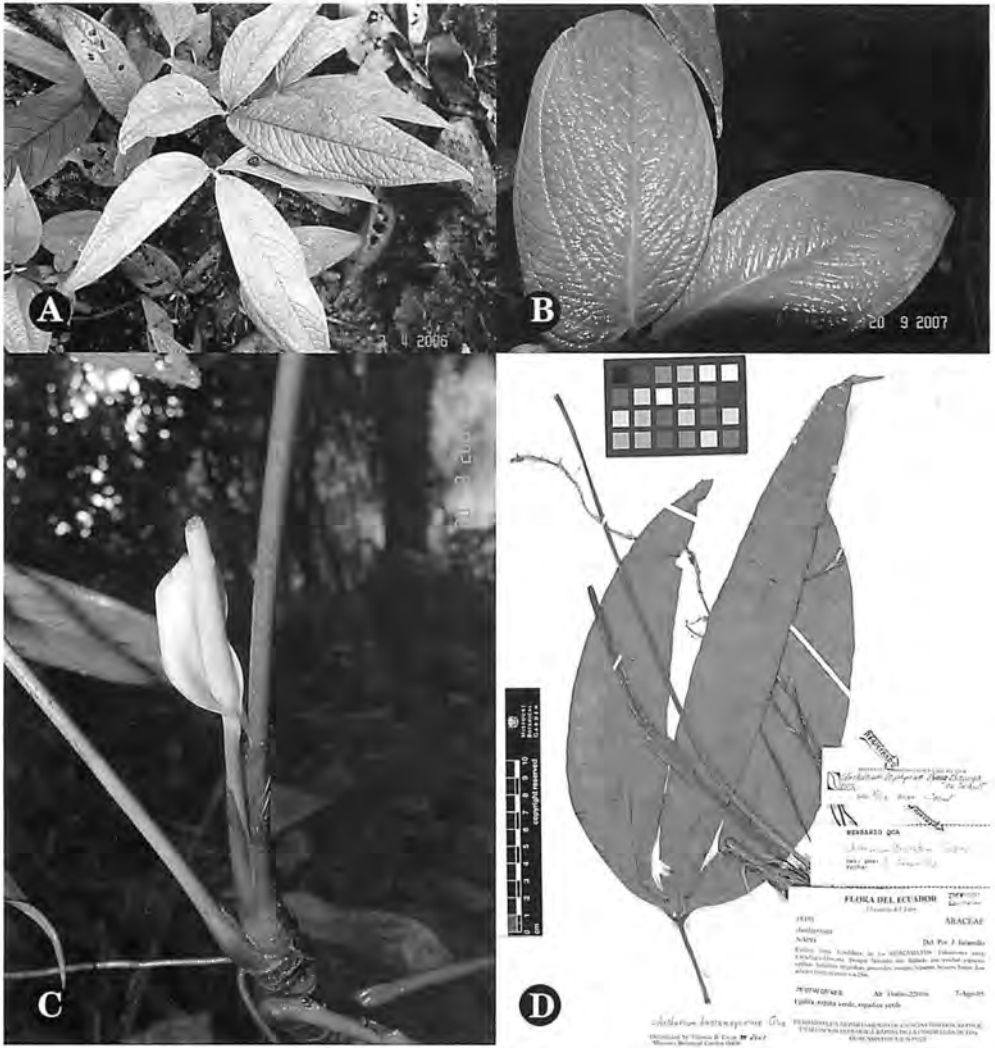


Fig. 1. a–c. *Anthurium arisaemoides* Madison. (Croat 96739). a. Habit. (Croat 98889). b. Blade adaxial surface. c. Stem with inflorescence and petioles. d. *Anthurium huacamayoense* Croat. (Jaramillo & Tapia 18456). Herbarium type specimen.

inequilateral, 6.5–19 cm long, 2–10.5 cm wide, one side 3–13 mm wider; **midrib** narrowly or bluntly acute or raised and concolorous above, thicker than broad, narrowly rounded and slightly paler or reddish purple below; **primary lateral veins** thicker than broad, etched-sunken and concolorous above, bluntly acute, narrowly raised, convex and concolorous below; primary lateral veins on medial segment number 3–4, the 1st being a collective vein that approaches and paral-

lels the margin at a slight inset, also marked by numerous scarious veins (visible at 30X magnification); primary lateral veins on lateral segment number 2–3 with each vein also being a collective vein with numerous scarious veins running in between; **tertiary veins** moderately obscure, weakly etched or deeply sunken above, obscure or raised below. **INFLORESCENCES** axillary, erect; **peduncle** half as long as petiole, terete, erect, purplish red, densely greenish speckled, 5 mm diam., weakly glossy; **spathe**

ovate to oblong-linear, 3.2–8.3 cm long, 1–2.5 cm wide, reflexed, oblong, shorter than spadix, pale to medium green, tinged purple, erect-spreading, matte to semiglossy outside, weakly to semiglossy inside reflexed, twisted; **spadix** sessile or with stipe 2–5 mm long, tapered, erect, 3–9 cm long, 6–8 mm diam. near base, 5–6 mm diam. at 1 cm from apex dark, yellow-green to pink, usually becoming purple at anthesis, weakly glossy to matte. Flowers 6–7 visible per spiral, 1.9–2 mm long, 2.1–2.2 mm wide, dark brown, conspicuously pale granular; lateral tepals 2.0–2.5 mm wide, narrowly shield-shaped or with outer margin 2-sided, inner margin rounded. INFRUCTESCENCE with spadix purplish violet; **berries** green, early emergent, ovoid, medium green, dark green at tip; flowers sub 4-lobed, difficult to discern, 5–6 per spiral; tepals shield-shaped, inner margin rounded, outer margin bluntly triangular.

Anthurium arisaemoides ranges from Ecuador (Pastaza, Morona-Santiago, Zamora-Chinchipe) to Peru (Loreto) at 300–2,000 m in *Tropical moist forest* and *Tropical wet forest* life zones (Holdridge, 1971). At the type locality in the Cordillera de Cutucú, *A. arisaemoides* grows terrestrially in dense stands in the forest understory and in its general aspect it is remarkably similar to *Arisaema*. The species frequently grows on soil in small groups or sometimes at the base of trees in moss.

The species is recognized by its trisect blades with all segments attenuated at the base and usually with a noticeable petiole, by having the peduncle longer than the petioles and a short green to purplish spadix. The lateral segments are usually markedly inequilateral with only 2–3 primary lateral veins, all of which are collective veins that extend to the apex, collecting numerous scarious veins that run between. The species is highly variable in the texture of the blades with some populations having a conspicuously bullate upper blades surface (see *Croat 75196* from the Cordillera del Cóndor S.E. of Los Encuentros).

According to Madison (1978), *A. arisaemoides* is most closely related to *A. trisectum* from which it is geographically separated by the intervening barrier of the Andes. Both species are diminutive plants with similar trisect leaves, and often are terrestrial. In *A. arisaemoides* the spathe is green and the peduncle longer than the petiole, while in *A. trisectum* the spathe is white or yellow at anthesis, and the peduncle is shorter than the petiole.

In reality, *A. arisaemoides* is most easily confused with smaller plants of *A. triphyllum*. The latter differs in that it is a larger plant with a mostly epiphytic habit and a greenish to white spadix that is 4.5–26.5 cm long, as compared to the 3–9 cm pink to purplish spadix of *A. arisaemoides*. A further distinction is that the lateral lobes of *A. triphyllum* are more or less equilateral.

Other collections which have been confused with *A. arisaemoides* include several undescribed species including one represented by *Neill et al. 14140* with the primary lateral veins more regularly spaced along the length of the segments and having a lateral segment less inequilateral and not attenuated at the base. In addition, it has a collective vein arising from one of the lowermost primary lateral veins and extending all the way to the apex very near the margin. In contrast, the lowermost primary lateral veins in *A. arisaemoides* are oblique to the margins and invariably merge with the margins before reaching the apex of the segment. Moreover this new species has a cream-colored spadix, unknown in *A. arisaemoides*.

Anthurium arisaemoides is also related to *A. zuloagae* collected in Colombia in the Department of Boyaca, Municipio de Pajarito, Corregimiento de Corinto. That species differs in having a much longer, more slender lemon-green spadix and fewer, less conspicuous primary lateral veins.

Finally a new species from the Cordillera de los Huacamayos in Napo Province in Cantón Tena to be called *A. huacamayoense* (see below), has been confused with both *A. triphyllum* and *A. arisaemoides*. It even resembles *A. cutucuense*.

owing to its elongate and narrow medial lobe. It differs from the latter in lacking the mottled petioles and quilted primary lateral veins of *A. cutucuense* and has one of the lower primary lateral veins extending obliquely to the margin. In *A. cutucuense*, all the primary lateral veins are directed to the margin at about a 90° angle.

Anthurium huacamayoense differs from *A. arisaemoides* in having longer blade segments and in having the primary lateral veins of the medial segment scarcely apparent and numerous, directed at almost a 90° angle.

Anthurium huacamayoense differs from *A. triphyllum* by having blades averaging twice as long as wide, with narrow, medial lobes and lateral veins at 90° angles to the midrib versus blades that are shorter than wide to only slightly longer than wide with lateral veins at 30–45° angles to the midrib.

Additional specimens examined—**ECUADOR. Morona-Santiago:** Cantón Macas. Parque Nacional Sangay, Lagunas de Sardinayacu, 02°04'S, 78°13'W, 1,730 m, 24 May 2003, *Cerón et al.* 48599 (MO); Tumbez–Tucumbatza, Km 20, 1,600 m, 20 Apr 1985, *Harling & Andersson* 24364 (GB); Limón–Indanza, Plan del Milagro, 1,600–1,700 m, 24 Apr 1985, *Harling & Andersson* 24571 (GB); Macas–Riobamba (Guamote), 10.5 km west of Proaño, 02°16'09"S, 78°11'35"W, 956 m, 23 Aug 2002, *Croat & L. Hannon* 86806 (MO); Gualaquiza–Limón, vic. Indanza, 03°02'10"S, 78°28'28"W, 300 m, 8 Sep 2002, *Croat* 87331 (MO); Limón–Gualaquiza, 41.4 km S of Plan de Milagro (jct. with Limón–Gualaceo Rd.), 35.3 Km S of San Juan Bosco, 14.8 km N of Tucumbatza, 03°10'59"S, 78°33'27"W, 1,584 m, 23 May 2003, *Croat & Menke* 89325 (MO); Cordillera de Cutucú, ridge just south and west of Río Itzinta, 02°40'S, 78°00'W, 1,371–1,676 m, 17 Nov–5 Dec 1944, *Camp E-1318* (MO); Cordillera de Cutucú, western slopes, along trail Logroño–Yaupi, 02°46'S, 78°06'W, 1,300 m, Nov 1976, *Madison et al.* 3301 (MO); NW range of Cordillera del Cóndor; a short distance N and NW of base camp overlooking Río Zamora at headwa-

ters of Río Piuntza, 1,830 m, 6 Jan 1972, *MacBryde* 996 (MO); Cordillera del Cóndor, Valle del Río Coangos, Río Tsurim entre los centros Shuar de Numpatkain y Banderas, 03°20'44"S, 78°14'08"W, 1,100 m, 21 Oct 1999, *P. Fuentes et al.* 1135 (MO, QCNE); along road Chuchumbleza–Cordillera del Cóndor, then 6.8 km S of Chuchumbleza to Quime ferry on Río Zamora, then SW via Numbaime into Cordillera del Cóndor, 24 km SW of Río Zamora, 03°38'11"S, 78°25'49"W, 1,562 m, 14 July 2004, *Croat et al.* 91002 (MO); *Croat et al.* 91011 (MO). **Limón:** Indanza, Cordillera del Cóndor region, Valley of Río Coangos, E of Shuar village of Tinkimints, 03°15'25"S, 78°12'50"W, 1,000 m, 25 Mar 2001, *Neill & Manzanares* 13209 (MO, QCNE); Cordillera del Cóndor, trail from Comunidad Warints to camp 1 towards crest of Cordillera del Cóndor, 03°13'58"S, 78°15'11"W, 830–1,200 m, 11 Dec 2002, *Clark et al.* 6945 (MO, QCNE, US); Cordillera del Cóndor, trail from camp 2 to camp 1, ca. 15–20 km S/SE from the Comunidad Warints, 03°13'S, 78°16'W, 1,400–1,900 m, 16 Dec 2002, *Clark* 7048 (MO, QCNE, US); Cordillera del Cóndor, Parroquia Santa Susana, Kuankus, comunidad Shuar, Cumbre del Cerro Chuank Naint, 03°03'40"S, 78°14'21"W, 1,250 m, 19 Jun 2005, *Tuntiak Katan et al.* 308 (QCNE, MO). **Pastaza:** Along road to Río Anzu, 17.1 Km N of Mera, 3.5 km N of Río Anzu, trail W into mountains, 01°23'26"S, 78°03'19"W, 1,238–1,400 m, 6 May 2003, *Croat et al.* 88692 (MO). **Zamora-Chinchi-****ipe:** Podocarpus National Park, plot near Trail T2, S of Estacion Científica San Francisco, 30 km E of Loja near Sabanilla, 03°58'S, 79°03'W, 2,000 m, 30 Nov 2000, *Leimbeck & Windeballe B.* 448 (MO); 1,500 m, Dec 1975, *Madison* 2496 (SEL); Vic. El Pangui, hills west of town, 03°40'S, 78°37'W, 1,200 m, 7 Sep 2002, *Croat* 87185 (MO); Cordillera del Cóndor, SE of Los Encuentros, 16 Apr 1996, *Croat* 75196 (MO); Zamora Chinchipe, Cordillera del Cóndor, 03°49'S, 78°36'W, 4,350 m, 19 Nov 1995, *Croat* 78249; Pachicutza, sendero hacia el Hito. Vegetación tropical con árboles entre 12 a 18 m. Especies repre-

sentativas de Tapiria, Clusia, Rollinia., 04°09'S, 078°38'W, 1,200–1,350 m, 19 Oct 1991, *J. Jaramillo 14134* QCA); Along road Namirez–Nambija (22.3 Km S of Yanzaza), 8.1 Km S of San Carlos, 04°03'37"S, 78°47'25"W, 1,524 m, 28 May 2003, *Croat & Menke 89634* (MO); Along road from Namirez on Río Zamora and Nambija, 17.9 km E of Río Zamora, 04°03'57"S, 78°47'36"W, 1,790 m, 19 Jul 2004, *Croat 91525* (MO); Nangaritzá, Parroquia Guayzimi, Camino al Hito de Pachicutza desde el Campamento Militar, 04°07'S, 78°37'W, 1,050–1,100 m, 19 Oct 1991, *Cerón et al. 16829* (MO); El Pangui, Vicinity of Ecuacorrientes copper mine development, valley of Río Waiwaime, 8.1 km S of mine headquarters on road to mine site, 03°35'51"S, 78°25'57"W, 1,291 m, 7 April 2006, *Croat, Chris & Sharon Davidson 96739* (MO). PERU. **Loreto**. Río Huallaga: Santa Rosa, lower Río Hualaga below Yurimaguas, 125 m, 1–5 Sep 1929, *E.P. Killip & A.C. Smith 28882* (MO, US).

Anthurium cutucuense Madison, *Selbyana* 2(2–3): 256. 1978. **Type:** ECUADOR. Morona-Santiago: Cordillera Cutucú, general region of 02°46'S, 78°46'W, 1,830 m, *M.T. Madison, E.O. Bush & E.W. Davis 3386* (holotype, SEL; isotype, US). Figures 2a–c.

Hemiepiphytic or epiphytic (occasionally terrestrial) vine, growing to 8 m; **stem** smooth, 1–2 cm diam.; **internodes** elongate, 2–10 cm long, 1 cm diam., reddish with green spots (sometimes dark green), semiglossy; **cataphylls** 8–13.3 cm long, persisting at upper nodes as fibers with fragments of epidermis intact, narrowly rounded at apex with very slender, 1.5–2 mm long, subapical epiculum. LEAVES with **petioles** 14–54.5 cm long (averaging 27.3 cm), red to dark purple, densely pale green speckled (sometimes pale green mottled red to densely red punctulate) weakly glossy, terete, narrowly and weakly to deeply sulcate, punctate; **blades** trisect, the segments elongated and narrow, subcoriaceous to coriaceous, strongly bullate, dark green and matte-subvelvety above,

sometimes shiny, metallic blue-green, paler green to silvery green and matte below; **medial segment** lanceolate, slightly longer and wider than lateral segment, acuminate at apex, acute at base, 15–50 cm long, 8–22 cm wide (averaging 29.1 × 14), 1.3–2.8 times longer than wide (averaging 2.1), .8–1.3 times longer than petiole, averaging about as long as petiole; **lateral lobes** lanceolate, falcate, acuminate at apex, acute at base, nearly equal, 11.4–42.5 cm long, 1.3–5.9 cm wide (averaging 26.1 × 3.0); **midrib** (of both medial and lateral segments) acute and bright red to deep red concolorous, deeply sunken above, narrowly to acutely raised and semiglossy, red, rose or purple below, thicker at base, becoming narrower towards apex; **primary lateral veins** extend at 90° angle from midrib, quilted-sunken above, narrowly convex and pleated-raised below; **collective veins** arising from the base, 0–1 mm from the margin, as prominent as primary lateral veins, sunken above, raised below; **tertiary veins** in part raised and concolorous on both surfaces. INFLORESCENCE. **Peduncle** 19–36.5 cm long (averaging 25.8 cm), dull lavender, pale green or reddish with dull green, red or purple mottling, flattened, weakly and broadly sulcate; **spathe** 10–12.5 cm long (averaging 10.8), 10–21 mm wide (averaging 12.8 mm), dull green to green suffused purple, reflexed; **spadix** 8.5–16.7 cm long (averaging 13.1 cm), 7–13 mm wide (averaging 10 mm), dull lavender to greenish purple. Flowers 6–7 visible per spiral, 2.8–3.0 mm in both directions, purplish-spotted and inconspicuously pale granular; lateral tepals 2.5–2.8 mm wide, outer margin 3-sided, inner margin rounded. INFRUCTESCENCE. Spathe and spadix green at anthesis and in fruit.

Anthurium cutucuense is endemic to Ecuador occurring in Morona-Santiago and Zamora-Chinchipe at elevations of 1,542 to 3,000 meters in *Montane moist forest* and *Montane wet forest*.

Anthurium cutucuense is a member of sect. *Dactylophyllium* and is characterized by its trisect blades with the blade segments metallic blue-green, strongly bullate and

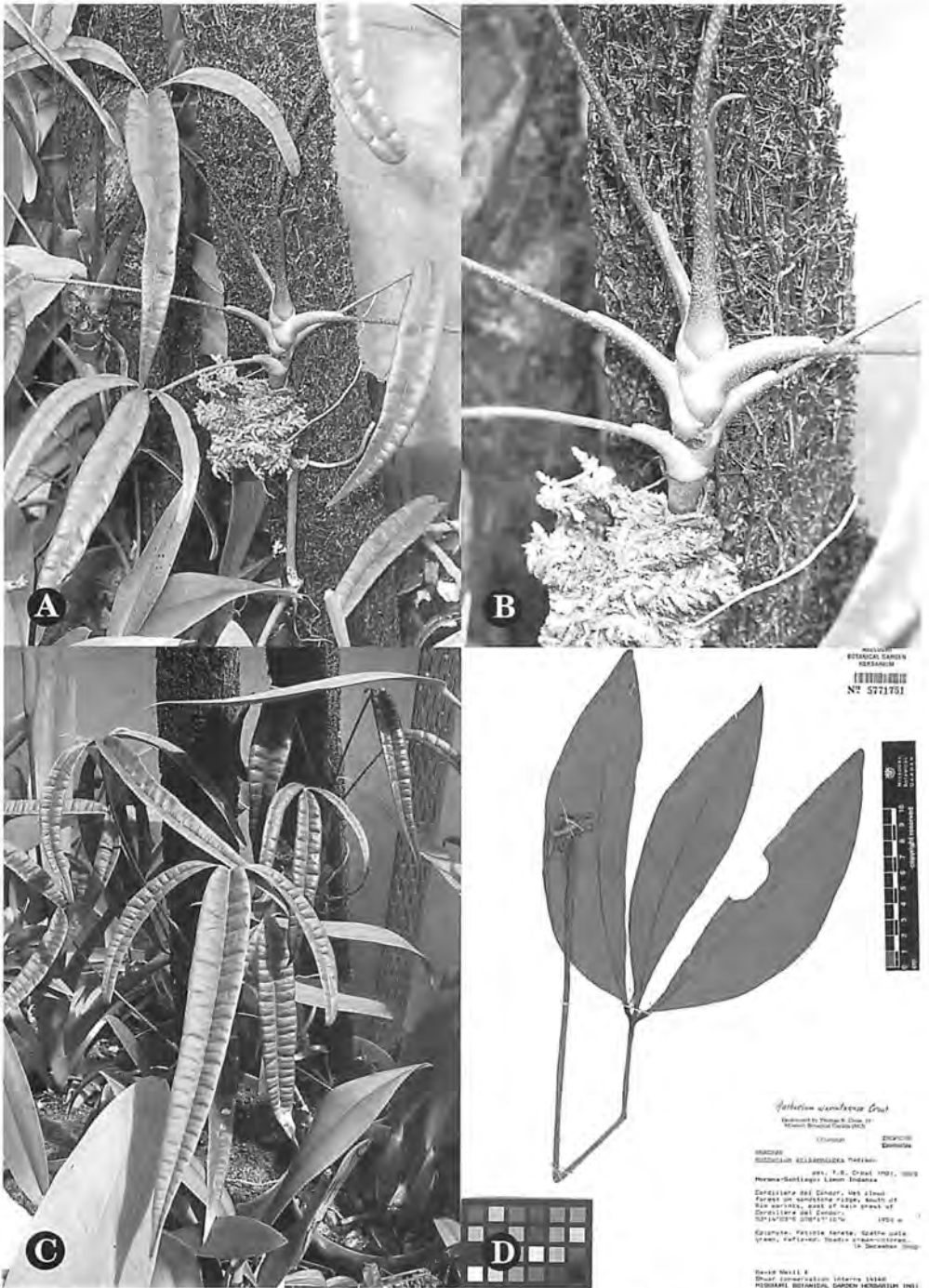


Fig. 2. a–c. *Anthurium cutucuense* Madison. a. Habit of cultivated plant by Ron Kaufman. b. Close-up of stem of cultivated plant by Ron Kaufman. c. Blades showing adaxial surface of cultivated plant by Ron Kaufman. d. *Anthurium warintense* Croat. (Neill *et al.* 14140). Herbarium isotype specimen.

pendent from rigidly horizontal, red-punctate petioles. This species has long internodes and single leaflets on thin wiry stems. As it climbs towards brighter light and a better view, *A. cutucuense* develops its characteristic trisected leaves and the internodes begin to get closer together.

Additional specimens examined—ECUADOR. **Morona-Santiago:** Ridge just south and west of Río Itzintza, Cordillera Cutucú, 02°40'S, 78°00'W, 1,542–1,798 m, 17 Nov–5 Dec 1944, *Camp 1339* (MO, NY); Río Valladolid, Quebrada Honda-Valladolid, 2,000–3,000 m, 12 Oct 1943, *Steyermark 54612* (MO, NY). **Zamora-Chinchi:** Loja–Zamora, ca. 5 km E of pass on new road, 03°58'S, 79°07'W, 2,300 m, 01 Sep 1988, *Madsen & Ellemann 75178* (AAU); Podocarpus National Park, plot near Trail T2, S of Estación Científica San Francisco, 30 km E of Loja near Sabanilla, 03°58'S, 79°03'W, 2,000 m, 30 Nov 2000, *Leimbeck & Windeballe 446* (MO); Area of ECSF (Estación Científica San Francisco) Research Station, Loja–Zamora, ca. Km 30, East of Ceja Andina, 03°58'18"S, 79°04'44"W, 2,000 m, 7 June 2000, *F. Werner 273* (MO); Estación Científica San Francisco, 16.9 km E of Loja border on Loja–Zamora Hwy, 03°58'21"S, 79°04'36"W, 1,908 m, 24 July 2004, *Thomas B. Croat 92105* (MO); NW range of Cordillera del Cóndor, base camp overlooking Río Zamora at headwaters of Río Piuntza; ca. 1 hr. by trail E from base camp, 04°15'S, 78°35'W, 1,850 m, 7 Jan 1972, *B. MacBryde 1017* (MO); Sabanilla, road Loja–Zamora, ca. 38 km from Loja, 1,995 m, 31 Mar 2005, *Homeier & Miersch 1522* (LOJA, MO); El Panguí, Cordillera del Cóndor, Cresta de la Cordillera, en la frontera Ecuador–Perú, 1 km S of destacamento militar Cóndor Mirador, Hito de la Paz, 13, 03°37'26"S, 78°23'35"W, 1,800 m, 15 Dec 2000, *Cuascota et al. 334* (QCNE, MO); Cordillera del Cóndor, near Cóndor Mirador military post, on Ecuador–Peru border, at low point of summit ridge, below sandstone outcrops, 03°38'20"S, 78°23'29"W, 1,760 m, 8 Sep 2003, *Neill et al. 14504* (MO, QCNE); Parque Nacional

Podocarpus, localidad de San Francisco, 79°10'W, 04°05'S, 2,800 m, 12 July 1993, *J. Jaramillo 15282* (MO); Area of Estación Científica San Francisco, road Loja–Zamora, ca. 35 km from Loja; moist montane forest Q3., 03°58'S, 079°04'W, 2,150 m, 1 July 2004, *F.A. Werner 1046*.

***Anthurium buacamayoense* Croat, sp. nov.** Type: ECUADOR. Napo: Cantón Tena, Cordillera de los Huacamayos, between Carachupa and Chacana, wet cloud forest with many epiphytic species: ferns, orchids, mosses, lichens, vines and lianas, 00°48'S, 78°07'W, 1,940–2,200 m, 7 Aug 1995, *J. Jaramillo & I. Tapia 18456* (holotype, QCA). Figure 1d.

Epiphyta; cataphylla 8 cm longa, persistens semi-intacta; petiolus 41 cm longus; lamina trisecta; segmenta media lanceolata, 36 cm longa, 5 cm lata; segmenta lateralis falcata, 26–28.5 cm longa, 6 cm lata; nervis primariis lateralibus debilibus; pedunculus 16.5 cm longus, 1–2 mm diam.; spathe 6 cm longa, 9–11 mm lata, viridis; spadix 9 cm longus, 4 mm lata, viridis, green.

Epiphytic; **cataphylls** 8 cm long, persisting at upper nodes as fibers with fragments of epidermis intact. LEAVES with **petiole** 41 cm long, 2–4 mm diam., becoming narrower towards blade, concolorous, terete, broader than thick, narrowly to broadly V-sulcate both adaxially and abaxially; **blades** trisect with medial lobe markedly longer and slightly narrower than lateral lobes, 36 cm long, 16 cm wide, 2.3 times longer than wide, 9–1.3 times as long as petiole, matte-subvelvety above, weakly glossy below; **medial lobe** lanceolate, acuminate at apex, obtuse at base, 36 cm long, 5 cm wide; **lateral lobes** lanceolate, falcate, acuminate at apex, obtuse at base, unequal in length (right lateral lobe 28.5 cm long, left lateral lobe 26 cm long), more or less equal in width, 6 cm wide; **midrib** weakly to deeply sunken above, acutely raised below; **primary lateral veins** on medial and lateral segments scarcely apparent and quite numerous above, acutely raised below, extending to

margin at almost a 90° angle, with the notable exception of one of lower primary veins on lateral segments only which extends obliquely to margin from midrib at 6 cm from base and is weakly to deeply sunken above and acutely raised below, closely resembling midrib; **tertiary veins** numerous, in part raised and concolorous on both surfaces. INFLORESCENCE. **Peduncle** 16.5 cm long, 1–2 mm diam., flattened, weakly and broadly sulcate; **spathe** 6 cm long, 9–11 mm wide, green; **spadix** green, 9 cm long, 4 mm wide, scarcely tapered to apex, bluntly rounded at apex. Flowers 6–7 visible per spiral, 4.3–4.5 mm long, 3.0–3.5 mm wide, dark brown and densely granular; lateral tepals 2.8–3.2, outer margin 2-sided to broadly rounded, inner margin rounded to broadly rounded.

Anthurium huacamayoense is known only from the type locality in Ecuador in the Cordillera del los Huacamayos in Napo Province between Cosanga and Narupa north of Archidona at 1,940–2,200 m elevation in *Premontane wet forest* and/or *Premontane rain forest*. The Cordillera de los Huacamayos is an isolated ridge with several other known endemic species.

The new species has been confused with both *A. triphyllum* and *A. arisaemoides*. It even resembles *A. cutucuense* owing to its elongate and narrow medial lobe. It differs from the latter in lacking the mottled petioles and quilted primary lateral veins of *A. cutucuense* and on the lateral segments it has one of the lower primary lateral veins extending obliquely to the margin. In *A. cutucuense* all the primary lateral veins are directed to the margin at about a 90° angle.

Anthurium huacamayoense differs from *A. arisaemoides* in having longer petioles, longer and proportionately narrower blade segments and falcate lateral segments as well as differing in having the primary lateral veins of the medial segment scarcely apparent and more numerous, directed at almost a 90° angle. In contrast the primary lateral veins of the medial segment on *A. arisaemoides* are 5–8 per side and departing midrib at a 30–40° angle.

Anthurium huacamayoense differs from *A. triphyllum* in having longer and proportionately narrower blade segments, falcate lateral segments, a medial lobe that is significantly longer than the lateral lobes, and unequal lateral lobes. It also differs in having the primary lateral veins of the medial segment scarcely apparent and more numerous, directed at almost a 90° angle. In contrast the primary lateral veins of the medial segment on *A. triphyllum* are 7–10 per side and departing midrib at a 45° angle.

The epithet for *Anthurium huacamayoense* comes from the type locality in Ecuador in the Cordillera del los Huacamayos in Napo Province, Ecuador, where it was first collected.

Anthurium moonenii Croat & Gonçalves, *Willdenowia* 35: 173–177, Fig. 1–2. Type: FRENCH GUIANA: Route de l'Est (#2), Cayenne–Regina, vic. pk 93, 00–150 m, 04°18'N, 52°10'W, *Croat & Moonen 74316* (holotype, MO-4343678; isotypes B, CAY, INPA, K, NY, P, US, U, UB). Figures 3a–d.

Appressed-climbing epiphyte; **stems** to 1 m long; roots dark green, spreading laterally, initially to 15 cm long; **internodes** much shorter than broad, 1.5–3.0 cm diam, dark green, semiglossy, the uppermost hidden by cataphylls; **cataphylls** to 14 cm long, persisting intact (splitting at base); **petioles** erect-spreading to spreading, terete, sometimes weakly and narrowly sulcate, medium green, semiglossy, 6–8 mm diam. midway, faintly striate but otherwise unmarked, 18–60 cm long, longer than the blades; **blade** simple when young, becoming deeply 3-lobed, pendent when young then spreading-pendent and arching, subcoriaceous, semiglossy, weakly bicolorous, lobes 18–56 cm long, 5–15.5 cm wide, acuminate at apex, median lobe acute at base; lateral segments unequal, obtuse on the outside, acute on the inside; **midrib** convex and concolorous (becoming narrower toward the apex) above; convex and yellow-green below; **primary lateral veins** 20–25 pairs,

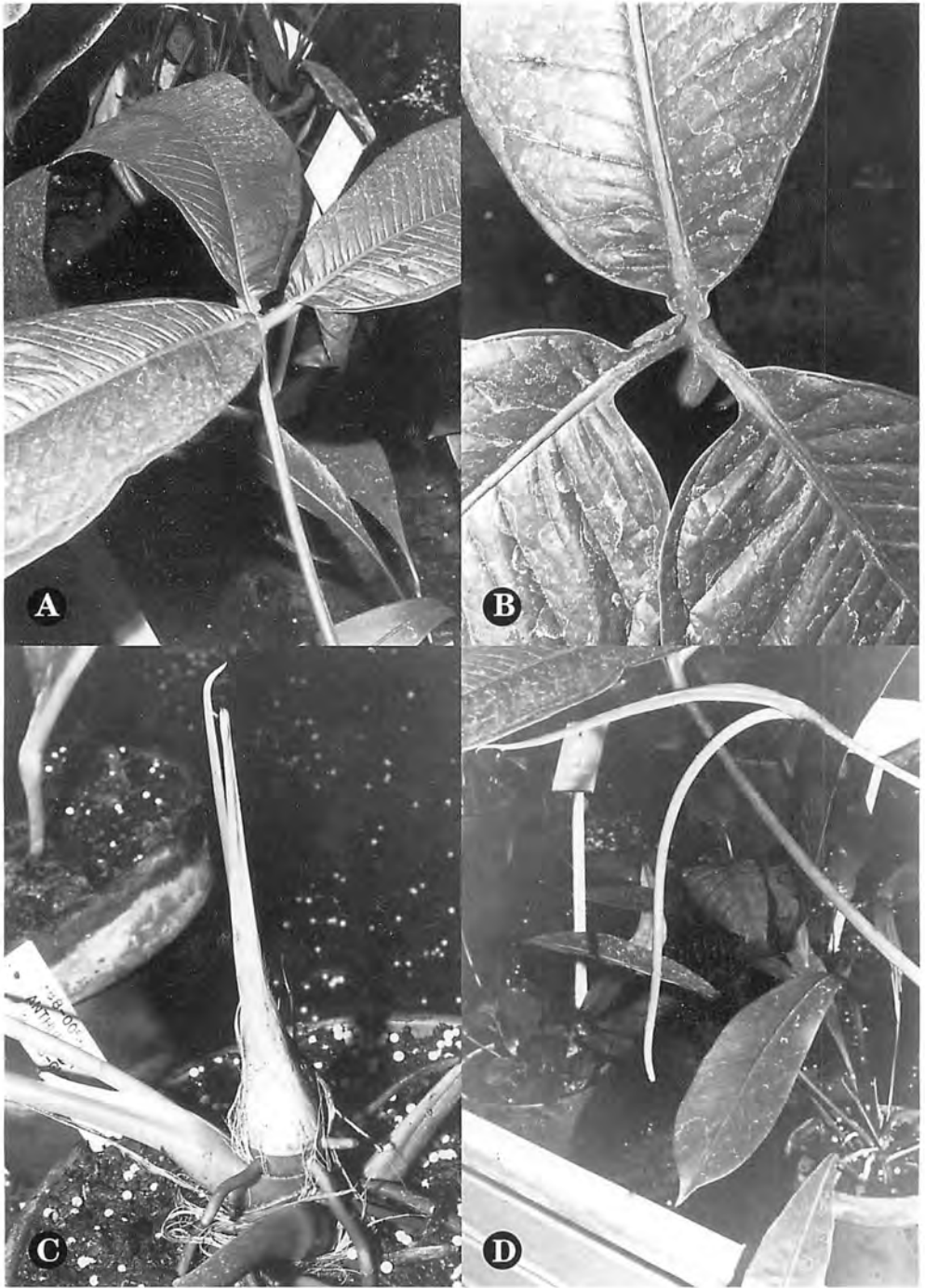


Fig. 3. a-d. *Anthurium moonenii* Croat. (Croat 74316). a. Habit. b. Blades adaxial surface, close-up. c. Stems showing fibrous cataphylls and petiole bases. d. Inflorescence with pendent spadix.

arising at 45–60° angle, quilted-sunken above, prominently pleated-raised below; interprimary and tertiary veins in part sunken above, prominently raised below, the petiolules erect-spreading, sharply sulcate, becoming prominently wavy on older plants. INFLORESCENCE pendent; **peduncle** 30–60 cm long, longer than the petioles, 5–7 mm diam., terete; **spathe** linear-lanceolate, 16–25 cm long, 7–10 mm diam. light green, directed at 180° to the peduncle, slightly arched near the base; **spadix** pale green, 28–60 cm long, 4–5 mm diam., barely tapered, pendent. Flowers 4-lobed, 2–3 × 2–3 mm, sigmoid; 5–6 flowers visible in the principal spiral, 5 flowers visible in the alternate spiral, lateral tepals .5–.7 mm wide, inner margin convex; pistils non-emergent; stigma ellipsoid, .4–.5 × .4 mm; stamens weakly exerted, filaments flattened, .3 × .2 mm, anthers covering the stigma, retrorse, thecae ovoid, .4–.5 mm long, .3 mm wide. tepals semiglossy. INFRACTESCENCE pendent; spathe green, linear-lanceolate, persistent in fruit; spadix to 70 cm long, 8–10 mm diam.; **berries** yellowish green, 6–7 mm long, 5–6 mm diam.

Antburium moonenii is endemic to French Guiana, occurring in and known only from primary forest at less than 200 m. In addition to the localities listed in the exsiccatae the species has been observed or collected by Mr. Joep Moonen along (1.) the Rte de l'Est, on the Compté River, one hour by powerboat above the Village Cacao, (2.) the Cascades River, one hour by powerboat above the CD5 Bridge, (3.) in the Kaw Mountains near the road to Fourgassie, (4.) along the Piste de Belizon at PK 30 (5.) on the Montagne Gabrielle, (6.) along the Crique Inéry, 5 km N. of Regina (collected by J. Moonen 20 Aug., 1987) and (7.) along the Route de Coralie. The entire area in which it has been seen in French Guiana is an area about 100 km long and 40 km wide.

The species is distinguished by its appressed-climbing habit, short internodes with persistent intact cataphylls (splitting at base), terete, semiglossy petioles weakly or not sulcate, deeply 3-lobed blades with

over 25 pairs of primary lateral veins, the heavily undulate-marginate petiolules and by the pendent inflorescence with a slender, elongate spadix. It is apparently closely related to *A. thrinax* Madison, which differs in growing on rocks with erect, free-standing stems, fewer primary lateral veins (up to 14) which are merely etched on the upper surface and moderately inconspicuous (versus more or less quilted-sunken on *A. moonenii*). In addition the midrib on the latter is convex on both surfaces, whereas in *A. thrinax* the upper midrib is narrowly & acutely raised above and more or less quadrangular below with acute margins. Another difference is that the inflorescence of *A. thrinax* is erect and bluish green (matte) whereas in *A. moonenii* the inflorescence is pendent and greenish.

The species is named in honor of Mr. Joep Moonen, naturalist and tour guide in French Guiana who first brought the species to the attention of the senior author and who has collected the living material from which the type specimens were prepared. The species is in cultivation both at the Missouri Botanical Garden and at the Emerald Jungle Village residence of Mr. Moonen.

Antburium thrinax Madison, *Selbyana*, 2:249. 1978. Type: Guyana. Upper Mazaruni River Basin, Mt. Ayan-ganna, mixed evergreen forest on tallus from cliffs along NE side, 800–900 m, Aug. 1960, S. Tillet, C. Tillet, & R. Boyan 45665 (holotype NY). Figures 4a–d.

Usually terrestrial among rocks, rarely epiphyte. Stems short, runners from stem with tuber-like swellings, often stilt-rooted; **internodes** 1–2 cm long, 8–18 mm diam., dark green, semiglossy; **cataphylls** persisting intact, semi-intact or withering to light brown fibers, soon deciduous. Leaves erect-spreading; **petioles** terete, sharply and narrowly flattened adaxially, obscurely and narrowly sulcate with faint medial-rib adaxially, 21–116 cm long, ca. 4 mm diam., 1–3 times longer than the blades; **blades**

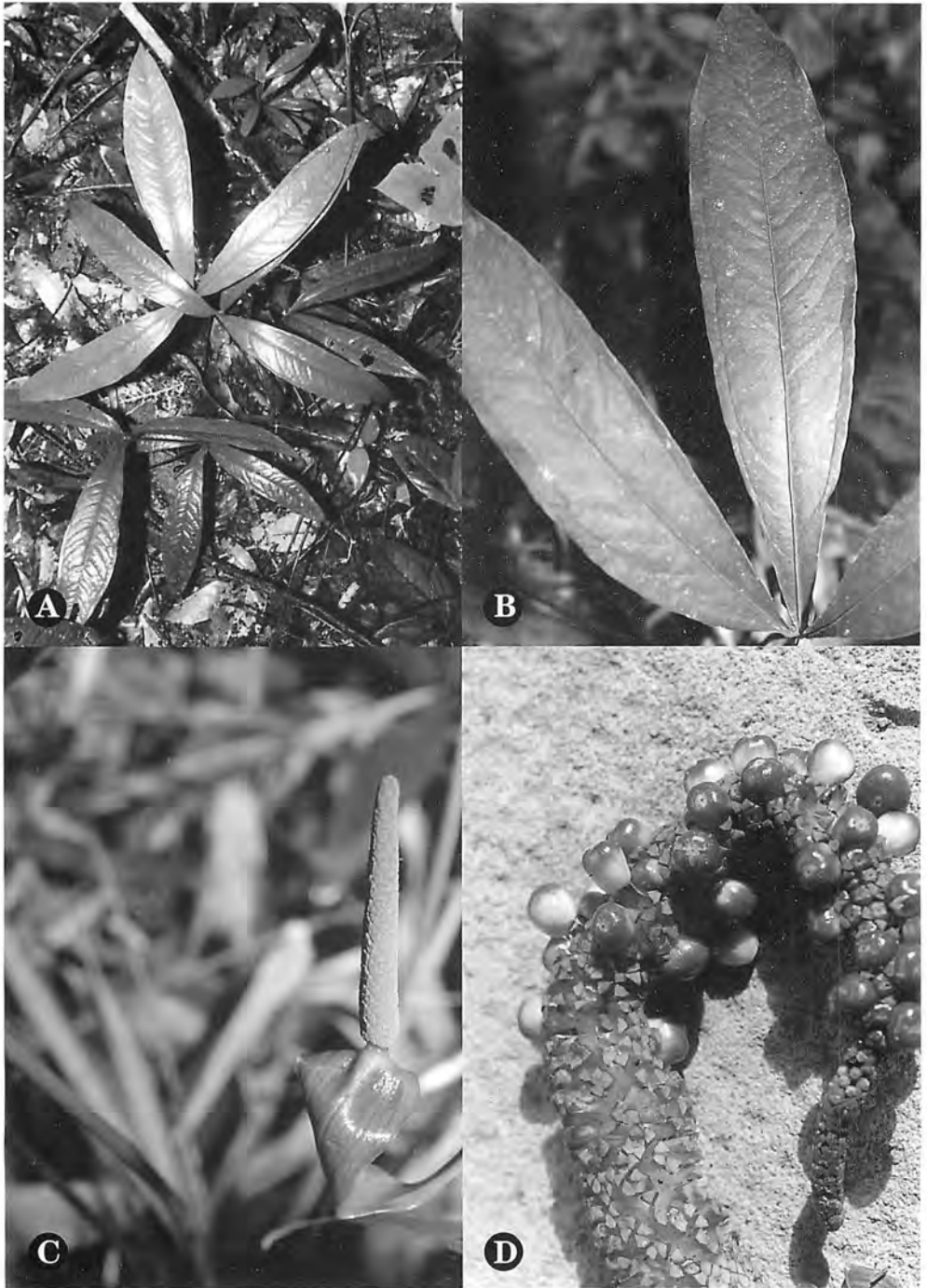


Fig. 4. a–d. *Anthurium thrinax* Madison. (Croat 74175). a. Habit. b. Blade adaxial surface. c. Inflorescence. d. Inflorescence.

20–57 cm long, 16–38 cm wide, thinly coriaceous, dark green and subvelvety above, slightly paler and matte below, **leaflets** trisect oblong-elliptic or rarely elliptic, acuminate at apex, attenuate to cuneate at base, 25–35 (44) cm long, 7–9 (15) cm wide, with margins undulate; midrib narrow-raised above, narrow-raised and paler below; **primary lateral veins** 10–14 per side, arising at 45–55° angle, loop-connected, forming collective vein usually arising from base, rarely from one of the lower primary lateral veins; **tertiary veins** weakly quilted-sunken above, weakly pleated-raised below; tertiary veins darker than surface; collective veins 6–11 mm from the margins. INFLORESCENCE erect with **peduncle** slender, terete, spreading and recurled, 16–85 cm long, 2.5 mm diam., medium green or purplish green; **spathe** green to purplish green, sometimes tinted red, purplish at base, linear-lanceolate, 5–10 cm long, 6–10 mm wide, erect-spreading, reflexed persistent; **spadix** 5–10 cm long, 4–6 mm diam., pale green, ochre yellow, or bluish green, matte, stipitate to ca. 1 cm or rarely sessile; tepals matte; pollen white. Flowers 6–7 visible per spiral, 3.6–3.7 mm long, 3.0–3.3 mm wide, drying tan, smooth with a short row of whitish cellular inclusions along the margins; lateral tepals 1.8–2.0 mm wide, outer margins 2-sided, inner margin rounded. INFRUCTESCENCE: **berries** purplish red, globose.

Anthurium thrinax is endemic to the Guianas at 550–900 m, known presently from French Guiana and Guyana but to be expected in Suriname.

The species is characterized by its long petioles and peduncles which may be longer than 1 m. Madison (1978) considered the species to be most closely related to *A. kunthii* Poeppig, a smaller species with 5-foliolate leaves. It differs greatly from the only other member of this group in the Guianas, namely *A. moonenii*, since that species has pendent blades with 20–25 pairs of quilted-sunken primary lateral veins arising at 45–60° angle, versus 10–14 pair of veins, arising at an angle of 45–55° for *A. thrinax*. In addition *A. moonenii* has

a pendent inflorescence with a pale green spadix 28–60 cm long in contrast to an erect spadix 5–10 cm long.

Additional specimens examined—FRENCH GUIANA. Haute Camopi–Mont Belvédère, forêt sur pente à 800 m à 9 l'ouest de la rivière, 7 Dec 1984, *Granville 7154* (CAY, MO); Montagnes de Kaw, caves of Kaw, along Route de Montagne Trésor, ca. 10 km E of Camp Caïmans, N of road ca. 5 km, 04°34'15"N, 52°10'00"W, 100 m, 20 Feb 1993, *Croat 74276* (MO); Saül and vicinity: Sentier Botanique, E of Eaux Claires, at one of the tributary streams of the St. Eloi River, 03°37'N, 53°12'W, 250 m, 1 Sep 1994, *S. Mori et al. 23752* (MO); Montagne Cacao, 400 m, 12 Dec 1994, *F. Billiet et al. 6544* (BR, CAY); Montagne de Kaw. Forêt sur cuirasses latéritiques, 04°33'N, 52°09'W, 13 Feb 1992, *G. Cremers 12721* (CAY, MO); La Combe river, Plaat KK 18, La Comté river, 1 Sep 1988, *F. Billiet 2292* (BR, MO); Saul, Vicinity of Saül, along headwaters of St. Eloi River, 03°37'N, 53°12'W, 350 m, 10 Feb 1993, *Croat 74175* (CAY, CDBI, CM, K, MO, NY, P, VEN); Saut Mapaou: Bassin de L'Approuague, 04°12'N, 52°18'W, 13 Feb 1992, *Cremers 12720* (CAY); Station des Nouragues, Station des Nouragues–Bassin de l'Approuague, Arataye, pied du ersant Sud-Est: Crique Roche, forêt de basse altitude, sur blocs de granite en bord de crique, 04°03'N, 52°42'W, 100 m, 4 Aug 1989, *J.J. de Granville et al. 11030* (CAY, MO). **CAYENNE**: Montagne de Kaw, 04°33'N, 52°09'W, 13 Feb 1992, *Cremers 1721* (CAY); Layon Montagne Prise d'Eau–Bassin de l'Approuague, Bas-fond dans une forêt de basse altitude, 04°28'N, 052°02'W, 11 July 1997, *V. Hequet 403* (CAY, MO); Mont Inéri–Bassin de l'Approuague, Mont Inéri–Bassin de l'Approuague, 04°22'N, 052°10'W, 300 m, 9 Sep 1997, *G. Cremers et al. 15368* (CAY, MO); Montage de Kaw, 04°33'N, 52°09'W, 40 m, 20 Oct 1991, *G. Cremers & C. Feuillet 12423* (MO); Montagne de Kaw, chemin allant du Camp Caïman vers le Degrad Lalanne, a 3 km du Camp Caïman: abords de la Crique Maïpouri, 13 June 1979, *Granville 2969* (CAY,

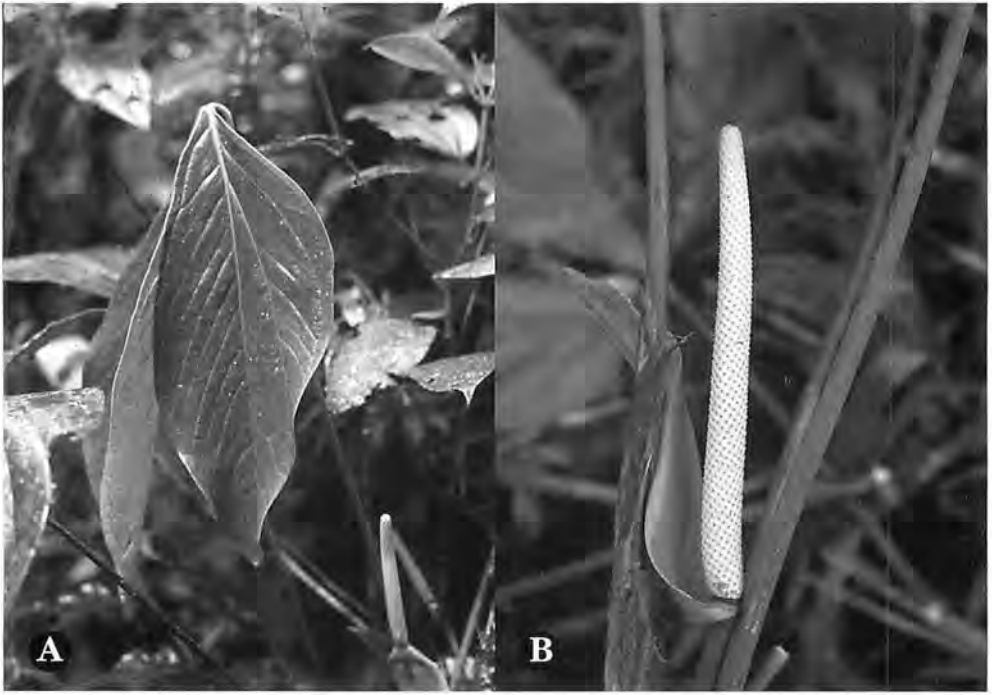


Fig. 5. a–b. *Anthurium triphyllum* (Willd. ex Schult.) Brongn. ex Schott. a. Habit. (Croat 50549). b. Inflorescence. (Croat 50781).

MO). **Saint-Laurent-du-Maroni**: Montagne Bellevue de l'Inini, zone centrale, versant sous le vent, forêt ripicole au bord d'une crique, 550 m, 27 Aug 1985, *Granville et al.* 7844 (CAY, MO). GUYANA: Cuyuni–Mazaruni Region: Foothills immediately S of Mt. Ayanganna; +/- 1 km W of Pong Creek, Dominants: Inga, Dicymbe, and Swartzia, 05°28'N, 60°04'W, 550–600 m, 26 Feb 1987, *J.J. Pipoly et al.* 10637 (NY, US, FDG); Potaro River: Eagle Mt., 25 Jan. 1943, *Forestry Dept. of British Guiana* 3861 (K, MO).

Anthurium triphyllum (Willd. ex Schult.) Brongn. ex Schott, *Prodr. Syst. Aroid.* 548. 1860. Type: BOLIVIA: Yungas, 1,000–2,000 m, *d'Orbigny* 412 (holotype, P). Figures 5a, 5b.

Anthurium pastazae Sodiro, *Revista Chilena Hist. Nat* 9: 278. 1905. Type: Ecuador.

Anthurium neblina G.S. Bunting, *Acta Bot. Venez.* 10(1–4): 273. 1975. Type: Venezuela.

Epiphytic (occasionally hemiepiphytic) or terrestrial; **stems** to 1 m long, 1.5–3 cm diam.; **internodes** elongate to 10 cm long, .6–4 cm diam., medium to dark green, matte to semiglossy; **cataphylls** 18–30 cm long, 6–10 mm diam., soft, pale to dark green, coriaceous, marcescent, matte-subvelvety, unribbed or sharply 1-ribbed, mostly deciduous, only pale fibers persisting semi-intact at nodes or as few, pale, fine fibers at base. LEAVES with **petioles** 27–83 cm long (averaging 53 cm), finely ribbed, subterete to terete, obtusely and narrowly sulcate, slightly thicker than broad, medium to dark green, purplish violet tinged, matte to weakly glossy to semiglossy, weakly flattened at times adaxially, 1–2 faint ribs abaxially, obscurely sulcate on geniculum; **geniculum** pale green, very swollen; **blades** trisect with medial lobes slightly longer and wider than lateral lobes, 15–56 cm long, 15–65.9 cm wide (averaging 35.8 × 42 cm), approximately .85 times as long as wide, .5–1.0 times longer than petiole but

averaging .7 times as long as petiole, subcoriaceous, dark green and semiglossy to glossy (occasionally matte) above, moderately paler, weakly to moderately bicolorous and semiglossy below; **medial lobes** ovate-elliptic, acute to cuspidate at apex, acute at base, broadest at the middle, 15–56 cm long, 5.2–23.5 cm wide (averaging 36×13 cm); **lateral lobes** ovate-elliptic falcate, ranging from bluntly acute to occasionally cuspidate at apex, acute at base, broadest at the middle, nearly equal, 16–46 cm long, 5.2–19 cm wide (averaging 32×11 cm); **midrib** weakly sunken and concolorous above, raised convexly and darker below; **primary lateral veins** 7–10 per side, on medial lobe departing midrib at approx. 45° angle, weakly sunken and concolorous above, bluntly raised and darker below, on lateral lobes first 2–3 veins extend to margin, remaining veins extend to collective vein which approaches margin as it approaches apex; **interprimary veins** etched and concolorous above, weakly raised below; **tertiary veins** partly conspicuous above, weakly raised below; collective vein arises in bottom third of lobe and approaches the margin as it approaches the apex of the lobe. INFLORESCENCE erect; **peduncle** 8.5–41 cm long (averaging 23.9 cm), half as long as petiole, terete, medium green (sometimes purplish violet), matte to matte-subglistening, weakly sulcate adaxially toward apex; **spathe** 4.7–17.5 cm long (averaging 11.4 cm), .7–4 cm wide (averaging 2.0 cm), medium green, turning brownish in fruit, brittle, cylindroid, matte to weakly glossy on both surfaces, reflexed-spreading and twisted, incurled along margins; **spadix** 4.5–26.5 cm long (averaging 14.4 cm), .4–2 cm wide (averaging 1 cm), greenish-white, pale yellow-green, pale to dark green, dark gray-green or olive-green, matte to semiglossy, sometimes yellow-green to green toward apex and creamy white toward base. Flowers 6–8 visible per spiral, 2.5–3.0 mm long, 2.0–2.3 mm wide, lateral tepals 1.2–1.4 mm wide, drying brown, minutely granular outer margin 2–3 sided, inner margin rounded. INFRUCTESCENCE with **tepals** brown and semiglossy; **pistils** green,

promptly emergent; **stamens** prominently exerted, exerted at anthesis, whitish; **pollen** pale yellow; **fruits** medium green, immature, early protruding, acute at apex.

Anthurium triphyllum ranges in Bolivia (Cochabamba, La Paz), Ecuador (Morona-Santiago, Napo, Pastaza, Tungurahua, Zamora-Chinchi), Peru (Amazonas, Cajamarca, Cusco, Huanuco, Loreto, Madre de Dios, Pasco, San Martín, Venezuela (Amazonas) at elevations of 150 to 3,100 meters in *Tropical moist forest*, *Premontane moist forest*, *Premontane wet forest*, and *Lower montane moist forest*.

The species is recognized by its triset blades with all segments ovate-elliptic, broadest at the middle and attenuated at the base, by a peduncle approximately half as long as the petiole and by a creamy white to green spadix. The medial lobes are characterized by 7–10 primary veins that depart the midrib at a 45° angle and a collective vein that arises in the bottom third of lobe and runs along margin at inset of 1–4 mm. The lateral lobes have primary lateral veins that initially depart midrib at 90° angle, then sweep more and more upward until the final primary vein is nearly parallel to midrib.

The species is most easily confused with *Anthurium arisaemoides* which is a smaller, usually terrestrial plant. The main distinction appears to be the spadix which is smaller (3–9 cm in *A. arisaemoides* vs. 4.5–26.5 cm in *A. triphyllum*) and often pink to purplish on *A. arisaemoides*. A further distinction is that the lateral lobes of *A. triphyllum* are markedly inequilateral.

Additional specimens examined—BOLIVIA. **Cochabamba**: Arani, El Limbo, ladera con exposición sud de hasta 35° de pendiente, $17^\circ 08' 38''$ S, $65^\circ 37' 44''$ W, 2,180 m, 14 June 2003, *Altamirano et al.* 893 (MO); Carrasco, 130 km antigua carretera Cochabamba–Villa Tunari, $17^\circ 07'$ S, $65^\circ 36'$ W, 2,000 m, 10 July 1996, *M. Kessler et al.* 7160 (CM, LPB, MO); Chapare, Cochabamba–Villa Tunari in vicinity of Hotel Caballeros at Km 95 from Cochabamba, $17^\circ 05'$ S, $65^\circ 35'$ W, 21 Nov 1980, *Croat 51324* (MO); Kuriroma, heptet au

Stamin bei San Onofre, 1,700 m, 21 Feb 1929, *Steinbach 9279* (MO); Territorio Indígena Parque Nacional Isiboro–Secure, Mosetenez, crest above Laguna Carachupa, 16°14'S, 66°25'W, 1,550 m, 2 Sep 2003, *M. Kessler et al. 13213* (MO); Tiraque, Limbo, 20 m de altura del dosel, 17°07'23"S, 65°34'27"W, 1,706 m, 28 Oct–7 Nov 2003, *N. Altamirano & Huaranca 458* (MO). **La Paz:** Abel Iturralde, Apolo–San José de Uchupiamonas, Parque Nacional Madidi, Comunidad Mamacona, trail to Apolo and San José de Uchupiamonas, 1 km down to Río Mamacona, 14°27'02"S, 68°11'47"W, 1,626 m, 7 Aug 2002, *Maldonado et al. 2622* (MO, UB); *Maldonado et al. 2622* (LPB, MO); Franz Tamayo, Madidi, Apolo Chiriuno, Parque Nacional Madidi, Quebrada Jatun Chiriuno, 31 km in a straight line E of Apolo by trail to San José de Uchupiamonas, 14°30'00"S, 68°13'58"W, 1,850–1,950 m, 26 June 2002, *A. Fuentes et al. 4579* (LPB, MO, UB); *A. Fuentes et al. 4606* (LPB); Parque Nacional Madidi, Piñalito (Parcela Permanente), 30 km straight E of Apolo by trail to San José de Uchupiamonas, 14°30'00"S, 68°13'58"W, 1,850–2,020 m, 4 July 2002, *Bascopé 232* (LPB, MO); Parque Nacional Madidi, Lagunillas, Tokoake–Carjata, 14°36'56"S, 68°56'51"W, 2,097 m, 28 June 2005, *A. Fuentes et al. 8938* (LPB, MO); Muñecas, Madidi, Marumpampa, 15°14'03"S, 68°38'50"W, 2,100 m, 22 Apr 2005, *A. Fuentes et al. 7178* (MO, LPB, MO); Nor Yungas, 13.7 km NW of San Pedro on road Incahuara–Mejillones and along trail to 12 de Octubre, 15°58'S, 67°37'W, 1,500 m, 15–16 Jan 1983, *Solomon 9280* (MO); 13.7 km NW of San Pedro on road Incahuara–Mejillones, along trail to 12 de Octubre, 15°58'S, 67°37'W, 1,500 m, 12–14 Feb 1983, *Solomon 9603* (MO); 10 km, Chuspipata–Coroico, 16°24'S, 67°47'W, 2,500 m, 19 Sep 1997, *Kessler et al. 12136* (MO); Unduavi–Caranavi, 34.8 km E of Unduavi, 16.3 km SW of Yolosa, 16°25'S, 67°46'W, 2,980 m, 27 Nov 1980, *Croat 51580* (GOET, MO); Estación Biológica de Tunquini, 16°12'S, 67°53'W, 2,000 m, 25 July 2000, *E. Garcia et al. 4407* (MO, LPB); Yungas: Sacramento, Chuspipata–Yolosa, 16°18'S, 67°48'W, 2,360–2,400 m, 5 Oct

1985, *Gentry & Solomon 52105* (MO); 4.6 km below Yolosa, 19.1 km on road up the Río Huarinilla, 16°12'S, 67°53'W, 1,700 m, 12 Nov 1982, *Solomon 8818* (MO); 12.8 km NE of Chuspipata, trail to Yolosa, 16°16'S, 67°47'W, 2,200 m, 26 May 1988, *Solomon 18377* (MO). ECUADOR. Mission Shandia, Jatun Yaku River, 3,100 m, 14 Aug 1957, *H. G. Barclay 4874* (COL, MO); *Anonymous s.n.* (MO). **Morona-Santiago:** Mendez–Morona, 03°00'S, 78°10'W, 650 m, 16 Aug 1989, *van der Werff & Gudiño 11116* (MO); Bomboiza, Centro Tiink, 07 Aug 1985, *Jimpikit 2012* (NY); 6 km E of Limon on road to La Union, 1,300 m, 23 Apr 1985, *Harling & Andersson 24491* (GB); 800 m, *Madison 2629* (SEL); 31 km N of Yangzatta, 03°55'S, 78°46'W, 1,000 m, 19 Oct 1981, *Croat 50781* (MO); Limón (Gen. Plaza Gutiérrez)–Gualaceo, 1.2 km N of Limón, 02°58'36"S, 78°26'24"W, 1,211 m, 11 Aug 2002, *Croat et al. 86483* (HUA, MO, QCNE); Macas–Riobamba, Proaño–Parque Nacional Sangay, 28.6 km W of Proaño, 02°14'31"S, 78°16'40"W, 1,659 m, 13 Aug 2002, *Croat et al. 86532* (MO); Gualaquiza–Indanza, 8.1 km N of Tucumbatza, 50 km S of Indanza, 03°12'50"S, 78°33'39"W, 1,400 m, 8 Sep 2002, *Croat 87260* (LE, MEXU, MO, Z); Vic. Huamboya, 10.5 km W of Puyo–Macas Rd. (Hwy. 45), 6.6 km N of Río Chiguaza, 01°36'56"S, 77°59'23"W, 1,015 m, 24 Aug 2002, *Croat & L. Hannon 86922* (MO); Palora–Yushin, 3.8 km E of main Palora–San Vicente de Tarqui Road, 00°40'57"S, 78°01'33"W, 895 m, 25 August 2002, *Croat & L. Hannon 86998* (MO); Méndez–Paute, 43.7 km W of Méndez, 02°36'36"S, 78°28'12"W, 1,551 m, 12 July 2004, *Croat, L. Hannon, Walbert & Jua 90937* (MO); Cordillera de Cutucú, 1,100 m, 11 July 1977, *Madison 4117* (MO); On path Nueva Tarqui–La Florida, 1,219 m, 13 Dec 1979, *S. Thompson 327* (MO); Environs of Santa Susana de Chiviaza, 1,200 m, 1 March 1993, *Harling & Stahl 26833* (S); Santa Susana de Chiviaza and Caserios El Panecillo and Las Orquideas, 6–7 km N of Chiviaza, 1,300–1,400 m, 3 Mar 1993, *Harling 26905* (S); Gualaquiza, Cordillera del Cóndor, Cuangos, 20 km east

of Gualaquiza, near disputed Peru–Ecuador border, 03°29'S, 78°14'W, 1,500–1,600 m, 17 July 1993, *Gentry 80024* (MO, QCNE); Cordillera del Cóndor, Valle del Río Quimi, Orillas del Río Quimi, 03°30'24"S, 78°25'35"W, 1,090 m, 13 Dec 2000, *Cuas-cota & Post-Grado MO-QCNE 286* (QCNE, MO); Limon Indanza, Cordillera del Cóndor, Trail from Shuar village, Warints, towards crest of Cordillera del Cóndor, ca. 10–15 km S/SE of Warints, 03°13'S, 78°15'W, 830–1,200 m, 17 Dec 2002, *Clark 7072* (MO, QCNE, US); Morona, Mendez–Morona, 650 m, 16 Aug 1989, *van der Werff 11116* (MO); Tiwintza, Cordillera de Cutucú, N of Río Santiago, Centro Shuar Yamahas, 03°00'31"S, 78°04'09"W, 380 m, 28 Oct 2005, *C. Morales & group Shear de conservation 1442* (MO, QCNE); **Napo:** Villa no, near Recur Lacto, 00°54'S, 77°45'W, 02 Aug 1990, *Bennett et al. 4403* (NY); Cantón El Chaco, Río Granadilla, Campmate de INECEL, "Coda Alto", 00°08'S, 77°28'W, 1,300 m, 13–15 Sep 1990, *Palacios 5516* (MO); Humane Centro Callahan Yak, 31 km E of Tena–Baeza Road, on new road to Coca, 00°40'S, 77°40'W, 1,150 m, 24 Dec 1988, *Gentry et al. 64115* (MO); Km 2, Cotundo–Coca, 1,130 m, 05 Aug 1984, *Dodson et al. 15060* (MO); Cantón Loreto, Parroquia San Vicente de Huaticocha, Comunidad Santa Rosa de Arapino, Bloque 19 Triton, Pozo Santa Rosa, 00°58'S, 77°40'W, 600 m, 15 Aug 1997, *E. Freire et al. 2279* (MO, QCNE); Narupa–Coca, 4.5 km E of main Baeza–Archidona, 00°43'52"S, 77°45'35"W, 1,189 m, 19 Apr 2003, *Croat et al. 87808* (MO); 4 km S of Puerto Napo en el Río Napo, 500 m, 4 Aug 1984, *Dodson et al. 14943* (MO); Cantón Loreto, Parroquia San Vicente de Huaticocha, Comunidad Santa Rosa de Arapino, Bloque 19 Triton, Pozo Santa Rosa, 00°58'S, 77°40'W, 600 m, 15 Aug 1997, *E. Freire et al. 2279* (GB, MO, QCNE); Jatun Sacha, Estación Biológica Jatun Sacha, 01°04'S, 77°36'W, 450 m, 24 Aug 1988, *C. Cerón & M. Cerón 4618* (MO); Reserva Biológica Jatun Sacha, Río Napo, 8.0 km N of Misahuallí, 01°04'S, 77°36'W, 450 m, 17 Jan–06 Feb 1987, *C. Cerón 563* (MO); Estación Biológica Jatun Sacha, 8 km

de Puerto Misahuallí, 01°04'S, 77°37'W, 450 m, 07–16 Sep 1988, *Palacios 3008* (MO); 8 km río N of Misahuallí, 01°08'S, 77°30'W, 450 m, 02 Oct 1986, *Palacios 1311* (MO); Río Cenepa, Jatun Sacha Biological Station, 8 km E of Misahuallí, 01°04'S, 77°36'W, 450 m, 30 Dec 1987, *Gentry et al. 60225* (MO); Sumaco, Carretera Hollín–Loreto, Km 25, Centro Challuayacu, trail to Guagua Sumaco, 00°43'S, 77°40'W, 1,230 m, 10–19 Nov 1988, *Hurtado & Alvarado 1111* (MO); Carretera Hollín–Loreto, Km 40–50, vic. Comunidad Huamaní and Río Pucuno, 00°43'S, 77°36'W, 1,200 m, 10–22 Oct 1988, *Hurtado 603* (MO); Hollín–Loreto, Km 25, Centro Challuayacu, trail to Guagua Sumaco, 00°43'S, 77°40'W, 1,230 m, 10 Nov 1988, *Hurtado & Alvarado 1137* (MO); 3 km E of Caserío de Huamaní, N of Hollín–Loreto Road, 00°43'S, 77°36'W, 1,200 m, 17 Sep 1988, *Hurtado & Alvarado 398* (MO); Hollín–Loreto, Km 40–50, vic. of Comunidad Huamaní and Río Pucuno, 00°43'S, 77°36'W, 1,200 m, 10–22 Oct 1988, *Hurtado 634* (MO); Cantón Archidona, Hollín–Loreto, Km 25, slopes of Volcán Sumaco, Comunidad Challua Yacu, 00°43'S, 77°36'W, 1,100 m, 17 Dec 1988, *Hurtado 1172* (MO); Hollín–Loreto, Km 40–50, vic. of Comunidad Huamaní and Río Pucuno, 00°43'S, 77°36'W, 1,200 m, 10–22 Oct 1988, *Hurtado 682* (MO); Hollín–Loreto, Km 25, Centro Challuayacu, En trocha hacia la zona del Guagua Sumaco, 00°43'S, 77°40'W, 1,230 m, 10–19 Nov 1988, *Hurtado & Alvarado 1008* (MO); *Hurtado & Alvarado 901* (MO); Hollín–Loreto, Km 40–50, vic. Comunidad Huamaní and Río Pucuno, 00°43'S, 77°36'W, 1,200 m, 10–22 Oct 1988, *Hurtado 704* (MO); Hollín–Loreto, Km 25, Centro Challuayacu, trail to Guagua Sumaco, 00°43'S, 77°40'W, 1,230 m, 10–19 Nov 1988, *Hurtado & Alvarado 1029* (MO); Cantón Archidona, Hollín–Loreto, Km 25, Volcán Sumaco, Comunidad Challua Yacu, 00°43'S, 77°36'W, 1,100 m, 17 Dec 1988, *Hurtado 1241* (MO); Hollín–Loreto, Km 25, Centro Challuayacu, 00°43'S, 77°40'W, 1,230 m, 10–19 Nov 1988, *Hurtado & Alvarado 1034* (MO); *Hurtado & Alvarado 1038* (MO); 00°43'S, 77°36'W, 1,100 m, 27

Dec 1988, *Hurtado et al. 1258* (MO); Hollín-Loreto, Km 25, Centro Challuayacu, 00°43'S, 77°40'W, 1,230 m, 10–19 Nov 1988, *Hurtado & Alvarado 1055* (MO); Hollín-Loreto-Coca, Comunidad Chaluayacu, Km 25, 00°45'S, 77°40'W, 1,200 m, 23 Dec 1988, *C. Cerón et al. 5751* (MO); Cotundo-Coca, 15 km E of Baeza-Tena Road, slopes of Volcán Sumaco, 00°40'S, 77°40'W, 1,300 m, 13 Feb 1987, *Neill & Palacios 7633* (MO); Hollín-Loreto, Río Guamani-Río Pucuno, Km 40, 1,200 m, 12 Dec 1987, *Palacios 2237* (MO); Cotundo-Coca 15 km E of la carretera Baeza-Tena, Faldas del Volcán Sumaco, 00°40'S, 77°40'W, 1,300 m, 13 Feb 1987, *Palacios & Neill 1576* (MO); Archidona, Coca-Baeza-Tena, via Loreto and Hollín; 6.7 km W of Río Pucuno, 20 km W of Loreto, 0°48'S, 77°30'W, 1,130 m, 02 Mar 1992, *Croat 72647* (MO); Comunidad de Pacto Sumaco, Sector Suroriental, 00°38'56"S, 77°35'49"W, 1,550–1,600 m, 27 Apr 1997, *A. Alvarez et al. 2051*; Comunidad de Mushullacta, 00°49'39"S, 77°33'47"W, 1,200 m, 25 Feb 2003, *N. Altamirano 211* (MO, QCNE); Tena, Campococha-Chontapunta, 00°55'S, 77°25'W, 300–500 m, 23 Aug 1997, *Nuñez & Tapuy 641* (MO, QCNE); Jatun Sacha: Estación Biológica Jatun Sacha; along S bank of Río Napo, 8 km E of Puerto Misahualii, 01°04'S, 77°36'W, 450 m, 02 Apr 1992, *Croat 73394* (MO, S); Pastaza, Puyo-Macas (under construction), 31 km from Puyo, 01°37'S, 77°50'W, 1,100 m, 31 Aug 1976, *Ølgaard & Balslev 9041* (AAU, MO); Tnte. H. Ortiz, 18 km from Puyo on road to Tena, 01°23'S, 77°57'W, 1,100 m, 03 Sep 1976, *Ølgaard & Balslev 9215* (AAU); Hacienda San Antonio de Barón von Humboldt, 2 km NE of Mera, 01°27'S, 78°06'W, 1,100 m, 27 Feb–20 Mar 1985, *Zaruma et al. 2* (MO); *Sodiño s.n.* (B: photo F, US); Puyo-Baños, vic. Shell, less than 1 km N of village, 01°29'39"S, 78°03'52"W, 1,096 m, 15 Aug 2002, *Croat et al. 86609* (MO); Vic. Shell, Km .8 on road N to Río Alpayacu, 01°28'42"S, 78°04'53"W, 1,121 m, 9 May 2003, *Croat et al. 88922* (MO); Puyo-Macas at Km 19 (SE of Puyo), 01°37'S, 77°53'W, 1,200 m, 9 Oct 1980, *Croat 50549* (MO); Mera-Río Anzu and beyond, 3.6 km N of Río Anzu, 01°24'24"S, 78°28'21"W, 2,016 m, 7 July 2004, *Croat et al. 90501* (MO); Colonia 24 de Mayo, side road to road Puyo-Puerto-Napo, ca. 18–20 km from Puyo, 13 Sep 1968, *H. Lugo 437* (MO); Río Cayabe, Mera-Río Topo, 1,100 m, 17 July 1967, *Sparre 17646* (MO); 5 km W of Río Negro, 1,500 m, 8 Jan 1962, *Dodson & Thien 1948* (MO); Mera, 1,100 m, 27 Feb 1972, *Harling 11079* (MO); 1,100 m, 25 May–6 June 1968, *Harling et al. 9784* (MO). **Pastaza:** Canelos, SE of Puyo on Río Bobonaza, 01°36'S, 77°44'30"W, 550 m, 15–23 Nov 1958, *Harling 3330* (MO, S); Pozo petrolero "Moretecocha" de ARCO, 75 km E of Puyo, 01°34'S, 77°25'W, 580 m, 4–21 Oct 1990, *Gudiño et al. 988* (MO); Colonia La Independencia, 30 km E of Puyo, 01°22'S, 77°45'W, 1,000 m, 6 Sep 1997, *Neill et al. 10923* (MO, QCNE); Parroquia Simón Bolívar, Los Vencedores, E. E. Pastaza, 01°38'S, 77°53'W, 1,040 m, 13 Apr 1996, *Caranqui & Cariajano 96* (CHEP). **Tungurahua:** Baños-Mera, 35 km from Baños, along line from Television Plant to antenna (along Río Cashaurco), 01°25'S, 78°10'W, 1,450–1,550 m, 04 Sep 1976, *Ølgaard & Balslev 9294* (AAU); Río Negro-La Estancia and Parque Nacional Sangay, 1.8 Km S of bridge over Río Pastaza, 01°25'24"S, 78°13'01"W, 1,335 m, 4 May 2003, *Croat et al. 88509* (MO); Río Negro, in rastrojo, 1,250 m, *Asplund 18625* (MO); Valley of Río Pastaza, Río Zuña forest, *Asplund 10024* (MO); Banos, Los Llanganates, Colonia México, 18 Km from Topo, 01°21'S, 78°18'W, 1,800–2,000 m, 9 Mar 1995, *H. Vargas & Sandoval 376* (QCNE, MO). **Zamora-Chinchipec:** trail above N bank of Río Zamora, ca. 25 km E of Loja on new road to Zamora, 2,092–2,125 m, 11 July 1989, *Dorr & Valdespino 6613* (NY, QCA); Vic. El Pangui, hills west of town, 03°40'S, 78°37'W, 1,200 m, 7 Sep 2002, *Croat 87184* (MO); Zamora-Romerillos, 13.3 km E of bridge over Río Bombuscaro at Zamora, .4 km N of Pituca along river, 04°08'02"S, 78°56'31"W, 975 m, 30 May 2003, *Croat & Menke 89794* (MO, QAP); Río Nangaritzza, Destacamento Militar de Miasi, 04°20'S, 78°40'W, 950 m, 22 Oct 1991, *J. Jaramillo 14320* (NY); Area of Estación Científica San Francisco, Loja-Zamora, ca. 35 km from Loja,

above Sabanilla village, 03°58'S, 79°04'W, 1,990 m, 07 Feb 2005, *Werner 1476* (MO); Cordillera del Cóndor, Campamento Pachicutza along Río Nangaritzza, lower part of trail to El Hito, 04°07'S, 78°37'W, 900–1,200 m, 22 Feb 1994, *van der Werff & E. Freire 13346*; Río Nangaritzza, trail from Shaime to Mariposa, Río Nangaritzza, 920 m, 21 Nov 1996, *Van den Eynden et al. 846* (MO); Río Nangaritzza, centro Shuar Shayme, 04°19'05"S, 78°40'08"W, 930 m, 12 Apr 1996, *Van den Eynden et al. 668* (MO); Los Encuentros–El Sarsa, 4.7 km E of Los Encuentros, 03°46'42"S, 78°38'32"W, 822 m, 26 May 2003, *Croat & Menke 89442* (MO); Los Encuentros–El Sarsa, Cordillera del Cóndor, 14.4 km SE of Los Encuentros, 03°47'44"S, 78°37'01"W, 1,188 m, 26 May 2003, *Croat & Menke 89484* (MO, Q); Namirez (22.3 km S of Yanzaza)–Nambija, 8.1 km S of San Carlos, 04°03'37"S, 78°47'25"W, 1,524 m, 28 May 2003, *Croat & Menke 89633* (MO); Along road from Quime Ferry crossing into Cordillera del Cóndor, 22 km above Río Zamora, in a southward direction, along creek at old military camouflage sheds, 03°37'46"S, 78°26'17"W, 1,489 m, 14 July 2004, *Croat et al. 91060* (MO); Along road from near Paquisha S to Las Orchideas and end of road on Río Nangaritzza via Guayzimi, beginning 15.9 km E of Zumbi and Río Zamora, then 49.6 km S at Las Orchideas, vic. of Las Orchideas, 04°13'44"S, 78°39'30"W, 877 m, 16 July 2004, *Croat et al. 91297* (GB, MO); Zamora–Romerillos along Río Jambué, 13.3 km E of Río Bombuscaro Bridge in Zamora, .3 km E of Pituca, 04°08'03"S, 78°56'37"W, 1,068 m, 21 July 2004, *Croat 91774* (GB, MO); Namiera–Nambija, along mining road, 10 km S of Namirez and Río Zamora, vic. of Nambija, along road to mine headquarters ca. 5 km long, just S of Nambija, 04°03'44"S, 78°47'29"W, 1,779 m, 23 Jul 2004, *Croat 92055* (MO); Vic. of mining camp at Río Tundaima, along road to military base El Cóndor, 03°37'31"S, 78°26'26"W, 1,000 m, 5 Nov 2004, *van der Werff et al. 19344* (MO); Podocarpus National Park, 1 km SW of Bombuscaro Visitor Centre, 6 km S of Zamora, 04°06'S, 78°57'W, 1,050 m, 20 Nov 2000, *Leimbeck & Windballe 417* (AAU, MO, QCA); Chinchipe,

Parque Nacional Podocarpus, La Esmeralda (Cooperativa San Francisco de Numbala Alto), 04°22'S, 79°03'W, 2,250 m, Jan 1994, *Palacios & Tirado 13051* (CM, MO, QCNE); Nangaritzza, Parroquia, Zurmi, Comunidad Centro Shaime (along Río Nangaritzza), forest 2–4 km NW of Centro Shaime, 04°04'S, 78°54'W, 1,000 m, 15 Dec 2001, *Clark & Terry 6534* (MO, QCA, QCNE, US); Shaimi, Alto Nangaritzza, 950 m, 6 Nov 2004, *Werner 1339* (MO); Cordillera del Cóndor, Shaime, Frente a destacamento Militar, Río Nangaritzza, 04°18'S, 78°43'W, 930 m, 27 Oct 1991, *Palacios et al. 8719* (MO); Pachicutza, trail to Hito, 04°07'S, 78°37'W, 900 m, 18 Oct 1991, *Palacios et al. 8253* (MO); Río Nangaritzza, Pachicutza, 04°07'S, 78°37'W, 900 m, 03 Dec 1990, *Palacios & Neill 6467* (MO); *Palacios & Neill 6494* (MO); Miazi, along Río Nangaritzza, 04°18'S, 78°40'W, 850 m, 29 Jul 1993, *Gentry 80663* (MO); Zamora, Cordillera de Nanguipa, along road to Cerro Colorado, ca. 6 km S of Nambija, 20 km SE of Zamora, 04°05'51"S, 78°47'43"W, 1,930 m, 19 Feb 2002, *Delinks 1369* (MO, QCNE); *Delinks 1390* (MO, QCNE); Palanda, Región de la Cordillera del Cóndor, sector sur Parroquia San Francisco de Vergel, Playones, Río Vergel, 04°43'01"S, 78°57'47"W, 1,800–2,100 m, 13 Mar 2005, *Quizhpe et al. 1027* (LOJA, MO). PERU. **Amazonas.** Bagua, Río Cenepa, Dtto. Imaza, Comunidad Aguaruna de Kusú–Listra, Cerro Apág, margen derecha Quebrada Kusú, 600–700 m, 17 Sep 1996, *C. Díaz et al. 8246* (MO, WU); *C. Díaz et al. 8253* (MO); Ca. 17 trail km E of La Peca in Serranía de Bagua, 1,850–1,900 m, 14 June 1978, *Gentry et al. 23005* (MO); Near O'Neill base camp, ca. 12 trail km E of La Peca in Serranía de Bagua, 1,650–1,800 m, 13 Jun 1978, *Gentry et al. 23035* (MO); Río Cenepa, La Peca, 20 km. (by trail) E of La Peca, 1,981 m, 12 Aug 1978, *Barbour 2856* (MO); Luya, Río Cenepa, Distrito Camporedondo, Tullanya, Pascana, La Laguna, Quebrada San Francisco, 06°06'33"S, 78°20'55"W, 2,120 m, 1 Dec 1996, *R. Vásquez & R. Rojas 21921* (MO); Cóndorcanqui, Cordillera del Cóndor, Puesto de Vigilancia 'Alfonso Ugarte' (PV3), Cabeceras del Río Comainas, tributario W of Río Cenepa, Cuchillo atrás del campamento, 03°53'35"S, 78°25'30"W, 1,200 m, 15 July

1994, *Beltrán & Foster 805* (MO, USM); Río Cenepa, Distrito El Cenepa, Comunidad de Tutino, 04°33'05"S, 78°12'54"W, 320 m, 19 July 1997, *R. Rojas et al. 0085* (MO); *R. Rojas et al. 0174* (MO); Distrito El Cenepa, Comunidad de Mamayaque, Cerro Sakeegaig, 04°34'58"S, 78°14'01"W, 1,010 m, 14 Feb 1997, *R. Vásquez et al. 22559* (MO); Río Cenepa, Cordillera del Cóndor, Puesto de Vigilancia Alfonso Ugarte (PV 3), cabeceras del Río Comainas, tributario W of Río Cenepe, 03°55'S, 78°25'W, 1,000–1,100 m, 20 July 1994, *Beltrán & Foster 1103* (MO).

Cajamarca. San Ignacio, Cordillera del Cóndor, Distrito San José de Lourdes, Santo Tomás, Nororiental del Marañón RENOM, 04°55'S, 78°50'W, 1,950–2,200 m, 31 Oct 1995, *Quipuscoa 404* (MO); Sr. José de Lourdes, 2,210 m, 28 Oct 1995, *C. Díaz & A. Torres 7795* (MEXU, MO, NY); Huarango, Nuevo Mundo–Caserío Gosen, 05°18'30"S, 78°44'00"W, 1,590 m, 18 July 1997, *J. Campos et al. 4166* (CM, F, MO); San José de Lourdes, Localidad Camaná, 05°00'00"S, 78°55'00"W, 2,000–2,200 m, 20 Mar 1997, *J. Campos & Corrales 3579* (MO); San José de Lourdes, Selva Andina, 04°59'22"S, 78°53'53"W, 2,020 m, 21 Nov 1999, *R. Vásquez & S. Flores 26289* (MO, QCNE); Huarango, Localidad de Pisaguas, 05°14'52"S, 78°38'23"W, 1,650 m, 10 Mar 2000, *J. Campos et al. 6551* (MO); San José de Lourdes, "Base del Cerro Picorana, restos de bosque andino y arbóreo", 04°59'25"S, 78°54'15"W, 2,050–2,160 m, 3 Dec 1998, *C. Díaz & S. Fernández 10200* (MO); San José de Lourdes, Buenos Aires, 05°04'38"S, 78°52'58"W, 1,880 m, 8 Nov 2000, *R. Vásquez et al. 26558* (MO); San José de Lourdes, Base del Cerro El Parco, 05°04'38"S, 78°53'30"W, 2,010 m, 11 Nov 2000, *R. Vásquez et al. 26657* (F, MO, UB); San Ignacio, San José de Lourdes, Selva Andina, Base del Cerro Picorana, 1,900–2,010 m, 26 Aug 1999, *C. Díaz et al. 10768* (F, MO).

Cusco. La Convención, Vilcabamba, Dist. Vilcabamba, Espiritupampa, 12°48'59"S, 73°09'06"W, 1,600 m, 26 July 2004, *G. Calatayud et al. 2711* (CUZ, MO, USM); Quispicanchis, Cadena, Camanti, near summit of Cerro Santa Ana, trail to the mine, 13°19'S, 70°51'W, 1,000–1,500 m, 11 Sep 1990, *Timaná 944* (MO); Maniri, Cerro

Camanti, along Quebrada Toquimayo, 13°17'S, 70°45'W, 720 m, 4 Sep 1990, *Timaná 890* (MO); Camanti, Maniri, along trail paralleling Río Maniri toward Quebrada Garrote, 13°17'S, 70°48'W, 720 m, 17 Oct 1990, *Timaná 1027* (MO).

Huanuco: Huamalies, Río Monzon, trail to Cueva de las Lechuzas, 700–800 m, 18 July 1948, *R. Ferreyra 4261* (NY, USM); Leoncio Prado, Tingo María–Pucallpa, 2.4 km N of San Isidro, 09°13'18"S, 75°49'40"W, 891 m, 3 June 1998, *Croat & Sizemore 81660* (CM, MO, USM).

Loreto: Maynas, Río Yubinetto, tributary of Río Putumayo, Bellavista, 01°00'S, 74°20'W, 150 m, 24 Feb 1978, *Haxaire 1796* (MO, P).

Madre de Dios: Pantiacolla, Serrania across Río Alto Madre de Dios from Shintuya, 480–840 m, 29 Oct 1979, *Gentry et al. 27327* (MO); Manu, Atalaya, Vic. Hacienda Amazonia, 2–3 km W of village, across Río Alto Madre, 12°55'S, 71°12'W, 600–900 m, 7 Dec 1983, *Foster & Wachter 7251* (MO, USM).

Pasco: Oxapampa, Road in construction–Villa Rica; Km 7, 10°37'S, 75°20'W, 2,100 m, 4 Jan 1984, *Foster et al. 7792* (MO, USM); Gran Pajonal, vic. of Chequitavo, 10°45'S, 74°23'W, 1,250 m, 23 Sep 1983, *D. Smith 5183* (MO, USM); Chontabamba, Distrito Chontabamba, road to the Swiss mine, 10°33'S, 75°27'W, 2,211 m, 4 Apr 2003, *Lingan et al. 380* (MO, USM); Oxapampa, Distrito Oxapampa, vic. Parque Nacional Yanachaga–Chemillen (Sector San Alberto), Bajada del Refugio el Cedro, 10°32'S, 75°21'W, 2,400 m, 25 Mar 2003, *Lingan & Opisso 358* (MO, USM); Palcazu, Distrito Palcazu, Estación Biológica Paujil, Trocha a la colpa, 00°19'S, 75°15'W, 380 m, 14 May 2003, *Lingan et al. 510* (HOXA, USM, MO); Distrito Palcazu, Estación Biológica Paujil, Río Palcazu, Trocha al hito, 10°19'S, 75°15'W, 373 m, 20 May 2003, *Lingan et al. 561* (HOXA, USM, MO); Villa Rica, Distrito Villa Rica, Sector Union–Shimaki, Bosque de Protección San Matias–San Carlos, trail to old school along trail to San Roque, 10°45'S, 74°55'W, 1,320 m, 26 June 2003, *Lingan 616* (HOXA, USM); Distrito Villa Rica, Sector Unión–Shimaki, Bosque de Protección San Matias–San Carlos, trail from old school to Villa Progreso, 10°44'S, 74°55'W, 1,322 m, 30 Jun 2003, *Lingan 648* (HOXA, USM, MO);

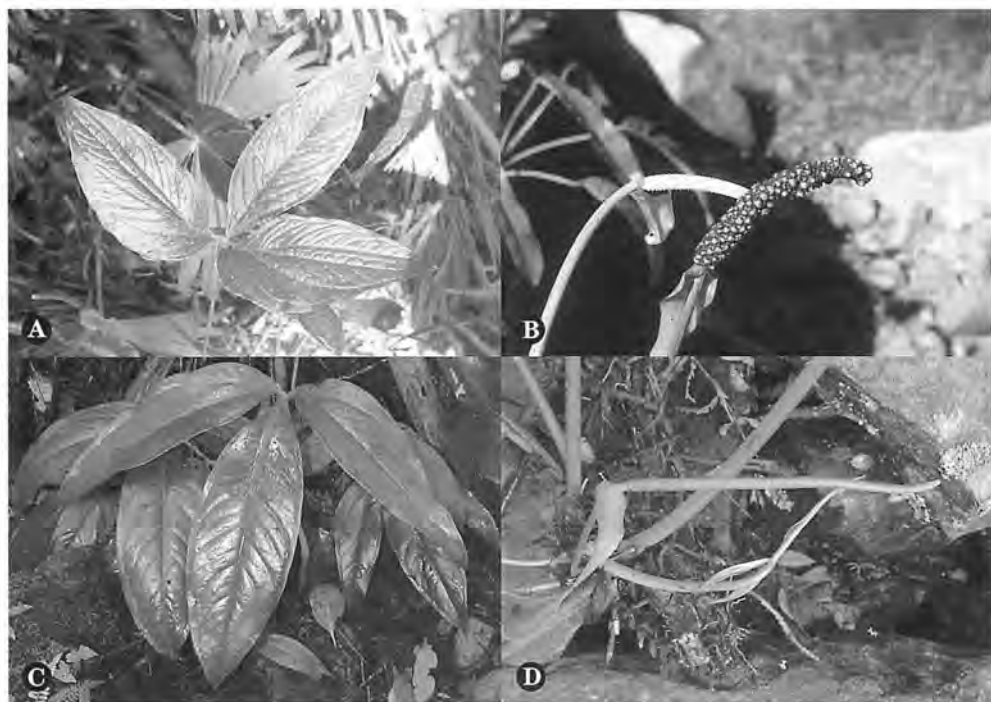


Fig. 6. a–b. *Anthurium trisectum* Sodiro. (Croat 48977). a. Blade adaxial surface. b. Inflorescence and infructescence. c–d. *Anthurium zuloagae* Croat. (Zuloaga 296). c. Habit. d. Petiole bases and inflorescence.

Distrito Villa Rica. Sector Union-Shimaki, Bosque de Protección San Matías–San Carlos, 10°45'S, 74°55'W, 1,352 m, 2 July 2003, *Lingan 655* (HOXA, HUT, MO, USM, AMAZ, HUA). **San Martín:** Moyobamba–Chachapoyas, vic. of Km 415, 13.5 km W of Naranjos, 05°38'S, 77°25'W, 700 m, 12 Apr 1984, *Croat 58182* (MO); Rioja, Pedro Ruiz–Moyobamba, Km 390, Venceremos, 05°45'S, 77°45'W, 1,800–2,000 m, 25 July 1983, *D. Smith 4345* (MO); Dist. Naranjillo, Sector Tupac Amaru, cerca Poblado de Alto Naranjillo, Bosque de Protección de Alto Mayo, 05°51'S, 77°24'W, 1,000 m, 6 Nov 1996, *I. Sánchez & M. Dillon 8553* (MO). VENEZUELA. **Amazonas:** Río Negro, Cerro de La Neblina Camp V., Valley N of base of Pico Cardona, 1,250 m, 00°49'N, 66°00'W, 1,250 m, 21–24 Mar 1984, *Liesner & Stannard 16869* (MO); Trail S from Cerro Neblina, Camp 5, 00°49'N, 66°10'W, 1,200–1,300 m, 12 Apr 1984, *Gentry & B. Stein 46560* (MO); Cerro de la Neblina, Río Yatua, 140–1,700 m,

30 Dec 1953, *Maguire et al. 36993* (MO); *Croat 75438*.

Anthurium trisectum Sodiro, *Rev. Chilena Hist. Nat.* 9: 281. 1905. Type: ECUADOR. Esmeraldas: mouth of Río San Antonio, Aug 1904, *Sodiro s.n.* (B). Figures 6a, 6b.

Small, creeping herb, epiphytic or terrestrial to 1 m tall; **internodes** 1–10 cm long, 4–10 mm diam., green, subterete; cataphylls narrowly triangular, 2–8 cm long, disintegrating to fibers, ultimately deciduous; **petioles** slender, 18–41 cm long, drying 2–3 mm diam., narrowly flattened adaxially, narrowly and bluntly sulcate; **blades** trisect, 15–25 cm long, 16–23 cm wide, subcoriaceous, dark green and matte to semiglossy above, matte and slightly to moderately paler below; **midrib** sunken above, convex below; **primary lateral veins** 3–5 pair, the segments sessile

or with petiolules to 2 cm long; medial segment ovate, acuminate at apex, acute at base, 12–25 cm long, (4–)18–25 cm long, 4–11 cm wide. INFLORESCENCE erect; **peduncle** slender, terete, 1/2–3/4 the length of the petioles; **spathe** 4–6 cm long, 1–2.5 cm wide, medium green to pale green, becoming whitish or yellowish at anthesis, ovate, acuminate at apex, acute or rounded at base, erect-spreading, finally reflexed; **spadix** cylindrical, pale yellow-green, to yellowish except green at tip, 3–8 cm long, 5–7 mm diam. Flowers 6–8 visible per spiral, 2.5–3.0 mm long, 2.0–2.3 mm wide, lateral tepals 1.2–1.4 mm wide, drying brown, minutely granular; outer margin 2–3 sided, inner margin rounded. INFRUCTESCENCE: **berries** white at base, red to violet-purple at apex, white at base, globose with a short beak.

Anthurium trisectum ranges from Costa Rica (Heredia and San José) and Panama (Chiriquí, Coclé, Colón and Veraguas) then along the Pacific slope to Colombia (Choco, Narino and Valle del Cauca) and Ecuador (Carchi, Esmeraldas and Pichincha) at elevations of 0–2,000 m in *Tropical moist forest*, *Tropical wet forest*, and *Tropical rain forest*, *Premontane moist forest*, *Premontane wet forest*, and *Premontane rain forest*, and *Lower montane rain forest*.

According to Madison (1978) *A. trisectum* is most closely related to *A. arisaemoides* from which it is geographically separated by the intervening barrier of the Andes. Both species are diminutive plants with similar trisect leaves, and often are terrestrial. In *A. arisaemoides* the spathe is green and the peduncle longer than the petiole, while in *A. trisectum* the spathe is white or yellow at anthesis, and the peduncle is shorter than the petiole.

Additional specimens examined—COLOMBIA. **Chocó**: Serranía de Baudo, road Las Animas–Pato on Río Pato, ca. 4 km SW of Pato on property of Sr. Gutierrez, 05°30'N, 76°46'W, 150 m, 18 Apr 1983, *Croat 56135* (MO); Road Medellín–Quibdo, Km 208.5, 9 km W of Tutunedo, ca. 9 km E of Quibdo, 05°39'N, 76°40'W,

100 m, 20 Apr 1983, *Croat 56215* (MO); Quebrada Changamé hasta su desembocadura en el río Jurubidá alto, 06°05'N, 77°10'W, 0–100 m, 5 May 1990, *Barbosa 6430* (MO); Taparalito, Quebrada Taparal, N of Palestina, 04°15'N, 77°12'W, 30 m, 30 Mar 1986, *Gentry et al. 53792* (MO); Region del Río Pichimá, 04°25'N, 77°17'W, 100 m, 29 Nov 1976, *Forero et al. 774* (COL); Vicinity of Quibdó, road Quibdó–Istmina at Km 4, 06°28'N, 76°36'W, 100 m, 18 Dec 1980, *Croat 52228* (MO); Río San Juan: La Sierpa, 04°10'N, 77°10'W, 5 m, 25 Mar 1979, *Forero et al. 3874* (COL); Alrededores de Palestina, 04°10'N, 77°10'W, 5 m, 26 Mar 1979, *Forero et al. 4039* (COL); Río San Juan and Río Fujiadó: Hoya del Río San Juan, Río Fujiadó, afluyente del Río San Juan, 04°36'N, 70°54'W, 7 Apr 1979, *Forero et al. 4816* (COL); Nuquí, Choco: Corregimiento de Coquí, quebrada Trapiche al sureste de Coquí, 05°32'N, 77°15'W, 100–160 m, Feb 1994, *G. Galeano et al. 5516* (MO, COL); *G. Galeano et al. 5619* (MO, COL); San José del Palmar, Mun. de San José del Palmar, hoyo del Río Torito (afluente del Río Hábita), declive occidental, Finca “Las Guadales”, 630 m, 7 Mar 1980, *Forero et al. 6852* (COL, MO); Río Torito: Finca “Los Guadales”, 630–830 m, 14 Mar 1980, *Forero et al. 7287* (COL); Finca “Las Guadales”, 630–830 m, 14 Mar 1980, *Forero et al. 7289* (COL). **Narino**: Junín–Barbacoas, Road Junín–Barbacoas, 18.1 km NE of Junín, 01°21'N, 78°06'W, 940 m, 27 Feb 1992, *Croat 72433* (MO). **Valle del Cauca**: Road Buenaventura–Bahía Málaga, vic. Km 37, 03°59'N, 76°59'W, 50 m, 13 July 1997, *Croat & Gaskin 79781* (CUVC); *Croat & Gaskin 79785* (CUVC); Vic. Bahía Málaga, Base Naval Málaga, Río Bongito, 04°00'44"N, 77°20'04"W, 40 m, 29 July 1997, *Croat & Gaskin 80532* (COL, CUVC, HUA, JAUM, MO, VEN). Buenaventura, Bajo Calima: Bajo Calima, road to Junchaco Palmeras, 03°55'N, 77°12'W, 100 m, 10 July 1984, *Gentry et al. 47869* (MO); Bajo Calima, Concesión Pulpapel, 100 m, 20 Jan 1988, *van der Werff & Monsalve 9655* (MO); Bajo Calima Region, Carton de Colombia lumber concession area, Carretera Gasolina 6 km S

of main road Cali–Buenaventura highway–Canalete, 1 km W of Carretera Gasolina, 03°56'00"N, 77°7'30"W, 50–80 m, 19 July 1988, *Croat 69434* (MO); Bajo Calima, ca. 15 km North of Buenaventura, Carton de Colombia concession, 03°56'N, 77°08'W, 50 m, 16 Feb 1983, *Gentry et al. 40409* (COL, MO); Bajo Calima, Concesión Pulpapel/Buenaventura, 03°55'N, 77°00'W, 100 m, 24 Sep 1986, *Monsalve 1166* (MO); Bajo Calima Region, Road Buenaventura–Málaga, Km 31.5, 6 Feb 1990, *Croat 70244A* (MO); Bajo Calima Region, Buenaventura–Málaga, Bajo Calima Region, road Buenaventura–Málaga, Km 31.5, less than 100 m, 04°01'N, 77°05'W, 6 Feb 1990, *Croat & Watt 70247* (CM, MO, US); Río Calima, Río Calima (región del Chocó), La Trojita, 5–50 m, 19 Feb–10 Mar 1944, *J. Cuatrecasas 16451* (F). COSTA RICA. **Heredia.** S of Puerto Viejo, 2 km S of Magsasay Penal Colony, 10°22'48"N, 84°03'36"W, 200 m, 5 Feb 1983, *Garwood et al. 1158* (BM); Parque Nal. Braulio Carrillo Estación Penal Magsasay Sendero Terciopelo, 10°24'00"N, 84°03'00"W, 200 m, 20 Oct 1990, *Umaña & Chacón 444* (MO); Parque Nal. Braulio Carrillo Estación Magsasay, Cauce del Río Peje, 10°24'00"N, 84°03'00"W, 150 m, 14 Nov 1990, *Zumbado 106* (MO); La Selva, La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 25 Feb 1986, *Wilbur 39355* (DUKE); La Selva Biological Station., 10°25'53"N, 84°00'13"W, 100 m, 29 May 1985, *Wilbur 37597* (DUKE); La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 31 May 1985, *Wilbur 37672* (DUKE); La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 3 June 1985, *Wilbur 37812* (DUKE); La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 17 Feb 1986, *Wilbur 38874* (DUKE); La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 10 Feb 1986, *Wilbur 38414* (DUKE); La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 16 May 1985, *Wilbur 36923* (DUKE); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of junction with Río Sarapiquí, 10°25'53"N, 84°00'13"W, 100 m, 3 Dec 1982, *McDowell 1036* (MO); Finca La Selva, the OTS field

station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N, 84°00'13"W, 100 m, 28 Mar 1982, *Hammel 11496* (MO); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N, 84°00'13"W, 100 m, 15 July 1979, *Grayum 1833* (MO); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N, 84°00'13"W, 100 m, 13 Nov 1980, *Hammel 10457* (MO); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N, 84°00'13"W, 100 m, 3 Dec 1982, *T. McDowell 1048* (MO). **San José.** Perez Zeledon, San Gerardo: Chirripo, San Gerardo de Canaan, Chirripó National Park [Parque Nacional Chirripó], Path from Agua Potable to lowest edge of forest, near San Gerardo [San Gerardo de Canaán], 09°27'36"N, 83°35'24"W, 1,300–2,000 m, 19 Feb 1983, *Garwood et al. 1400* (BM). ECUADOR. **Carchi.** Carchi, trail along plain above Tobar–Donoso and to Río Gualpe, 01°10'00"N, 78°18'31"W, elev. 244–396 m, 19 Feb 1984, *Hoover 1296* (MO); N side of Río Mira, across from Lita, steep N-facing slope directly across from (S of) community of Baboso, on S side of Río Baboso, 00°53'N, 78°27'W, 750 m, 11 Aug 1994, *Boyle & Boyle 3525* (MO); Tulcan, Reserva Indígena Awá, Parroquia Tobar Donoso, sector El Baboso, 00°53'N, 78°20'W, 1,600 m, 03 Oct 1991, *Tipaz et al. 279* (MO); Parroquia Tobar Donoso, Sector Sabalera, Reserva Indígena Awá, 01°00'N, 78°24'W, 650–1,000 m, 19–28 June 1992, *Tipaz et al. 1508* (MO); Reserva Indígena Awa, Parroquia Tobar Donoso, Reserva Indígena Awá, Centro El Baboso, 00°53'N, 78°25'W, 1,800 m, 17–27 Aug 1992, *Tipaz et al. 1972* (MO). **Esmeraldas.** Lita–San Lorenzo road, ca. 30 km NW of Lita, 01°05'N, 78°40'W, 300–500 m, 12 May 1991, *Gentry et al. 70002* (MO); Zapallo Grande, along Río Cayapa, 00°48'N, 78°54'W, 200 m, 11–15 Oct 1983, *Barford et al. 48118* (AAU, MO); San Lorenzo, Estación Experimental La Chiquita, 01°13'N, 78°44'W, 70 m, 04 July 1990,

Palacios 5240 (MO); Lita, Atlanta Botanical Garden (93-1454), Aug 1996, *Croat 78421* (MO); Lita–San Lorenzo Road, vicinity of Alto Tambo, 19.4 Km W of Río Lita, 00°54'00"N 78°32'41"W, 829 m, 5 Oct 1999, *Croat et al. 83016* (GB, MO); Lita–San Lorenzo Road, 7.2 Km E of Río Tululbí, 21.1 Km E of Gasolinera San Lorenzo at E edge San Lorenzo, 01°07'55"N, 78°45'46"W, 130 m, 7 Oct 1999, *Croat et al. 83107* (MO); Lita–San Lorenzo Road, 28.5 Km W of Río Lita, near Lita, 6.2 Km E of El Durango, 00°57'58"N, 78°33'48"W, 795 m, 17 Oct 1999, *Croat et al. 83398* (MO,USM); Road San Lorenzo–Mataje, departing main Lita–San Lorenzo highway, 7.5 Km N of Gasolinera San Lorenzo, .4 Km W of main Lita–San Lorenzo highway, 01°14'30"N, 78°45'50"W, 60 m, 11 July 2000, *Croat et al. 83854* (F, MO, PMA, DUKE); Road San Lorenzo–Mataje, 1.9 Km E of Mataje, 16.4 Km W of main San Lorenzo–Lita Hwy, 01°02'52"N, 78°43'01"W, 45 m, 14 July 2000, *Croat et al. 83972* (AAU, MO, QCA,); Comunidad Awá Río Bogotá, 11.5 Km W of Alto Tambo, 30.5 Km W of Río Lita, 3 Km by trail to Río Bogotá on S side of Lita–San Lorenzo Road., 00°58'57"N, 78°35'58"W, 380 m, 15 Sep 2002, *Croat et al. 87507* (MO); Lita–San Lorenzo Region, Lita–San Lorenzo Road, 3.7 km W of Río Lita Bridge (below Lita), on steep creek banks, 00°52'51"N, 78°28'30"W, 647 m, 30 June 1998, *Croat et al. 82130* (QCNE, MO); Río Cayapa: Río Cayapa, Zapallo Grande, 00°48'N, 78°54'W, 200 m, 11 Oct 1983, *Barfod et al. 48249* (AAU); Eloy Alfaro, Cotacachi–Cayapas: Reserva Ecológica Cotacachi–Cayapas, Charco Vicente, Río San Miguel, afluente del Río Cayapas, 00°43'N, 78°53'W, 150 m, 06–09 Sep 1993, *Palacios & Tirado 11303* (MO, QCNE); Quininde, Bilsa, The Mache–Chindul Ecological Reserve, Bilsa Biological Station, Mache Mountains, 35 km W of Quininde, 00°21'N, 79°44'W, 500 m, 18 Nov 1996, *Clark et al. 3443* (MO, QCNE); San Lorenzo: Road Lita–San Lorenzo, 16.6 km W of Lita, .5 km W of Anchayaca (campamento de construcciones), 00°55'N, 78°28'W, 700 m, 20 Feb 1992, *Croat 72265* (AAU, MO, SEL); Reserva Etnica

Awá, Centro Guadualito, 01°15'N, 78°40'W, 80 m, 20–29 July 1992, *Aulestia et al. 145* (MO,US); Reserva Awa: Trail from Awá encampment on Río Palaví to Río Matajé Awá encampment, beginning about 1.5 km from Río Palaví., 01°07'N, 78°37'W, 200 m, 10 Feb 1988, *Hoover et al. 3869* (MO); Forest along banks of Río Palaví, .5 km below Awá encampment, on sides of stream, 01°07'N, 78°37'W, 100 m, 14 Feb 1988, *W Hoover et al. 4315* (MO); Reserva Etnica Awá, Centro Ricaurte, 01°10'N, 78°32'W, 300 m, 19–24 Oct 1992, *Tipaz et al. 2157* (MO, QCNE); Trail from Awá encampment on Río Palaví to Río Matajé Awá encampment, beginning about 1.5 km from Río Palaví, 01°07'N, 78°37'W, 200 m, 10 Feb 1988, *Hoover et al. 3867* (MO); Territorio Awá, Río Bogotá valley, 2 km south of Lita–San Lorenzo road, 00°59'11"N, 78°35'50"W, 350 m, 6 Apr 2002, *Neill et al. 13874* (QCNE). **Pi-chincha**. Reserva Forestal ENDESA: Quito–Puerto Quito Roa., Km 113, 10 km N of main highway, along Río Silanche, "Corporacion Forestal Juan Manuel Durini", 06 Apr 1984, *Jaramillo 6554* (QCA); Reserva Endesa, 9 km N of Km. 113 on Quito–Puerto Quito Highway, 00°05'N, 79°02'W, 750 m, 15 July 1986, *Croat & J. Rodríguez 61494* (MO, QCA); Reserva Forestal ENDESA: 4 Km N of main Nanelgalito–Puerto Quito Hwy (at Km 113), beginning 5 Km W of San Vicente Andoas, 00°06'24"N, 79°01'46"W, 648 m, 26 June 2000, *Croat et al. 83793* (MO); Road Pacto–Cielo Verde on Río Guayabamba (Imbabura), 23.8 km W of Pacto, 00°11'47"N, 78°52'07"W, 844 m, 27 Mar 2006, *Croat et al. 96534* (MO); Carretera Quito–Puerto Quito, Km 113, 10 km al norte de la carretera principal, 00°05'N, 79°02'W, 800 m, 25 Feb 1984, *J. Rodríguez 186* (MO, QCA); *J. Rodríguez 186A* (MO, QCA); Reserva Endesa, 6 km WNW of P. Vicente Maldonado, 800 m, 23 Mar 1985, *Harling & Andersson 23261* (GB); Santo Domingo de Los Colorados, La Centinela, Vicinity of El Centinela, .2 km past Escuela Mixta El Centinela, along trail to left of road, exactly 13 km E from main Santo Domingo–Quevedo Hwy in Patricia Pilar, 00°32'S, 79°11'W, 1,000 m,

14 Mar 1992, *Croat 73020* (MO). PANAMA. **Chiriquí.** Road to Fortuna dam site N of Gualaca, 17.3 mi. beyond bridge over Río Estí, 7.2 mi. beyond Los Planes de Hornito, 1,400 m, 28 Nov 1979, *Croat 49077* (MO). **Coclé.** Caribbean side of divide at El Copé, 08°45'N, 80°35'W, 200–400 m, 4 Feb 1983, *Hamilton & Davidse 2699* (MO); Area between Caño Blanco del Norte, Caño Sucio and Chorro del Río Tife, 08°42'43"N, 80°37'15"W, 200–400 m, 3 Feb 1983, *Davidse & Hamilton 23518* (MO); Cerro Moreno, Molejón–Coclecito, ca. 13 km NW of Cascajal, 08°46'44"N, 80°31'54"W, 130–250 m, 7 Feb 1983, *Davidse & Hamilton 23718* (MO); Road to Coclesito, logging camp 12 mi. from Llano Grande, 08°47'N, 80°28'W, 200 m, 9 Dec 1983, *Churchill et al. 3982* (MO); *Churchill et al. 4012* (MO); La Conga, 08°45'13"N, 80°38'12"W, 109 m, 5–7 June 2001, *Mendieta 16-119* (MO); Trail from Caño Sucio–waterfall of the Río Tife, base of Cerro Tife, 08°44'N, 81°40'W, 400–500 m, 21 Feb 1982, *S. Knapp 3749*; Los Pedregales, ridge Río Blanco del Norte–Río Caño Sucio (ridge eventually leads to Cerro Tife and the Continental Divide), 08°44'N, 81°40'W, 500 m, 22 Feb 1982, *Knapp & Dressler 3790* (MO); Forest around Limon, 5 hr walk north of Alto Calvario (north of El Cope), 800–1,000 m, 10 Oct 1977, *Folsom 5842* (MO); 44 km north of Penonome on road to Coclesito, 91–152 m, 21 Feb 1978, *Hammel 1679* (MO); Near sawmill 16.7 km north of turnoff to Coclesito from Llano Grande, 213 m, 6 Mar 1978, *Hammel 1794* (MO); Near sawmill 16.7 km N of turnoff to Coclesito from Llano Grande., 700 f, 7 Mar 1978, *Hammel 1826* (MO); Atlantic slope of NW of El Copé, along Río San Juan near fork with Río Tife, 5–6 hr walk on trail from El Copé sawmill, 365 m, 9 Jun 1978, *Hammel 3322* (MO); Río Blanco–Caña Susio 1 hr hike to the west, Río Blanco is ca. 5 hr hike north down from the Continental Divide above El Copé and El Petroso sawmill, 08°38'N, 80°36'W, 106–121 m, 13 Dec 1980, *Sytsma et al. 2496* (MO); Cascajal: Llano Grande–Coclecito, Penonomé–Coclecito, 5.6 mi. N of Llano Grande, along Río Cascajal 5.6 mi. N of Llano Grande, 1.4 mi. N of Continental

Divide, 08°42'19"N, 80°27'11"W, 150 m, 11 Sep 1987, *Croat 67462* (MO); La Pintada: La Pintada–Coclesito, Road from La Pintada to Coclesito, 08°45'N, 80°30'W, 600 m, 7 Feb 1983, *Hamilton & Davidse 2878* (MO); La Pintada. Llano Grande: Coclecito–La Pintada, Llano Grande–Coclecito (N of La Pintada), 4.0 mi. N of stream at Llano Grande, 08°40'02"N, 80°27'08"W, 330 m, 7 Dec 1979, *Croat 49227* (MO); **Colón.** Distrito de Donoso: Hacia Valle Grande, dirección 13° SE, 976696 N, 534132 E (Coord. UTM), 3 July 1996, *Zapata et al. 980* (MO); Distrito de Donoso: Río Caimito arriba, lado derecho, dirección 53° NW. 991621 N, 536165 E, (Coord. UTM)., 4 July 1996, *Zapata et al. 987* (MO); Distrito de Donoso: Río Caimito: río arriba, dirección 74°SE.992054 N, 535986 E, (Coord. UTM)., 5 July 1996, *Zapata et al. 1034* (MO); *Zapata et al. 1036* (MO); Distrito de Donoso: Campamento de Botija, dirección 60° SE, 976580 N, 538449 E (Coord. UTM)., 8 July 1996, *Zapata et al. 1116* (MO); *Zapata et al. 1118* (MO); Distrito de Donoso: Bajando el río Botija, recorrido en dirección 87° SE. hacia la comunidad de San Benito, 11 July 1996, *Zapata et al. 1179* (MO); La Macha: La Macha, 08°59'04"N, 80°32'35"W, 20 m, 18 Aug 2001, *Mendieta 10-29* (MO); *Mendieta 10-212* (MO). Donoso: Quebrada Colorada abajo hasta caer al Río Petaquilla, luego a la derecha, río abajo, dirección 80° SW, 2 July 1996, *Zapata et al. 923* (MO); Botija: Campamento Botija, unos 2 km SW of campamento principal, 08°49'N, 80°33'W, 08–14 July 1996, *Polanco et al. 1896* (MO). **Veraguas.** Vicinity Santa Fe, Santa Fe–Calovebora, 1.7 mi. past Alto Piedra School, 1.5 mi. beyond Quebrada Cosilla (previously referred to as Río Primero Braso), 08°33'N, 81°08'W, 570 m, 13 July 1994, *Croat & Zhu 76817* (MO); Santa Fe–Calovebora beyond Escuela Agrícola Alto Piedra, along first major stream ca. 3 mi. from fork in the road at the school, 700 m, 1 Dec 1979, *Croat 48977* (MO); Forests above Primero Brazo del Río Santa María, N of Escuela Agrícola Alto de Piedra, just W of Santa Fe, 08°34'N, 81°07'W, 600–750 m, 4 June 1982, *Knapp & Dressler 5378* (MO); Headwaters of Río Caloveborita, ca. 15 km

past Escuela Agrícola Alto Piedra above Santa Fe, 500 m, 16 May 1981, *Sytsma & Andersson 4765* (MO); Vic. of Escuela Agricultura Alto Piedra, near Santa Fe along trail to top of Cerro Turte, 670 m, 4 Apr 1980, *Antonio 4028* (MO); Beyond Tres Brazos River along steep descent 11 km beyond Santa Fe, 650 m, 24 July 1974, *Croat 25633* (MO); Valley of Río Dos Bocas on road Alto Piedra-Calovebora, 350–400 m, 29 Aug 1974, *Croat 27362* (MO); Forest at base of Cerro Tuti, 6.5 km outside Santa Fe, 6 May 1977, *Folsom 3038-Z* (MO); 16 km NW of Santa Fe, on road to Calovebora (Panama Hwy. 35), 300–500 m, *Mori & Kallunki 6099* (MO); Río Calabacito, Aguabal, 400 m, 7 Sep 1974, *Maas & Dressler 1626* (MO); 11 km from Escuela Agrícola Alto de Piedra, along Río Dos Bocas, 15 Nov 1974, *Mori & Kallunki 3095* (MO); On road Santa Fe-Calovebora (Panamanian Hwy. 35), 16 km from Santa Fe, on Atlantic slope near Río Caloveborita, 18 June 1975, *Mori et al. 6700* (MO); Santa Fe: Santa Fe-Río San Luis, Vic. of Santa Fe, road Santa Fe-Río San Luis, past Escuela Circo Alto de Piedra, 8 mi. N of school, 8°33'N, 81°08'W, 450 m, 28 June 1987, *Croat 66958* (MO).

***Anthurium warintsense* Croat, sp. nov.**

Type: ECUADOR. Morona-Santiago. Cordillera del Cóndor, wet cloud forest on sandstone ridge, S of Río Warints, E of main crest of Cordillera del Cóndor, 03°14'03S, 78°17'10"W, 1,950 m, *David Neill and Sbar conservation interns, 14140* (holotype, QCNE; isotype, MO-57717551). Figure 2d.

Epiphyta; lamina trisecta; petiolus 34.5 cm longa, 2–4 mm diam.; segmenta media, 22.5 cm longa, 5 cm lata; segmenta lateralis falcata, 21.5 cm longa, 5.5–6 cm lata; nervis primariis lateralibus 7–8 utroque; spatha palide viridis, 6 cm longa; spadix cremeus, 6 cm longus, 5 mm diam.

Epiphytic. LEAVES trisect with **petiole** 34.5 cm long, 2–4 mm diam., becoming narrower towards blade, concolorous, terete; **blades** trisect with medial lobe slightly narrower and slightly longer than

lateral lobes, 22.5 cm long, 19.5 cm wide, 1.2 times longer than wide, .7 times as long as petiole, matte below; **medial segment** lanceolate, acuminate at apex with short shoot-projection of midvein, obtuse at base, 22.5 cm long, 5 cm wide; **lateral segments** lanceolate, falcate, weakly acuminate at apex, obtuse at base, more or less equal in length (21.5 cm long) more or less equal in width, 5.5–6 cm wide; **midrib** acutely raised below; **primary lateral veins** 7–8, acutely raised below, extending to margin at approximately a 30–45° angle; **collective vein** arises from first primary lateral vein and extends to apex paralleling margin at 2 mm inset, as prominent as primary lateral veins, raised below; **tertiary veins** numerous, in part raised and concolorous; INFLORESCENCE. **spathe** pale green, 5 cm long, 1 cm wide; **spadix** cream-colored, 6 cm long, 5 mm diam.

Anthurium warintsense is endemic to the Cordillera del Cóndor in Morona-Santiago Province in wet cloud forest on a sandstone ridge at 1,950 m in *Premontane wet forest*.

The species has been confused with *A. arisaemoides* but differs by having the primary lateral veins more regularly spaced along the length of the segments and in having lateral segments less inequilateral and not attenuated at the base. In addition it has a collective vein arising from one of the lowermost primary lateral veins and extending all the way to the apex very near the margin. In contrast the lowermost primary lateral veins in *A. arisaemoides* are oblique to the margins and invariably merge with the margins before reaching the apex of the segment. Moreover *A. warintsense* has a cream-colored spadix, unknown in *A. arisaemoides*.

The species has also been confused with *A. triphyllum* but again differs in having lateral segments not attenuated at the base. However, the main distinction appears to be the venation on the lateral lobes which in *A. warintsense* is very similar among all three lobes. In contrast, the venation on the lateral lobes of *A. triphyllum* is distinctive in that the first 2–3 primary veins extend to the margin, then collective vein arises in

bottom third of lobe and approaches the margin as it approaches the apex. More-over *A. warintsense* has a cream-colored spadix, unknown in *A. triphyllum*.

The epithet for *Antburium warintsense* comes from the locality near Río Warints in the Cordillera del Cóndor in Morona-Santiago where the type specimen was collected.

***Antburium zuloagae* Croat, sp. nov.**

Type: COLOMBIA: Departamento de Boyacá, Municipio de Santa María, cerca del km 3 de la carretera Santa María-Bogotá, sendero ecológico de la compañía AES Chivor, 1,075–1,150 m, June 2007, *Zuloaga* 296 (holotype, COL). Figures 6c, 6d.

Epiphyta; internodia brevia, 1.5 cm diam.; cataphylla 7–11.5 cm longa; petiolus 40–47 cm longus, 4–5 mm diam., subteretes; lamina trisecta, 22–31.5 cm longa, 18.5–26 cm lata; segmenta media anguste longe-acuminata, anguste attenuatum ad basim; segmenta lateralalis 19.5–25.5 cm longa, 5.5–11.5 cm lata, debilis falcata; pedunculus 33–39 cm longus; spatha 8.7–9 cm longa, viridis; spadix viridis, sessilis, 13–19 cm longus, 4–5 mm diam. in sicco.

Epiphytic; **internodes** short, 1.5 cm diam.; **cataphylls** 7–11.5 cm long, initially with the dark reddish brown parallel fibers, turning pale brown with fragments of brown epidermis, soon disheveled. LEAVES erect, trisect; **petioles** pale olive-green, tinged with violet, 40–47 cm long, 4–5 mm diam., subterete, drying light grayish brown, weakly glossy; **geniculum** 11 mm long, subterete, weakly sulcate; **blades** 22–31.5 cm long, 18.5–26 cm wide, bright yellow-green above, paler and greenish gray below, drying medium gray above, medium yellowish gray-brown to gray below; **medial segment** oblanceolate, 22.7–31.5 cm long, 6–8 cm wide, narrowly long-acuminate and down-turned at apex, narrowly attenuate at base; the **primary lateral veins** arising at up to 60° angle toward the base, to 35° angle toward the apex; the collective veins arising from one of the lowermost primary lateral veins;

lateral segments 19.5–25.5 cm long, 5.5–11.5 cm wide, weakly falcate, inequilateral with the outer side up to 1 cm wider, bluntly acute to weakly acuminate at apex, inequilateral and attenuate at base; **primary lateral veins** arising at an acute angle then spreading at 20–30° angle from midrib, forming an inner collective vein that extends to the apex, the outermost pair of collective veins running close to the margin and extending to near the apex before merging with the margin. INFRUCTESCENCE erect-spreading; **peduncle** shorter than the petiole, 33–39 cm long, tinged with violet, drying dark brown, 3 mm diam.; **spathe** 8.7–9 cm long, 8 mm wide, narrowly acuminate at apex, dark lemon-green, paler on the upper surface; **spadix** weakly tapered to apex, lemon green, sessile, 13–19 cm long, 4–5 mm diam. on drying; **flowers** 6–7 per spiral, 1.8–2.5 mm long, 1.7–2.2 mm wide; lateral tepals 1.1 mm wide, outer margin 2-sided, inner margin broadly rounded; stamens aggregated closely around stigma; anthers .5–.6 mm long, .8 mm wide; thecae ovoid, moderately divaricate.

Antburium zuloagae is known only from the type in Boyaca Province of Colombia in the Municipio de Pajarito, Corregimiento de Corinto at 1,000 m elevation in *Premontane rain forest*.

The species is similar to *A. arisaemoides* Madison in that it has three segments and the lateral segments are attenuated at the base but differs in having the peduncle shorter than the spathe and a much longer, more slender lemon-green spadix and fewer, less conspicuous primary lateral veins.

The species is also similar to *A. triphyllum* in that it has trisect blades with all segments attenuated at the base but differs in having the medial segment down-turned at the apex and weakly falcate lateral lobes. Furthermore, the spadix of *A. zuloagae* is far more slender and elongated than that of *A. triphyllum*.

The species is named in honor of Alejandro Zuloaga, a Colombian botanist from the Universidad Nacional de Colombia in Santa Fe de Bogotá and specialist

with Araceae who is studying the area of Santa María in the Department of Boyacá where he collected the type specimen.

Paratypes—COLOMBIA. **Boyacá**: Municipio Pajarito, Corregimiento de Corinto, 05°23'N, 72°44'W, 1,000 m 13 Oct. 1967, *G. Lozano, F. Diaz, S. Diaz* P. 937 (COL); Municipio Santa María, Vereda Caño Negro, trail between Finca Santa Rosita and Quebrada La Cristalina, between potreros and virgin forest; 1,150–1,450 m, 4°51'24"N, 73°17'01"W, *J. Betancur, N.R.*

Nelson, L. Clavijo, Z. Cordero, F. Gómez, C. Avellaneda & R. Díaz 10382 (COL).

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