

A NEW SPECIES OF *OPHIOCARYON* (SABIACEAE) FROM THE
AMAZONIAN SLOPE OF THE EASTERN CORDILLERA OF COLOMBIA

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ABSTRACT

Ophiocaryon nicolasii, from the “Camino de los Andaquíes,” in the Amazonian slope of the Eastern Cordillera of Colombia, Caquetá department, is described and illustrated and its morphological relationships with other similar *Ophiocaryon* species are discussed. This new species is a small tree from the foothills to montane forest (500–1000 m). Morphologically it is related to *O. manausense* (W.A. Rodrigues) Barneby, but it differs by: smaller leaves, petioles, petiolules, and inflorescences; leaflets with 8–16 secondary veins; leaflets, bracteoles, staminodes and ovary with different shape; margins of sepals erose. Information about the Andaki region and its ancestral inhabitants is presented. An updated key to the species of *Ophiocaryon* is provided.

KEY WORDS: Andaquíes, Caquetá, Flora of Colombia, *Ophiocaryon*, Sabiaceae

RESUMEN

Ophiocaryon nicolasii colectada en el “Camino de Los Andaquíes,” en la vertiente amazónica de la cordillera Oriental (Sureste de Colombia) departamento del Caquetá, es descrita e ilustrada y sus relaciones morfológicas con su especie afin son discutidas. Esta nueva especie es un árbol pequeño de bosques del piedemonte y los montanos (500–1000 m), morfológicamente posee similitudes con *O. manausense* (W.A. Rodrigues) Barneby. Sin embargo, difiere por los peciolos, peciolulos y las inflorescencias más pequeñas; folíolos con 8–16 venas secundarias, los folíolos, bractéolas, estaminodios y ovario de forma diferentes, y los márgenes de los sépalos erosos. Se incluye información acerca de la región Andaquí, sus habitantes ancestrales, y una clave actualizada de las especies de *Ophiocaryon*.

PALABRAS CLAVE: Andaquíes, Caquetá, Flora de Colombia, *Ophiocaryon*, Sabiaceae

INTRODUCTION

The Neotropical genus *Ophiocaryon* Endl. (Endlicher 1841), comprises nine species (Ulloa-Ulloa et al. 2017). They are shrubs or small to medium trees occurring in moist forests in Colombia, Venezuela, Guyana, Ecuador, Peru, and Brazil, especially on the Guayana Shield, and in the Amazon basin; rarely in the Andes (only *O. neillii* Aymard & Daly, and *Ophiocaryon nicolasii*, a new species described here). Generally, the classification of Sabiaceae recognizes two subfamilies: *Meliosmoideae* Mast. and *Sabioideae* Y.W. Law & Y.F. Wu (Law & Wu 1985) and three genera: *Meliosma* Blume, *Ophiocaryon*, and *Savia* Colebr. (Kubitzki 2004, 2007; Ramos & Lombardi 2009; Morales 2013). Zuñiga (2015) showed *Ophiocaryon* was embedded within *Meliosma* as part of a basal clade with *Meliosma alba* Schltld. This close relationship of *Ophiocaryon* with *M. alba* was previously unknown. However, a recent phylogenetic study based on morphological and molecular data showed that *Meliosma* was a paraphyletic group (Yang et al. 2018). This resulted in the genus *Kingsboroughia* Leibm. being reinstated and reinforcing that *Meliosma* and *Ophiocaryon* are monophyletic.

Ophiocaryon, as currently circumscribed, is distinguished from *Meliosma* and *Kingsboroughia* by its pinately compound leaves [vs. simple leaves, except in the Mexican *K. alba* (Schltld.) Walp.], two stigmas (vs. one), anthers dehiscence valvate (vs. transverse), and embryo spirally twisted or coiled (vs. folded). Herbarium specimens of *Ophiocaryon* are often misidentified as either *Talisia* Aubl. (Sapindaceae) or *Dacryodes* Vahl (Burseraceae). However, *Ophiocaryon* is distinguished from these two genera by the abscission layer marked by an articulation or joint at the insertion of the petiolule. In addition, this genus is further distinguished from

Talisia by its leaves with a well-developed terminal leaflet (vs. rudimentary terminal leaflet) and from *Dacryodes* by the absence of resin canals in all vascularized tissues (Aymard & Daly 2006).

Barneby (1972) divided *Ophiocaryon* into two groups: series *Phoxanthus*, defined as having petals narrowly triangular-acuminate to lance-caudate and acute and series *Ophiocaryon*, having petals ovate-oblong and obtuse, or, if subacute, then cucullate at the apex. Aymard and Daly (2006) maintained the two Barneby series, recognized nine species, described two new taxa, and included a key to species. Until recently, the genus was the focus of limited taxonomic research. However, Thaowetsuwan et al. (2017), identified an array of new characters in *Ophiocaryon*, e.g., conical cells on petals, different kinds of orbicules in anthers, stomata on nectary appendage tips and ovary, two distinct surface patterns on stamens and ovary, tanniferous cell layers in the ovary wall, and acorn-shaped unitegmic ovules with very short integuments. In addition, these authors pointed out that the calyx, corolla, androecium, and gynoecium of *Ophiocaryon* resemble an undeveloped state of *Meliosma*; these conditions reflect a paedomorphic regression of its flowers.

An examination of herbarium specimens of Sabiaceae in COL and COAH revealed an undescribed species of *Ophiocaryon* from the “Camino de los Andaquíes,” a sector located in the Eastern slopes of the “Cordillera Oriental” of Colombia, Caquetá department. This region is a biogeographically known hotspot area as it connects with the Andes and the Amazon basin, two of the most species-rich regions in the world (WWF 2014). This new discovery highlights the need for increasing botanical exploration to improve our understanding and knowledge of these megadiverse tropical countries (Dexter & Chave 2016; ter Steege et al. 2016, 2019; Zizka et al. 2018).

MATERIALS AND METHODS

This work is based on the morphological study of herbarium material and the examination of current taxonomic literature on *Ophiocaryon*. The new species was discovered after examination of specimens in COAH, COL, GH, MO, and NY (Thiers 2017). Type specimens of *Ophiocaryon* were studied using on-line images from the JSTOR Global Plants database (<https://plants.jstor.org/>). The specific terminology for vegetative characters, vestiture description, inflorescences, flowers, and fruits morphology is from either Harris and Harris (2001), Keller (2004), and Endress (2010), respectively.

TAXONOMIC TREATMENT

***Ophiocaryon nicolasii* Aymard, sp. nov. (Fig. 1).** TYPE: COLOMBIA. CAQUETA: municipio Belén de Los Andaquíes, Parque Nacional Municipal Andaquí, sector Filo Seco y La Mina, 1°37'36.1"N, 75°54'13.2"W, 920–1000 m, 05 Feb 2017(II), N. Castaño, D. Cárdenas, J. Betancur, A. Barona, N. Marín, E. Paky, J. Navarro, O. Cerquera, A. Valencia, M. Rojas, B. Rojas, D.J. Jaimes, L.C. Luna, H. Muñoz, & D. Osorio 9550 (HOLOTYPE: COAH!, ISOTYPE: COL!).

Ophiocaryon nicolasii is morphologically similar to *O. manausense* (W. Rodrigues) Barneby, from which it differs by having leaves 14–30 cm length, leaflets oblanceolate to narrowly elliptic, 2–4.5 cm wide, chartaceous to subcoriaceous, glabrous at both sides, 8–16 secondary veins, petiole 4–12 mm long; inflorescences 10–25 (30 in fruit) cm long, bracteoles triangular, 0.3–0.5 mm long, pedicels 0.5–0.7 mm long, sepals margins erose, staminodes obconical and ovary widely-obovate, ca. 0.4 mm long.

Trees 6–8 m tall; **branches and branchlets** gray, striate, sparsely white tomentose, glabrous when mature. **Leaves** imparipinnate, 14–30 cm long, petiole 8–15 cm long, thickened at base (2–4 mm diam.), striate, canaliculate, glabrous, rachis 4–15 cm long, glabrous, canaliculate and striate; petioles 4–12 × 1–2 mm, glabrous, canaliculate; **leaflets** 5–9, chartaceous to subcoriaceous, oblanceolate to narrowly elliptic, 5–20 × 2–4.5 cm, glabrous on both sides, base acute or attenuate, apex acuminate, acumen 1–1.5 cm long, margin entire, sub-revolute, secondary veins 8–16 pairs, convergent towards margin and linking 2–3 mm close to it, secondary veins and midrib (canaliculate) impressed on upper surface, prominent on lower surface, tertiary venation reticulate at upper surface, obscure at lower surface. **Inflorescence** axillary, densely paniculate, 10–25 cm long (ca. 30 cm in fruit), main axis and secondary branches, striate, shortly ferruginous-pubescent, bracts 1–1.5 mm, triangular, with same type of indument of the inflorescence. **Flowers** 5-merous, bracteoles 1 per flower, located at base of pedicels, triangular, shortly ferruginous-pubescent on both surfaces, 0.3–0.5 mm long; pedicels 0.5–0.7 (ca. 1 cm in fruit) × 0.25 mm, with same type of indument of the bracteoles; sepals unequal,

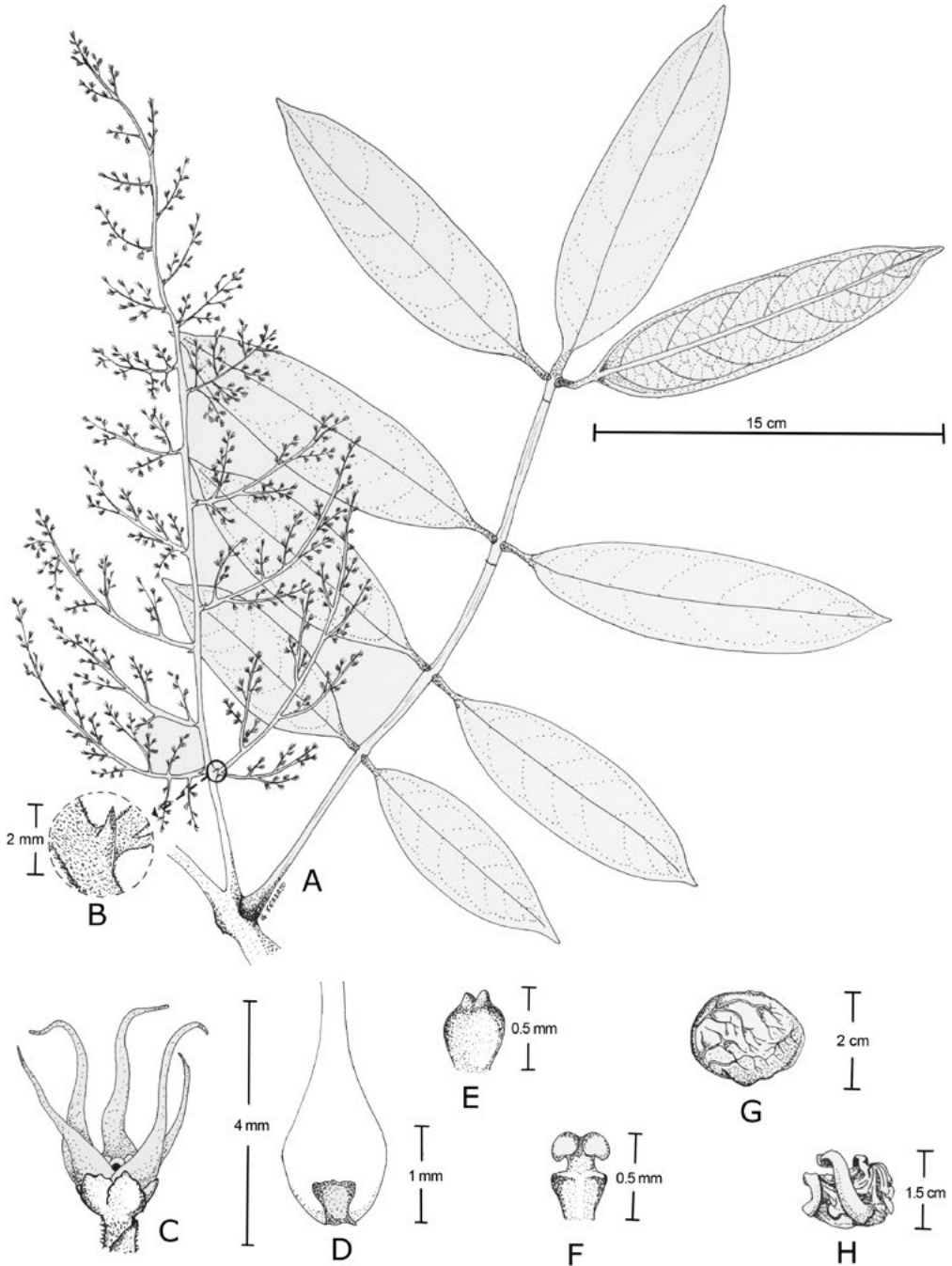


FIG. 1. *Ophiocaryon nicolasii*. A. Flowering branch. B. Detail of the bracteoles. C. Detail of the flower. D. Detail of adaxial surface of petal showing the obconical staminode. E. Ovary. F. Stamen showing the thickened connective. G. Fruit. H. Detail of coiled seed (From the holotype, *N. Castaño et al. 9550*, COAH).

imbricate, ovate, glabrous on both surfaces, margin erose, outer sepals 2, ca. 0.7×0.6 mm, inner sepals 3, ca. 0.8×0.7 mm; petals white, unequal, imbricate, triangular-acuminate to lanceolate, 0.5 mm wide at base, glabrous on both surfaces, outer petals 2, ca. 3 mm long, inner petals 3, 2–2.3 mm long; stamens 2, opposite to inner petals, filaments glabrous, ovate, ca. 0.3×0.3 mm, swollen at apex, ca. 0.2 mm wide, connective elongate, anthers ca. 0.25×0.4 mm; staminodes 2, membranaceous, obconical, glabrous, ca. 0.5×0.5 mm; ovary glabrous, ca. 0.4 mm long, widely obovate, styles 2, ca. 0.1 mm long. **Fruit** globose, $1\text{--}2 \times 2\text{--}3$ cm, glabrous, reticulate, crested at base; seed 1.5×1.5 cm, glabrous, cotyledons with reduced endosperm, deeply coiled.

Phenology.—Collected with flowers and fruits from February to July.

Distribution and habitat.—The species is known only from moist premontane (foothills) to montane forest in southern Colombia, between 500–1000 m, from the “Camino de Los Andaquíes,” a trail located inside the “Andaqui” municipal park. This park is only accessible by crossing over a muddy and steep trail which connects the crest of the Andes Mountains of the “Cordillera Oriental” with the Amazonian plain (Aguirre-Santoro & Betancur 2018).

Notes about the region.—“Los Andaquíes” region was inhabited by the “Andakí,” one of the most important pre-Colombian nations that occupied what is now southwest Colombian territory (Friede 1946a). The name “Andakí,” or “daaki,” is linked to the ritual consumption of Yajé [*Banisteriopsis caapi* (Spruce ex Griseb.) Morton], a name some indigenous languages adopt as a synonym of “Andakí” (Aguirre-Santoro & Betancur 2018). Yajé is a preparation with healing powers for South American indigenous cultures and includes “borrachero” (*Brugmansia* spp.) flowers. According to mythology, the flower of the “borrachero” became the sun after being penetrated and fertilized by a Yajé plant (Ramírez de Jara & Pinzón 1987). In addition, Andakí were known for using “Quina” (*Cinchona* spp.) to treat malaria and for the utilization of numerous other medicinal plants (Albis 1855). The Andakí resisted the Spaniards acculturation for more than two centuries, and courageously defended their territory situated between the Magdalena River headwaters to the upper Caquetá River near the eastern slopes of the “Cordillera Oriental” (Rivet 1924; Freide 1953). Today, the “Andakí” is considered an extinct indigenous Colombian language (Coronas-Urzúa 1995). Nonetheless, an interesting and unique “Andakí” vocabulary was gathered by the great botanist José Celestino Mutis in 1787 (Freide 1946b), and enhanced by Rivet in 1924 and Coronas-Urzúa in 1995.

Presently, this region is a large area covered with humid forests and connects the Andean and Amazonian regions. It is known for exceptional biodiversity (WWF 2014; Trujillo et al. 2015a). However, habitat loss is ongoing due to forests being converted to pastures which is changing Colombia by altering soil fertility, creating new roads, changing the density of rural populations, and forcing local migration (Echeverría-Londoño et al. 2016). Even with its biological significance, exploration of the Eastern slopes of the “Cordillera Oriental” has been limited in the last five decades due to public issues and concerns (Clerici et al. 2018). Nevertheless, this area was explored in 2007 and six new species were discovered: *Philodendron caranoense* Croat, *P. edwinii* Croat & M. Correa, *P. marcorreanum* Croat, M. Mora, & E. Trujillo (Araceae; Croat et al. 2013), *Scaphyglottis obtusiseipala* Szlach. & Kolan. (Orchidaceae; Szlachetko & Kolanowska 2014), and *Piper andakiensis* W. Trujillo & Callejas (Piperaceae; Trujillo & Callejas 2015). In addition, a new distribution record for *Chelyocarpus ulei* was recorded for Colombian flora (Trujillo et al. 2015b). The Colombian peace agreement signed in 2016 brought good news to field researchers and provided greater access to inaccessible areas like the “Los Andaquíes” region. This access allowed a scientific expedition sponsored by the program called “Expedición Colombia-BIO a la transición Andino-Amazónica del Caquetá” (COLCIENCIAS-Sinchi) in 2016. These activities resulted in interesting findings such as a new bromeliad species, *Achmea andaquiensis* Aguirre-Santoro & Betancur (Aguirre-Santoro & Betancur, 2018), and *Ophiocaryon nicolasii*, the new species described here. The latter represents the second species of *Ophiocaryon* reported from outside the Guayana Shield or the central Amazon basin.

Eponymy.—Named in honor of the young botanist Nicolas Castaño Arboleda (COAH), who collected this new species and coordinated the 2016 “Expedición Colombia-BIO a la transición Andino-Amazónica del Caquetá.”

Conservation status.—IUCN Red List category. According to IUCN criteria, this species would be ranked as DD (data deficient). This indicates that, while the species has been overlooked until recently, future research may show that a threatened classification is appropriate (IUCN 2017). Currently, *O. nicolasii* is known from several collections of the same region, however, we expect this new species to have a wider distribution across the moist premontane (foothills) to montane forest in southern Colombia to northeastern Ecuador, and, if so, it may not be threatened.

Additional specimens examined: **COLOMBIA. Caquetá. Belén de Los Andaquíes:** Camino Andaquí, al Sur del cruce entre el camino Andaquí y la quebrada Las Verdes, 1°37'46.1"N; 75°34'19.6"W, 800–1000 m, 15 Mar 2016(fr), N. Castaño, D. Daly, E. Paky, & A. Osorio 7849 (COAH). Belén de Los Andaquíes: Vereda Las Verdes, sector bocana quebrada Los Verdes, camino hacia el Cerro El Oso, 1°36'18.8"N, 75°53'20.5"W, 500–750 m, 27 Jun 2011(fl), D. Cárdenas, N. Castaño, X. Cornejo, N.R. Salinas, E. González & E. Paky 42213 (COAH). Belén de Los Andaquíes: camino entre Acevedo y Belén, Cerro Monserrate, 1°36'48"N; 75°53'36"W, 700–1000 m, 25 Jul 2011(fl), D. Cárdenas, N. Castaño, X. Cornejo, N.R. Salinas, E. González & E. Paky 42022 (COAH).

Taxonomic notes.—Because of its narrowly triangular-acuminate to lanceolate petals, *O. nicolasii* belongs to Barneby's (1972) series *Phoxanthus*. It is most similar to *O. manausense* from the Amazon basin of Brazil, Colombia, Ecuador, Peru, and Venezuela. Both species have leaves homomorphic, all imparipinnate; petals white, the longest 1.8–3 mm long, acuminate to lanceolate. However, *O. nicolasii* differs from *manausense* by the characters indicated in Table 1 and the following key to species.

TABLE 1. Comparison of diagnostic morphological characters and geographical distribution between *Ophiocaryon nicolasii* and *O. manausense*.

| Character | <i>Ophiocaryon nicolasii</i> | <i>Ophiocaryon manausense</i> |
|----------------------|---|---|
| Leaf length | 14–30 cm | 30–80 cm |
| Leaflets | oblanceolate to narrowly elliptic 2–4.5 cm wide, chartaceous to subcoriaceous, glabrous 8–16 secondary veins | elliptic-oblong 4–7 cm, coriaceous pilose below 5–12 secondary veins |
| Leaf apex | acuminate, apex 1–1.5 cm | caudate-acuminate, 2–2.5 cm |
| Petiole length | 8–15 cm | 25–30 cm |
| Petiolule length | 4–12 mm | ca. 15 mm |
| Inflorescence length | 10–30 cm | 20–60 cm |
| Bracteoles | triangular, 0.3–0.5 mm long | ovate-oblong, ca. 1 mm |
| Pedicels | 0.5–0.7 mm long | 1–1.5 mm |
| Sepal margin | erose | serrulate |
| Staminodes | obconical | scale-shaped |
| Ovary | widely-obovate, ca. 0.4 mm long | compressed-globose, ca. 5.5 mm |
| Habitat | submontane to montane forests | lowland forests |

AMENDED KEY TO THE SPECIES OF *OPHIOCARYON*

(BASED ON AYMARD & DALY 2006)

1. Petals ovate-oblong, obtuse, or, if subacute, then cucullate at the apex.
 2. Leaves pinnately compound or 1–3-foliolate; pedicels 0.7–1.2 mm long, exceeding the bracteoles; perianth flat or shallowly saucer-shaped, petals white _____ **O. maguirei** Barneby (Guyana)
 2. All leaves pinnately compound; pedicels 0.1–0.5 mm long, not exceeding the bracteoles; perianth cup-shaped, petals pink.
 3. Leaflets ovate or obovate; perianth 5-merous _____ **O. paradoxum** R. Schomburgk (Guyana)
 3. Leaflets elliptic to elliptic-ovate; perianth 4-merous.
 4. Leaflets 28–50 × 8–15 cm, rigid-coriaceous, densely papillate abaxially, with 8–12 secondary veins; sepals ciliate at margin _____ **O. barnebyanum** Aymard & Daly (Brazil-Venezuela border)
 4. Leaflets 6–24 × 2.5–7 cm, chartaceous, not papillate abaxially, with 5–7 secondary veins; sepals not ciliate at margin _____ **O. duckei** Barneby (Brazil, Peru)
1. Petals narrowly triangular-acuminate to lanceolate, acute at the apex.
 5. Petals white to reddish, the longest ones 2–4.3 mm long.
 6. Leaflets rigid-coriaceous; pedicels stout, 0.5–0.6 mm diam; longest petals 3–4.3 mm long _____ **O. chironectes** Barneby (Brazil-Guyana border)

6. Leaflets chartaceous, subcoriaceous or coriaceous; pedicels slender, 0.15–0.25 mm diam; longest petals 1.8–3 mm long.
7. Leaves heteromorphic, imparipinnate but simple on flowering branches _____ **O. heterophyllum** (Benth.) Urban (Brazil, Colombia, Ecuador, Peru)
7. Leaves homomorphic, all imparipinnate.
8. Leaves 30–80 cm long; leaflets coriaceous, pilose at lower surface, oblanceolate to narrowly elliptic, with 5–12 pairs of secondary veins; inflorescences 20–60 cm long _____ **O. manausense** (W. Rodrigues Barneby (Brazil, Colombia, Ecuador, Peru, Venezuela)
8. Leaves 14–30 cm long; leaflets chartaceous to subcoriaceous, glabrous, elliptic-oblong, with 8–16 pairs of secondary veins; inflorescences 10–30 cm long _____ **O. nicolasii** Aymard (Colombia)
5. Petals white or bright yellow, the longest 4.5–7 mm long.
9. Leaflets obovate or obovate-elliptic, 8–18 cm long, with 5–8 pairs of secondary veins; inflorescence 8–27 cm long; sepals lanceolate-acuminate, the margin entire; petals, 2–3 mm wide at the base _____ **O. neillii** Aymard & Daly (Ecuador)
9. Leaflets oblong to oblong-lanceolate, 20–40 cm long, with 12–13 pairs of secondary veins; inflorescence 50–60 cm long; sepals ovate, the margin erose; petals 0.7–1 mm wide at the base _____ **O. klugii** Barneby (Brazil, Colombia, Peru)

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