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A Revision of *Xanthosoma* (Araceae). Part 2: Central America

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ABSTRACT

Eighteen species of *Xanthosoma* from Central America are treated including seven new species: *X. cerrosapense* Croat & O. Ortiz, *X. hammelii* Croat, Delannay & O. Ortiz, *X. knappiae* Croat & Delannay, *X. laselvaense* Croat & Delannay, *X. ortizii* Croat, *X. petaquillense* Croat and *X. pringlei* Croat. A dichotomous key and illustrations of all species are provided. A taxonomic history of *Xanthosoma* is also provided.

KEY WORDS

Araceae, *Xanthosoma*, Central America, New species.

INTRODUCTION

Xanthosoma is a genus that had been poorly studied until recently due to the large size of many species and the difficulty to make adequate specimens. In three companion articles also published in this issue, the authors present a comprehensive revision of *Xanthosoma* for Western South America with a total of 124 species including 92 new species (Croat, Delannay & Hannon, 2017) and a revision of *Xanthosoma* for the Guianas with a total of 22 species including 10 new species (Croat & Delannay, 2017a). They also describe 9 new species for Puerto Rico, French Guiana and Venezuela and present a determination

key for all 29 *Xanthosoma* species found in Venezuela (Croat & Delannay, 2017b). The *Xanthosoma* of Brazil have been studied extensively by Eduardo Gonçalves of Universidade Católica Dom Bosco in Campo Grande, who published many new species over the last 16 years. A detailed review of *Xanthosoma* phylogeny, taxonomic history, morphology and anatomy can be found in Part 1 of this *Xanthosoma* revision series (Croat, Delannay & Hannon, 2017).

This article presents a revision of *Xanthosoma* for Central America, including

11 previously published species and 7 new species. The new species are *X. cerrosapense* Croat & O. Ortiz, *X. hammelii* Croat, Delannay & O. Ortiz, *X. knappiae* Croat & Delannay, *X. laselhaense* Croat & Delannay, *X. ortizii* Croat, *X. petaquillense* Croat and *X. pringlei* Croat. A dichotomous key and illustrations of all 18 species are also provided. For the widespread species, some of the illustrations may include specimens from outside the area covered by this revision to ensure that the best images are used to represent that species.

KEY TO *Xanthosoma* species of Central America.

1. Blades pedately compound.
 2. Leaf blades 5–7 pedatisect (3-lobed when juvenile); medial segment 1.4–2(2.6) times longer than broad, typically broadly confluent onto rachis and often connecting the adjacent lateral segments ***X. wendlandii*** (Schott) Schott
 2. Leaf blades typically 9–13 pedatisect; medial segment typically more than 3 times longer than broad, typically not confluent onto rachis and connecting lateral segments ***X. helleborifolium*** (Jacq.) Schott
1. Blades simple, sagittate or deeply 3-lobed.
 3. Leaf blades conspicuously peltate, glaucous on lower surface; Panama (Gunayala & Darién), 100–500 m ***X. caladioides*** Grayum
 3. Leaf blades basifixed.
 4. Plants densely pubescent at least on petioles and major veins ***X. mexicanum*** Liebm.
 4. Plants glabrous.
 5. Large plants to 2–3 m tall, acaulescent or with a trunk 10–20 cm diam.
 6. Species mostly cultivated for food or as ornamental plants, sometimes naturalized.
 7. Posterior rib not at all naked or nearly so; posterior lobes usually rounded at the tip; spadix with sterile portion white or yellow ***X. sagittifolium*** (L.) Schott
 7. Posterior rib naked at least 1 cm; posterior lobes pointed at the tip; spadix with sterile portion pink.
 8. Stem elongated in older plants; petioles, peduncles and major veins (on the lower blade surface) heavily tinged violet ***X. violaceum*** Schott
 8. Acaulescent plants; petioles, peduncles and major veins never tinged violet ***X. mafaffa*** Schott
 6. Wild species growing in natural environments.
 9. Plants acaulescent or with a trunk no more than 40 cm tall; petiole, lower blade surface and inflorescence often glaucous; major veins sunken on the upper surface ***X. robustum*** Schott
 9. Plants with a trunk at least 1.5 m tall, petiole, lower blade surface and inflorescence never glaucous.
 10. Plants to 3 m tall, with a long and often decumbent trunk.

11. Blades drying coriaceous, brown and matte or semiglossy; major veins thick, raised on the upper surface, basioscopic basal veins at least 7 pairs, prominent and thick ***X. undipes*** (Koch & Bouché) Koch
11. Blades drying thin, medium green above and light green and glossy below; major veins thin, basioscopic basal veins 5 pairs, weak and thin ***X. laselvaense*** Croat & Delannay
10. Plants with an erect trunk 1.5–2 m tall; blades drying thin, dark green above and medium green and glossy below; major veins thick, basioscopic basal veins at least 7 pairs, prominent and thick ***X. knappiae*** Croat & Delannay
5. Plants of more moderate size, less than 1.5 m tall.
12. Species from Mexico; moderately small plants with blades either prominently 3-lobed or with spreading, hastate lobes.
13. Leaf blades conspicuously constricted at the base of the anterior lobe with the posterior lobes directed outward and with a prominent auricle then directed inward forming the lower edge of the sinus . . . ***X. pringlei*** Croat
13. Leaf blades weakly constricted at the base of the anterior lobe with the posterior lobes directed mostly downward ***X. yucatanense*** Engl.
12. Species from Middle America or Panama.
14. Leaf blades with the posterior rib scarcely or not at all naked, conspicuously bicolorous, moderately dark green on upper surface, whitish on lower surface (Costa Rica and Panama) ***X. dealbatum*** Grayum
14. Leaf blades with the posterior ribs naked at least 1 cm.
15. Plants moderately small (less than 1 m tall), blades usually more than 35 cm long, spadix less than 15 cm long.
16. Caulescent herb, stems elongated (to 60 cm long), Panamá, Darien province (Cerro Pirre) . . . ***X. hammelii*** Croat, Delannay & O. Ortiz
16. Tuberos herb, stems subterranean, Panamá (Colón province).
17. Blades more than 20 cm long, midrib sunken above and narrowly round-raised below; petioles longer (more than 35 cm long); spathe with naviculiform blade ***X. ortizii*** Croat
17. Blades less than 20 cm long; midrib flat on both surfaces; petioles shorter (less than 35 cm long); spathe blade not naviculiform ***X. petaquillense*** Croat

15. Plants more robust, tuberous, usually more than 1 m tall; blades usually more than 35 cm long, spadix more than 15 cm long; Panama (Darién), near sea level ***X. cerrosapense*** Croat & O. Ortiz



Figure 1



Figure 2

Figure 1. *Xanthosoma caladioides* Grayum (Ortiz *et al.* 2426; photo: Orlando Ortiz). Live plant growing in a rock crevice, showing petioles and leaf blades, adaxial surface.

Figure 2. *Xanthosoma caladioides* Grayum (Ortiz *et al.* 2426; photo: Orlando Ortiz). View of leaf blade, adaxial surface.

Xanthosoma caladioides Grayum, *Ann. Missouri Bot. Gard.* 73: 471–473 (1986). Holotype: PANAMA, Kunayala: Puerto Obaldia near Colombian border, sea level, 08°40'N, 77°24'W, 0 m, 18 Apr 1982, Knapp & Mallet 4687 (MO). **Figures 1–4.**

The species is a member of group *Chamaexanthosoma* (Croat, Delannay & Hannon, 2017) and is characterized by its tuberous stem, small size and thin peltate ovate blades which are glaucous on the lower surface.

Tuberous herb, terrestrial or epipetric, 25–70 cm tall; tuber 1.5–2.5 cm



Figure 3



Figure 4

Figure 3. *Xanthosoma caladioides* Grayum (Ortiz *et al.* 2426; photo: Orlando Ortiz). View of leaf blade, abaxial surface.

Figure 4. *Xanthosoma caladioides* Grayum (Ortiz *et al.* 2426; photo: Orlando Ortiz). View of opened inflorescence showing spathe tube green outside and dark purple inside, pistillate spadix pale yellow and sterile staminate spadix yellowish at the base.

diam. when dried, subglobose; **petioles** 17–58 cm long, sheathed one-eighth to one-third; **blades** peltate, simple, ovate, 14.8–36 cm long, 9.2–24.4 cm wide (averaging 25.8 x 16.6 cm), 1.4–1.6 times longer than broad, 0.6–1 times as long as petioles, asymmetrically acute at apex, subcordate at base, glabrous, drying membranaceous,

glaucous below; **anterior lobe** 11–25 cm long, broadly rounded on margins; **posterior lobes** 3.9–12.5 cm long, narrowly rounded; **sinus** V-shaped, 2.7–5.5 cm deep; **midrib** flat and concolorous above, narrowly rounded and paler below; **primary lateral veins** 2–4 pairs, arising at 30–45° angle. **INFLORESCENCES** 1 per axil, 2

sometimes present; **peduncles** (10.5)17–32 cm long; **spathe** 6.5–11 cm at anthesis, constricted above tube; tube 2.5–5 cm long, 1.4–2.3 cm diam., green outside, purple within, blade (3.3)4.3–6.3 cm, white; **spadix** 5.3–10 cm, slightly shorter than the spathe, sessile; staminate spadix 2.7–7.1 cm long, broader in middle, 4–7 mm (drying 3–5 mm diam.); sterile staminate portion 1.3–3.6 cm, drying 3 mm diam., broader than pistillate portion at base, the lowermost staminoida few (4 visible), these subrounded, 1.8–3 mm long, 1–2.1 mm wide, drying dark brown, these immediately transitioning to a row of staminoida prominently tapered upward, drying lighter brown, the apical two-thirds and uppermost staminodial portion uniformly slender, narrower than the fertile staminate portion, the staminodia narrowly elongated and flattened, 4–5 mm long, 0.5–2.2 mm diam. (drying 1–2.1 mm wide); pistillate portion 1.6–2.9 cm long; pistils with ovary broadly conical, style discoid. **INFRUCTESCENCE** with spathe 5–6 cm long; berries ca. 3–3.3 mm diam. and whitish, when dried; seeds ca. 0.8–1 mm, ovoid, brown, longitudinally ribbed.

Xanthosoma caladioides is endemic to Panama, known from Darién Province and the Comarca of Gunayala from less than 100 m to 830 m in regions of *Tropical moist forest* and *Premontane wet forest* life zones.

Additional specimens seen: PANAMA. **Darién:** Río Tuquesa below Quebrada Venado, 30 June 1967, N. Bristán 1074 (PMA); South of Garachine on western slope of Serranía Sapo, above place called Casa Vieja, along

boundary trail of Darién National Park, forested slopes, 07°58'N, 78°23'W - 07°58'N, 78°23'W, 550–830 m, 25 May 1991, G. McPherson, N. Hensold, G. Palacios, H. Herrera & J. Polanco 15380 (MO, PMA); Serranía de Majé, Reserva Privada Chucantí, Cerro Chucantí, Cascada Chucantí, 08°47'31"N, 78°26'51"W, 699 m, 28 Aug. 2014, O. Ortiz, R. Flores, A. Sierra, J. Batista, Y. Guadalupe, C. Rodríguez, Z. Samudio & Z. Serracín 2426 (MO, PMA).

Xanthosoma cerrosapense Croat & O. Ortiz, **sp. nov.** Type: PANAMA. Darién: Distrito Chepigana, Parque Nacional del Darién, along trail to summit on slopes of Cerro Sapo, 14 Apr. 2014, Orlando O. Ortiz, J. Aranda, J. Batista & J. Moreno 2312 (holotype, PMA; isotype, MO). **Figures 5–8.**

The species is a member of group *Xanthosoma* and is characterized by its modest size, acaulescent habit, maculated petioles, brown-drying ovate-sagittate blades, and its inflorescences with the spathe tube green sometimes blotched with purple outside and medium green inside and the pistillate spadix pale yellowish orange.

Modest-sized terrestrial herb, often associated with sandy streams; rhizomatous, short, barely extending above the soil line; sap milky. **LEAVES** arising from the ground, **petioles** 71–80 cm long more or less erect, 1.7 cm diam, sheathed to about lower ¼ to 1/3 their length, medium dark green and semiglossy, tinged or streaked



Figure 5



Figure 6

Figure 5. *Xanthosoma cerrosapense* Croat & Ortiz (Ortiz *et al.* 2312, PMA-107365). Herbarium specimen showing leaf blade, adaxial and abaxial surfaces with mostly abaxial surface, with the apex and some adaxial surfaces folded inward), petiole and inflorescence.

Figure 6. *Xanthosoma cerrosapense* Croat & Ortiz (Ortiz *et al.* 2312; photo: Orlando Ortiz). Habit of live plant showing petioles, leaf blades, adaxial surface and inflorescence.

purple to purplish toward the base abaxially, sheath erect-incurled, acutely ending at apex; unsheathed part weakly and obtusely flattened with an obtuse medial rib adaxially; **blades** ovate-sagittate, held flat to somewhat pendent in life, 51 cm long, 29.5 cm wide, 1.6 times longer than broad, broadest across across the middle of the

blade below middle and above the petiolar plexus in life owing to the disposition of the posterior lobes (broadest across the tips of the posterior lobes when flattened), narrowly long-acuminate at apex, prominently lobed at base, thinly coriaceous, dark green and lustrous, weakly glossy to semiglossy above, sometimes blotched with



Figure 7

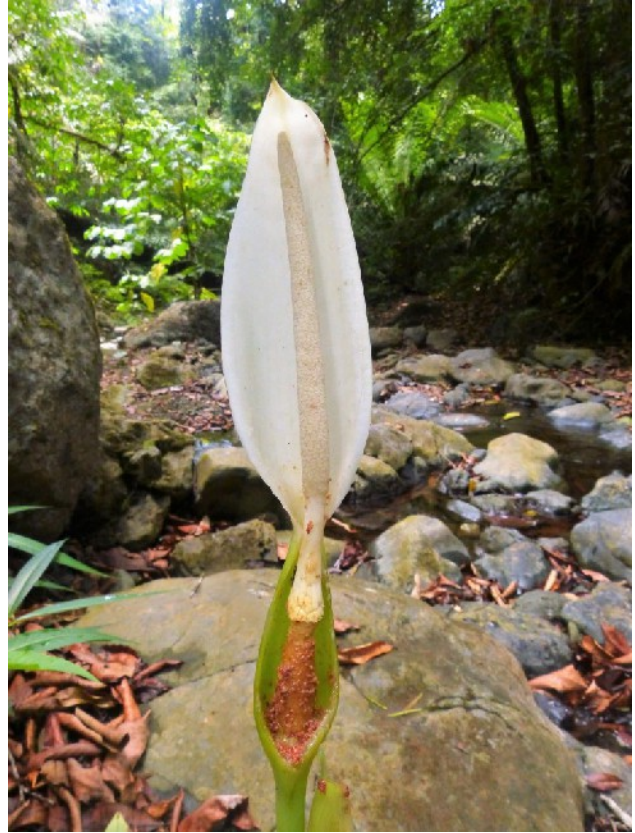


Figure 8

Figure 7. *Xanthosoma cerrosapense* Croat & Ortiz (Ortiz *et al.* 2312; photo: Orlando Ortiz). View of plant base showing the purple-tinged petioles and an open inflorescence (left) as well as an immature inflorescence (right).

Figure 8. *Xanthosoma cerrosapense* Croat & Ortiz (Ortiz *et al.* 2312; photo: Orlando Ortiz). View of opened inflorescence showing spathe tube green on both surfaces, pistillate spadix yellowish orange and lower sterile staminate spadix yellowish.

white in from margins, moderately paler and matte and somewhat spongy below, drying dark brownish green above, medium brown below; **anterior lobe** 39.5 cm long, broadly rounded on the margin; **posterior lobes** 18.5 cm long, 13 cm long, 9 cm wide; **posterior rib** straight to the posterior lobe

apex; **sinus** parabolic to spatulate, 12 cm deep, 12 cm wide when flattened. **INFLORESCENCE** erect, 1 per axil; **peduncle** 5.4 cm long, 5 mm diam., medium green, weakly glossy; **spathe** 26 cm long; tube 8.5 cm long, 3.2 cm diam., ovate-elliptic, medium green outside, sometimes

blotched with purple, medium green inside; blade creamy white, narrowly ovate-elliptic naviculiform, 16.8 cm long, 5.8 cm wide in open condition (flattening to ca. 6.5 cm); **spadix** 22 cm long; staminate portion 2.2 cm long, sterile staminate portion 5.5 cm long, the lower thickened portion, 2.3 cm long, 1.4 cm diam., pale yellowish, the lower broadened portion 2 cm long, 1.4 cm diam.; pistillate portion 3.8 cm long, 1.4 cm diam. near base, to 0.8 mm diam. near apex, pale yellowish orange.

Xanthosoma cerrosapense is endemic to Panama, known only from the Cerro Sapo area in Darién Province at 45–60 m in a *Tropical moist forest* life zone.

The species is named for the type locality at Cerro Sapo in Darién Province.

Paratypes: PANAMA. **Darién**: Base of Cerro Sapo, 08°01'N, 78°19', 4 Feb. 1978, *Hammel 1341* (MO, PMA); Base of Cerro Sapo, 08°00'N, 78°18'W, 200 feet, 4 Feb. 1978, *Barry Hammel 1333* (MO, PMA).

Xanthosoma dealbatum Grayum, *Phytologia* 82(1):30–57 (1997).
Holotype: COSTA RICA, Puntarenas: Along road at base of hills behind Playa Espadilla, SE of Punta Quepos, 09°23'N, 84°09'W, 10 m, 24 Sep. 1984, *M.H. Grayum & P.J. Sleeper 3927* (CR). **Figures 9–11.**

The species is a member of group *Xanthosoma* and is characterized by its tuberous stem, moderately small size and thin conspicuously bicolorous ovate-cordate-sagittate blades with a V-shaped sinus as well as by the spathe tube being green on both surfaces, the pistillate portion pale yellow and the berries yellow-orange to orange.

Tuberous herb; **tuber** subterranean, subglobose, ca. 3 cm diam greenish externally and within; **petioles** 46–89 cm long, 0.6–1.2 cm diam. sheathed 30–43% their length, free part terete, medium green, weakly glossy; **blades** (20)30–57 cm long, (10)17.5–32 cm wide, 1.3–1.8 times longer than wide, simple, ovate-elliptic to triangular-ovate or somewhat pandurate, sagittate at base, prominently bicolorous, dark green and weakly glossy above, much paler and matte, whitish below (the thin surface capable of being peeled free in dried specimens); **anterior lobe** (13)30–39 cm long; **posterior lobes** (8)19–35 cm long, narrowly rounded to bluntly pointed; **posterior rib** not at all naked or naked up to 8 mm.; **sinus** narrowly triangular to closed on flattened specimens; **midrib** weakly convex and concolorous above, convex and paler below; **primary lateral veins** 5–10 pairs, obtusely sunken above, convex and weakly glossy below. INFLORESCENCE to at least 4 per axil; peduncles 16–37 cm; **spathe** 13.5–18.5 cm long, 1.5–2.3 cm diam.; tube 4.5–5.5 cm long, green on both surfaces; blade 8.3–12.5 cm long, white to cream-colored; **spadix** ca. 10.5–10.7 cm long, ; fertile staminate



Figure 9



Figure 10

Figure 9. *Xanthosoma dealbatum* Croat & Ortiz (*Ortiz et al.* 2424; photo: Orlando Ortiz). Habit of live plant showing petioles and leaf blades, adaxial surface.

Figure 10. *Xanthosoma dealbatum* Croat & Ortiz (*Ortiz et al.* 2424; photo: Orlando Ortiz). View of leaf blades, abaxial surface.

portion white, 6.5–8 cm long, 5–7 mm diam. on thickest part; sterile staminate portion weakly separated (by up to 1 mm) from pistillate segment, 2–2.5 cm long, the lowermost thickened staminodia in 2–3 rows, the first row often rounded, the upper row of the series prominently tapered upward, 2.2–3.2 mm long, 1.2–2 mm wide, drying dark brown, the next higher series

2.2–mm long, 0.8–1.1 mm wide, narrowly rounded on both ends, drying light brown, densely pale granular; pistillate portion 1.5–2 cm long, 8–10 mm diam., pale yellow. INFRUCTESCENCE with **spathe tube** to 8 cm long, 3.5 cm diam.; **berries** becoming yellow-orange to orange.



Figure 11



Figure 12

Figure 11. *Xanthosoma dealbatum* Croat & Ortiz (*Ortiz et al.* 2424; photo: Orlando Ortiz). View of opened inflorescence showing spathe tube green on both surfaces, pistillate spadix light yellow and sterile staminate spadix white throughout.

Figure 12. *Xanthosoma hammelii* Croat, Delannay & O. Ortiz (*Croat & Hua Zhu* 77089, MO-4612293). Herbarium specimen showing blade abaxial surface with a portion of adaxial surface folded over, one infructescence (left) and one inflorescence (right) as well as portion of stem.

Xanthosoma dealbatum ranges from SE Costa Rica (San José & Puntarenas Province) on the Pacific slope to Panama (Chiriquí on Pacific slope near Puerto Armuelles; Veraguas on the Caribbean slope; Canal Area on the Caribbean slope and Darién on Pacific slope of Serranía de

Majé), occurring in *Tropical moist forest*, *Tropical wet forest*, rarely in *Premontane wet forest* (Panama on Caribbean slope).

Grayum (1997) reports that the species is most similar to *X. sagittifolium*, differing from that species in having

markedly bicolorous blades (dark green above and whitish but not glaucous below) versus weakly bicolorous with the lower surface glaucous or tinged with purple in *X. sagittifolium*. In addition, the spadix of *X. dealbatum* is ca. 610.7 cm long, 5–7 mm diam. whereas the spadix is more than 14 cm long and 7–12 mm diam in *X. sagittifolium*.

Additional specimens seen: COSTA RICA.

Puntarenas: Osa Peninsula, Rincón de Osa, along ridge between Quebrada Aparicio and Quebrada Aguabuena, 08°42'N, 83°31'W, 200–400 m, 7 Oct. 1984, *Michael H. Grayum, Gerardo Herrera Ch., George E. Schatz & Felipe Chavarría D. 4016* (CR, MO). PANAMA.

Canal Area: Along road between Gatun and Pina ca. 3 km S of Pina, primary forest and roadside vegetation, 09°16'25"N, 79°58'42"W, 50 m, 7 July 1976, *Thomas B. Croat 36934* (MO).

Chiriquí: San Bartolo Arriba west of Puerto Armuelles, 08°19'18"N, 82°55'24"W, 125 m, 10 Aug. 1974; *Thomas B. Croat 26714* (MO).

Darién: Serranía de Majé, Reserva Privada Chucantí, Cerro Chucantí, Cascada Chucantí, 08°47'31"N, 78°26'51"W, 699 m, 28 Aug. 2014, *O. Ortiz, R. Flores, A. Sierra, J. Batista, Y. Guadalupe, C. Rodríguez, Z. Samudio & Z. Serracín 2424* (MO, PMA).

Veraguas: Santa Fe, along road between Escuela Agrícola Alto Piedra (above Santa Fé) and Río Dos Bocas, ca. 10 km from the Escuela, 08°32'40"N, 81°09'44"W, 530–620 m, 26 July 1974, *Thomas B. Croat 25904* (MO); Valley of Río Dos Bocas, 11 km from Escuela Agrícola Alto Piedra (above Santa Fé) on road to Calovebora, primary forest

along river, 08°33'03"N, 81°10'17"W, 450 m, 30 Aug. 1974, *Thomas B. Croat 27542* (MO).

Xanthosoma hammelii Croat, Delannay & O. Ortiz, **sp. nov.** Type: PANAMA. Darién: Parque Nacional Cerro Pirre, vicinity of station along Río Perisenico, 08°01'N, 77°44'W, 110 m, 26 July 1994, *Thomas B. Croat & Guang Hua Zhu 77089* (holotype, MO-4612293, MO-5005959).

Figures 12–16.

The species is a member of group *Xanthosoma* and is characterized by its elongated, trailing stems, petioles about as long or slightly longer than the blades, green-drying ovate-cordate-sagittate blades with acute posterior lobes and the lower surface densely areolate, and with its inflorescences with the spathe tube green on both surfaces and the pistillate spadix pale orange.

Moderately small terrestrial near stream; **stem** elongated, trailing; **internodes** 1–2.5 cm diam., dark green becoming brownish. LEAVES with **petioles** 46–54 cm long, medium green, semiglossy, weakly flattened adaxially, sheathed for about ½ their length; **blades** ovate-cordate-sagittate, 40–48 cm long, 24–30 cm wide, 1.5–1.7 times as long as wide, 0.8–1.05 times as long as petiole, deeply lobed at the base, long-acuminate at apex, widest near the petiolar plexus, subcoriaceous, dark green and weakly glossy above, much paler and weakly glossy to almost matte below, drying

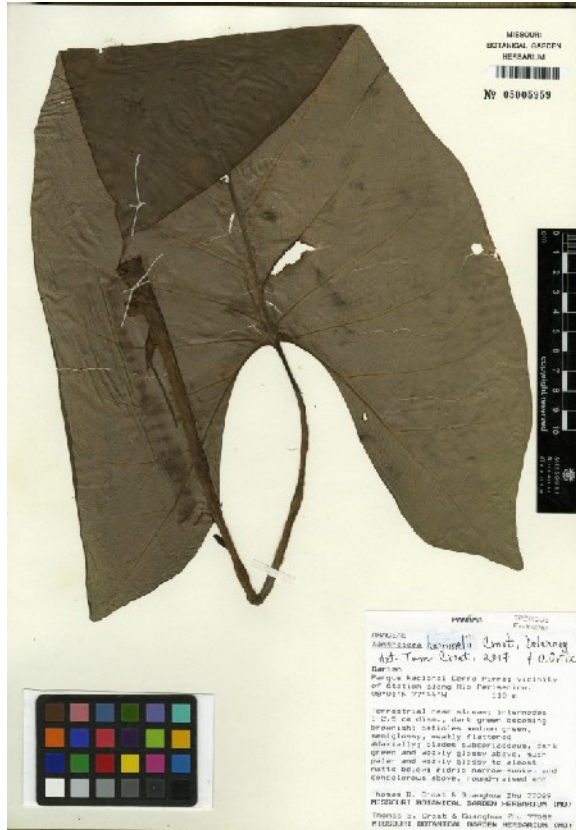


Figure 13



Figure 14

Figure 13. *Xanthosoma hammelii* Croft, Delannay & O. Ortiz (*Croft & Hua Zhu 77089*, MO-5005959). Herbarium specimen showing blade abaxial surface with a apical portion of adaxial surface folded over .

Figure 14. *Xanthosoma hammelii* Croft, Delannay & O. Ortiz (*Ortiz & Contreras 2599*; photo: Orlando Ortiz). Habit of live plant showing decumbent stem, petiole and leaf blades, adaxial surface.

medium-dark green and semiglossy above, light green and glossy below; **anterior lobe** 26–32 cm long, rounded on margins, **posterior lobes** 17–19 cm long, 9–13 cm wide, acutely pointed at the tip, with the tip curving slightly outward; **sinus** parabolic, 13–15 cm deep, 6–7 cm wide in the middle; **midrib** narrowly sunken and concolorous above, round-raised and paler below;

primary lateral veins 5 pairs, arising at a 5060° angle, weakly sunken above, round-raised below; **basal veins** 6–8 pairs, the 1st pair free to the base, 4–5 pairs acroscopic, 2–3 basioscopic; **posterior rib** naked 2.5–3 cm, arcing at the base, directed to the tip of the posterior lobe; **tertiary veins** darker and distinct below; **lower surface** densely areolate. INFLORESCENCES 1–2 per



Figure 15

Figure 16

Figure 15. *Xanthosoma hammelii* Croat, Delannay & O. Ortiz (Ortiz & Contreras 2599; photo: Orlando Ortiz). View of leaf blade, adaxial surface.

Figure 16. *Xanthosoma hammelii* Croat, Delannay & O. Ortiz (Ortiz & Contreras 2599; photo: Orlando Ortiz). View of leaf blade, abaxial surface.

axil; **peduncle** 5–13 cm long, drying 2 mm diam., dark brown; **spathe** 9.5–11.7 cm long; tube 1.7 cm diam. furled, flattening to 2.5 cm wide, green on both surfaces; blade white, flattening to 2 cm wide, moderately constricted above tube; **spadix** 8–9.6 cm long; staminate spadix 8.2 cm long, 6.3 mm diam. in middle of fertile portion; sterile staminate portion 2.8 cm long, the lowermost 2–3 rows of staminodia 1.3–2.5 cm long, drying pale tan, 1st & 2nd rows subrounded, the next row oblong-elliptic, acute on upper end, rounded at base, the uppermost row of the pale-drying staminodia, subrhombic, minutely purplish-speckled, immediately transitioning to a 2 rows of subrhombic staminodia of equal

size, then in the narrow segment of the staminodial zone with 9 rows of slender medium brown to light gray-brown low staminodia 3–5 mm long, 0.8–1 mm wide, the uppermost of these with a narrow deep medial sulcus; pistillate spadix 2.1 cm long, 4 mm diam. midway, 3 mm diam. at apex, pale orange.

Xanthosoma hammelii is endemic to Panama, found only in Darién Province at 70–270 m in *Tropical moist forest* and *Premontane wet forest* life zones.

Xanthosoma hammelii can be confused with *Xanthosoma cerrosapense* which occurs in

the same general area but the latter differs that its larger size, acaulescent habit and heavily purple-tinged and proportionately longer petioles,

The species is named in honor of Dr. Barry Hammel of the Missouri Botanical Garden who was the first to collect the species. Barry is an excellent collector, finding new species in areas where others have failed but owing to Hammel's keen eye for differences in plants he often comes up with the new ones. Barry is a specialist on Cyclanthaceae and Guttiferae and is in charge of the Costa Rican Manual Project. I believe he holds the distinction of having species named in his honor from more aroid genera than anyone else. He lives with his wife Isabel in Costa Rica. It is an honor to name this species after my old friend.

Paratypes: PANAMA. **Darién:** Parque Nacional del Darién, Estación Rancho Frío at N base of Cerro Pirre, ca. 9 km S of El Real, along Quebrada Perisenico, in forest, 08°01'N, 77°44'W, 70–270 m, 8 Oct. 1987, *Barry E. Hammel, Heraclio Herrera & Greg C. de Nevers 16097* (MO); Cerro Sapo, ca. 5 km south of Garachiné, in forest along stream at base of cerro and secondary growth along Río San Antonio, 07°59'N, 78°25'W, 200–250 m, 25 Mar. 1986, *Barry E. Hammel, O. Franco, C. de Gaiza & Jill Trainer 14888* (MO); Parque Nacional Darién, Cerro Pirre, Rancho Frío, cerca de la estación de la antigua ANAM, 08°01'16"N, 77°44'04"W, 103 m, 16 Apr. 2016, *Orlando Ortiz & Contreras, Tilson 2599* (MO, PMA).

Xanthosoma helleborifolium (Jacq.) Schott, *Oesterr. Bot. Z.* 15(2): 33. 1865. *Arum helleborifolium* Jacq. *Collectanea* 3: 217. 1789. Type. VENEZUELA. Caracas: *Jacquín, Ic. Pl. Rar. pl. 613. Figures 17–20.*

Caladium helleborifolium (Jacq.) Vent., *Mag. Encycl.* 4(16): 471. 1801.

Acontias helleborifolius (Jacq.) Schott, *Melet. Bot.* 1: 19. 1832.

The species is a member of group *Basisectum* and is easily recognized by its pedately lobed leaf blades, in Central America, compared only with *X. wendlandii* Schott a species with only 5–7-lobed leaves with much larger leaf segments.

Medium sized tuberous herb, 40–60 cm tall, occasionally to 1 m tall; caudex tuberous; internodes short, to 3 cm diam. LEAVES with **petioles** 39–64 cm long, 1–1.5 cm midway, thick and succulent, the lower part broadly sheathed; petioles and parts of leaf rachis with characteristic textured pattern of purplish violet and white, thick and succulent; **blades** reniform in outline, deeply dissected, thin and semiglossy, moderately bicolorous, drying greenish; the central lobe (13.5)18–30 cm long, (2.7)3.3 6–8.5 cm wide, rachis branching, curving to both sides; leaflets 5–18, thin, sessile, well-spaced on rachis and diminishing markedly in size toward both sides, oblong or lanceolate, markedly acuminate at apex, cuneate at base and often



Figure 17



Figure 18

Figure 17. *Xanthosoma belleborifolium* (Jacq.) Schott (not collected). Habit of live plant showing purplish violet and white mottled petioles, leaf blades, adaxial surface, and inflorescence.

Figure 18. *Xanthosoma belleborifolium* (Jacq.) Schott (Croat 86021). View of leaf blades, adaxial surface.

markedly confluent in the direction of the petiole; major veins prominent; **primary lateral veins** 10–12 pairs, arising at an acute angle, the **collective vein** loop-connecting primary lateral veins and (4)5–7 mm of margin. **INFLORESCENCE** with **peduncle** (35)40 cm or more long, textured like petioles and rachis; **spathe** 1319.5 cm long, enveloping the spadix; blade white or greenish white at anthesis, soon withering,

the tube green, 1.5–1.8 cm diam persisting, broadly ellipsoid in fruit; **spadix** white, to 11.5–17 cm long, with broad short stipe, staminate part 7–12 cm long, protruding out of spathe at anthesis, the sterile staminate part constricted apically, 1–1.5 cm long, 8–1.2 cm diam., much broadened basally, larger staminodia rounded, drying blackened, 1.6–2.6 mm long, immediately transitioning to a single row of dark-drying



Figure 19



Figure 20

Figure 19. *Xanthosoma belleborifolium* (Jacq.) Schott (Croat 86021). View of inflorescences, one on left at anthesis, showing purple-violet and white mottled peduncle and spathe tube green outside.

Figure 20. *Xanthosoma belleborifolium* (Jacq.) Schott (specimen unknown; photo: William Vargas). Close-up of lower portion of opened inflorescence showing spathe tube glossy and green inside, yellow pistillate spadix and lower portion of sterile staminate portion of spadix.

more narrowly ovate staminodia then to 5–6 rows of irregular sparsely spaced more elongated yellowish brown and irregularly shaped staminodia 1.8–2 mm long, often with the margins prominently raised; pistillate portion 2–3 cm long, 9–12 mm diam. INFRUCTESCENCE to 5 cm long, 3.5 cm diam., mature berries not seen.

Xanthosoma belleborifolium ranges from Panama to the Greater Antilles, N. Colombia, Venezuela, the Guianas; eastern Brazil (Para, Maranhão) and to Amazonian Ecuador, Peru and Bolivia, primarily in a *Tropical moist forest* life zone. In Panama, known from *Tropical moist forest* and *Premontane wet forest* life zones.

The species was reported from Mexico based on a collection from Chiapas by *Breedlove & Strother 46124* (CAS) but that collection has not been seen and is assumed to be a misdetermination since the species has not been found north of Panama.

Additional specimens seen: PANAMA. **Canal Area:** Curundu Air Force Survival School, 08°58'59"N, 79°30'57"W, 50 m, 12 Aug. 1971, *Ahryn H. Gentry 1440* (MO); Vicinity of Juan Mina, hill at Canal Zone boundary, 09°10'N, 79°39'W, 0–100 m, 27 July 1940, *Harley H. Bartlett & Tobias Lasser 16577* (MO); Vicinity of Juan Mina, 09°10'15"N, 79°39'14"W, 0–50 m, 20 July 1940, *Harley H. Bartlett & Tobias Lasser 16511* (MO); Barro Colorado Island, at edge of clearing near Lab, 09°09'45"N, 79°50'30"W, 20 m, 23 June 1960, *John E. Ebinger 139* (MO); Barro Colorado Island, Barbour-Lathrop Trail, 09°09'30"N, 79°49'25"W, 10–100 m, 12 Oct. 1931, *Otis E. Shattuck 133* (MO); Northwestern point of island, 1 July 1938, *Peggy White 148* (MO); Vicinity of Salamanca Hydrographic Station, Río Pequení, 09°18'18"N, 79°34'56"W, 80 m, 28–29 July 1938, *R.E. Woodson, Jr., Paul H. Allen & Russell J. Seibert 1606* (MO); Barro Colorado Island, 09°09'47"N, 79°50'14"W, 10–20 m, 10 July 1982, *Robert J. Schmalzgel 670* (MO); Barro Colorado Island, 09°09'47"N, 79°50'14"W, 0–10 m, 5 June 1970, *Thomas B. Croat 10752* (MO); Barro Colorado Island. Barbour-Lathrop Trail, 09°09'30"N 079°49'25"W, 10–100 m, 25 May 1968, *Thomas B. Croat 5869* (MO); Barro Colorado Island. Lab Clearing, 09°04'07"N 079°50'30"W, 20 m, 17 Jun

1970, *Thomas B. Croat 10892* (MO); Barro Colorado Island, Vicinity of Lutz Creek near dock, 09°09'49"N, 79°50'11"W, 0–5 m, 23 July 1970, *Thomas B. Croat 11483* (MO); Barro Colorado Island, Lab Clearing, 09°09'45"N, 79°50'30"W, 20 m, 12 Sep. 1968, *Thomas B. Croat 5968* (MO); Along road between Gatun and Pina ca. 3 km S of Pina, primary forest and roadside vegetation, 09°16'25"N, 79°58'42"W, 50 m, 7 July 1976, *Thomas B. Croat 36932* (MO); Low forested area near Summit Hills Golf Course, 09°03'08"N, 79°38'17"W, 75 m, 20 June 1970, *Thomas B. Croat 10951* (MO); Parque Nacional Soberania, formerly (Madden Forest), Las Cruces Trail, 09°06'20"N, 79°37'20"W, 140 m, 17 July 1994, *Thomas B. Croat & Guang Hua Zhu 76986* (CM, MO, TEX); Along road between Gatun Locks and Fort Sherman, ca. 1 mi E of Fort Sherman, 09°19'00"N, 79°57'30"W, < 25 m, 20 June 1994, *Thomas B. Croat & Guang Hua Zhu 76281* (CM, MO); Pipeline road near Gamboa Gate, 09°07'10"N, 79°42'02"W, 50 m, 2 Aug. 1972, *William G. D'Arcy 6266* (MO). **Comarca Guna Yala:** Río Diablo, voucher de análisis farmacognóstico, 09°26' N, 78°35' W, 25 May 1996, *Florpan & et al. 2130* (MO, PMA); Gamboa, camino del Oleoducto, voucher de análisis farmacognóstico, 09°08'59"N, 79°43'59"W, 30 m, 22 Aug. 2001, *Florpan & et al. 5292* (MO, PMA); Tierra firme frente a la Isla Playón Chico, camino del acueducto, a 1 km de la costa, 09°16'30"N, 78°15'00"W, 10 m, 15 June 1994, *Heraclio Herrera 1641* (CM, MEXU, MO, PMA, SCZ); Along the headwaters of Río Mulatupo, 08°55'N,

77°44'W, 17 Aug. 1967, *Thomas S. Elias 1781* (MO). **Colón:** Remanente boscoso cercano a la Estación Biológica de Galeta-STRI, adyacente a zona de manglares, 13 Aug. 2008, *A. de Sedas M. & et al. s.n.* (MO); Canal Area, Ft. Sherman and nearby, wet forest, 09°19'59"N, 79°58'00"W, 0–100 m, 16 June 1983, *Clem W. Hamilton & Henry Stockwell 3707* (MO). **Panamá:** Parque Nacional Soberanía, Campo Chagre, voucher de análisis farmacognóstico, 09°12'06"N, 79°35'51"W, 12 July 2001, *Florpan & et al. 5208* (MO, PMA); Curundu forest, 08°58'N, 79°33'W, 40 m, 15 July 1985, *Greg C. de Nevers & Susan Charnley 5971* (MO); Distrito de Capiro. Cerro Trinidad. Límite E del Parque Nac. Campana, 8°44' N, 79°57' W, 800–900 m, 24 junio 1994, *C. Galdames & et al. 1190* (PMA); Cerro Azul, 9°10' N, 79°25' W, 4 septiembre 1986, I.A. Valdespino 119 (PMA); Arraiján. A orillas del río Bique, 8°53' N, 79°40' W, 6 junio 1995, *E. Montenegro 1087* (PMA).

Xanthosoma knappiae Croat & Delannay, **sp. nov.** Type: PANAMA. Panamá: 10 miles from the Pan-American Highway on the El Llano-Cartí Road, Tropical wet forest, 09°14'N, 79°00'W, 350 m, 21 Apr. 1982, *Sandy Knapp, W. Mark Whitten & Michael J. Huft 4751* (holotype, MO-3043589). **Figure 21.**

The species is a member of group *Xanthosoma* and is characterized by its large size, long and thick erect trunks, green-drying ovate-cordate-sagittate blades with

thick major veins raised above and below and numerous prominent basal veins, and by its infructescences with the spathe tube green on both surfaces.

Large terrestrial plant; **stems** erect, 1.5–2 m tall, 8–10 cm diam. **LEAVES** with **petioles** ca. 1 m long, drying brown and densely pale-maculate, sheath 2.5 cm wide on each side at the base; **blades** ovate-cordate-sagittate, 64–84 cm long, 54–72 cm wide, 1.15–1.2 times as long as wide, ca. 0.8 times as long as petiole, obtuse and short-acuminate at apex, prominently broadly lobed at the base, drying medium-dark green and semiglossy above, medium green and glossy below; **anterior lobe** 44–56 cm long, broadly rounded on margin; **posterior lobes** 32–38 cm long, 22–25 cm wide, obtuse and bluntly pointed at the tip, with inner margin broadly rounded and projecting into the sinus; **sinus** rhomboid, 19–22 cm long, 7–8 cm wide at the widest point; **midrib** broadly rounded, slightly paler, many-ribbed above, round-raised, many ribbed, sparsely pale-pustular with ribs minutely granular below; **primary lateral veins** 8–9 pairs, arising at a 50–60° angle, obscurely 7-ribbed and concolorous above, prominently 7-ribbed and dark brown below; **basal veins** 15 pairs, the 1st free to the base, 6 acroscopic, 9 basioscopic, all thick and prominent; **posterior rib** naked 5 cm, directed to the tip of the posterior lobe; **tertiary veins** prominulous on the lower surface. **INFLORESCENCE** with **spadix** in part missing, a portion of staminate portion present, the lowermost 12 mm of staminodia thickened (these largely



Figure 21



Figure 22

Figure 21. *Xanthosoma knappiae* Croat & Delannay (*Knapp et al.* 4721, MO-3043589). Herbarium specimen showing base of petiole, leaf blade, adaxial surface exposed at base with part of anterior lobe folded down exposing abaxial surface, as well as two inflorescences (one on right opened)..

Figure 22. *Xanthosoma laselvaense* Croat & Delannay (*Hammel 8015*, DUKE-271878). Herbarium specimen showing folded petiole, leaf blade with abaxial surface of basal lobes folded over onto the anterior lobe as well as an opened inflorescence on right.

eaten by beetles), the next higher series in 3 rows, 1.8–2.2 mm long, 0.6–1.2 mm wide, drying blackened. **INFRUCTESCENCES** 3–4 per node; **peduncle** 15–19 cm long; **spathe tube** 4–6 cm long, 1.5–2.5 cm diam., green on both surfaces; developing **fruits** white.

Xanthosoma knappiae is endemic to Panama, found only on the El Llano-Cartí road in San Blas and Panamá Provinces at 250–350 m in a *Premontane wet forest* life zone.

Xanthosoma knappiae could be confused with *Xanthosoma undipes* (Koch & Bouché) Koch, another large species that occurs in the same general area, but the latter differs by its coriaceous blades drying brown rather than being thin and drying green in the case of *X. knappiae* and by its spathe tube at least partly tinged purple outside and entirely deep purple inside rather than being green on both surfaces in the case of *X. knappiae*. It also generally occurs at higher elevations in the central Cordillera, at 1000–2200 m rather than 250–350 m for *X. knappiae*.

The species is named in honor of Sandy Knapp who collected this species first in 1982 when she was the Curator of Summit Herbarium (SCZ) and the official collector for the Flora of Panama Project while working for the Missouri Botanical Garden. Sandy is an expert with Solanaceae and is currently the Head of the Division of Life Sciences at the British Museum of Natural History in London.

Paratypes: PANAMA. **San Blas**: El Llano-Cartí Road, 19.1 km from Interamerican Hwy, 09°18'00"N, 78°58'30"W, 350 m, 18 Nov. 1984, *Greg C. de Nevers 4293* (MO); 1–5 miles of Nusagandi on El Llano-Cartí Rd, 09°16'N, 79°00'W, 250–300 m, 31 Mar. 1988, *Sue A. Thompson 4659* (CM).

Xanthosoma laselvaense Croat & Delannay, **sp. nov.** Type: COSTA RICA. Heredia: Quebrada El Salto near S boundary, 10°25'53"N,

84°00'13"W, 100 m, 11 Mar. 1980, *Barry E. Hammel 8015* (holotype, DUKE-271878). **Figure 22.**

The species is a member of group *Xanthosoma* and is characterized by its large size, long and thick decumbent stems, green-drying ovate-cordate-sagittate blades with broad posterior lobes and thin major veins, and by its large inflorescences with the spathe tube burgundy outside.

Large terrestrial plant with decumbent caudex to 3 m long, 15 cm diam. LEAVES with **petioles** 83–100 cm long, drying 1 cm diam. in the middle, drying brown. sheathed ca. ½ their length, sheath to 5 cm wide on each side near the base; **blades** ovate-cordate-sagittate, 46–70 cm long, 37–50 cm wide, deeply lobed at the base, obtuse and short-acuminate at apex, 1.25–1.4 times as long as wide, 0.55–0.7 times as long as petiole, widest near the petiolar plexus, drying thin and fragile, medium green and semiglossy above, light green and glossy below; **anterior lobe** 34–52 cm long, broadly rounded on margins; **posterior lobes** 21–32 cm long, 18–27 cm wide, broad, obtuse and bluntly pointed at the tip, almost as wide as long, with inner margin broadly rounded and projecting into the sinus; **sinus** rhomboid, 12 cm long, 5 cm wide; **major veins** drying raised above, slightly darker above, drying light brown below; **midrib** flattened and weakly 5-ribbed, slightly darker above, flattened, many-ribbed drying light brown with margins overlapping below; **primary lateral veins** 8 pairs, arising at a 50–60°

angle, thin and not prominent above, flattened to convex, 7-ribbed, light brown, with the ribs granular below; **basal veins** 9–10 pairs, the first pair free to the base or almost so, 5 pairs acroscopic, 4–5 pairs basioscopic, the basioscopic veins very weak and thin; **posterior ribs** naked 2–2.5 cm, directed to the tip of the posterior lobe; **tertiary veins** diffuse, barely visible with the naked eye on the lower surface. INFLORESCENCES with **peduncle** 13 cm long, drying 8 mm– diam.; **spathe** 16 cm long; tube 5 cm long, 3 cm diam., burgundy outside; **spad cmix** 14 cm long; staminate portion 11 cm long, 1.3 cm diam.; sterile portion 2 cm long, 8 mm diam. the thickened staminodia in the lower 11 mm eaten, the next higher 4 rows oblong, low, drying dark brown, 1.8–2.1 mm long, 0.6–1.1 mm diam., these not transitioning but abruptly changing to fertile synandria; pistillate portion 3 cm long, 1.5 cm diam.

Xanthosoma laselvaense is endemic to Costa Rica, found so far only at the La Selva OTS field station in Heredia Province at 100 m in a *Tropical wet forest* life zone.

Xanthosoma laselvaense could be confused with *Xanthosoma undipes* (Koch & Bouché) Koch, another large species with long thick decumbent stems that occurs in the same general area, but the latter differs by its coriaceous blades drying brown with thick major veins and numerous prominent basal veins, rather than drying green and having thin major veins and weak basal veins in the case of *X. laselvaense*. It also generally occurs at higher elevations in the

central Cordillera, at 1000–2200 m rather than 100 m for *X. laselvaense*.

The species is named for Finca La Selva where it has so far only been found.

Xanthosoma mafaffa Schott, *Arac. Betreff.* 2: 5 .1855. Type: Original material was questionably attributed to Mexico but either not collected or was lost. Neotype designated here: Cultivated at Missouri Botanical Garden, Sept. 18, 1999, *Thomas B. Croat* 82979 (neoholotype, MO5172954–57). This corresponds to Schott drawings 3384 and 3386. **Figures 23–26.**

Xanthosoma roseum Schott. *Oesterr. Bot. Wochenbl.* 3: 370. 1858. Type: COSTA RICA. *Oersted s.n.* (C, not seen).

The species is a member of group *Xanthosoma* and is characterized by its large size, acaulescent stems, thick waxy petioles, large medium-brown-drying ovate-cordate-sagittate blades deeply lobed at the base, posterior ribs naked 1–3 cm, and large inflorescences with the spathe tube reddish or pinkish green outside and the sterile portion of the spadix pink.

Large terrestrial plant to 1.7 m tall; **stems** hypogeous or occasionally epigeous and decumbent, rhizomatous, to 15 cm diam., sometimes to 10 cm tall, densely covered by brown fibers, white, turning pinkish, producing sparse turbinate cormels.



Figure 23



Figure 24

Figure 23. *Xanthosoma mafaffa* Schott (*Thompson 182*, CM) Sheet 1. Herbarium specimen showing lower half of leaf blade with adaxial surface exposed.

Figure 24. *Xanthosoma mafaffa* Schott (*Thompson 182*, CM). Sheet 2. Herbarium specimen showing upper half of leaf blade with abaxial surface exposed.

LEAVES 5–6; **petioles** 104–130 cm long, green, sometimes red at base, conspicuously waxy, sheathed 1/4–1/2 their length, sheath margins erect to revolute; **blades** ovate-cordate-sagittate or subhastate, 44–85 cm long, 31–50 cm wide, 1.4–1.7 times as long as wide, deeply lobed at the base, obtuse and acuminate at the apex, widest at the tip of the posterior lobes, spreading, dark green

and semiglossy above, medium green and matte below, margins reddish or purplish, drying medium brown and semiglossy above, light brown or light green and matte below; **posterior lobes** acute to acuminate at the tip; **sinus** parabolic or spatulate; **midrib** flattened, concolorous, drying finely ribbed above, thick, drying concolorous or darker and weakly flattened-raised, up to 20-



Figure 25



Figure 26

Figure 25. *Xanthosoma mafaffa* Schott (Thompson 182, CM). Sheet 3. Herbarium specimen showing entire inflorescence opened to expose spadix.

Figure 26. *Xanthosoma mafaffa* Schott (not collected; photo: Enrique Vargas). Live plant showing petioles and leaf blades, adaxial surface, with Enrique Vargas standing next to it to show the large size of this plant.

ribbed below; **primary lateral veins** 7–9 pairs, arising at a 50–70° angle, lighter above, concolorous below; **posterior ribs** naked 1–3 cm, directed to the tip of the posterior lobes. INFLORESCENCES 1–5 per axil, **peduncle** 30–35 cm long, 1–1.8 cm diam.; **spathe** 27–38 cm long; tube 8–9.5 cm long, 4–6 cm diam., reddish or pinkish green outside, white to yellow-red inside;

blade 17–22 cm long, greenish-yellow on both sides, margins occasionally reddish; **spadix** 22–30 cm long; staminate portion (12)19–23 cm long, 1.2–2.5 cm diam., obtuse to truncate at apex, white (or sometimes yellow-red); sterile portion (3.5)6–7 cm long, (0.8)1.0–2.3 cm diam. at base, constricted above to 7–15 mm, pink to red-purple, moderately dimorphic; the

thickened staminodia at base subrounded dark brown to blackened, matte, (0.9)2.8–3.2 mm, the next 1–3 higher rows ovate to subrhombic, dark yellow-brown on drying, (2.3)4–5.5 mm long, 1.6–3.2 mm wide, the remaining 3–6 rows low and oblong, 4–6 mm long with both ends obtusely pointed, sometimes smooth, sometime with a weak medial groove, drying light yellow-brown pistillate portion conical, (3)6–8 cm long, 1.5–1.8 cm diam., bright yellow.

Xanthosoma mafaffa is widely cultivated as a food crop in many parts of Central and South America and the Caribbean.

According to E.G. Gonçalves (Gonçalves 2011), *Xanthosoma mafaffa* has been confused with *Xanthosoma sagittifolium* (L.) Schott which is also widely cultivated. It differs from the latter by its naked posterior rib (versus not at all naked for *X. sagittifolium*) and by its pink sterile portion of the spadix (versus white or yellow for *X. sagittifolium*).

The tubers may be used in soups “locro” and the youngest leaves (cogollo) is eaten as a green vegetable after cooking and is also mixed with rice and pork blood to make sausage (Thompson 182).

Additional specimens seen: BELIZE. **Corozal:** Calcutta, 18°20'N, 88°25'W, 10 m, 18 Nov. 1989, *Michael J. Balick* 2212 (NY). COSTA RICA. **Heredia:** Santo Domingo, Cuenca del Tárcoles, calles, lotes y cafetales, 09°58'12"N, 84°05'24"W, 1100 m, 6 Dec. 1996, *Barry E. Hammel* 20571 (INB, MO).

San Jose: Montes de Oca, residential neighborhood along south side of Route 202, ca. 0.5 km west of Cristo, Sabanilla de Montes de Oca, 09°57'00"N, 84°01'48"W, 1310 m, 5 Feb. 1985, *Michael H. Grayum* 5069 (MO). HONDURAS. **Santa Bárbara:** Along gravel road on northwest side of Lago de Yojoa, rocky, disturbed slope, 14°56'N, 88°03'W, 700 m, 4 Aug. 1977, *Thomas B. Croat* 42750 (MO). NICARAGUA. **Atlántico Norte:** Wawa, 18 air km SW of Puerto Cabezas, 13°52'15"N, 83°27'40"W, 0–5 m, 15 Nov. 1994, *Patricia De Angelis* 533 (MO). PANAMA. **Bocas del Toro:** Vicinity of Ojo del Agua, ca. 7 km W of Almirante, disturbed areas along road, 09°18'48"N, 82°27'18"W, 190–220 m, 4 Aug. 1976, *Thomas B. Croat* 38157 (MO). **Colón:** Along Río Guanche ca 3–5 inland, 10–100 m, 3 Aug. 1974, *Thomas B. Croat* 26216 (MO); Thickets and pasture along Río Viejo, between the Portobelo road and Quebrada Ruiz, 4 km NE of Puerto Pilon, 5 m, 29 Sep 1973, *M. Nee* 7202 (MO). **Veraguas:** Santa Fe, Mouth of río Concepción, beach, cliffs and adjacent swamp, 08°50'39"N, 80°58'14"W, 0–5 m, 4 Dec. 1967, *Walter H. Lewis*, *Thomas B. Croat* & *John L. Hawker* 2851 (MO).

Xanthosoma mexicanum Liebm., *Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn* 1849 (1–2): 15. 1849. Type: MEXICO. Oaxaca: Trapiche de la Concepción, entre Totontepec y Comaltepec, 17°17'N, 96°02'W, 2500–3000 ft [760–920 m], July 1842, F. Liebmann s.n. (C). **Figures 27–32.**



Figure 27



Figure 28

Figure 27. *Xanthosoma mexicanum* Liebm. (not collected). Habit of live plant in cultivation showing petioles, leaf blades, adaxial surface, and inflorescence.

Figure 28. *Xanthosoma mexicanum* Liebm. (not collected). View of leaf blade, abaxial surface.

Xanthosoma croatianum L.D. Gómez & Gómez-Laur., *Phytologia* 52(4): 227. 1982. Type: Costa Rica. Guanacaste: Río Cabuyo, apx. 40 km NW of Cañas, G. Frankie & L.D. Gómez 18489 (CR, MO, F, K).

Xanthosoma pilosum K. Koch & Augustin, *Index Sem. (Berlin)* App. 2. 1855. Type: Planta in horto Augustino culta a Lindenio, hortulano belgico.

The species is a member of group *Chamaexanthosoma* and is recognized by its small size, variegated petioles and especially by the rather densely pubescent vegetative

parts, especially the lower leaf blade surfaces.

Moderate size terrestrial plant on rocky ground, to 1 m tall; **stem** tuberous, tubers depressed-globose, 2–5 cm diam. **LEAVES** with **petioles** sparsely hispid-pubescent, spongy, subterete, obtusely flattened adaxially, obtusely 1-ribbed adaxially, 36–55 cm long, drying ca. 5 mm diam., sheathed 41–47% their length; **blades** ovate-cordate-sagittate 23–39 cm long, 13.5–28 cm wide, 1.3–1.7 times as long as wide, 0.6–0.7 times as long as petiole, widest near the base or just below the middle, thin, prominently rounded at base, rounded or obtuse and shortly acuminate at apex, dark green and matte



Figure 29



Figure 30

Figure 29. *Xanthosoma mexicanum* Liebm. (not collected). Close-up showing dense pubescence on petiole and major veins of abaxial surface.

Figure 30. *Xanthosoma mexicanum* Liebm. (Croat & Zhu 78239). Habit of live plant in cultivation showing inflorescence at anthesis with spathe tube green outside and spathe blade dark purple at the base (on right), young infructescence on left.

above, moderately paler and weakly glossy below, drying dark green or dark brownish green and matte above, light grayish green and semiglossy below, granular and sparsely hispid above, hispid on surface below; **anterior lobes** 19–29 cm long, rounded on the margins; **posterior lobes** 8–16 cm long, 6–12.5 cm wide, short and broad, rounded

at the apex; **sinus** broadly parabolic or hippocrepiform, sometimes closed, 6–11 cm deep, 2–5 cm wide in the middle; **major veins** weakly sunken above, raised below, all prominently hispid on lower surface, often densely so; **primary lateral veins** 3–5 pairs, arising at a 35–50° angle; **basal veins** 4–6 pairs, 1st & sometimes 2nd pair free to base,



Figure 31



Figure 32

Figure 31. *Xanthosoma mexicanum* Liebm. (Ortiz 2425; photo: Orlando Ortiz). Close-up of opened inflorescence showing spathe tube green inside, greenish yellow pistillate spadix, white lower staminodia, and reddish purple upper staminodia.

Figure 32. *Xanthosoma mexicanum* Liebm. (Ortiz 2425; photo: Orlando Ortiz). Close-up of opened infructescence showing white berries.

3–4 acroscopic, 1–2 basioscopic; **posterior rib** naked at mosts 1 cm, weak and not thicker than basal veins, not reaching the tip of the posterior rib (merging into inner collective vein); **collective veins** 2 pairs, the 1st running very close to margin, the 2nd loop connected and running 3–10 mm from margin; **tertiary veins** not prominent.

INFLORESCENCES 1–4 per axil; **peduncle** pubescent, spongy, 30–37 cm long, light green; **spathe** 12.5–13 cm long; tube 4–4.5 cm long, 1.5–1.8 cm diam., tube medium green both surfaces but heavily dark purple at constriction; blade white or pale green, dark purple at the base; **spadix** 8–12.5 cm long; staminate portion 9.5–10.7

cm long, 5–8 mm diam. in the middle, white; sterile portion 2.5–4.5 cm long, 2 mm diam. in the elongated area, 1 cm diam. at the base; the larger staminodia at base in 2–3 rows, these white, subrounded, 3–3.6 mm long, the remaining staminodia, violet purple, elongated, transitioning immediately to a row of tapered staminodia, the remaining 4–5 rows, narrow, 4–5 mm long, 0.8–1.2 mm wide, drying light brown; pistillate portion 1.5–2.5 cm long, 5–8 mm diam., pale green or yellow.

Xanthosoma mexicanum ranges from Mexico to Colombia, occurring in areas of *Tropical moist forest*. Plants disappear during the dry season and reappear with the beginning of the rainy season.

Xanthosoma mexicanum is most easily confused with *X. pubescens* Poeppig which differs by its ovate-subcordate blades rather than being deeply cordate in the case of *X. mexicanum*. *X. pubescens* also occurs much farther south, in Peru and Bolivia.

Additional specimens seen: BELIZE. **Toledo:** Southwestern Maya Mountains, Columbia River Forest Reserve, trail between Gloria Camp and Edwards Camp to the South, 16°22'N, 89°10'W, 15 Apr. 1992, Bruce K. Holst 4497 (MO). COSTA RICA. *H.G.A. Engler 139* (MO). **Guanacaste:** Lowland woods along river, Finca Taboga, 6 mi. S, 6 mi. W. Canas, 19 July 1968, Rudy G. Koch 4857 (WIS); La Cruz, along road from Cuajiniquil to Hda. Murciélago, ca. 1.5 km E of Salinas German, Península de Santa

Elena, 10°55'48"N, 85°42'00"W, 70 m, 15 Aug. 2003, Michael H. Grayum 11599 (MO); Along upper Río Mairena and tributaries thereof, Península de Santa Elena, 10°52'48"N, 85°39'36"W, 135–150 m, 19 Aug. 2003, Michael H. Grayum & Roberto Espinoza 11698 (MO); Ca. 15 km from Interamerican Hwy. at La Cruz on gravel road leading generally S-ward (passing Bahía de Salinas), disturbed deciduous forest on calcareous sedimentary rocks, 10°58'48"N, 85°39'00"W, 80 m, 23 Aug. 1979, W. D. Stevens 13592 (MO); Nandayure, area no protegida, Pacífico Norte, Bejuco, Pilas de Bejuco, Finca de Benigno Mayorga, 09°50'24"N, 85°20'24"W, 60 m, 24 July 1994, Armando Estrada & Alexander Rodríguez 74 (MO); P.N. Barra Honda, Península de Nicoya, Estación Barra Honda, Sendero Los Mesones, 10°09'36"N, 85°21'36"W, 300–400 m, 7 Sep. 1993, Marielos Reyes, J. F. Morales & Eduardo Lépez 188 (CR, INB, MO); P.N. Barra Honda, Península de Nicoya, Estación Barra Honda, Sendero Los Mesones, 10°09'36"N, 85°21'36"W, 300–400 m, 7 Sep. 1993, Marielos Reyes, J. F. Morales & Eduardo Lépez 206 (CR, INB, K, MO, WU); Santa Cruz, Camino del ICE de Santa Cruz a Vista al Mar, 10°15'36"N, 85°34'48"W, 900 m, 22–26 July 1985, Luis Diego Gómez P., Gerardo Herrera Ch. & Programa Patrimonio Natural 23671A (MO); Camino del ICE de Santa Cruz a Vista al Mar, 10°15'36"N, 85°34'48"W, 900 m, 22–26 July 1985, Luis Diego Gómez P., Gerardo Herrera Ch. & Programa Patrimonio Natural 23673 (MO). **Heredia:** Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its

junction with the Río Sarapiquí, 10°25'12"N, 84°00'36"W, 100 m, 28 July 1981, *Barry E. Hammel 11073* (DUKE); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'53"N, 84°00'13"W, 100 m, 18 July 1982, *Barry E. Hammel & Jill Trainer 13248* (DUKE); Belen, Valle Central, San Antonio de Belén, Puente de Mulas, 09°58'12"N, 84°10'48"W, 900 m, 20 Sep. 1996, *José A. González R. 1235* (MO); Sarapiquí, La Selva Biological Station, entre cuarto de hornos y laboratorio, 10°25'53"N, 84°00'13"W, 100 m, 7 June 2006, *Orlando Vargas 1571*. **Puntarenas:** Nicoya Peninsula, Curú, semideciduous forest in uplands, evergreen forest in canyons and wet areas, deciduous forest on exposed bluffs, pasture and orchards on central flat, mangroves at Río Curú mouth, this from a roadcut at the top of the hill on the Paquera-Cobano Road, 09°46'48"N, 84°55'48"W, 90 m, 30 July 1996, *Andrew C. Sanders 19411* (MO); Monte Verde area, along road from Santa Elena to Interamerican Highway, 10°17'N, 84°50'W, 1200 m, 4 Aug. 1985, *Barry E. Hammel & Jill Trainer 14359* (MO); Isla San Lucas, Golfo de Nicoya, 09°57'N, 84°54'W, 0–25 m, 19 Oct. 1984, *Michael H. Grayum 4209* (MO); Reserva Biológica Carara, along S side of Río Grande de Tárcoles from Carretera Costanera E to vicinity of Paso Rieles (N base of Lomas Pizote), 09°48'00"N, 84°36'00"W, 20 m, 3 Oct. 1987, *Michael H. Grayum & Richard H. Warner 8363* (MO); Guacimal Road from Inter American highway to Monteverde, 7 km from highway, 10°13'N, 84°51'W, 300 m, 4

Aug. 1988, *William A. Haber 8527* (CR, MO); Buenos Aires, Valle del General, Carretera Interamericana Km 217–218, savanas, potreros secos y quebradas ca. 5 km a N de Paso Real, Finca Murciélago, 09°01'48"N, 83°15'00"W, 200 m, 9 July 1991, *Barry E. Hammel 18276* (CR); Esparza, Faja Costeña de Puntarenas, Macacona, Finca de Fam. Herrera, cerca de Quebrada Honda, 10°01'48"N, 84°37'12"W, 200 m, 23 July 1993, *Álvaro Fernández & C. Hood 1153* (CR); Golfito, Conte Burica, 08°24'57"N, 83°02'36"W, 250 m, 2 July 1980, *Rafael A. Ocampo S. 2872* (CR); Montes de Oro, Cuenca del Aranjuez, San Isidro, Las Lomas, 2.5 km N de Cuatro cruces, 10°01'33"N, 84°44'12"W, 10 m, 13 Aug. 1998, *Alexánder Rodríguez, Luis Diego Vargas & Víctor H. Ramírez 3910* (MO). **San José:** Acosta, Cuenca del Pirris-Damas, Río Jorco, bosques remanentes entre Bajo Badilla y Bajo Cardenas, 09°47'20"N, 84°16'32"W, 430–550 m, 22 Aug. 1996, *J. F. Morales 6472* (MO); Aserri, Bijagua, 09°37'57"N, 84°09'56"W, 1300 m, 13 May 1983, *Luis Diego Gómez P. 20566* (MO); Perez Zeledon, Pasturelands 0.5 km west [east] of Chiles between Quebrada Caño and Río General about 4 km west [east] of San Isidro de El General, 09°21'48"N, 83°39'59"W, 680 m, 1 July 1972, *James L. Luteyn 3280* (MO); Near bridge over Río Buena Vista 1/2 mile southwest of Rivas, 09°24'36"N, 83°39'36"W, 800 m, 14 Aug. 1977, *Thomas B. Croat 43408* (MO). **EL SALVADOR.** **Ahuachapán:** San Benito, al N del paso de los Aguilares, El Imposible, 13°49'N, 89°56'W, 7 Aug. 1992, *Eliberto A. Sandoval & Chinchilla 555* (B, LAGU, MO); Along

road from San Francisco Menéndez to Tacuba, 0–2 miles NE of San Francisco Menéndez, disturbed forest, 13°50'35"N, 90°00'57"W, 200–450 m, 28 July 1977, *Thomas B. Croat 42073* (MO); 1.5 miles SW of Tacuba on road to San Francisco Menéndez, riverbank (Río "Chocana"), 13°53'12"N, 89°56'22"W, 700 m, 28 July 1977, *Thomas B. Croat 42163* (MO); Along road from San Francisco Menéndez to Tacuba, 1–3 miles above intersection with road to Río Cara Sucia, roadsides and steep slopes in cultivated area, 13°52'01"N, 89°57'24"W, 1000–1250 m, 28 July 1977, *Thomas B. Croat 42118* (MO). **Cabañas:** Cinquera, ruta Paso Hondo-Campamento de La Cascabel, 13°52'N, 88°57'W, 550 m, 21 Aug. 2006, *Jorge Monterrosa S. 1067* (LAGU, MO); Cinquera, ruta Paso Hondo-Campamento de La Cascabel, 13°52'N, 88°57'W, 550 m, 21 Aug. 2006, *Jorge Monterrosa S., A. Soto & A. M. Rivera 1067* (LAGU, MO). **San Vicente:** San Vicente, Ctón. La Joya, A.N.P. La Joya, Puerta de Golpe-La Locura, 13°36'26"N, 88°43'42"W, 253 m, 13 Aug. 2013, *P. Galán, N. Espinoza & W. Lovato 2441* (LAGU, MO). GUATEMALA. **Alta Verapaz:** Along access road to Finca Argentina above Papalhá [Papaljá], 15 miles W of Telemán, 15°19'04"N, 90°00'05"W, 250 m, 19 July 1977, *Thomas B. Croat 41530* (MO); Coban, along route CA-14 between Cobán and Tactic, 6 miles S of Cobán, 13 miles N of Tactic, 15°24'21"N, 90°24'24"W, 1300 m, 18 July 1977, *Thomas B. Croat 41416* (MO); Along route CA-14 between Cobán and Tactic, 6 miles S of Cobán, 13 miles N of Tactic, 15°24'21"N, 90°24'24"W, 1300 m, 18

July 1977, *Thomas B. Croat 41416A* (MO). **Baja Verapaz:** El Chol, 4 km north of El Chol, on steep upper slopes of Sierra de Chuacus, 14°59'20"N, 90°27'51"W, 15 July 1970, *William E. Harmon & John D. Dwyer 3134* (MO); Salama, 8 miles south of turnoff to Salamá on Highway ca 14 to Cobán, 15°56'20"N, 90°13'13"W, 1000 m, 16 July 1977, *Thomas B. Croat 41127* (MO). MEXICO. Cordoba, Aug 1882, *E. Kerber 140* (MO); *E. Kerber 1b* (MO); 1841–1843, *F. M. Liebmans s.n.* (MO). **Chiapas:** Acacoyahua, Cacaotal, al S de Monte Ovando, Sierra del Soconusco, bosque tropical caducifolio, con Clethra, Piper, Conostegia, Malvaviscus, Trema, Costus, Araceae, 15°22'48"N, 92°40'12"W, 400 m, 12 July 1991, *Luz María González Villarreal, Rafael Ramírez D., R. González Tamayo & E. Salcedo 4160* (WIS); A 5 km N of Triunfo, 22 km N of Escuintla, veg: cafetal, 15°22'12"N, 92°31'48"W, 17 Sep. 1983, *Oswaldo Téllez V. & Richard J. Pankehurst 6914* (MO); 5 km N of Triunfo, 15°22'12"N, 92°31'48"W, 17 Sep. 1983, *Oswaldo Téllez V. & Richard J. Pankehurst 6914* (BM); Acacoyagua, Ejida Las Golondrinas, Cerro Mt. Ovando Trail to summit through coffee fincas, 15°27'N, 92°37'W, 900–1050 m, 21 Aug. 1996, *Thomas B. Croat 78470* (M, MO, NY); Angel Albino Corzo, slopes of Río Cuxtepec, along stream below Finca Cuxtepec [Custepec], 15°44'33"N, 92°58'01"W, 900 m, 12 Aug. 1981, *Dennis E. Breedlove 52114* (MO); Escuintla, about 10 miles NE of Escuintla just above El Triunfo, 15°20'39"N, 92°32'09"W, 300 m, 21 Aug. 1977, *Thomas B. Croat 43853* (MO); About 14 miles N of Escuintla, along gravel

road to Finca Tres de Mayo, ca. 4 miles NE of El Triunfo, 15°22'05"N, 92°30'44"W, 400 m, 21 Aug. 1977, *Thomas B. Croat 43881* (MO); About 14 miles N of Escuintla, along gravel road to Finca Tres de Mayo, ca. 4 miles NE of El Triunfo, 15°22'05"N, 92°30'44"W, 400 m, 21 Aug. 1977, *Thomas B. Croat 43894* (MO); Tapachula, 2 miles SW of Guatemalan border along Highway 200 to Tapachula, 14°55'49"N, 92°09'39"W, 300 m, 20 Aug. 1977, *Thomas B. Croat 43773* (MO). **Jalisco:** 6 km al N de El Tuito, municipio de El Tuito, bosque de encinos, 20°22'12"N, 105°19'12"W, 800 m, 11 Aug. 1986, *Sergio Zamudio R. 4358* (MO). **Oaxaca:** Mpio. Sta. María Chimalapa, al NE de Sta. María por la vereda al Paso Lagarto, cerca el entronque con la vereda al Paso Tzajinjeun, monte perturbado con cafetal con *Termanilia*, *Bursera*, *Spondias*, *Cordia alliodora*, *Zanthoxylum*, plano, suelo profundo color café, 16°55'48"N, 94°39'36"W, 250 m, 3 Aug. 1986, *Heriberto Hernández G. 2291* (MO); Xianaguilla, above, 16°12'00"N, 96°36'36"W, 2575 m, 23 Oct. 1995, *James C. Hinton 26374* (GBH); Juchitán, entrada al camino de la Gloria al SE de Sta. María Chimalapa, veg. ecotonia de selva alta perennifolia alterada con encinar, 30 Aug. 1984, *Rafael Torres C. & Cipriano Martínez R. 6063* (MO). **Sinaloa:** La Noria, foothills, N. slope wooded hill S of village, 23°28'N, 106°16'W - 23°33'N, 106°22'W, 800 ft, 9 Oct. 1925, *Ynés Mexia 217* (MO); Cerro El Elefante, 17.85 mi E of Hwy 15 and 5 mi E of Concordia, canyon in foothills, with rocky soil, tropical deciduous forest, with *Acacia*, *Ficus*, *Pachycereus*, *Mimosa*, *Bursera*, etc.,

23°18'N, 106°00'W, 200 m, 18 Aug. 1988, *Andrew C. Sanders, G.R. Ballmer, Ignacio García Ruiz & T.P. Krantz 8041* (MO); Concordia, Transecto del Rancho Coyotes a El Pirame, Comunidad La Guásima, 23°23'17"N, 105°58'42"W - 23°24'55"N, 105°59'23"W, 411–728 m, 24 July 2009, *Marcela Ruiz Guerrero, Albert van der Heiden & Alwin van der Heiden 2009–092* (MO). **Veracruz:** San Andrés Tuxtla, Ver, Sep 1957, *E. Hernández X. 133* (CHAPA); San Andrés Tuxtla, EBT, camino a Laguna escondida, 18°35'02"N, 95°04'38"W, 78 m, 30 Aug. 2014, *Pedro Díaz Jiménez 1320* (MO). NICARAGUA. **Atlántico Norte:** Municipio de Siuna, Santa Rosa, 13°39'30"N, 84°55'00"W, 135 m, 6 Sep. 1982, *F. Ortíz 131* (CHAPA, MO). **Atlántico Sur:** Rama, rain forest [seymour series], 12°10'N, 84°13'W, 0–50 m, 13 Dec. 1968, *John T. Atwood & A.D. Moore 582* (MO). **Carazo:** Entrada a La Paz de Oriente, 1 km de la carretera Sur, Km 54, 11°49'N, 86°08'W, 380–400 m, 31 Aug. 1981, *P.P. Moreno 10702* (MO). **Chinandega:** faldas SE del Volcán Casita, 1 km antes de Argelia, 12°40'N, 86°57'W, 650–700 m, 30 July 1980, *P.P. Moreno 1583* (MO). **Chontales:** 12°04'N, 85°06'W, 430 m, 28 Sep. 1976, *Avinoam Danin 76–25–8*; 3 km N of Cuapa, premontane moist forest, 12°17'N, 85°23'W, 500 m, 3 Sep. 1977, *David Neill 2484* (MO); Sobre el camino entre Juigalpa y Puerto Díaz, 11°58'N, 85°22'W - 12°06'N, 85°31'W, 31–130 m, 11 July 1980, *M. Guzmán, D. Castro C. & A. Montiel J. 362* (MO); Along road from Juigalpa NE toward La Libertad, ca. 17.4 km NE of Río Mayales, at ford of Río El

Bizcocho, pastures, gallery forest and steep cliffs S of river, 12°12'N, 85°17'W, 350–400 m, 23–25 Sep. 1977, *W. D. Stevens 4027* (MO); Along road from Juigalpa NE toward La Libertad, ca. 17.4 km NE of Río Mayales, at ford of Río El Bizcocho, pastures, gallery forest and steep cliffs S of river, 12°12'N, 85°17'W, 350–400 m, 23–25 Sep. 1977, *W. D. Stevens 4178* (MO); Hda. Veracruz, including Cerro La Batea, pasture on rocky slopes and deciduous forest on basaltic mesas, 12°11'N, 85°21'W, 120–375 m, 30 Oct. 1984 – 2 Nov. 1984, *W. D. Stevens 23276* (MO); 2.2 km NW of Río Cuapa bridge below Cuapa, moist forest along stream, 12°17'18"N, 85°22'10"W, 465 m, 21 Aug. 2015, *W. D. Stevens 36809* (HULE, MO); Along road from Juigalpa NE toward La Libertad, ca. 17.4 km NE of Río Mayales, at ford of Río El Bizcocho, pastures, gallery forest and steep cliffs S of river, 12°12'N, 85°17'W, 350–400 m, 23–25 Sep. 1977, *W. D. Stevens 4162-A* (MO). **Granada:** NE del Volcán Mombacho, en el empalme de los caminos a Santa Isabel y Cutirre, 11°51'N, 85°57'W, 340–360 m, 16 Sep. 1980, *P.P. Moreno 2596* (MO). **Madriz:** Ca. 5 miles E of El Jocote, roadside fencerow, 13°29'N, 86°20'W, 750 m, 6 Aug. 1977, *Thomas B. Croat 42873* (MO). **Nueva Segovia:** 0.6–3.9 km N of San Fernando, roadside and river floodplain, 13°41'N, 86°19'W, 720–820 m, 13 Aug. 1977, *W. D. Stevens 3350* (MO). **Río San Juan:** Along the road to San Carlos 5 km SE of Río Oyate, seasonally inundated forest and marsh along roadside, 11°42'N, 84°57'W, 40 m, 28 Aug. 1983, *James S. Miller & Michael H. Nee 1354* (MO). PANAMA. **Canal Area:**

Near Survival School, Curundu, 08°58'59"N, 79°30'57"W, 50 m, 14 Aug. 1965, *Edwin L. Tyson 1082* (MO); Behind Survival School, Fort Clayton, 08°58'59"N, 79°30'57"W, 50 m, 23 Sep. 1972, *Edwin L. Tyson 6777* (MO); Curundu, Survival School area, 08°58'59"N, 79°30'57"W, 50 m, 27 Sep. 1965, *Edwin L. Tyson 1312* (MO); Panamá City, Curundu district, 08°58'59"N, 79°30'57"W, 50 m, 2 Sep. 1984, *H.W. Churchill & A. Churchill 6026* (MO); Mohinga Swamp, lower Chagres River, 09°07'50"N, 79°40'30"W, 0–5 m, 26 Aug. 1940, *Harley H. Bartlett & Tobias Lasser 16861* (MO); Vicinity of Juan Mina, 09°10'20"N, 79°39'00"W, 0–5 m, 24 July 1940, *Harley H. Bartlett & Tobias Lasser 16532* (MO); Pipeline Road, 10–15 mi from Gamboa, 09°10'N, 79°45'W, 100 m, 6 Aug. 1983, *James S. Miller 1026* (MO); Madden Dam, 09°12'32"N, 79°37'00"W, 50 m, 10 Aug. 1960, *John E. Ebinger 832* (MO); Madden Lake, various trails beyond dam, 09°12'32"N, 79°37'00"W, 50 m, 20 Oct. 1975, *John T. Witherspoon & Fran Witherspoon 8807* (MO); Across highway from Summit Garden, 09°03'52"N, 79°38'58"W, 75 m, 8 Oct. 1975, *John T. Witherspoon & Fran Witherspoon 8697* (MO); Road to Boy Scout Camp off Madden Dam Road, 09°11'55"N, 79°36'47"W, 75 m, 2 Aug. 1967, *Joseph H. Kirkbride, Jr. 54* (MO); Along road to radar station on Semaphor Hill. 1km NW of Summit Garden, secondary tropical moist forest, 09°04'31"N, 79°38'52"W, 100 m, 7 Oct. 1973, *Michael H. Nee 7292* (MO); Balboa, across from fire station, 08°57'N, 79°34'W, 10–50 m, 6 Sep. 1974, *Scott A. Mori & Jacquelyn A. Kallunki 1712* (MO);

Barro Colorado Island, 09°09'N, 79°51'W, 10–100 m, 1931, *Silvestre Aviles 50* (MO); Road C-16, northwest of Pedro Miguel, 09°01'05"N, 79°36'41"W, 0–20 m, 18 Sep. 1970, *Thomas B. Croat 12260* (MO); Barro Colorado Island. Near dock, 09°09'49"N, 79°50'11"W, 0–5 m, 15 Sep. 1968, *Thomas B. Croat 6079* (MO); Barro Colorado Island, lab clearing near stairs at dock, 09°09'49"N, 79°50'11"W, 0–5 m, 15 July 1970, *Thomas B. Croat 11256* (MO); Along highway at Summit Garden, 09°03'52"N, 79°38'58"W, 75 m, 16 June 1971, *Thomas B. Croat 15007* (MO); Madden Forest Road 1, 09°04'49"N, 79°37'15"W, 100 m, 28 June 1970, *Thomas B. Croat 11051* (MO); Barro Colorado Island, laboratory clearing, Canal Zone, 09°09'45"N, 79°50'30"W, 20 m, 21 Sep. 1970, *Thomas B. Croat 12290* (MO); Forest across from Summit Golf Course, 09°03'08"N, 79°38'17"W, 75 m, 12 July 1970, *Thomas B. Croat 11203* (MO); Barro Colorado Island, vicinity of lab clearing, 09°09'45"N, 79°50'30"W, 50 m, 10 Aug. 1971, *Thomas B. Croat 16631* (MO); Madden Forest (Parque Nacional Soberanía) Las Cruces Trail, 3.6 mi N of Gamboa Road turn-off, 09°06'20"N, 79°37'20"W, 140 m, 23 July 1994, *Thomas B. Croat & Guang Hua Zhu 77059* (CAS, MO); Along road between Gatun Locks and Fort Sherman, ca. 1 mi E of Fort Sherman, 09°19'00"N, 79°57'30"W, 25 m, 20 June 1994, *Thomas B. Croat & Guang Hua Zhu 78239* (CM, MO); Ca. 1/2 mile south of Río Pedro Miguel, Madden Forest, 09°05'16"N, 79°37'09"W, 150 m, 24 July 1972, *William G. D'Arcy & Janet J. D'Arcy 6023* (MO); Barro Colorado Island, Lab Clearing, on either side of stairs and

cart, 25 Aug. 1988, *N.C. Garwood 2481A* (PMA). **Chiriquí:** Río Chorchita, 08°24'17"N, 82°17'47"W, 25 m, 10 Sep. 1972, *Albyn H. Gentry 5854* (MO); Cerro Colorado, 3.7 km before Escopeta, along stream, 08°30'N, 81°48'W, 800–1000 m, 17 Aug. 1977, *James P. Folsom 4919* (MO); Tolé, vicinity of Santa Ana Well, thicket on hillside paralleling brook, 08°15'N, 82°40'W, 1000 ft, 1 Aug. 1967, *John D. Dwyer & Joseph H. Kirkebride, Jr. 7466* (MO); Gualaca-Chiriquí Grande Quebrada La Mina, 2.3 mi N of Los Planes, 08°41'N, 82°13'W, ca. 800 m, 24 June 1994, *Thomas B. Croat & Guang Hua Zhu 76359* (CM, MO); San Felix, Corregimiento of Hato Culantro, hamlet of Cerro Otoe, ca. 15–20 km N of San Felix, 08°25'42"N, 82°45'54"W, 3000 f, 3 Aug. 1975, *John Bort 45* (MO). **Coclé:** Antón, El Valle de Antón and vicinity, 08°36'N, 80°07'W - 08°37'N, 80°09'W, 500–700 m, 23–27 July 1935, *Russell J. Seibert 491* (MO). **Colón:** Chilibre, alrededores de la represa Madden, 09°12'39"N, 79°37'10"W, 89 m, 13 Aug. 2008, *C. Galdames & et al. 6244* (PMA). **Darién:** Cerro Pirre, 07°52'N, 77°44'W, 11 Apr. 1967, *Narciso Bristan 596* (MO); Serranía de Majé. Reserva Privada Chucantí, Cerro Chucantí, Cascada Chucantí, 08°47'31"N, 78°26'51"W, 699 m, 28 Aug. 2014, *O. Ortiz & et al. 2425* (PMA). **Los Santos:** Macaracas, Los Toretos, 07°40'N, 80°26'W, 10 Aug. 1962, *John D. Dwyer 2431* (MO); Pedasi, Los Asientos, 07°31'N, 80°08'W, 15 Aug. 1969, *Corina Wendebake 23* (DUKE, MO); Tonosi, collected in deciduous woods North of village of Guaniquito, about 10 miles north of Tonosí along Río Tonosí, 07°29'01"N, 80°36'05"W,

100–200 m, 17 July 1970, *James L. Luteyn & Robin B. Foster 1360* (MO). **Panamá:** Canal Area, Lake Madden, 09°14'14"N, 79°34'41"W, 100 m, 29 Aug. 1982, *Clem W. Hamilton & Henry Stockwell 1116* (MO); Curundú, 08°58'N, 79°33'W, 10 m, 28 July 1985, *Greg C. de Nevers 6088* (MO); Pipeline road, N of Gamboa, upstream of the tenth bridge (Río Guacharo), beyond the big waterfall, 09°10'N, 79°45'W, 100 m, 4 Aug. 1984, *Greg C. de Nevers & D. Hews 3628* (MO); Balboa, San José Island, along road between Bodega Bay and Río Mata Puerco, 08°15'29"N, 79°07'18"W, 10–20 m, 18–19 July 1967, *James A. Duke 12541* (MO); Capira, road up to Cerro Campana (Su-Lin motel), 08°41'14"N, 79°55'19"W, 800 m, 3 Sep. 1972, *Helen Kennedy 1531* (MO); Bald savanna-like areas along road toward top of Cerro Campana, 08°41'21"N, 79°54'54"W, 600 m, 22 Oct. 1962, *James A. Duke 5956* (MO); Chame, rocky slope on Interam. Hwy. 4 mi. NW[NE] of Bejuco, 08°38'55"N, 79°52'36"W, 41 m, 8 Oct. 1961, *James A. Duke 4561* (MO); Chepo, en el camino de Trocha C, cerca de la quebrada, campamento del G.M.I. isla Bayano, Altos de Majé, 09°09'30"N, 78°49'52"W, 50 m, 20 Aug. 1976, *Cristina Garibaldi E. 213* (F, MO, PMA); Open grazed area near Jenine [Jenené], along Pan-Am Highway, Río Cañita, 09°12'54"N, 78°51'52"W, 20–50 m, 24 Sep. 1961, *James A. Duke 3800* (MO); Panamá, Juan Diaz, carretera central, cerca del río, 09°02'30"N, 79°26'40"W, 10 m, 24 Aug. 1969, *Joaquina N. Castillo 25* (MO); Tocumen, 09°05'N, 79°23'W, 10–20 m, 23 July 1961, *John D. Dwyer 1082* (MO); Alhajuela, 09°11'01"N, 79°35'02"W, 600 m, July 1961, *John D. Dwyer 1047* (MO); 5 miles above Interamerican Highway on road to Cerro Azul, 09°07'37"N, 79°23'00"W, 240 m, 26 July 1970, *Thomas B. Croat 11523* (MO); Taboga, Isla Taboga, 08°47'N, 79°33'W, 0–186 m, 23–24 July 1938, *R.E. Woodson, Jr., Paul H. Allen & Russell J. Seibert 1521* (MO); Carretera Maden, 09°12'7.65"N, 79°37'21.6"W, 26 Aug 2014, *M. Samaniego & C. Galdames MS0253* (PMA); Parque (Nacional) Metropolitano. Cerca del área de construcción del Corredor Norte, 08°59'N, 79°33'W, 16 July 1996, *E. Montenegro 1397* (PMA); Parque Nacional Chagres, Carretera Madden, entrando por la calle que da a la estación hidrológica de la ACP, 09°07'N, 79°37'W, 5 July 2000, *R. Aizprúa & N. Flores B2032* (PMA, SCZ); Chilibre, 23 June 1996, *B. Cuadra & A. Velásquez 93* (PMA); Capira, growing next to road on way to Cerro Campana ridge, 08°41'N, 79°55' W, 19 Aug. 1967, *R.J. Garner 29* (PMA); Capira, Cerro Trinidad, limite E del Parque Nac. Campana, bosque nuboso entre dos grandes masas rocosas, 08°44'30"N, 79°57'45"W, 800–900 m, 24 June 1994, *Galdames & et al. 1192* (PMA). **Veraguas:** El Cuchillo, near Cerro Tute, up from Santa Fe, open rocky hillside, 08°32'N, 81°07'W, 1300 m, 8–9 Sep. 1982, *Clem W. Hamilton, William G. D'Arcy & David W. Roubik 1221* (MO); Sante Fe River area just past turn to Alto de Piedra, 08°31'N, 81°05'W, 500 m, 26 Aug. 1984, *H.W. Churchill 5992* (MO); Calobre, along stream which feeds Laguna La Yeguada, 15 miles north of Calobre, 08°26'51"N, 80°51'20"W, 644 m, 21 July 1970, *James L. Luteyn 1448* (MO); Canazas, ca. 1 km above Cañasas [Cañasas] on road to Los Valles,

disturbed area along stream, 08°19'59"N, 81°12'43"W, 230 m, 14 July 1976, *Thomas B. Croat 37065* (MO); Santa Fé, Los Llanos, El Cuay, 08°26'41"N, 81°07'37"W, 400 m, 26 July 1995, *Florpan 2149* (MO, PMA); Cerro Tute, 08°28'56"N, 81°05'53"W, 700–1000 m, 8 Aug. 1963, *John D. Dnyer 4285* (MO); Sona, Bahia Honda, Aledaños de Salmonete, bosque alterado, 17 N MU 4562, 07°40'25"N, 81°36'22"W, 10–40 m, 9 July 2001, *Santiago Castroviejo, José L. Fernández-Alonso, Alicia Ibáñez & Beatriz Wong 16555SC* (MO, PMA).

Xanthosoma ortizii Croat, **sp. nov.** Type: PANAMA. Colón: Parque Nacional Portobelo, Cascajal, Área boscosa a los alrededores de Bajo Bonito, bosque húmedo con presencia de muchos cuerpos de agua, 09°30'55"N, 79°31'56"W, 165 m, 17 Aug. 2013, *O. O. Ortiz, L. Martínez, A. Cubilla, J. I. Dojirama & J. Dojirama 1572* (holotype, MO-6581419; isotype, PMA). **Figures 33–37.**

The species is a member of group *Xanthosoma* and is characterized by its moderately small size, greenish-brown-drying narrowly ovate-triangular blades deeply sagittate at the base, and its long-pedunculated inflorescences with the spathe tube green inside and outside.

Moderately small tuberous herb; stem to 4 cm diam.; **petioles** 54 cm long, sheathed to 30% of their length, medium green, semiglossy obtusely, weakly flattened

adaxially; **blades** narrowly ovate-triangular, 34.5 cm long, 18 cm wide, 1.9 times longer than broad, 0.63 times as long as blades, acuminate at apex, deeply sagittate at base, medium green and semiglossy above, moderately paler, whitish and weakly glossy below, drying greenish brown below; **midrib** sunken and concolorous above, paler and narrowly round-raised below, drying darker than surface with 2–3 dark ribs; **primary lateral veins** 6–7 pairs, arising at 45–50° angle, bluntly sunken and concolorous above, narrowly rounded and pale sunken in part above, weak, moderately few and flattened, drying below, drying flattened with 1–2 dark ribs; **tertiary veins** in part weakly darker than surface below. INFLORESCENCE with **peduncles** 15 cm long; **spathe** 12.7 cm long; tube bulbous, 4.5 cm long, 12 mm diam. when furled, 3 cm diam. at anthesis, medium green, semiglossy outside, glossy and greenish on inside; blade 7.7 cm long, 4.7 cm diam. at anthesis, oblong-elliptic, naviculiform, white on both surfaces, somewhat hooded; **spadix** 8.3 cm long; staminate portion 6.5 cm long; sterile staminate portion 2.3 cm long, the basal portion at base eaten away, tapering upward with low sulcate staminodia to 2 mm long, 0.6 mm wide; **pistillate portion** 2 cm long, 6 mm diam.

Xanthosoma ortizii is endemic to Panama, known only from Colón Province at 136–165 m in a *Tropical wet forest* life zone.

In terms of size and blade shape the species resembles *X. mexicanum* Liebm., *X.*



Figure 33



Figure 34

Figure 33. *Xanthosoma ortizii* Croat (Ortiz et al. 1972, MO-6581419). Herbarium specimen showing adaxial blade surface, inflorescence and petiole.

Figure 34. *Xanthosoma ortizii* Croat (Ortiz et al. 1972, PMA-106724). Herbarium specimen showing petiole, leaf blade, mostly abaxial surface with a portion of the anterior lobe folded upward to expose adaxial surface, infructescence (left) and opened inflorescence (right).

caladioides Grayum, *X. dealbatum* Grayum and *X. cerrosapense* Croat & O. Ortiz. *Xanthosoma mexicanum* differs by its densely pubescent blades and by having the spathe tube purple inside. *Xanthosoma caladioides* Grayum is a similar small tuberous plant but it too differs by having the spathe dark purple inside the tube; *X. dealbatum* differs by

occurring in open sunny areas on the western slope of the mountains in Costa Rica and Panama and by having prominently discolored leaf blades which are whitish on the lower surface and have posterior ribs which are not naked; *X. cerrosapense* Croat & Ortiz from Darién Province differs by being a more robust



Figure 35

Figure 36

Figure 35. *Xanthosoma ortizii* Croat (*Ortiz et al. 1572*; photo: Orlando Ortiz). Live plant showing acaulescent habit, petioles, leaf blades, adaxial surfaces, inflorescence and infructescence.

Figure 36. *Xanthosoma ortizii* Croat (*Grayum et al. 13269*; photo: Michael Grayum). View of bases of petioles and inflorescence with spathe tube green outside and naviculiform spathe blade.

plant (more than 1 m tall) and having petioles heavily tinged with red, and spathes more than 15 cm long with blades not naviculiform.

Two Mexican species might be confused with *X. ortizii*, namely *X. pringlei* Croat which differs by having the posterior lobes acuminate at apex and about 2/3 as long as the anterior lobe in contrast to bluntly pointed to narrowly rounded in *X. ortizii*, and *X. yucatanense* Engl. which differs by having the anterior lobe moderately constricted somewhat above the petiolar plexus and by having subrounded posterior lobes which are directed somewhat outward on flattened leaves.

The species is named in honor of Panamanian botanist Orlando Ortiz who discovered the type collection. Orlando, who works at the Universidad de Panamá has worked with Araceae only a few years but has become one of the principal world authorities on the Araceae of Panama.

Paratype: PANAMA: **Colón**, Minera Panamá copper-mining concession, along Río Botija and tributary creeks, 08°50'01"N, 80°38'40"W, 136 m, 31 Aug. 2014, *M. H. Grayum & et al. 13269* (PMA).

***Xanthosoma petaquillense* Croat, sp. nov.** Type: PANAMA. Colón: Teck Cominco Petaquilla mining



Figure 37

Figure 37. *Xanthosoma ortizii* Croat (*Ortiz et al.* 1572; photo: Orlando Ortiz). Close-up of inflorescence and young infructescence.



Figure 38

Figure 38. *Xanthosoma petaquillense* Croat (*McPherson* 19518, MO-6072111). Herbarium specimen showing petiole, leaf blades, abaxial (left and on far right) and adaxial surfaces (center), and exposed infructescence (lower left).

concession; streamside in dense forest; 08°50'20"N, 80°41'28"W, 121 m, 14 Sep. 2007, *Gordon McPherson* 19518 (holotype, MO-6072111; isotype, PMA). **Figure 38.**

The species is a member of group *Xanthosoma* and is characterized by its small

size, long-petiolate leaves, small narrowly ovate-elliptic-sagittate, narrowly long-acuminate at apex blades with prominently and acutely lobed posterior lobes which are weakly constricted near the point of the petiolar plexus, with 4–5 pairs of primary lateral veins as well as by the short-pedunculate infructescence and orange

berries. Especially characteristic is the black seeds which are normally pale tan.

Terrestrial; stem short; **internodes** short, 2 cm diam. LEAVES with **petioles** (18)23–26.5 cm long, 4–5 mm diam., sheathed to middle, gradually ending at apex; **blades** (13.3)18–19 cm long, (5)7.3–8.4 cm wide, 2.2–2.4 times longer than wide, 0.71–0.75 times as long as petioles, narrowly ovate-elliptic-sagittate, narrowly long-acuminate at apex, prominently and acutely lobed at base, moderately thin, glabrous, drying dark gray brown, matte above, moderately paler and gray, weakly glossy below, smooth; **anterior lobe** 10.5–13.3 cm long, 7.3–8.5 cm wide, broadest 2–3 cm above base, sometimes weakly constricted near the point of the petiolar plexus; **posterior lobes** directed at 150–158° angle, (3.3)5.5–6.3 cm long, (1.3)1.8–3 cm wide, sharply pointed; **midrib** flat and concolorous above, flattened, 9-ribbed, darker, short pale-lineate, matte below with the margins over-spreading; **primary lateral veins** 4–5 pairs, arising at 35–60° angle, drying darker than surface, arising at 30–70° angle, flattened and concolorous above, flattened with 5 ribs near the midrib, 3-ribbed midway, finally with the margins blackish and no other ribbing; **tertiary veins** weakly visible, flattened. INFLORESCENCE erect; **peduncle** 9.3 cm long, drying dark brown, matte, 4 mm diam.; spathe to 2.5 cm diam., mostly absent; **spadix** to 3.7 cm long, 1.7 cm diam. BERRIES orange, drying black, 8–9 mm long, 4–5 mm diam.; seeds 1 mm long, 0.8 mm diam., coarsely ribbed, black, glossy.

Xanthosoma petaquillense is endemic to Panama, known only from the Province of Colón at 121 m in a *Tropical wet forest* life zone.

Xanthosoma petaquillense is somewhat similar to small plants of *X. mexicanum* Liebm. but that species differs in having more broadly ovate-sagittate blades with densely pubescent lower blades surfaces.

The species is named for the type locality at the Petaquilla mining site in Colón Province.

***Xanthosoma pringlei* Croat, sp. nov.**

Type: MEXICO. Morelos: vic. Cuervavaca, In swampy soil, lava fields near Cuernavaca., 18°54'36"N, 99°13'48"W, 1524 m, 29 Sep. 1899, C.G. Pringle 7911 (CAS, DUKE, F, GH, JBSD, LL, RSA, UC, WISC). **Figure 39–40.**

The species is a member of group *Basisectum* and is characterized by its sagittate-hastate juvenile leaf, prominently 3-lobed greenish to brownish drying leaves with rounded to acuminate apices on the posterior lobes, with the lateral lobes spreading broadly and with more basioacopic veins than acroscopic veins as well as by the moderately long-pedunculate inflorescence.

Moderately small herb no less than 1 m tall; stem not seen, probably tuberous. LEAVES with **petioles** subterete, 16–30 cm



Figure 39

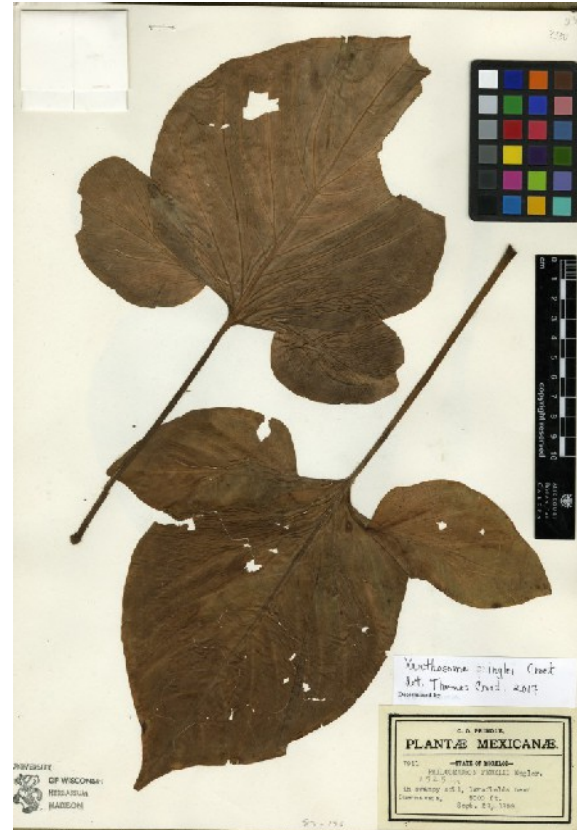


Figure 40

Figure 39. *Xanthosoma pringlei* Croft (Pringle 9711, RSA-227908). Herbarium specimen showing inflorescence (left), adult leaf blade (adaxial surface) and preadult leaf blade (abaxial surface).

Figure 40. *Xanthosoma pringlei* Croft (Pringle 9711, WISC-3350). Herbarium specimen showing adult leaf blades (abaxial surface above and adaxial surface below).

long, 3–4 mm diam. on drying, sheathed 7–15 cm at base, 0.20–0.39 its length, densely rufescent-flobose, especially toward apex; **blades** more or less 3-lobed, hastate, 14.5–32.5 cm long, 12.5–32 cm wide, 0.8–1.5 times as long as wide, broadest across the posterior lobes, about as long as petioles to 0.6 times as long as petioles, not markedly inequilateral, gradually long-acuminate at

apex, deeply lobed at base, thinly coriaceous, dark green and matte above, moderately paler and semiglossy below; drying dark olive-green above, moderately paler and yellowish green below; **anterior lobe** 13–21 cm long, broadly convex on margin, 7.5–15 cm across the middle of the anterior lobe, markedly constricted near base, the constricted area 3.5–9.5 cm wide;

posterior lobes 7–16.5 cm long, 4–7.5 cm wide, directed prominently outward at 110–120° angle, bluntly pointed at apex, broadly confluent onto the medial lobe with the lower margin ending abruptly, sometimes subcordate; **sinus** oblong to sub-mitered, 2–5 cm deep, 3–6 cm wide; basal veins 7–8 pairs, 1st pair often free to base, 3–4 acroscopic, 4–6 basioscopic; **posterior rib** straight to the tip of the lobe; **primary lateral veins** 3–4 pairs with intervening interprimary veins, arising at 35–55° angle; **minor veins** moderately obscure; both surfaces glabrous. INFLORESCENCE long-pedunculate; **peduncle** 9–22.5 cm long, 6–10 mm diam. on drying; **spathe** 15–17 cm long, tube 5.5–7 cm long, 1.7–2.4 cm diam., seemingly glaucous, matte; blade 11–19.5 cm long, to 2.2 cm diam. when furled, white, acuminate at apex; **spadix** 14 cm long; staminate portion 9 cm long, 10 mm diam. on thickest part near the apex; sterile staminate portion 3 cm long, 6 mm diam. at thickened base, 4 mm diam. at constricted portion; pistillate spadix color not known, 2 cm long, 5 mm diam.

Xanthosoma pringlei is endemic to Mexico, known only from Morelos and Nayarit States at 1000–1524 m in a *Tropical dry forest* life zone.

Xanthosoma pringlei is most closely related to *X. wendlandii* Schott which differs in having a pedately deeply lobed blade with 5–7 lobes.

Paratypes: MEXICO. **Nayarit**: Road from Tepic to Las Delicias, damp place under wild fig, 1000 m, 11 Sep. 1926, *Ynes Mexia 539* (MO); Tepic, Alameda Central, Paseo de la Loma, 22 Oct. 1987, *Rocío Ruenes M. 54*(MEXU).

Xanthosoma robustum Schott, *Oesterr. Bot. Wochenbl.* 3(47): 370. 1853. Type: MEXICO. Veracruz: Nov. 1841, *Liebmann s.n.* (C, F-022363). Schott drawings 3407 and 3412 also represent the species. **Figures 41–46.**

The species is a member of group *Xanthosoma* and is characterized by its large size, near absence of a tall stout stem, petioles sheathed 20–50% their length, the large triangular-sagittate moderately bicolorous blades typically 1.2–2.4 times longer than wide with the posterior rib naked 1.5–2.0 cm along the sinus as well as by up to 6 inflorescences per axil, glaucous peduncles, spathe tube green and glaucous outside, slightly paler green and semiglossy inside with pistillate portion tan to brown and the yellowish berries.

Perennial herb, 1.5–2 m tall; sap milky, sparse; **stem** absent or very short, to 40 cm long, inner part sometimes pinkish; **internodes** short, 6–15(20) cm wide; cataphylls 44–50 cm long; **petioles** 60–160 cm long, 1–2 cm wide midway, 1.0–1.5 cm at apex, obtusely sulcate to slightly convex adaxially above sheath, obtusely 1-ribbed near apex, sheathed 0.20–0.50 percent of its length, sheath decurrent at apex, the



Figure 41



Figure 42

Figure 41. *Xanthosoma robustum* Schott (not collected). Live plant showing acaulescent habit, petioles and leaf blades, adaxial surface. Note glaucous surface on the youngest petiole.

Figure 42. *Xanthosoma robustum* Schott (Croat 78607). View of glaucous petiole bases.

margins erect-incurred; **blade** triangular-sagittate, (33)36–110 cm long, (22)30–72(110) cm wide at the base, (0.8)1.2–2.4 times longer than wide, semilustrous to matte-subvelvety and dark green above, paler and matte below, sometimes glaucous, bluish green, drying moderately thin, dark yellow or brown on upper surface, somewhat paler and yellowish gray to brown below; **anterior lobe** 15–65 cm long,

the margins broadly concave; **posterior lobes** 19–39(57) cm long, 9–23(30) cm wide, spreading at an angle of 60–90°; **posterior ribs** more or less straight to the apex of the lobes, naked 1.5–2.0 cm along the sinus; **sinus** 9–20 cm deep, narrowly rounded at apex with the sides almost straight; **midrib** almost flattened and concolorous on drying, broadly rounded, moderately paler to concolorous, broadly



Figure 43



Figure 44

Figure 43. *Xanthosoma robustum* Schott (Croat 78607). View of leaf blade, adaxial surface, with posterior rib naked at the base.

Figure 44. *Xanthosoma robustum* Schott (Croat 78607). View of leaf blade, abaxial surface, showing glaucous lower surface.

acute and moderately paler, brownish yellow below; **midrib** and primary lateral veins concave and slightly paler above, narrowly round-raised, faintly striate and paler below; **primary lateral veins** 4–9 per side, departing midrib at 45–55° angle, the lower most at 55° angle then spreading at 65–75° angle; **basal veins** 3–4 pairs, the primary pair coalesced 1–7 cm, the 2nd pair fused for 6–7 cm, the acroscopic veins spreading perpendicularly from the petiole and joining the collective veins; **collective veins** 3–6 mm from the margin, extending to the apex of the posterior lobes; **tertiary veins** prominently darker than surface, in part prominulous. INFLORESCENCE erect, to

6 per axil; bracts sharply 2-ribbed, glaucous; **peduncle** 22–46(60) cm long, obtusely 3-sided, flattened, glaucous; **spathe** 20–29(37) cm long at anthesis, 37–47 cm long in fruit; tube medium green and weakly glaucous, matte outside, slightly paler green and semiglossy inside, 4.5–8.5 cm long; blade cream to creamy yellow, 21–30 cm long, 7.5 cm wide, flattening to 12–13 cm wide; **spadix** 20–30 cm long; staminate portion white, 16.3–21.5 cm long, 2 cm wide on drying; sterile staminate portion 3.5–5.5 cm long, the lower thickened portion broader than apex of pistillate portion, cream; lowermost thickened staminodia in 4–5 rows, drying blackened, 2–3.5 mm long,



Figure 45



Figure 46

Figure 45. *Xanthosoma robustum* Schott (not collected). Close-up of inflorescence showing spathe tube light green and glaucous outside.

Figure 46. *Xanthosoma robustum* Schott (not collected). Close-up of inflorescence showing spadix with yellowish pistillate spadix and cream-colored staminodia.

1.6–2.5 mm wide, gradually transitioning upwards to more squarish and increasingly more light brown-drying staminodia, the uppermost 4–5 rows all drying light brown, 2–3.5 mm long, 0.8–1 mm wide, bluntly pointed at both ends; pistillate portion tan to brown or pink (sometimes purple, see discussion), 3.5–5.3 cm long in front, 2.3–3.5 cm long in back, 2 cm diam. at the base

(dried), 1.5 cm diam. near apex (dried), ovary oblong-elliptic, with stigmas prominently sunken medially, 0.8–1.0 mm wide when dried. INFRUCTESCENCE to 5–8 cm long, 4.5–5.0 diam. drying dark brown; berries yellowish, drying light brown, 4–6 mm diam.; seeds narrowly ovate, coarsely striate longitudinally, 1.2–1.4 mm long, 0.5–0.6 mm diam.

Xanthosoma robustum ranges from Mexico (Chiapas, Colima, Guerrero, Oaxaca, Queretaro, Tabasco, Veracruz) to Guatemala, Belize, Honduras, Nicaragua and Costa Rica ranging from sea level to 1400 m, in *Tropical moist forest*, *Premontane wet forest* and *Tropical wet forest* life zones, occurring along streams or in open stands sometimes in full sun. Common name “rajalgar”.

In Central America, the species can be confused with the introduced but common *X. sagittifolium* (L.) Schott which also has little or no development of a prominent above-ground stem. That species differs in having more glaucous petioles and lower blade surfaces and in having the posterior rib barely or not at all naked.

In addition, *X. robustum* can be confused with *X. undipes* (Koch & Bouché) Koch, which differs in having a much longer trunk and leaf blades which have the major veins raised on the upper surface, not sunken and by having the spathe tube dark purple inside with a bright orange pistillate spadix.

In Nicaragua *Stevens 11469* reported the pistillate spadix to be yellow pre-anthesis and purple at anthesis

Additional specimens seen: BELIZE. **Stann Creek:** Mile 25, south of Belmopan, Hummingbird Highway, 17°03'N, 88°34'W, 22 Jan. 1974, *John D. Dwyer & Ronald L. Liesner 12078* (MO). **Toledo:** In high ridge,

at base of hill near Manga Camp, Edwards Road beyond Columbia, 16°20'N, 89°10'W, 1 June 1948, *Percy H. Gentle 6545* (LL); *Percy H. Gentle 6574* (LL); Columbia River Forest Reserve, Little Quartz Ridge, SW slopes, NE of Camp 1, shady, rocky creek bed on border between limestone and volcanic soils, 16°23'25"N, 89°06'40"W, 800–850 m, 21 Feb. 1997, *Bruce K. Holst 5922* (MO); Southern Maya Mountains, Bladen Nature Reserve, riverside vegetation between "AC Camp" and "AC Camp" helicopter landing site, upper Bladen Branch, 16°29'31"N, 88°54'37"W, 13 May 1997, *Gerrit Davidse 36369* (BRH, MO, UB); Southern Maya Mountains, Bladen Nature Reserve, narrow valley bottom around "AC Camp", along unnamed tributary of the upper Bladen Branch, 16°29'44"N, 88°54'47"W, 250 m, 7 May 1996, *Gerrit Davidse 35665* (BRH, CM, MO). COSTA RICA. Ountarenas and Alajuela Provinces, in and around the Monteverde Nature Reserve, mostly on the Pacific watershed, 10°18'N, 84°47'W, 1450–1650 m, 31 Oct. 1975–2 Nov. 1975, *William C. Burger & Richard K. Baker 9737* (MO). **Alajuela:** Beside road from Cariblanco to Laguna Hule about 2 km west of Costa Rica Highway 9, 10°17'N, 84°13'W, 7 Dec. 1975, *Richard K. Baker, John F. Utley & K. Burt-Utley 222* (MO). **Heredia:** Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'12"N, 84°00'36"W, 100 m, 24 Oct. 1980, *Barry E. Hammel 10286* (DUKE); Finca La Selva, the OTS field station on the Río Puerto Viejo just E of its junction with the Río Sarapiquí, 10°25'12"N, 84°00'36"W, 100 m, 8 Sep. 1980, *Barry E. Hammel 9718*

(DUKE); La Selva Biological Station, 10°25'53"N, 84°00'13"W, 100 m, 1 May 1981, *James P. Folsom 9963* (DUKE); Estación Biológica La Selva at confluence of Río Sarapiquí and Río Puerto Viejo, Atlantic slope, 10°25'48"N, 84°00'36"W, 50 m, 12 Apr. 1988, *Michael H. Grayum 8545* (MO); 3 miles south of Cariblanco on road between Vara Blanca and Puerto Viejo, 760 m, 29 May 1976, *Thomas B. Croat 35850* (MO); Heredia, R.F. Cordillera Volcánica Central, Cuenca del Sarapiquí, Aberque ALAS-1500, en Finca de Oscar Murillo, 10°14'07"N, 84°07'04"W, 1493–1500 m, 6 April 2005, *Armando Soto 607* (CR, INB, MO); Albergue ALAS-1500, en Finca de Oscar Murillo, 10°14'07"N, 84°07'04"W, 1493–1500 m, 6 April 2005, *Armando Soto 607*; San Isidro, North of San Isidro, Concepción, 10°01'12"N, 84°03'00"W, 1450 m, 24 Feb. 1984, *Ronaq Khan, M. C. Tebbs & A. R. Vickery 1261* (BM, CR, MO); Sarapiquí, Zona Protectora La Selva, 6 km by road from Río Peje crossing, 5 km south-southeast of Magsasay, along picada through primary forest southeast of basecamp eventually doubling back on Quebrada Cantarana, 10°21'N, 84°04'W, 340 m, 17 Jan. 1983, *George E. Schatz & Michael H. Grayum 645* (DUKE). **Limón:** Vicinity of Bribri, steep banks near Río Catarata, 09°37'48"N, 82°48'36"W, 0–50 m, 12 Aug. 1977, *Thomas B. Croat 43222* (MO). **Puntarenas:** Cantón de Osa Rincón, Agua Buena, Fila Casa Loma a Cerro de Osa, 08°42'36"N, 83°31'48"W, 50–450 m, 17 Oct. 1990, *Abelardo Chacón 1079* (INB, MO). EL SALVADOR. **Ahuachapán:** Along road from San Francisco Menéndez to Tacuba,

0–2 miles NE of San Francisco Menéndez, 13°50'35"N, 90°00'57"W, 200–450 m, 28 July 1977, *Thomas B. Croat 42059* (MO). **Cabañas:** 2.6 km east of Illobasco, coffee plantation owned by Malcolm Chisholm, 13°52'04"N, 88°51'04"W, 870 m, 21 Jan. 1998, *Gerrit Davidse, Karen J. Sidwell & Alex K. Monro 37104* (MO). **La Libertad:** Entrada a Finca Cumbres, 13°40'N, 89°15'W, 830 m, 13 July 1989, *Raul Villacorta, P. Lemus & S. Martínez 315* (MO). GUATEMALA. **Alta Verapaz:** Along road to El Estor (Lago Izabal), 2–4 miles E of Tamahú, 9–11 miles E of Highway CA-14 to Cobán, 15°18'44"N, 90°16'34"W, 700–800 m, 18 July 1977, *Thomas B. Croat 41495* (MO). **Escuintla:** San Vicente Pacaya, 1–5 km E of CA-9 on dirt road to San Vicente Pacaya, 14°25'23"N, 90°39'05"W, 15 Feb. 1970, *William E. Harmon 1941* (UMO); 1–5 km E of CA-9 on dirt road to San Vicente Pacaya, 14°25'23"N, 90°39'05"W, 15 Feb. 1970, *William E. Harmon 1941* (MO). **Guatemala:** Along National Hwy. 5, between Salamá and Guatemala City (via El Chol), 2 km past turnoff to San Raimundo (leaving paved road), 14°54'00"N, 90°38'00"W, 1000 m, 23 Jan. 1987, *Thomas B. Croat & Dylan P. Hannon 63533* (MO). **Izabal:** Collected 7.3 mi. N of Río Dulce on road to Tecal, 15°43'47"N, 89°03'43"W, 80–120 f, 8 Aug. 1975, *Douglas G. LeDoux, David B. Dunn & Kenneth J. Torke 2135* (MO); Collected 7.3 mi. N of Río Dulce on road to Tecal, 15°43'47"N, 89°03'43"W, 80–120 f, 8 Aug. 1975, *Douglas G. LeDoux, David B. Dunn & Kenneth J. Torke 2135* (MO, UMO); Along new dirt road ca. 1 mile E of Santo Tomás, ca. 4 miles SE of Puerto

Barrios, 15°41'18"N, 88°35'51"W, 50 m, 22 July 1977, *Thomas B. Croat 41862* (MO); Montañas del Mico, 7–8 km W of Santo Tomás de Castilla on road to microwave tower, 15°40'54"N, 88°40'42"W, 600–650 m, 19 Aug. 1988, *W. D. Stevens, Esteban M. Martínez S., Herbert Droege & Ava Nury Díaz 25545* (MO); Puerto Barrios, along new dirt road ca. 1 mile east of Santo Tomás, ca. 4 miles SW of Puerto Barrios, 15°41'18"N, 88°35'51"W, 50 m, 22 July 1977, *Thomas B. Croat 41820* (MO). **Jutiapa:** 8 miles SW of San Cristóbal along Hwy. CA-2, near a picnic area, deep canyon, Monjoy, 14°08'00"N, 89°45'51"W, 1600 f, 3 Aug. 1979, *David B. Dunn, Pan Case, Shelly Trott, Diane Thurm & Chester T. Dziekanowski 23283* (MO). **Petén:** Tikal, 17°13'30"N, 89°36'47"W, 3 Apr. 1959, *Cyrus L. Lundell 15857* (LL); Dolores, 1 km NNW of Dolores on Santo Toribio Trail, 16°31'45"N, 89°27'15"W, 24 May 1961, *Eliás Contreras 2390* (LL). **Sacatepéquez:** 5 km E of Antigua, 14°33'33"N, 90°42'18"W, 1700 m, 24 May 1970, *William E. Harmon 2369* (MO). HONDURAS. **Colón:** Trujillo, riverine forest, Howler site, 19 May 1980, *Janice G. Saunders 289A* (MO). MEXICO. 1841–1843, *F. M. Liebmann s.n.* (MO); Mirador, *H.G.A. Engler 120* (GH, MO). **Chiapas:** Escuintla, Along trail between Finca California (at base of S slope of Monte Ovando and ca. 4 km N of of Ovando Turquia) and summit of Cerro Ovando, disturbed forest in coffee plantation, 15°22'12"N, 92°36'00"W, 450–850 m, 14 Feb. 1979, *Thomas B. Croat 47571* (MO); 31 May 1965, *Dennis E. Breedlove s.n.* (F); 0–4 mi. N of Tapilula on Highway 195

to Villahermosa, 17°05'N, 93°08'W - 17°07'N, 93°08'W, 750 m, 1 June 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 434* (MO); Arriaga, along Mexican Highway 95 near Mone Bonito, Municipio of Arriaga, 1200 ft, 15 Dec. 1967, *Alonso Méndez Girón 3399* (F); Ixhuatán, along road between Bochil and Pichucalco, near shrine, 17°16'54"N, 93°00'47"W, 430 m, 24 Aug. 1996, *Thomas B. Croat 78607* (MO); La Independencia. Region E of Lagos de Montebello, along road Dos Lagunas and Ojo de Agua, 1.6 km beyond Ojo de Agua at ca. km 16, 16°06'20"N, 91°36'16"W, 1330 m, 28 Jan. 1979, *Thomas B. Croat 46684* (MO); Motozintla, along road from Motozintla to Huixtla, 15 miles S of Motozintla, 15°17'01"N, 92°22'56"W, 900 m, 10 July 1977, *Thomas B. Croat 40762* (MO); Ostucacán, E of Río Magdalena, El Chichon, 17°18'43"N, 93°12'32"W, 541 m, 16 Feb. 1984, *R. Burnham & P.R. Grant 70* (BM). **Colima:** Ca. 8 mi. SEE of Armería on road to Colima, 18°57'N, 103°52'W, 60 m, 23 May 1980, *Sue A. Thompson 417* (CM); Comala, Rancho El Jabali, 25 km (airline) NNW of Colima in the SW foothills of Volcan de Colima, humid montane forest, at Jalisco state line, forest at NE end of ridge between Lago Calabozo and L. Epazote, 19°26'24"N, 103°42'36"W, 1400 m, 18 May 1991, *Andrew C. Sanders & et al. 11013* (MO). **Guerrero:** 21 mi S of Tierra Colorado on Chilpancingo to Acapulco road (Rte. 95), 17°00'N, 99°45'W, 1200 m, 27 May 1980, *Sue A. Thompson, David S. Seigler & Mick Richardson 422* (B, MEXU, MO, US); Juan R. Escudero, along gravel road between Tierra Colorado and

Xalpatlahuac, between Tierra Colorado and bridge over Río Omitlán, 17°09'N, 99°31'W, 900–1000 m, 5 Jan. 1979, *Thomas B. Croat 45754* (MO). **Jalisco:** 20 mi S of Tecalitlán on Rte. 110 Colima-Ciudad Guzmán, 19°15'N, 103°24'W, 660 m, 24 May 1980, *Sue A. Thompson, David S. Seigler & Mick Richardson 418* (MO); 11 mi S of Tecalitlán on Rte. 110 Colima-Ciudad Guzmán, 19°24'23"N, 103°23'45"W, 900 m, 24 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 421* (MEXU, MO); 11 mi S of Tecalitlán on Rte. 110 Colima-Ciudad Guzmán, 19°24'23"N, 103°23'45"W, 900 m, 24 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 419* (CR, MEXU, MO); 11 mi S of Tecalitlán on Rte. 110 Colima-Ciudad Guzmán, 19°24'23"N, 103°23'45"W, 900 m, 24 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 420* (MEXU, MO); Shallow water and mucky edge of stream, disturbed open gallery forest (bosque tropical caducifolio perturbado) along a small stream (now a flume), 3/4 km SW of Zenzontla, NE-facing slopes above Río Ayuquila, 13–14 km SE of El Chante (by air), 19°39'07"N, 104°04'56"W - 19°39'13"N, 104°05'00"W, 900 m, 15 Mar. 1989, *Theodore S. Cochran, Mark A. Wetter & Francisco J. Santana M. 11662* (MO). **México:** Temascaltepec, Ixtapan, 18°50'24"N, 99°40'12"W, 28 May 1935, *George B. Hinton 7821* (GBH). **Michoacán:** Hacienda Coahuayula, Nov. 1906, *G.M. Emrick 65* (F). **Nuevo León:** Moist soil near the stream in gray silt between large pebbles, on an island in Río Santa Catarina about 1 mile above the entrance to Cañon de Ouasteca about 5

miles from Villa Santa Catarina, 28 Oct. 1944, *Antonio Hernández Corzo, Jamie A. Honey Boucquet & Fred A. Barkley 44M803* (MO); Moist gray salt on island in the Río Santa Catarina., 28 Oct. 1944, *Antonio Hernández Corzo, Jamie A. Honey Boucquet & Fred A. Barkley 44m805* (MO); Santa Catarina. on a island in Río Santa Catarina about a mile above the entrance to Canon de Ouastecs about 5 miles from Villa Santa Catarina, 25°40'12"N, 100°27'36"W, 28 Oct. 1944, *Antonio Hernández Corzo, Jamie A. Honey Boucquet & Fred A. Barkley 803* (MO); On an island in Río Santa Catarina about a mile above the entrance to Canon de Ouasteca about five miles from Villa Santa Catarina, *Hernández, Antonio, Bouquet & Fred A. Barkley 44M803* (NY). **Oaxaca:** Mpio. Eloxochitlán, San Antonio Elox. de Flores Magón, 18°12'N, 96°53'W, 1315 m, 14 Apr. 1990, *Bernal, H. 19* (CHAPA); 1 mi E of Pinotepa Nacional, 16°21'N, 98°05'W, 180 m, 28 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 423* (F, MEXU, MO, NY); 20 mi N of Puerto Escondido on Rte. 131 to Oaxaca, 16°13'N, 97°05'W, 540 m, 29 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 425* (MEXU, MO); 20 mi. N of Puerto Escondido on Rte. 131 to Oaxaca, 16°13'N, 97°05'W - 16°47'N, 97°08'W, 540 m, 29 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 426* (MEXU, MO); 29 mi. N of Puerto Escondido on Rte. 131 to Oaxaca, 16°13'N, 97°05'W - 16°47'N, 97°08'W, 1000 m, 29 May 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler 428* (B, MEXU, MO, NY); Mun. San Juan Bautista Valle Nacional, 4.5 mi S of Valle Nacional, on

steep hills above Highway 175 between Tuxtepec and Oaxaca, 17°43'48"N, 96°19'12"W, 430 m, 29 June 1977, *Thomas B. Croat* 39722 (MO); Along road from Valle National to Arriba Tortuga and Armadillo via Rancho Grande and Loma San Rafael 5–6 km NW of Valle Nacional Center (Hotel de la Valle), roadside with forest on steep slope, 17°47'25"N, 96°17'55"W, 474–476 m, 2 Mar. 2008, *Thomas B. Croat* 100117 (MO); Uxpanapa Region, along gravel road between Esmeralda (17 km E of Sarabia) and Río Manea (tributary of Río Verde), 11.5–13.5 mi S of Esmeralda, roadside vegetation with primary forest elements, 17°03'36"N, 94°45'W, 90–110 m, 19 Jan. 1987, *Thomas B. Croat & Dylan P. Hannon* 63262 (MO); Municipio: Eloxochitlan de Flores Gagon, aprox. 2 km del Puente de Flerro, por la brecha a Puerto Rosete (en dirección San Antonio Eloxochitlán de Flores Magón), 18°09'48"N, 96°51'15"W, 1323 m, 12 Feb. 2002, *Xochitl Munn-Estrada & F. Mendoza* 1923 (MO); Putla, along Highway 125 between Pinotepa and Tlaxiaco, ca. 11.4 mi S of Putla de Guerrero, 17°03'36"N, 97°51'36"W, 850 m, 16 Jan. 1979, *Thomas B. Croat* 45805 (MO). **Puebla:** Jonotla, 2 km adelante de Jonotla camino a Tuzamapan, Veg. Encinar, secundaria, 20°02'24"N, 97°34'12"W, 1050 m, July 1976, *Miguel Cházaro B.* 519 (MO); Xochitlán, adelante de Xochitlan camino a Zapotitlan, bosque caducifolio, primaria, 19°57'36"N, 97°37'12"W, 1050 m, 26 July 1976, *Miguel Cházaro B.* 557 (MO); Adelante de Xochitlan camino a Zapotitlan, 19°57'36"N, 97°37'12"W, 26 July 1976, *Miguel Cházaro B.* 519 (MO). **Querétaro:**

Jalpan, alrededores de Tanchanaquito, bosque tropical caducifilo y subcaducifolio, orilla de arroyo, 21°38'24"N, 99°13'12"W, 270 m, 8 Dec. 1993, *E. Carranza G.* 4726 (MO); Alrededores de Tanchanaquito, bosque tropical caducifolio y subcaducifolio, orilla de arroyo y río, cañada, 21°38'24"N, 99°13'12"W, 270 m, 25 June 1992, *E. Carranza G.* 4080 (MO); Alrededores de Tanchanaquito, bosque tropical caducifolio, orilla de arroyo, 21°38'24"N, 99°13'12"W, 270 m, 9 Mar. 1993, *E. Carranza G. & Sergio Zamudio R.* 4547 (MO); Al Sur de Tanchanaquito, Los Rejalgares, 21°38'24"N, 99°13'12"W, 16 Oct. 1992, *L. López* 460 (MO); Cañón del Río Santa María, cerca de Tanchanaquito, 21°38'24"N, 99°13'12"W, 260 m, 13 Dec. 1989, *Sergio Zamudio R. & E. Carranza G.* 7199 (MO); Landa de Matamoros, 11 km al W de Tilaco, mun. de Landa de Matamoros, bosque tropical subcaducifolio en cañada, 900 m, 9 June 1986, *Rafael Fernández Nava & Jerzy Rzedowski* 3453 (IEB). **Sinaloa:** Concordia, Arroyo El Coco, near Rancho Coyote, Comunidad La Guásima (north-northeast of Concordia), 23°23'N, 105°59'W, 340 m, 28 Feb. 2007, *Ana Lilia Reina G. & et al.* 2007–181 (MO). **Tabasco:** along the bank of the Río Teapa, 2 km SE of Teapa, 17°31'48"N, 92°57'36"W, 20 m, 12 Nov. 1984, *Gerrit Davidse, Mario Sousa S., Osvaldo Téllez V., E. Martínez L. & Jeany Davidse* 29556 (MO); 1 mi. W of Cárdenas on Highway 180 from Villahermosa, 18°00'N, 93°24'W, 15 m, 6 June 1980, *Sue A. Thompson, Mick Richardson & David S. Seigler* 439 (MO); Teapa, 50° slope of Cerro las Campanas 3 km E of Teapa, ca. 50 km S of

Villahermosa, 17°32'24"N, 92°55'48"W, 50–100 m, 12 Aug. 1974, *Jim Conrad, Rosemary Conrad & D. Rodríguez G.* 2887 (MO); Puyacatengo, Centro Regional de Chapingo, 60 m, 13 Mar. 1979, *K. Hormia* 52 (H, MO); 3 km E of Teapa, along road to Jalapa, 17°32'24"N, 92°55'48"W, 40 m, 4 July 1977, *Thomas B. Croat* 40131 (MO); Southeast of Teapa at Km 4, on road to Tacotalpa, 17°32'24"N, 92°55'12"W, 325 m, 18 Feb. 1979, *Thomas B. Croat* 47879 (MO).

Tamaulipas: Sandy upland fourteen miles south of Nuevo Laredo, 24 Mar. 1944, *Fred A. Barkley* 14596 (MO); Victoria, 320 m, 1 Feb. - 9 Apr. 1907, *Edward Palmer* 202 (F, GH, NY).

Veracruz: Fortín, near Fortín above the hydroelectric plant of the Cervecería Moctezuma, 18°53'24"N, 96°59'24"W, 1000–1150 m, 26 June 1977, *Thomas B. Croat* 39381 (MO); A 200 m al E de la carretera, a 8 km al N de Veracruz, rumbo a la Antigua, 5 m, 27 Apr. 1979, *Alejandro Novelo R.* 552 (MEXU, MO); Valleé de Cordova, 18°53'24"N, 96°55'48"W, 26 Jan. 1866, *Eugène Bourgeau* 1903 (P); Zona pantanosa de la Estación de Biología El Morro de la Mancha, 19°34'48"N, 96°22'48"W, 0 m, 20 July 1992, *M. Olvera* 58 (MEXU); Along road between Catemaco and Montepio, 2.6 km S of Los Tuxtlas Field Station, 9.3 beyond end of asphalt highway, 19.4 km N of Catemaco, 18°36'36"N, 95°03'36"W, 50 m, 25 Aug. 1996, *Thomas B. Croat* 78690 (CM, MO); Along Hwy. 125 to Huatusco, between Fortín and Huatusco, 3.6 mi N of Coscomatepec (at turnoff to downtown Coscomatepec), upriver from bridge over Río Jamapá, 19°06'N, 97°01'W, 300 m, 15

Jan. 1987, *Thomas B. Croat & Dylan P. Hannon* 63060 (MO); Actopan, "El Descabezadero", along Río Actopan, 2.7 km W of Chicausen, 8 km (by air) NW of Actopan, selva baja caducifolia, riparian vegetation with *Salix humboldtiana*, *Platanus mexicana* in small gorge of Río Actopan near the huge springs emerging from the walls of the gorge, 19°31'48"N, 96°40'48"W, 400 m, 9 Nov. 1981, *Michael H. Nee* 22982 (MO); Coatzacoalcos, isthmus of Tehuantepec, 18°07'48"N, 94°25'48"W, Jan. 1895, *Charles L. Smith* 1089 (GH, MO); 6 miles E of Coatzacoalcos along Highway 180, 18°04'48"N, 94°21'36"W, 10 m, 3 July 1977, *Thomas B. Croat* 40067 (MO); 6 miles E of Coatzacoalcos along Highway 180, 18°04'48"N, 94°21'36"W, 10 m, 3 July 1977, *Thomas B. Croat* 40067 (MEXU, MO); Colipa, 19°55'12"N, 96°43'12"W, 1841–1843, *F. M. Liebmann s.n.* (P); Córdoba, hillside above San José de Gracia, 1 mile S of highway between Córdoba and Veracruz, 18°51'36"N, 96°53'24"W, 750 m, 28 June 1977, *Thomas B. Croat* 39628 (MO); Hidalgotitlán, 1 km. SE of Agustín Melgar, Mun. Hidalgotitlán, 17°15'00"N, 94°33'00"W, 100 m, 2 Mar. 1984, *Michael H. Nee* 29766 (MO); Jalapa, Parque "Los Berros", 19°32'24"N, 96°55'12"W, 1300 m, 5 July 1982, *Michael H. Nee* 24774 (MO); Santiago Tuxtla, along Río Tepango ("Río Grande") at highway bridge, 3 km. SW of junction with Hwy. Mex. 180 in Santiago Tuxtla, Mun. Santiago Tuxtla, 18°27'00"N, 95°19'00"W, 160 m, 5 Apr. 2011, *Michael H. Nee & K. Taylor* 26485 (MO); Tlapacoyan, Vic. of "Cerro del Águila", 13 km N of Altotonga (19 km by road), on road to

Tlapacoyan, 19°52'48"N, 97°12'36"W, 1250 m, 28 June 1980, *Michael H. Nee & Bruce F. Hansen 18546* (MO); Veracruz, 1855, *Friedrich Müller 2141* (NY); 1855, *Friedrich Müller 2140* (NY). **Zacatecas:** Moyahua de Estrada, Arroyo los Aguacastiscos, entre Santa Rosa y Las Palmas, 21 Oct. 1992, *Enriquez, E. D. 330* (CHAPA). NICARAGUA. **Atlántico Sur:** Bluefields, open jungle trail [Seymour series], 12°02'N, 83°46'W, 0 m, 11 Dec. 1968, *John T. Atwood & A.D. Moore 351* (MO); Along new road from Río Blanco to Río Copalar, ca. 31 km E of Río Blanco, 12°52'30"N, 85°02'30"W, 200–400 m, 13 Feb. 1979, *W. D. Stevens 12127* (MO). **Boaco:** Cerro Mombachito, 4 km al NO de Camoapa, bosque nublado rodeado por pastizales, 12°24'N, 85°33'W, 700–1000 m, 1 Feb. 1979, *Alfredo Grijalva P. & M. Araquistain 54* (MO); Summit and upper SW slope of Cerro Mombachito, 12°24'00"N, 85°33'00"W, 950–1020 m, 18 Jan. 1981, *W. D. Stevens & William J. Hahn 18935* (MO). **Carazo:** Entrada a La Paz de Oriente, 1 km de la carretera Sur, Km 54, 11°49'N, 86°08'W, 380–400 m, 31 Aug. 1981, *P.P. Moreno 10708* (MO). **Chinandega:** faldas SE del Volcán Casita, 1 km antes de Argelia, 12°40'N, 86°57'W, 650–700 m, 30 July 1980, *P.P. Moreno 1585* (MO). **Estelí:** Laguna Miraflores, ca. 26.1 km (by road) NE of Hwy 1 at Estelí, 13°15'N, 86°15'W, 1250–1300 m, 10–11 June 1981, *J.E. Henrich & W. D. Stevens 262* (MO); Laguna Miraflores, 13°16'N, 86°16'W, 1240–1260 m, 14 Apr. 1981, *P.P. Moreno 8280* (MO); Quetzalcayán, al E del Cerro Tisey, 12°59'N, 86°24'W, 900–1100 m, 15 Oct. 1982, *P.P. Moreno 17859* (MO);

Municipio de Estelí, asentamiento Puertas Azules, 13°16'N, 86°16'W, 1300 m, 17 Apr. 1999, *R.M. Rueda & W. Velásquez 10957* (MO). **Jinotega:** Along Hwy 3 from Jinotega to Matagalpa, ca. 3 mi SE of Jinotega, 13°03'N, 85°58'W, 1200 m, 7 Aug. 1977, *Thomas B. Croat 43036* (MO); Cerro San Pedro, Cerro Kilambé, 13°36'N, 85°39'W, 600–800 m, 25 Mar. 1981, *P.P. Moreno & J.C. Sandino 7513* (MO); Entre las cabeceras de las quebradas Awaswas y Kubalí, Cerro Kilambé, 13°36'N, 85°38'W, 650–700 m, 26 Mar. 1981, *P.P. Moreno & J.C. Sandino 7624* (MO); Along Hwy. 3 from Jinotega to Matagalpa, ca. 5–8 miles SW of Jinotega, cloud forest, somewhat disturbed, 13°03'N, 85°58'W, 1500 m, 7 Aug. 1977, *Thomas B. Croat 43052* (MO); Macizos de Peñas Blancas, vicinity of Finca of Manuel Estrada (El Cielo), along and on steep slopes above Río El Gusaneras, 13°15'N, 85°41'W, 1200–1400 m, 13–18 Jan. 1979, *W. D. Stevens 11469* (MO). **Matagalpa:** Cordillera Dariense, Santa María de Ostuma, Cerro El Picacho, 13°00'N, 85°55'W, 1350–1500 m, 17 Mar. 1977, *David A. Neill 1576* (MO); Behind La Selva Negra Hotel, slopes of Cerro Picacho, near the border with Dept. Jinotega, 13°00'N, 85°55'W, 1200–1540 m, 23 May 1985, *Gerrit Davidse, Alfredo Grijalva P. & Mario Sousa S. 30519* (MO); Santa María de Ostuma, 13°00'N, 85°55'W, 1000 m, 19 Jan. 1980, *M. Araquistain & P.P. Moreno 735* (MO); Ridge along road between La Danta and La Luna, E of Esquipulas, 12°40'N, 85°43'W, 960–1000 m, 25 Jan. 1979, *W. D. Stevens 11881* (MO); Macizos de Peñas Blancas, SE side, drainage of Quebrada El Quebradon,

slopes N and W of Hda. San Martín (collection locality straddles border with Departamento de Jinotega), 13°14'N, 85°38'W - 13°15'N, 85°39'W, 1000–1400 m, 18–20 Jan. 1982, *W. D. Stevens, P.P. Moreno & T. Elmquist 20966* (MO). **Rivas:** Isla de Ometepe, NW slope of Volcán Maderas, to rim somewhat E of highest point, cloud forest below and elfin forest near rim, 11°26'N, 85°30'W - 11°27'N, 85°31'W, 1000–1350 m, 24 Feb. 1978, *W. D. Stevens 6505* (MO); Isla de Ometepe, NW slope of Volcán Maderas, 11°27'N, 85°31'W, 800–1000 m, 24 Feb. 1978, *W. D. Stevens 6583* (MO); Isla de Ometepe, N slope of Volcán Maderas on trail from Balgue to Laguna Maderas, 11°27'N, 85°32'W, 700–1200 m, 23 Jan 1981, *William J. Hahn 491* (MO). PANAMA. **Canal Area:** Road to Canal Signal Station on Guillard Cut, 09°04'02"N, 79°40'06"W, 50 m, 18 July 1970, *Thomas B. Croat 11423* (MO). **Chiriquí:** Back side of mountain, Boquete, 08°47'N, 82°26'W, 4400 ft, 20 Mar. 1977, *James P. Folsom 2210* (MO); Reserva La Fortuna, Divide Trail, 08°47'N, 82°13'W, 1200 m, 11 May 1991, *O'Connor 91-0511-001* (MICH); Cerro Colorado, along road to old copper mine development N of San Félix, 18.6 mi N of bridge over river near San Félix, 6.6 mi beyond Chame and road to Escopeta, 08°31'39"N, 81°48'50"W, 1475–1485 m, 30 Mar. 1993, *Thomas B. Croat 75009* (MO); Cerro Pate de Macho ca. 5 mi NE of Boquete, along trail to Continental Divide which leads on to Finca Serrano (Francisco Serrano), pacific slope, 08°48'36"N, 82°23'50"W - 08°49'30"N, 82°23'42"W, 1800–2200 m, 23 Nov. 1979, *Thomas B. Croat 48548* (MO).

Darién: Paca, just below Cana, 15 Apr. 1908, *Robert S. Williams 821* (NY); Cerro Tacarcuna Expedition, Río Pucuro between Cerro Mali and Cerro Tacarcuna, near Río Pucuro base camp, Tropical wet forest, 08°06'N, 77°18'W, 640 m, 27 Jan. 1975, *Abryn H. Gentry & Scott A. Mori 13973* (MO). **Panama:** NE slope of Cerro Jefe on road to Buenos Aires, 09°09'09"N, 079°27'40"W, 2600 ft, 27 Jan. 1966, *Edwin L. Tyson, John D. Dwyer & Kurt E. Blum 3265* (MO, SCZ). **San Blas:** Río Cangandi, pueblo Cangandi, 09°27'N, 79°07'W, 20 m, 20 June 1987, *Heraclio Herrera 259* (MO).

Xanthosoma sagittifolium (L.) Schott & Endl., *Melet. Bot.* 19. 1832. *Arum sagittifolium* L., *Sp. Pl.* 2: 966. 1753. Schott drawings 3421 and 3422 serve as the type. **Figures 47–51.**

Caladium sagittifolium (L.) Vent., *Mag. Encycl.* 4(16): 471. 1801.

Caladium xanthorrhizon (Jacq.) Willd. *Sp. Pl.* 4: 490. 1800.

Arum xanthorrhizon Jacq. *Hort. Schoenbr.* 2: 32 t188. 1797.

Xanthosoma xanthorrhizon (Jacq.) Koch. *Bonplandia* 4: 4. 1856.

Xanthosoma belophyllum (Willd.) Kunth. *Enum. Pl.* 3: 44. 1841.

Caladium belophyllum Willd. *Enum. Pl.* 987. 1809.



Figure 47

Figure 48

Figure 47. *Xanthosoma sagittifolium* (L.) Schott (Croat & Díaz-Jiménez 100164). Habit of live plant showing glaucous petioles, leaf blades, adaxial surface, and glaucous inflorescences.

Figure 48. *Xanthosoma sagittifolium* (L.) Schott (Croat & Díaz-Jiménez 100164). View of leaf blade, adaxial surface, showing sinuate margins and the posterior rib not naked at the base.

The species is a member of group *Xanthosoma* and is characterized by its short or lacking stem, large leaves with the lower surface and petioles glaucous, posterior rib usually not at all naked, as well as by having several inflorescences per axil with the spathe tube greenish on both surfaces and the sterile portion of the spadix white or yellow.

Large terrestrial herb to 2 m tall; **stems** stout, to 1 m. long, often short or not very apparent; **internodes** short, 6–15 cm diam. **LEAVES** with **petioles** erect-spreading, 80–160 cm. long, dark green, matte, weakly subvelvety, glaucous,

subterete, weakly and obscurely flattened adaxially, pale green and weakly glossy on inner surface, sheathed to ½ their length, 3–4.5 cm diam. just above end of the sheath, 3.5 cm diam. midway on free portion of petiole, 2.0 cm diam. just below the blade, pale green and weakly glossy on inner surface of sheath; **blades** ovate-sagittate, subhastate in young plants, 60–97 cm long, 30–44 cm wide, widest at the tip of the posterior lobes, obtuse at the apex, deeply lobed at the base, thinly subcoriaceous, dark green and weakly glossy above, much paler and matte below, often glaucous below, drying medium brown and semiglossy above, light brown or greenish brown and



Figure 49



Figure 50

Figure 49. *Xanthosoma sagittifolium* (L.) Schott (Croat & Díaz-Jiménez 100164). Close-up of leaf blade, abaxial surface, showing the glaucous tinge.

Figure 50. *Xanthosoma sagittifolium* (L.) Schott (Croat & Díaz-Jiménez 100164). View of leaf bases with clusters of inflorescences and infructescences with the spathe tube green and glaucous outside.

matte below; **posterior lobes** obtusely pointed or rounded at the tip; **sinus** V-shaped, often closed in live plants; **midrib** broadly sunken and medium green above, narrowly round-raised, paler and matte below; **primary lateral veins** 5–8 pairs, arising at a 45–80° angle, obtusely and deeply sunken and slightly paler above, prominently round-raised and paler below;

posterior rib usually not at all naked, sometimes shortly naked on larger specimens; **tertiary veins** weakly etched above, prominulous and slightly darker below. **INFLORESCENCES** 1–3 per axil; **peduncle** 40–51 cm long, somewhat flattened, to 3.5 cm x 2.0 cm diam., often glaucous; **spathe** 23–32 cm long, tube 7–10 cm long, 4–5 cm diam., dark green and



Figure 51



Figure 52

Figure 51. *Xanthosoma sagittifolium* (L.) Schott (Croat & Díaz-Jiménez 100164). Close-up of opened inflorescence showing spathe tube after departure of beetle pollinators, light green inner surface, eaten lowermost staminodia and the remaining yellowish upper staminodia.

Figure 52. *Xanthosoma undipes* K. Koch (not collected; photo: Chris Davidson). Live plant showing bases of petioles with prominent sheath.

sometimes glaucous outside, medium green and matte inside; blade creamy white on both surfaces; **spadix** 17–27.5 cm long; staminate portion 14–23 cm long, 2.3 cm diam. from the base to middle of spadix, slightly tapered to the apex; sterile portion 3–5 cm long, 2.0–2.3 cm diam. at base, 1.8–2 cm wide at apex, white or yellow; pistillate

portion to 3.0–3.5 cm long in back, 4.5–5.6 cm long in the front, 2.5–3 cm diam. at base, 1.5–1.8 cm diam. at apex, bronze.

Xanthosoma sagittifolium may be native to the West Indies. Engler & Krause in their 1920 treatment of the *Xanthosoma* in Das Pflanzenreich reported collections only

from the West Indies, both in the Greater Antilles (Cuba, Jamaica and Puerto Rico) as well as in the Lesser Antilles (St. Vincent) but the species has been introduced into virtually all parts of tropical America where it is widely used as a food crop.

Xanthosoma sagittifolium has been confused with *Xanthosoma mafaffa* Schott and *Xanthosoma violaceum* Schott which are also widely cultivated (Gonçalves, 2011). It differs from *X. mafaffa* by its posterior rib rarely naked (versus naked at least 1 cm for *X. mafaffa*) and by its white or yellow sterile portion of the spadix (versus pink for *X. mafaffa*). *X. violaceum* is further distinguished by its violet coloration on the petioles, major veins and peduncle.

Additional specimens seen: BELIZE. **Orange Walk:** Indian Church, 17°46'N, 88°39'W, 19 Aug. 1977, *Thor Arnason 17730* (MO). COSTA RICA. **Alajuela:** Below the cataract of San Ramón, 3.5–4 mi W of center of San Ramón, 10°04'48"N, 84°31'12"W, 800 m, 2 Feb. 1979, *Thomas B. Croat 46810* (MO); Finca Los Ensayos, ca. 11 mi NW of Zarcero, roadside and fencerows, 10°15'36"N, 84°27'00"W, 900 m, 15 Aug. 1977, *Thomas B. Croat 43523* (MO); Upala, Santa Maria National Park (Rincón de la Vieja), disturbed primary forest along stream, road down Caribbean slope, ca. 1 km west of east end of park, 7 km east of colored house at junction of road to Hacienda Santa Maria, 10°48'00"N, 85°15'36"W, 600 m, 8 Feb. 1978, *Ronald L. Liesner 5226* (MO). **Guanacaste:** P. Nac. Rincón de la Vieja Sendero Las Moras,

10°46'48"N, 85°18'00"W, 1400 m, 20 Nov. 1990, *Gerardo Rivera 893* (MO). **Limón:** Ca. 10 miles S of Punta Cahuita, ca. 3 miles S of turnoff to Bribri, disturbed primary forest on very steep slopes above river, 09°36'00"N, 82°48'36"W, 70 m, 11 Aug. 1977, *Thomas B. Croat 43189* (MO); Evergreen forest (tropical-premontane wet forest transition) and secondary growth near the Río Catarata (Río Sand Box) in the hills between Bribri on the Río Sixaola and the Caribbean Coastal Plain, 09°37'N, 82°49'W, 50–100 m, 10–13 Feb. 1977, *William C. Burger, Gary Visconti & Johnnie L. Gentry, Jr. 10336* (MO); Hacienda Tapezco-Hacienda La Suerte, 29 air km W of Tortuguero, primary rainforest in an area being selectively logged, area of low hills and mounds, a few small streams, 10°30'N, 83°47'W, 40 m, 14 Aug. 1979, *Christopher Davidson & Julian Donahue 8289* (MO); Along road between Puerto Viejo de Talamanca and Manzanillo, stretch from Quebrado Ernesto to Manzanillo, 09°37'48"N, 82°40'48"W, 5 m, 3 Nov. 1984, *Michael H. Grayum & Pamela J. Sleeper 4354* (CR, MO); Cordillera de Talamanca, along ridge separating headwaters of Río Madre de Dios from Quebrada Barreal, 10°01'48"N, 83°26'24"W, 460–480 m, 5 Sep. 1988, *Michael H. Grayum, Gerardo Herrera Ch. & Rafael Robles 8818* (CR, MO). **San José:** Rivas, near bridge over Río Buena Vista 1/2 mi SW of Rivas, 09°24'36"N, 83°39'36"W, 800 m, 14 Aug. 1977, *Thomas B. Croat 43413* (MO). EL SALVADOR. Jardín Botánico, Zona 23NWC, 13°40'N, 89°15'W, 800 m, 11 Aug. 1989, *Raul Villacorta & S. Martínez 319* (MO). **Usulután:** La Laguna del Alegría,

13°30'N, 88°30'W, 92 m, 20 Apr. 1977, *Thomas B. Croat 43755* (MO). HONDURAS. **Atlántida:** Tela, Lancetilla Valley ca. 10 miles southeast of Tela, in forest preserve along Río Lancetilla, on trail to water reservoir, 15°44'N, 87°27'W, 10–150 m, 3 Aug. 1977, *Thomas B. Croat 42636* (MO). **Cortés:** Tulian, *Cirilo H. Nelson 9177* (TEFH); Omoa, 2–3 miles southwest of Omoa on road from Puerto Cortes to Guatemalan border, sea level, pastures with few trees, 15°45'09"N, 88°04'00"W, 0 m, 2 Aug. 1977, *Thomas B. Croat 42565* (MO). **Olancho:** Along Río Olancho, on road between Gualaco and San Bonito Oriental, 7.4 miles NE of San Estéban, rocky area along road and in rocky stream, 15°20'N, 85°42'W, 540 m, 7 Feb. 1987, *Thomas B. Croat & Dylan P. Hannon 64359* (MO). MEXICO. **Chiapas:** Plantas de San Pablo Chalchihuitán, Milpa, K'an Ech', 1600 m, 16 Dec. 1987, *M. Pérez G. 139* (MO). **Oaxaca:** Mun. San Jose Tenango, zona boscosa al SW de San Martín Caballero, accesible por veredas que parten de San Martín, 18°05'51"N, 96°38'29"W, 1600 m, 19 Jan. 2002, *Xochitl Munn-Estrada, A. García, D. García & F. Mendoza 1750* (MO); Along Rte. 175 between Valle Nacional and Oaxaca, 7–10 km S of bridge over Río San Juan Bautista at Valle Nacional, steep roadside cliffs, 17°43'33"N, 96°19'39"W - 17°43'26"N, 96°19'18"W, 597–666 m, 3 Mar. 2008, *Thomas B. Croat & Pedro Díaz Jiménez 100164* (MO). **Veracruz:** Atzacan, Cerro de Huacapan, 2 km al N. de Atzacan - 51-B-2., 1260 m, 7 May 1967, *Marino Rosas R. 367* (MO, NCU). PANAMA. **Bocas del Toro:** Vicinity of Changuinola, 09°23'30"N, 82°29'30"W, 25 m, 3 Aug. 1976, *Thomas B. Croat 38083* (MO); Vicinity of Ojo del Agua, ca. 7 km W of Almirante, 09°18'48"N, 82°27'18"W, 190–220 m, 4 Aug. 1976, *Thomas B. Croat 38174* (MO); Río San Pedro, 08°47'00"N, 81°32'00"W, 10 July 1979, *Burton L. Gordon 6D* (MO); Río San Pedro, 08°49'00"N, 81°33'00"W, Jan. 1978, *Burton L. Gordon 74* (MO); *Burton L. Gordon 75* (MO); A1 N. O. del campamento Changuinola 1 de Corriente Grande, Cerro Bracha, 18 Jan. 1980, *Mireya D. Correa A., Alberto S. Taylor B., Noris Salazar A., Rodolfo Mendoza, Tania Béliç & Carmen G. Vergara 3243* (MO, PMA). **Canal Area:** Along road between Gatun and Pina ca. 3 km S of Pina, 09°16'25"N, 79°58'42"W, 50 m, 7 July 1976, *Thomas B. Croat 36934* (MO). **Chiriquí:** Quebrada Velo, in swampy ground, 1800 m, 8 July 1940, *R.E. Woodson, Jr. & R.W. Schery 264* (MO); Along road between Volcán and Serrano, 5.9 mi N of Volcán, disturbed area along creek with some remnants of primary forest, steep slope, 08°49'N, 82°38'W, 1545 m, 15 June 1987, *Thomas B. Croat 66224* (MO); Along road from Puerto Armuelles to San Bartolo Limite, 7 miles west of Puerto Armuelles, disturbed primary forest and roadside, 120 m, 19 May 1976, *Thomas B. Croat 35059* (MO); Exquisito bee yard, 19 Sep. 1983, *Robert J. Schmalz 1763* (MO); Puerto Armuelles, just above La Frontera, in bananas, 08°16'N, 82°52'W, 30 m, 27 Nov. 1975, *William G. D'Arcy 10077* (MO). **Coclé:** El Valle de Antón, edge of cloud forest and roadside, 1000–2000 f, 2–3 Dec. 1967, *W.H. Lewis, W.H. Blackwell, Jr., J.L. Hawker, J.W. Nowicke, R.L. Oliver, J.E. Ridgway, A.G. Robyns & S.E. Verboek 2623*

(MO). **Colón:** Río Guanché, between Puerto Pilon and Portobello, ca. 1.5 mi S of road, 09°30'N, 79°39'W, 100 m, 19 June 1994, *Thomas B. Croat & Guang Hua Zhu 76247* (MO). **Darién:** El Río Aruza, 07°59'N, 77°37'W - 08°07'N, 77°41'W, 24 Oct. 1967, *Narciso Bristan 1350* (MO); Vicinity of Yape, 08°07'N, 77°21'W, 30 m, 4 Oct. 1938, *Paul H. Allen 866* (MO). **Veraguas:** Parque Nacional Coiba, alrededores del Puente en el campamento La Lechería, borde ribereño, 30 m, 21 Sep. 2004, *O. Rodríguez & et al. 530JR* (PMA).

Xanthosoma undipes K. Koch, *Bonplandia* (Hanover) 4(1–2): 4. 1856. Basionym: *Alocasia undipes* K. Koch & C.D. Bouché. in A. Braun et al., *Append. gen. sp. Hort. berol. 1854* 5. 1854–1855; *X. jacquinii* Schott, nom. illeg.; *X. roseum* sensu Standl. (1937), non Schott. **Figures 52–56.**

The species is a member of group *Xanthosoma* and is characterized by its huge size, massive stem, large leaves with the major veins convex on the upper surface as well as by having mostly 5–7 inflorescences per axil with the spathe tube purplish or green tinged reddish purple near the tip outside, dark purple-violet inside at least at base and with the pistillate portion of the spadix bright orange.

Very large terrestrial plant, **stem** erect and typically massive, 1–3 m tall, 10–15 cm diam., usually decumbent and creeping over soil at base; **internodes** short, typically

brown and scurfy; **petioles** typically (0.5)1–1.5 m long, sheathed 0.30–0.80 their length, subcylindrical and obtusely somewhat flattened above sheath with a weak medial rib near apex; **blades** narrowly ovate-cordate-sagittate, 40–80 cm long, 37–90 cm wide, weakly acuminate at apex, deeply lobed at base, moderately thin, weakly glossy both surfaces, subvelvety above, drying greenish brown; **major veins** concolorous and convex above, thicker, round-raised and matte below; **primary lateral veins** 8–14 pairs, arising at 50–60° angle, **tertiary veins** etched-sunken above, raised below; **basal veins** 10–11 pairs, typically not free to base, most branching off the posterior rib; **posterior rib** straight to the apex of posterior lobes, naked (1.5)2–7 cm. **INFLORESCENCES** (3)5–7 per axil; **peduncle** pale green, 8–34 cm long, 1.8 x 1.4 cm diam.; **spathe** blade pale yellow-green to white outside, white inside; tube usually green tinged reddish purple near the tip outside (sometimes purplish), dark purple-violet inside (at least at base); **spadix** 9.5–18.4 x 0.9–1.7 cm; staminate portion 14.5 cm long, 1.7 cm diam at base, 1.4 cm diam. at constriction, 1.8 cm at broadest width of fertile portion of spadix; sterile male portion white to yellowish cream; lowermost staminodia subrounded, 0.8–.6 mm long, 0.8–1.4 mm wide, the remaining 4–5 staminodia elongated with a medial groove or with the outer margins all raised and paler, drying the same color as the lowermost spiral, 1.6–2.1 mm long, 0.5–0.8 mm wide, narrowly rounded to bluntly pointed at both ends; pistillate portion bright orange, 4 cm long,



Figure 53

Figure 54

Figure 53. *Xanthosoma undipes* K. Koch (Ortiz *et al.* 1777; photo: Orlando Ortiz). View of leaf blade, adaxial surface.

Figure 54. *Xanthosoma undipes* K. Koch (not collected). Close-up of sinus and petiolar plexus showing trapezoidal sinus and major veins convex on adaxial blade surface.

1.1 cm diam. at apex, 1.7 cm diam at base.
Fruits maturing greenish yellow.

Xanthosoma undipes ranges from Nicaragua to Panama at (200)1000–2200 m in *Premontane wet forest*, *Premontane rain forest* and *Lower montane rain forest* life zones.

The species is most easily confused with *X. robustum* Schott which differs by having a much shorter stem, major veins on the upper surface which are sunken, not convex and a spathe tube which is green on the inside.

Additional specimens seen: COSTA RICA. Costado Este, Lago Dabagri, Talamanca, 9 Nov 1984, L.D. Gómez, G. Herrera, A. Solís, J. Berrocal, J. Rodríguez & M. Solís 23324 (MO). **Alajuela:** Vicinity of Finca Peñas Blancas, E slope of Cerros Centinelas, Monte Verde Reserve, Cordillera de Tilarán, 10°18'N, 84°47'W. 1300–1450 m, 10°18'00"N, 84°46'48"W, 1300–1450 m, 9 June 1985, Michael H. Grayum 5368 (CR, MO); Monteverde Cloud Forest Reserve, Upper drainage of the Río Peñas Blancas below the Monteverde Cloud Forest Nature Reserve, Premontane rain forest formations with original forest and some pastures on hilly ground, 10°17'24"N, 84°45'00"W,



Figure 55



Figure 56

Figure 55. *Xanthosoma undipes* K. Koch (not collected; Costa Rica, Monteverde Reserve; Photo, Willow Zuchowski). View of stem with inflorescences clustered in a single leaf axil with spathe tube green at the base and tinged reddish purple at the top outside. Rolled leaf in middle of photo.

Figure 56. *Xanthosoma undipes* K. Koch (not collected). View of dissected inflorescence showing mostly removed spathe tube dark purple inside and deep orange pistillate spadix. Note chewed area at base of sterile staminate portion.

1250–1350 m, 25–26 Feb. 1977, *Burger, W. et al.* 10742 (MO); Río Achiote, San Isidro de Grecia, 10°06'36"N, 84°16'12"W, 1600 m, 25 June 1986, *Umana, G. & A. Campos* 42 (CR); San Ramon, Cerro Azahar, 10°09'00"N, 84°34'48"W, 1200–1600 m, 14 May 1983, *Gomez-Laurito, J.* 9366 (CR).

Cartago: along road from Cot and Pacayas through Trinidad and to Volcan Turrialba, above Cartago and Turrialba on the lower slopes of Volcan Irazu, 09°53'24"N, 83°49'48"W, 1600–1700 m, 27 July 1981, *Taylor, C.* 609 (DUKE); Very steep slopes with open forest and many epiphytes about

10 km S of Tapanti along the new road on the east slope above the Río Grande de Orosi, 09°42'N, 83°47'W, 1400–1600 m, 10–24 June 1968, *William C. Burger & Robert G. Stolze 5704* (F, MO, UWL); Reserva Forestal Río Macho, sendero para o lado oeste atravesando um prquenho río, lado esquerdo, 09°43'12"N, 83°55'12"W, 1300–1500 m, 30 Apr. 1993, *Nilsson, V. et al. 340* (CR); Tapantí Hydroelectric Reserve, trail along Río dos Amigos, 09°41'24"N, 83°47'24"W, 1600–1700 m, 23 June 1976, *Thomas B. Croat 36229* (MO). **Guanacaste:** Llanos E of El Hato de Volcán, savannah and woods on lava flow, 10°28'12"N, 85°22'12"W, 6600–7000 f, 5 Apr. 1979, *Hammel, B. et al. 6752* (MO). **Heredia:** vic. Vara Blanca, 10°10'12"N, 84°09'00"W, 1750–1800 m, 24 May 1972, *Luteyn 3020* (DUKE); Sarapiquí, Vara Blanca, Vicinity of Vara Blanca, 10°10'12"N, 84°09'00"W, 1880 m, 26 May 1976, *Thomas B. Croat 35518* (MO). **Limon:** Talamanca, along S side of Río Lori (tributary of Río Coén), between Quebrada Kuisa and crossing of Ujarrás-San José Cabécar trail, Cordillera de Talamanca, 09°21'00"N, 83°13'12"W, 1810 m, 19 Mar. 1993, *Michael Grayum 10374* (INB, MO). **Puntarenas:** Mostly secondary forest between Las Cruces Botanical Garden and Río Jaba, ca. 3 km SE of San Vito de Coto Brus. 08°46'48"N, 82°57'36"W, 1050–1200 m, 11 July 1985, *Michael H. Grayum 5622* (MO); Forest along trail between Las Alturas and Cotonsito, along the Río Cotón, Cotonsito, 08°56'24"N, 82°48'00"W, 1400 m, 31 Aug. 1983, *Gerrit Davidse 24353* (CR, MO); Foothills of the Cordillera de Talamanca,

just north of Santa Elena on Fila Cotón, south of Agua Caliente, Premontane wet forest remnant, 08°57'00"N, 82°55'48"W, 1100 m, 4 Sep. 1984, *G. Davidse, G. Herrera Ch. & M.H. Grayum 28304* (CR, MO); Between Cortu and La Union near San Miguel, 8 Aug. 1974, *Thomas B. Croat 26520* (MO); Buenos Aires. R.I. Ujarrás, Cordillera de Talamanca, Sabanas Murur Bisuk, Cabeceras del Río Kuiye, 09°18'36"N, 83°14'24"W, 1450 m, 20 Sep. 1989, *Marlon Valerio 50* (CR, MO); Osa, Rancho Quemado, Sector este, Sierpe, Cercanías de una laguna, 08°42'00"N, 83°33'36"W, 200–230 m, 9 Nov. 1991, *Juan Marin & Francisco Quesada 264* (MO); Valley of Laguna Chocuaco, ca. 9 km W of Rincón de Osa, 08°42'00"N, 83°33'36"W, 200 m, 8 Oct. 1984, *Michael H. Grayum 4073* (MO). **San José:** Braulio Carrillo National Park; San José-Siquerres Hwy., 14 km beyond San Isidro-San Josecito entrance to turnpike, 10°06'00"N, 83°58'53"W, 1090 m, 1 Sep. 1996, *Thomas B. Croat 78822* (MO); Las Vueltas, Tucurique, 09°49'48"N, 83°42'36"W, Dec. 1898, *Tonduz 12867* (G, P); Cerro de la Muerte, Along Highway CA-2 on western ascent of Cerro de la Muerte, north of turnoff for road 222, 09°44'24"N, 83°58'12"W, 2000 m, 27 Feb. 1976, *Thomas B. Croat 32858* (MO); P.N. Braulio Carrillo, from La Montura to Los Chorritos, 10°06'00"N, 83°58'48"W, 1200 m, 28 Jan. 1984, *Gomez, L. et al. 20933* (CR); Tarrazu, San Marcos de Tarrazu between Cerro Toro and Cerro Hormiguero along the road between Basuero de Tarrazu and Esquipulas, vicinity of Cerro Hormiguero, 09°33'30"N, 84°03'15"W, 1100–1200 m, 5

Sep. 1996, *Thomas B. Croat 78953* (INB, MO, WU). NICARAGUA. **Rivas:** Volcán Maderas. Isla de Ometepe, N slope of Volcán Maderas on trail from Balgue to Laguna Maederas, 11°27'N, 85°32'W, 700–1100 m, 23 Jan. 1981, *W. Hahn 491* (MO). PANAMA. **Bocas del Toro:** Fortuna, Chiriquí Grande - Fortuna, Along Continental Divide from road branching N off main Fortuna-Chiriquí Grande Highway near Continental Divide, 1.1 mi from main highway, 08°44'N, 82°17'W, 1200 m, 11 Mar. 1985, *Thomas B. Croat & Michael H. Grayum 60321* (MO); Pila, Punto 1, Rancho Santín, bosque secundario abajo de la casa, secondary forest of probable human origin, canopy 9–10 m dbh 15–20 cm, some emergent trees to 30 m, 09°06'49"N, 82°39'44"W, 1175 m, 29 July 2008, *A. Monro & et al. 6077* (PMA). **Chiriquí:** Along Río Colorado, wet forest, 08°50'N, 82°43'W, 1200–1400 m, 11 July 1983, *C. Hamilton & K. Krager 3767* (MO); Fortuna Dam area, Trail along Continental Divide to W of Oleoducto road, leading to unnamed ridge top, 08°47'N, 82°13'W, 1200–1500 m, 25 May 1984, *H.W. Churchill 5290* (MO); Vicinity of Monte Azul, 1.4 mi N of Entre Ríos on E slopes of Cerro Punta, 3 mi by road from town of Cerro Punta, 2250 m, 25 Nov. 1979, *Thomas B. Croat 48594* (MO); Near site of dam, lower slopes of Cerro Fortuna, IRHE Fortuna Hydroelectric Project, Premontane rainforest, 1150 m, 18 June 1982, *S. Knapp & M. Vodicka 5586* (MO); Cerro Colorado, along road to copper mine 34.1 km beyond bridge over Río San Felix near town of San Felix, (13.1 beyond turn-off to Escopeta), 1390 m, 15

July 1976, *Thomas B. Croat 37257* (MO); East of Boquete along steep, forested slopes and in wooded pastures on Cerro Azul near Quebrada Jaramillo, 1620–1700 m, 11 Aug. 1974, *Thomas B. Croat 26869* (MO); Cerro Colorado, near continental divide, 1500 m, 26 July 1979, *T. Antonio 1496* (MO); N.O. del campamento Fortuna (Hornito), sitio de presa, regresando al S.O. del campamento (fina Pitti), 1000–1200 m, 16 Aug. 1976, *M.D. Correa A., R. Dressler & C. Garibaldi 2539* (MO, PMA); Lower north slope of Baru, east of Bajo Choro region, forest, forest edge and pasture, 6000–6500 f, 7 May 1978, *Barry Hammel 2966* (MO); Uncut cloud forest at Monte Rey near Boquete, 20 July 1971, *Thomas B. Croat 15880* (MO); Along stream near trail north of Cerro Punta, aquatic, 29 May 1970, *Thomas B. Croat 10457* (MO); Road from Nueva California and Río Serano ca 9 mi from Río Chiriquí Viejo, 4500 f, 7 Apr. 1979, *W. D'Arcy, B. Hammel, E.C. Hill, S. Schwartz, O. & H. Wolcott 12983* (MO); Road from Nueva California to Río Serano; ca 7 mi from Río Chiriquí Viejo, 4200 f, 7 Apr 1979, *W. D'Arcy, B. Hammel, E.C. Hill, S. Schwartz, O. & H. Wolcott 13079* (MO); Cerro Horqueta, 08°50'N, 82°26'W, 1500–2000 m, 24 July 1966, *Kurt E. Blum & John D. Dwyer 2644* (MO, SCZ); Nueva Suiza, along stream behind FSU cabin near Nueva Suiza, 50 m, 23 July 1971, *Thomas B. Croat 16180* (MO, SCZ); Pate Macho, Trail to Cerro Pate Macho, headwaters of the Río Palo Alto, above Palo Alto, Montane rainforest, 08°47'N, 82°22'W, 1700–2100 m, 23 Apr. 1982, *Sandra Knapp & R. Schamlszel 4772* (MO); Río Chiriquí Viejo, ca. 2 km NE of

Guadeloupe, 25 Dec. 1971, *Wilbur, R. et al.* 15375 (DUKE); Primary forest and adjacent cut over areas, vicinity of Las Nubes, 2.7 mi NW of Río Chiriquí Viejo w of Cerro Punta, 08°20' N, 82°41' W, 2200 m, 27 Feb. 1973, *R.L. Liesner* 324 (PMA). **Coclé:** Above El Potroso sawmill at Continental Divide, N of El Clope. low cloud forest, 1200–1300 m, 13 May 1981, *K. Sytsma & L. Andersson* 4564 (MO); Parque Nacional Omar Torrijos Herrera, camino hacia la Rica, 08°40'30"N, 80°35'30"W, 800 m, 10 Apr. 2001, *R. Aizprúa & et al.* B2662 (PMA). **Darién:** Serranía de Pirre, along ascent of Serranía de Pirre above Cana Gold Mine between Río Cana and Río Escucha Ruido, Premontane rain forest (Holdridge Life Zone Map), 1000–1310 m, 27 July 1976, *Thomas B. Croat* 37753 (MO). **Panama:** Vicinity of Cerro Jefe, 4.6 km beyond peak on road to Altos de Pacora, 26.3 km from the Interamerican Highway, 600 m, 12 Jun 1976, *Thomas B. Croat* 35932 (MO). **Veraguas:** Santa Fe, Mouth of río Concepción. Beach, cliffs and adjacent swamp, 08°50'39"N 080°58'14"W, Lower montane wet forest 7 km W of Santa Fe on new road past agricultural school, along Quebrada Mulaba, a rocky tributary of Río Santa María, 2900 f, 13 Apr. 1974, *M. Nee* 11228 (MO, PMA); Along 1st river, on road from Santa Fe to Río Calovebora, 1.8 miles from fork in road at Escuela Agrícola Alto Piedra, 500 m, 5 Apr. 1976, *Thomas B. Croat* 34243 (MO).

Xanthosoma violaceum Schott, *Oesterr. Bot. Wochenbl.* 3: 370. 1853. Schott

drawings 3432 and 3436 serve as the type. **Figures 57–61.**

The species is a member of group *Xanthosoma* and is characterized by its large size, violet-tinged petioles with reddish sheath margins, ovate-triangular-sagittate-subhastate blades with major veins violet below, and its inflorescences with violet-tinged peduncle, spathe tube light green tinged with purple and strongly waxy outside and whitish green inside, and its spadix with a pale yellow pistillate portion and with pinkish staminodes.

Large terrestrial plant to 2 m tall; **stems** hypogeous in young plants, epigeous and decumbent in older plants, to 20 cm diam., covered with brown fibers from old petiole sheaths; cormels occasional; stolons usually long and abundant. LEAVES 4–6 per plant; **petioles** 80–134 cm long, violet-tinged, conspicuously waxy, sheathed up to 1/2 their length, sheath margins convolute, reddish; **blades** ovate to triangular, sagittate to subhastate, 69–113 cm long, 45–67 cm wide, 1.5–1.7 times as long as wide, 0.8–0.9 times as long as wide, obtuse and short-acuminate at the tip, deeply lobed at the base, medium green and semiglossy above, paler green and matte below, margins violet; **posterior lobes** acute to cuneate, with tip often projecting outward; **sinus** parabolic; **major veins** much lighter above, violet below; **primary lateral veins** 7–8 pairs, arising at an angle of 70–85°; **posterior rib** naked 2–3 cm, directed to the tip of the posterior lobe. INFLORESCENCES 1–3 per axil; **peduncle** 35–50 cm long, 3–4 cm



Figure 57



Figure 58

Figure 57. *Xanthosoma violaceum* Schott (not collected; Mexico. Puebla State; photo: Jonathan Amith). Habit of live plants showing spreading leaf blades, purple-violet petioles, leaf blades, abaxial and adaxial surfaces, and large inflorescence.

Figure 58. *Xanthosoma violaceum* Schott (Ortiz *et al.* 2692; photo: Orlando Ortiz). Cluster of plants showing purple-violet petioles and leaf blades, adaxial surface (cultivated in Panama).

diam., violet, **spathe** 39–42 cm long; tube ovoid, 12–14 cm long, 5.5–7 cm diam., light green tinged with purple and strongly waxy outside, whitish green inside; blade 27–28 long, 12–14 cm wide, yellowish green on both surfaces, margins purplish-tinged, **spadix** 35–39 cm long, staminate portion 25–29 cm long, 1.5–2 cm diam., tapering at

the apex; sterile portion 11–13 cm long, 1.8–2.8 cm diam., pinkish, the lower thickened staminodia subrounded, 1.4–1.8 mm long, 0.8–1 mm wide, the next spiral higher 2.1–2.4 mm long, 0.4–0.6 mm wide, thicker at base, the remaining 5–6 rows, 1.6–2 mm long, 0.2 mm wide at widest point but unequal in width throughout, greenish



Figure 59

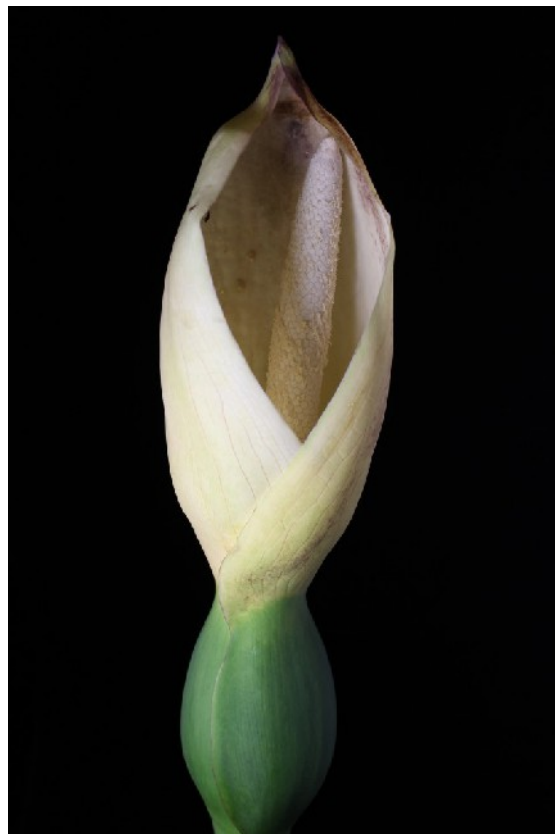


Figure 60

Figure 59. *Xanthosoma violaceum* Schott (Ortiz *et al.* 2692; photo: Orlando Ortiz). View of leaf blade, adaxial surface, with posterior rib naked at the base.

Figure 60. *Xanthosoma violaceum* Schott (not collected; Mexico. Puebla State; photo: Jonathan Amith). Close-up of inflorescence showing spathe tube medium green and glaucous outside.

brown, matte, moderately spaced, pointed or obliquely angular at both ends; pistillate portion conoid, 10–12 cm long, 1.8–2 cm diam., pale yellow.

Xanthosoma violaceum is of unknown origin, the type coming from a plant cultivated in Berlin. It is cultivated for food in many parts of Central and South

America and in the Caribbeans and also as an ornamental plant, particularly in Brazil (*taioba roxa*). It is also common in European conservatories, probably all from the original introduction.

According to Gonçalves (2011) *Xanthosoma violaceum* is the only broadly cultivated *Xanthosoma* species that has pure



Figure 61



Figure 62

Figure 61. *Xanthosoma violaceum* Schott (Ortiz *et al.* 2692; photo: Orlando Ortiz). Close-up of open inflorescence showing spathe tube light green inside and sterile spadix mostly pinkish and dark violet-purple at the base (pistillate spadix old).

Figure 62. *Xanthosoma wendlandii* (Schott) Schott (Kroemer & Acebey 2616); Photo: A. Acebey). Young plant growing in the wild showing acaulescent habit, petioles, leaf blades, adaxial surface with five leaflets, and inflorescence.

violet parts (petioles, major veins and peduncles). It is also one of the four cultivated species with pinkish staminodes (together with *X. blandum* Schott, *X. mafaffa* Schott and *X. taioba* E.G. Gonç.).

The species had often been considered a synonym of *Xanthosoma sagittifolium* (L.) Schott but Gonçalves (2011) clarified the taxonomy of the cultivated *Xanthosoma* and reinstated this species along with *X. mafaffa* and a few other species.

Other specimens seen: MEXICO. **Chiapas:** Bluffs above Presa La Angostura, 45 km from Tuxtla, 16°06'27"N, 92°24'04"W, 700 m, 9 Sep. 1974, *Dennis E. Breedlove 37436* (MO). PANAMA. **Canal Area:** Along Gaillard Highway, ca. 1 mi N of Summit Gardens, 09°04'27"N, 79°39'36"W, 300 ft, 8 Aug. 1976, *Thomas B. Croat 38233* (MO). **Veraguas:** Santa Fe, inicio de la carretera hacia el Alto, 08°28'47"N, 81°34'51"W, 260 m, 27 Dec. 2016, *Orlando Ortiz, Roxana Chavez, Anthony Juarez, Fernando Espino & Sonia Sánchez 2692* (PMA).

Xanthosoma wendlandii (Schott) Schott, *Oesterr. Bot. Z.* 15(2): 33. 1865. Basionym: *Acontias wendlandii* Schott. Schott drawings 3470 and 3471 serve as the type. **Figures 62–65.**

X. hoffmanii Schott, *Osterr. Bot. Zeitschr.* XV. 33. 1865.

Acontias hoffmannii Schott, *Prodr. Aroid.* 196. 1860.

X. mendozæ Matuda, *Anales Inst. Biol. Univ. Nac. México* 27: 351. 1957.

The species is a member of group *Basisectum* and is highly variable throughout its range both in the degree of lobing but also the positioning of the lobes. One collection in Jalisco (*J. Villa C et al. 854*) is interesting in that it is only 3-lobed with a broad medial lobe and the lateral lobes are merely auriculate, not approaching being pinched off as one would expect with a

plant which was going to produce a 5-lobed leaf.

Terrestrial 40–100 cm tall; tuber subglobose, orange on interior, 1.5–3 cm diam, producing tubercles 8 mm long at apex of tuber; sap milky; internodes short; **petioles** 40–130 cm long, sheathed 1/3–2/3 its length, obtusely flattened and striate, sulcate toward apex, dark green, weakly glossy, densely variegated with purple; **blades** pedately 5–9-foliolate, the lateral lobes with a prominent elongate oblong-elliptic to elliptic auricle, directed more or less downward, thin, semiglossy, sometimes matte below, weakly bicolorous; margins often turned upward on segments; medial lobe oblong-elliptic, 20–50 cm long, 5–20 cm wide, acuminate at apex, acute and often markedly confluent on to lateral lobes at base; rachis naked, curved; major veins sunken and slightly paler above; midrib narrowly raised and paler below; **primary lateral veins** 4–9 per side, weakly raised and slightly paler below; collective veins markedly loop-connecting primary lateral veins, 1–1.5 cm from margin; secondary and marginal collective vein present; **tertiary veins** prominent. INFLORESCENCE 1 or more per axil, erect at anthesis, much shorter than petioles; **peduncle** 23–37 cm long; **spathe** 13.5–21 cm long; tube green, elliptic, 4–7 cm long, weakly glossy outside, slightly paler green, glossier inside; blade white, erect and arching, 8–13 cm long, 3–4 cm diam. at anthesis but flattening to 5–8 cm or more, turning pale yellow; **spadix** 11–16 cm long, 1–1.3 cm wide, arching forward out of spathe, slender, curved at



Figure 63

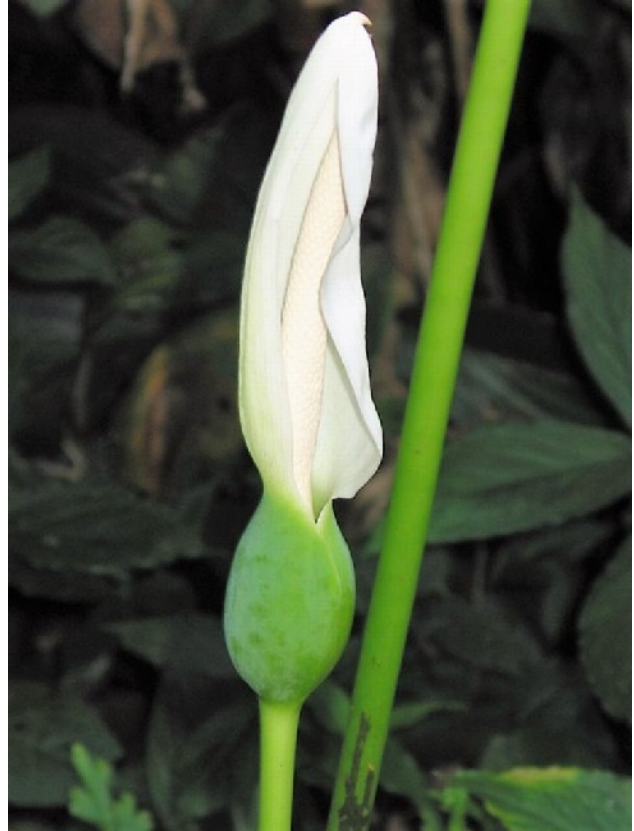


Figure 64

Figure 63. *Xanthosoma wendlandii* (Schott) Schott. Habit of cultivated plant at Kampong in Coral Gables, Florida. Older plant with leaf blades with seven leaflets (adaxial surface).

Figure 64. *Xanthosoma wendlandii* (Schott) Schott (Kroemer & Acebey 2616). Photo: A. Acebey). Close-up of inflorescence showing spathe tube green glaucous surface outside.

anthesis; staminate spadix 9.5–12.5 cm long; sterile staminate portion 2–2.7 cm long, 1.5 cm diam., drying 1.1 cm diam. at base, to 7 mm diam. in middle and to 1.1 cm diam. at apex, the lowermost thickened staminodia, 1.6–3.6 mm long, 1–1.6 mm wide, most somewhat tapered toward apex, drying orange-brown, promptly transitioning to 3–5 rows of elongated light brown low

staminoida 2.5–3.2 mm long, 0.8–1 mm wide, oblique and bluntly pointed on both ends; female spadix pale green, 2–2.5 cm long, 1–1.5 cm diam., drying blackened with a deeply depressed center on the style. INFRUCTESCENCE with **spathe** to 10 cm, 6 cm diam. **fruits** white.



Figure 65

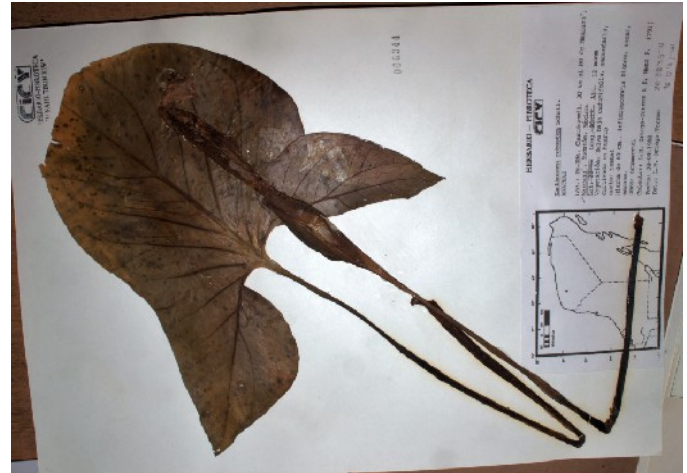


Figure 66

Figure 65. *Xanthosoma wendlandii* (Schott) Schott (not collected). Close-up of opened inflorescence showing spathe tube green inside and pale green pistillate spadix.

Figure 66. *Xanthosoma yucatanense* Engl. (Ortega-Torres & Mena 791, CICY). Herbarium specimen showing petiole, leaf blade, adaxial surface, and inflorescence.

Xanthosoma wendlandii ranges from Mexico (Sonora) to Panama (Azuer Peninsula), occurring principally on the Pacific slope in Central America; sea level to 1300 m in *Tropical dry forest* and *Tropical moist forest* life zones. A collection from Panama in Veraguas Province (Grayum & Evans 9916) was from an area mapped *Tropical wet forest* but the map is probably erroneous for that

region because while arborescent vegetation survives well in the region epiphytic and herbaceous material usually can not make it in the dry season. In other words the region is dry enough in the dry season to accommodate *X. wendlandii*.

The only species which could be confused with *X. wendlandii* in Central

America is *X. belleborifolium* which differs in having many more and much narrower leaflets with a broadly arcing rachis.

Other specimens such as *Kroemer & Acebey 3108* from the vicinity of San André Tuxtla in Veracruz State have 3-lobed blades with the lateral lobes prominently auriculate and with fewer and much thicker staminodia but otherwise seem to be the same species as the more prominently lobed material.

Additional specimens seen: COSTA RICA. Cultivated plant at the Missouri Botanical Garden greenhouse, originally collected in Palo Verde, roadside, ca. 500 m E of the OTS field station, 10°20'24"N, 85°19'48"W, 15 Nov. 1993, *G.H. Zbu 1477* (MO); San Ramon, *Wendland s.n.* (MO); *Hoffmann s.n.* (MO). **Cartago:** Near Río Segundo, ca. 1.5 km N of International airport, roadside, 10°00'00"N, 84°10'48"W, 900 m, 2 July 1976, *Thomas B. Croat 36852* (MO). **Guanacaste:** Santa Rosa National Park, Evergreen - Manilkara forest, 1 km left of fork in road to Playa Naranjo, 10°48'00"N, 85°39'36"W, 0–20 m, 21 June 1977, *Ronald Liesner 2255* (MO); Sparse shade, wet lowland pasture area, Finca Taboga, 6 mi. S, 6 mi. W of Canas, 10°20'24"N, 85°10'12"W, 19 July 1968, *Koch, R. 4875* (MO); Finca Pacifica, secondary forest, 12 Aug. 1965, *Croat, T.B. 1017* (MO); Cantón de Anton Bagaces, Parque Nacional Palo Verde Selva Baja Caducifolia, 10°20'45"N, 85°20'38"W, 15 m, 23 June 2003, *R.C. Moran & M.M. Mora P. 6803* (MO). **Bagaces:** P.N. Palo Verde, Valle del Tempisque, Ojo de Agua, Guayacán, 10°21'00"N, 85°19'48"W, 10–150

m, 31 July 1996, *Ulises Chavarría 1508* (INB, MO). **La Cruz:** Wet forest along Río Cuajiniquil, along main access road, Península de Santa Elena, 10°51'36"N, 85°36'36"W, 260 m, 16 Aug. 2003, *M. H. Grayum & Evelio Alfaro 11608* (MO). **Puntarenas:** Isla San Lucas, Golfo de Nicoya, 09°57'00"N, 84°54'00"W, 0–40 m, 20 Oct. 1984, *Michael Grayum, Miguel Rodríguez & Alonso Carvajal 4263* (CR, MO); Santa Elena to Coyolar de Guacimal, Pacific Slope, roadside and remnant forest patches of dry forest, 10°07'48"N, 84°51'00"W, 250 m, 16 July 1988, *Barry Hammel 17106* (MO); San Luis, Monteverde, Finca de Chepe Rojas, al oeste del pueblo, 10°15'36"N, 84°49'48"W, 750 m, 24 June 1988, *Erick Bello William Haber & Barry Hammel 100* (MO); Monteverde, Cloud Forest Reserve, Cordillera de Tilarán, Lower montane rain forest (Holdridge Classification), Pacific slope of Continental Divide, 10°15'36"N, 84°46'12"W, 1500–1620 m, 15 Aug. 1984, *Willow Z. Pounds 480* (MO); Nicoya Peninsula, Curú, Semideciduous forest in uplands, evergreen forest in canyons and wet areas, deciduous forest on exposed bluffs, pasture and orchards on central flat, mangroves at Río Curú mouth, up Punta Blanca Trail, across ridgetop to Marianas Trail, down Marianas, 09°46'48"N, 84°55'48"W, 30 m, 6 July 1996, *A.C. Sanders et al. 19296* (MO); Garabito, R.B. Carara, Valle del Tárcoles, Estación Quebrada Bonita, Bosque primario, 09°45'36"N, 84°36'00"W, 50 m, 27 July 1990, *Erick Bello 2372* (CR); Monteverde, Santa Elena - San Luis, road from Santa Elena to village of San Luis and Largartop Pacific slope, moist

forest, 10°15'36"N, 84°49'48"W, 750–900 m, 10 July 1990, *William Haber 9975* (MO); R.B. Monteverde, Cordillera de Tilarán, La Lindora, Pacífico, Río Lagarto, 10°18'00"N, 84°48'36"W, 900 m, 12 Aug. 1991, *Erick Bello 2968* (CR); R.B. Monteverde Cordillera de Tilarán, Cerro Plano. Finca de Marcos Vargas, 10°18'36"N, 84°49'12"W, 1300 m, 21 Aug. 1991, *Erick Bello 2997* (CR). **San Jose:** Cerros de Puriscal, San Martín de Puriscal, bosque primario remanente en la Fila Vara Blanca, cabecera de Río Negro, límite NW Cangreja, 09°43'48"N, 84°23'24"W, 800–950 m, 21 Apr. 1995, *J.F. Morales 3917* (CR, MO). **EL SALVADOR. Ahuachapán:** San Francisco Menéndez, El Corozo, Mariposario, zona "Los Sánchez, al pie de La Montaña", 13°49'N, 89°59'W, 350 m, 17 Aug. 2000, *Rosales, J.M. 1313* (LAGU, MO, B); San Francisco Menéndez, El Corozo, Mariposario, zona baja "Mariposario", 13°49'N, 89°59'W, 200 m, 18 July 2000, *Rosales, J.M. 1094* (LAGU, MO, B). **La Libertad.** Santa Tecla: 18 miles S of Santa Tecla (Nueva San Salvador), roadside, 3 Aug. 1971, *John D. Dwyer, D. Spellman, J. Vaughan & R. Wunderlin 426* (MO). **GUATEMALA. Sacatepequez:** Alotenango, 2.3 miles SW of Alotenango on road from Antigua to Escuintla, slopes of Volcán del Fuego, disturbed vegetation on volcanic ash, 14°27'32"N, 90°48'48"W, 1300 m, 26 July 1977, *Thomas B. Croat 41963* (MO); *Thomas B. Croat 42027* (MO). **Santa Rosa:** Barberena, Km 38, 16 km northwest of Barberena, grassy pasture on thin soil of ancient lava field, 22 July 1970, *W.E. Harmon & John D. Dwyer 3231* (MO); Los Esclavos. Río Los Esclavos, 14°15'N,

90°17'W, 2500 f, Aug 1892, *Heyde & Lux 3868* (MO). **HONDURAS. Copán:** Santa Rita, Copán - La Entrada, 10 miles west of Copán along gravel road to La Entrada, disturbed roadsides, 14°52'N, 89°06'W, 700 m, 1 Aug. 1977, *Thomas B. Croat 42522* (MO). **MEXICO. Chiapas:** 37.2 mi. SE of Tonala, wet habitat type of vegetation, roadside grassy area, 100 f, 4 Aug. 1975, *David B. Dunn et al. 21966* (MO); SW escarpment of Sierra Madre de Chiapas, 19 km N of Arriaga, Highway 195, steep, moist roadside slope covered with Pinus woods and understory of grasses, 16°20'N, 93°50'W, 850 m, 4 Aug. 1965, *Keith Roe, Eunice Roe & Scott Mori 849* (WIS); La Trinitaria, El Jocote - Motozintla, 20–30 miles SW of El Jocote on road to Motozintla, 15.30N, 92.06.36W, 700–900 m, 10 July 1977, *Thomas B. Croat 40708* (MO). **Colima:** Comala, Lago Jabali, on Rancho El Jabali, 22 km NNW of the city of Colima, 19°27'N, 103°42'W, 1300 m, 25 Aug. 1988, *A.C. Sanders, G. Ballmer, G. Castillo, I. Garcia, A. Gomez-Pompa & T. Krantz 8281* (MO). **Jalisco:** La Huerta, Vereda a Rincón de Ixtán, viejo camino a Nacastillo, Selva Mediana Subcaducifolia, Estación de Biología CHAMELA (UNAM), 19°30'00"N, 105°03'00"W, 9 Oct. 1982, *Emily J. Lott & R. Hernández M. 1417* (MO). **Nayarit:** Along road from Hwy. 15 to Santa Cruz (W of Tepic), ca. 6.3 mi. W of Hwy. 15, 21°28'48"N, 105°02'24"W, 28 Aug. 1971, *Stevens, W.D. 1477* (MO). **Jalisco:** 12 km al E del poblado El Cora camino a Palapita, Ecotonia de Bosque de Quercus y Bosque tropical caducifolio, 21°25'N, 105°03'W, 500 m, 8 Oct. 1993, *Flores-Franco, G. et al. 3081*

(MO). **Oaxaca:** Ixtlan, Municipio de Santiago Comaltepec, La Esperanza, Bosque mesófilo de montaña, 17°45'N, 96°30'W, 1600 m, 8 Dec. 1987, *Ricardo López Luna 145* (MO). **Sinaloa:** Escuinapa, La Presa del Penon, selva baja caducifolia, suelo café-rocoso con lomerios, 22°52'12"N, 105°44'24"W, 29 Aug. 1990, *Hernández, F. et al. 937* (MEXU). **Sonora:** 35 miles E of Villa Union, creek and cliffs along highway, 1066 m, 3 Sep. 1967, *R.L. Oliver, D.F. Austin & B. MacBryde 765* (MO); Río Cuchujaqui, Upper crossing of the Río Cuchujaqui, 12 km by road E of Alamos and ca. 1.5 mi. E of Sabinito Sur, tropical deciduous forest on slopes and *Taxodium* dominated wash along the river, 26°59'24"N, 108°48'36"W, 400–600 m, 6 Sep. 1989, *Sanders, A. et al. 9329* (MO). **NICARAGUA. Boaco:** Río Fonseca, "Los García", 3.5 km de Santa Lucía, carretera a Boaco, 12°30'N, 85°40'W, 460–500 m, 30 July 1981, *Pedro P. Moreno 10166* (MO). **Carazo:** Carretera a San Marcos, 2 km al E, 11°54'N, 86°13'W, 640–680 m, 31 Aug. 1981, *Pedro P. Moreno 10769* (MO). **Chinandega:** Volcán San Cristóbal (Volcán Viejo), Finca "Los Rojos", a 20 km de Chinandega, o sea 10 de Comarca La Mora, 12°42'N, 87°02'W, 790 m, 3 Aug. 1984, *Héctor M. Hernández, A. Chacón, A. Grijalva & D. Soza 599* (MO); Faldas del Volcán Casita, camino entre Posoltega y Finca Argelia, 12°34'N, 86°56'W, 150–700 m, 23 July 1982, *M. Araquistain 2978* (MO); Volcán San Cristóbal, hacienda Las Rojas (San Cristóbal), 20 km al NE de Ciudad Chinandega, 12°42'N, 87°02'W, 700–800 m, 3 Aug. 1984, *D. Soza, A. Grijalva & H.M. Hernández 128* (MO); Municipio El Viejo, Reserva Natural Volcán Cosigüina, comunidades El Jicarito, El Chorro, Elena María, 12°53'47"N, 87°31'37"W, 50 m, 19 July 2005, *Ricardo Ruedo & Bismarck Sánchez 18086* (MO); Volcán Casita, faldas SE del Volcán Casita, 1 km antes de Argelia, 12°40'N, 86°57'W, 650–700 m, 30 July 1980, *P.P. Moreno 1581* (MO). **Chontales:** Hda. Corpus, W of Juigalpa, 12°07'N, 85°28'W, 100 m, 5 Sep. 1982, *Warren Douglas Stevens 21804* (MO); Around Hacienda Corpus, 13.5 km W of Juigalpa, 12.07N, 85.28.29W, 100 m, 27 Aug. 1983, *M. Nee & J. Miller 27552* (MO). **Granada:** De la carretera Masaya-Granada, 1.5 km sobre el camino a la Laguna de Apoyo, 11°57'N, 86°02'W, 180–200 m, 20 Sep. 1981, *Pedro P. Moreno 11215* (MO); Volcán Mombacho, above Finca Cutiere, premontane moist forest, 11°50'N, 86°00'W, 600 m, 3 Oct. 1976, *D.A. Neill 1006* (MO). **Jinotega:** Ca. 5 mi. E of El Jocote, roadside fencerow, 750 m, 6 Aug. 1977, *Thomas B. Croat 42874* (MO); Lago Abanas, San Rafael del Norte - Jinotega, along gravel road along NW side of Lago Abanas, 1–2 miles E of turnoff of road between San Rafael del Norte and Jinotega. Disturbed roadsides, 1000–1100 m, 7 Aug. 1977, *Thomas B. Croat 42972* (MO). **Leon:** SW side of Isla de Momotombito in Lago de Managua, 12°21'N, 86°28'W, 40–389 m, 17 May 1981, *James E. Henrich 111* (MO); Municipio La Paz Centro, 4 km SW del pueblo, 12°18'N, 86°42'W, 60–80 m, 12 Sep. 1980, *M. Guzmán, A. Montiel & D. Castro 987* (MO). **Managua:** Ca. 16.0 km from Hwy. 12 (Carretera vieja a León) on Hwy. 10, roadside and small stream bed, on shell-

limestone, 11°58'N, 86°31'W, 80 m, 18 Aug. 1977, *W.D. Stevens 3384* (MO). **Masaya:** Laguna de Apoyo, 11°56'N, 86°04'W, 100 m, 24 Oct. 1980, *P.P. Moreno 3991* (MO); Parque Nacional Volcán Masaya, 11°59'N, 06°07'W, 250 m, 26 Aug. 1978, *D.A. Neill 4630* (MO); Parque Nacional Volcán Masaya, E slope of Volcán Masaya, deciduous forest on old lava flow, 11°59'N, 86°08'W, 400 m, 30 Aug. 1978, *D.A. Neill 4644* (MO). **Matagalpa:** Along road between Muy Muy and Esquipulas, ca. 9.5 km W of bridge at Muy Muy, at Quebrada Yare, disturbed forest along quebrada and roadside, 12°45'N, 85°42'W, 310 m, 30 July 1978, *W.D. Stevens 9552* (MO); El Tuma, 30 km E of Matagalpa, subtropical wet forest, 13°04'N, 85°44'W, 350 m, 13 Aug. 1977, *D.A. Neill 2348* (MO). **Nueva Segovia:** Valle de Casas Viejas, 7 km al NE de El Jicaro, 13°46'N, 86°06'W, 550–600 m, 2 Aug. 1980, *P.P. Moreno 1644* (MO); entre Casas Viejas y Hacienda Tranquera, 8 km al NE de El Jicaro, 13°45'N, 86°06'W, 650–700 m, 3 Aug. 1980, *P.P. Moreno 1712* (MO). **Rivas:** Isla de Ometepe, 11°29'N, 85°29'W, 40–55 m, 14 Sep. 1983, *Pedro P. Moreno 22044* (MO); San Jorge, adjacent Musa plantations and beach of Lago de Nicaragua, weedy places, 11°28'N, 85°47'W, 30–50 m, 17 Sep. 1983, *M. Nee 28202* (MO); Isla Ometepe, Volcán Concepción, "Los Hatillos", camino a "Las Delicias", Bosque seco tropical, 11°33'N, 85°36'W, 140–350 m, 9 Aug. 1984, *Walter Robleto 972* (MO); At convergence of Río La Pita and Río Escalante, at border of Departamentos Carazo and Granada, gallery forest, 11°34'N, 86°08'W, 20 m, 3 Aug. 1978, *W.D.*

Stevens 9706 (MO); Along road SE from San Juan del Sur, ca. 4.8 km SE of El Ostional, slope above road, tall evergreen forest, 11°05'N, 85°43'W, 40 m, 12 Sep. 1977, *W.D. Stevens 3836* (MO); Isla Ometepe, Falda oeste del Volcán Maderas, 11°28'N, 85°32'W, 300–600 m, 16 July 1981, *J.C. Sandino 935* (MO); Isla de Ometepe, pantanos entre playa de Finca Santa Cruz y el Istmo de Istian, 11°29'N, 85°33'W, 40–45 m, 17 July 1981, *J.C. Sandino 998* (MO). PANAMA. **Herrera:** 18 km W of Las Minas, trail to top of Alto Higo, N slope of Cerro Alto Higo (known locally as el Montoso), 2400 f, 5 Aug. 1978, *Barry Hammel 4241* (MO); Distrito de Las Minas, alrededores del Primer Ciclo de Chepo, bosque nuboso, 07°43'N, 80°50'W, 900 m, 29 Sep. 1994, *C. Galdames & et al. 1781* (PMA). **Veraguas:** Along Río Grande, Arenas del Quebro, Península de Azuero, 07°22'N, 80°52'W, 10 m, 21 July 1990, *M.H. Grayum & Randy Evans 9916* (MO, PMA).

Xanthosoma yucatanense Engl., *Bot. Jahrb. Syst.* 37: 137–138. 1905. Type: MEXICO. Yucatán: Xamacal, Cunch, camino de Sacalum a Guyalee, Aug. 1865, *Schott 630* (holotype, BM). **Figures 66–67.**

The species is member of group *Chamaexanthosoma* and is characterized by its tuberous stem and its deeply lobed subhastate blades with anterior lobes constricted at the base and posterior lobes broadly rounded on the lower edge.



Figure 67

Figure 67. *Xanthosoma yucatanense* Engl. Mexico. Yucatan, vic. Merida. Photo: German Carnevali. View of leaf blade, adaxial surface.

Tuberous herb going dormant during the dry season; tuber ca. 2 cm diam., heavily rooted in apical half. LEAVES with **petioles** 36–83 cm long, sheathed 50% their length; **blades** ovate-subhastate, 24–43 cm long, 23–34 cm wide, 1–1.25 times as long as wide, 0.5–0.65 times as long as petioles, deeply 3-lobed, broadly obtuse at the apex, the preadult blades merely heavily constricted near the base of the medial lobe and broadly confluent onto the lateral lobes, medium green and semiglossy above, drying dark brown and semiglossy above, medium

greenish brown and glossy below; **anterior lobe** 16.5–29 cm long, 16–22 cm wide at broadest point, broadly rounded on margins, constricted at the junction with the posterior lobes; **posterior lobes** 13–21.5 cm long, 7.5– cm wide, broadly rounded on the lower edge; **sinus** parabolic with a prominently decurrent petiole to emarginate at apex; 7–8 cm deep, 6–8 cm wide in the middle; **midrib** drying darker than surface above and below; **primary lateral veins** 2–4 pairs, arising at a steep angle then spreading at 25–35° angle; **basal veins** 5–8 pairs, 1st & 2nd pairs free to the base and arising at a steep angle (12–28° angle), the remainder fused to the posterior rib and branching off at regular intervals to midway on the lobe, 2 acroscopically, 3–4 basioscopically; **posterior rib** naked 1.5–2.5 cm, directed to the tip of the lobe. INFLORESCENCE with **peduncle** 31–52 cm long; **spathe** 16.5–19 cm long; tube 6.5–7 cm long, 2.5 cm diam., green; blade 10–12 cm long, white; **spadix** 14 cm long, staminate portion to 8 cm long, the broadest point of fertion portion 7 mm diam.; sterile staminate portion 4.6 cm long; the lowermost thickened staminodia drying dark brown, oblong-elliptic, ca. 4 mm long, the 2nd and 3rd rows upward drying blackened, the staminodia of 3rd row narrowed upward; the next 8–9 rows upward constituting a long narrow neck 3.5 cm long and 3.5 mm diam. with elongated light yellow-brown-drying low staminodia, each 4–5 mm long and ca. 1 mm or less wide, these bluntly pointed on both ends; pistillate portion 2 cm long.

Xanthosoma yucatanense is endemic to Mexico, known only from the region of the Yucatan Peninsula in southern Mexico at low elevations in a *Tropical dry forest* life zone. It is extremely rare in nature, and most collections have originated from backyards of houses in Mayan villages where they are used as fodder for pigs.

The collection made by Bunting in Yucatan State near Izamal is possibly also this species but it has barely any constriction near the base of the anterior lobe.

Additional specimens seen: MEXICO. **Quintana Roo:** vic. of Tres Garaantias, collected by German Carnevali (*Carnevali 6998*), 1 Nov. 2004, T.B. Croat 94076 (MO). **Yucatan:** Ex-Hda. Chunchucmil, 30 km al NO de Maxcanú, Maxcanú, 26°38'35"N, 90°12'41"W, 12 m, 8 Sep. 1988, L.M. Ortega & E. Mena P. 791 (CICY); Municipio Valladolid, Pixoy en un terreno frente al domicilio de la familia Tuz Kuyoc, 20°42'53"N, 88°15'45"W, 22 m, E. Ucán Ek 2811 (CICY).

Cultivated Plants: MEXICO. **Yucatan:** Original plant collected in Mexico, Bunting & Davies no. 6, cultivated from a propagule, Hortorium Conservatory, Cornell U., Ithaca, as BH 61, 21 Sep. 1970, M.H. Stone 1002 (MO); Original plant collected in Mexico. Bunting & Davies No. 6; beside trail to Cenote Jodzo, ca 18 km E of Izamal, Yucatan, 21 Sep. 1970, M.H. Stone 1102 (MO).

ACKNOWLEDGEMENTS

We are very grateful to the curators of the following herbaria: PMA, MO, SCZ, and UCH for allowing access to their collections. The third author of this paper (O.O. Ortiz) thanks GEMAS (Fondo Darién), Adopt a Panama Rainforest (ADOPTA), Panama's National Secretariat for Science and Technology (SENACYT) and the University of Panama (UP) for funding his fieldwork in Panama.

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