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Catasetum binarum (Orchidaceae, Catasetinae): a new species from the Brazilian Amazon

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Abstract

Catasetum is the genus presenting the biggest species richness among the genera of the subtribe Catasetinae and finds its diversity center within the Amazonian biome. In the present work we propose a new *Catasetum* species from the National Forest of Saracá-Taquera located in far western part of the state of Pará. The taxon is described, illustrated and compared to *C. barbatum*, that we consider the most related species. We give also information on its habitat, phenology, geographical distribution and conservation status.

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Résumé

Le genre *Catasetum* est le plus riche et le plus représentatif en termes de diversité spécifique de la sous-tribu Catasetinae et trouve son centre de diversification dans le biome amazonien. Dans cet article nous proposons une nouvelle espèce provenant de la Forêt Nationale de Saracá-Taquera, située à l'extrême ouest de l'état de Pará. Le taxon est décrit, illustré et comparé à *C. barbatum*, que nous considérons comme étant l'espèce la plus apparentée. Nous donnons en outre quelques informations sur l'habitat, la phénologie, la distribution géographique et le statut de conservation de la nouvelle entité.

Resumo

Catasetum é o gênero mais rico e representativo em riqueza de espécies dentro da subtribo Catasetinae e tem o bioma amazônico como centro de diversidade. Assim sendo, este trabalho propõe uma nova espécie de *Catasetum* proveniente da Floresta Nacional de Saracá-Taquera localizada no extremo oeste do Estado do Pará. Este táxon é descrito, ilustrado e comparado com *C. barbatum*, espécie considerada como relacionada. Além disso, são apresentadas ainda informações referentes ao habitat, fenologia, distribuição geográfica e status de conservação.

Key words: Amazonian basin, biodiversity, igapó, Pará, taxonomy.
Mots clés: Bassin amazonien, biodiversité, igapó, Pará, taxinomie.
Palavras-chave: Bacia amazônica, biodiversidade, igapó, Pará, taxonomia.

Introduction

Catasetum Richard *ex* Kunth (1822: 330) is a Neotropical genus of Orchidaceae, occurring from southern Mexico to southern Brazil and northern Argentina (Romero-González & Carnevali, 2009). With over 190 hitherto accepted species and over 45 natural hybrids documented (Krahl *et al.*, 2023a; Romero-González & Carnevali, 2024; Krahl *et al.*, 2025a, b, c; POWO, 2025), this genus stands out as the richest among the genera belonging to the subtribe Catasetinae Lindley (Chase *et al.*, 2015). Center of diversity is located in the Amazonian biome (Romero-González & Carnevali, 2009), with the Brazilian portion being particularly relevant due to the recorded occurrence of about 80 species and 26 natural hybrids (*e.g.*, Krahl

et al., 2020; Cantuária *et al.*, 2021; Petini-Benelli, 2025; POWO, 2025). This region proves to be of particular interest for both the conservation of the genus and the understanding of its biodiversity, not only because it harbors the highest species richness within *Catasetum* and several narrowly distributed taxa, but also due to the intense anthropogenic pressures affecting many of its populations (Silva & Silva, 1998). In addition, it includes species considered rare, such as *C. meeae* Pabst (1967: 64) and *C. sophiae* Valsko, Krahl & Benelli (2019: 117 in Valsko *et al.*, 2019), whose restricted distribution and low population densities highlight their vulnerability and emphasize the urgent need for targeted conservation strategies (Valsko *et al.*, 2019; Krahl *et al.*, 2023b).

The species of *Catasetum* present considerable morphological uniformity in the vegetative structure that makes difficult any taxonomic delimitation based on the only vegetative characters (Holst, 1999). As a result, the main diagnostic features are found in the staminate (male) flowers which have significant morphological variation and play a fundamental role in the species distinction (Holst, 1999; Walker-Larsen & Harder, 2000). These flowers are mainly characterized by the presence of two modified staminodes, usually called “antennae”, that have a very specialized mechanical function: the projection of the pollinarium towards the pollinator body during floral visit (Romero-González, 1992; Gerlach, 2007).

For a long time, the genus *Catasetum* has been divided into two subgenera based on the presence, absence and development degree of antennae. The subgenus *Pseudocatasetum* is defined by its antennae either rudimentary or lacking whereas the subgenus *Catasetum* is characterized by its well-developed antennae. The latter is further divided into two sections morphologically distinct: the section *Catasetum* (earlier *Anisoceras*), mainly characterized by its antennae crossed and asymmetrical, and the section *Isoceras*, with symmetrical antennae. This section is subdivided into three subsections: *Isoceras*, that has parallel antennae, *Divaricatae*, with divergent antennae, and *Convergentes*, where the antennae are convergent and tangent to each other (Bicalho & Barros, 1988; Senghas, 1990, 1991). However, recent phylogenetic analyses based on molecular markers have demonstrated that the traditional classification relying exclusively on antennae morphology does not reflect the evolutionary history of the genus, since similar antennae types have arisen independently in unrelated lineages, indicating morphological convergence and

homoplasy (Mauad *et al.*, 2022). Alternatively, Mauad *et al.* suggest that the biogeographic patterns provide a more consistent framework to understand phylogenetic relationships within *Catasetum*, as molecular clades show a strong correlation with major geographic regions (*e.g.*, Amazon Basin, Guiana Shield, Atlantic Forest), suggesting that historical dispersal events and vicariance have played a central role in the diversification of the genus.

The state of Pará, located in northern Brazil, stands out as one of the richest areas for Catasetum within the Brazilian Amazon, accounting for 43.75% of the species recorded in this biome. Although it is surpassed only by Amazonas and Mato Grosso in overall diversity (Krahl *et al.*, 2021a, b; 2022a, b; 2023a, c, d, e, f; 2024a, b; Petini-Benelli, 2025), Pará alone harbors 35 documented species and four recognized natural hybrids (Barberena, 2021; Cantuária *et al.*, 2021; Krahl *et al.*, 2023a; Petini-Benelli, 2025). This high richness reflects the ecological heterogeneity of the state.

Given the remarkable richness and diversity of *Catasetum* in Pará and the presence of several narrowly distributed or poorly known taxa, there remains a considerable gap in floristic knowledge for the region. In this context, the present study aims to contribute to the documentation of the genus by formally describing a new taxon from the National Forest of Saracá-Taquera (FloNa Saracá-Taquera), located in the far west of the state. Although recent molecular phylogenetic studies have shown that antennal morphology alone does not accurately reflect the evolutionary history of the genus (Mauad *et al.*, 2022), morphological characters remain indispensable for the practical recognition and taxonomic delimitation of species. At the same time, many taxa from the Amazon region remain unsampled or poorly represented in molecular datasets, reinforcing the relevance of morphological comparisons as a complementary tool to phylogenetic insights.

For this reason, the new taxon is here described and morphologically compared with *C. barbatum* (Lindley 1836: t. 1778) Lindley (1844: Misc. 28), *C. ariquemense* F.E.L. Miranda & K.G. Lacerda (1992: 50) and *C. teixeiranum* Campacci & J.B.F. Silva (2008: 190), which are sympatric species and traditionally placed in the same morphological group characterized by flowers with symmetrical parallel antennae and a widely fimbriate lip. In addition to the morphological comparisons, we provide

a photographic illustration of the species, a geographic distribution map, data on its habitat and phenology, and a preliminary assessment of its conservation status.

Material and methods

The taxon here described was collected during activities of surveying and rescuing epiphytes associated with vegetation removal in areas affected by mining operations, carried out in FloNa Saracá-Taquera, in the municipality of Oriximiná, Porto Trombetas, Pará, Brazil (Fig. 1). These collections were conducted by the technical team and associates of Mineração Rio do Norte (MRN), within the scope of its long-standing environmental conservation and social responsibility programs, including the rescue and relocation of orchids linked to mining activities.

The botanical material has been processed according to the processes proposed by Mori *et al.* (1989) and later incorporated into the collection of the herbarium HUAM, linked to the Federal University of Amazonas. The morphological measurements, analysis of structures and determination of colors have been made on fresh flowers. Pictures were obtained from a living specimen using a Canon EOS Rebel T5 camera with a Canon EFS 18–55 mm lens. The illustrative sheets were constructed from these digital pictures using the Adobe Photoshop® 2020 software. The morphological description follows the terminology standardized by Dressler (1993), Harris & Harris (2001) and Gonçalves & Lorenzi (2007). Habitat and phenology data were recorded during in situ observations. The map showing the type locality was made through the QGIS software, version 3.40.8 “Bratislava”, using the datum SIRGAS 2000 (QGIS, 2025). The preliminary evaluation of the conservation status of the species follows the criteria published by the International Union for Conservation of Nature – IUCN (2024).

With the purpose of locating additional materials attributable to the new taxon, we examined the collections of the herbaria AMES, BHCB, CNMT, EAFM, FLAS, HPL, HUAM, IAN, INPA, K, MG, MO, NY, R, RB, RON, SEL, SP, U, UB, UFMT, UPCB, US and USF, which represent the most significant collections in relation to the number of *Catasetum* specimens from the Amazon region and/or from the northern region of Brazil as a whole. However, no additional material was located.

It should be noted that the distinction of *Catasetum* species often relies on floral characters notably the position of the antennae, which are difficult to evaluate with precision in dried specimens and which, moreover, are frequently altered during the drying process. This limitation highlights the importance of field observations and the analysis of fresh material for reliable taxonomic interpretation. All acronyms of the aforementioned herbaria are in accordance with Thiers (2025).

The choice of the species used as a comparative basis took into account the following criteria: (i) sympatric occurrence or occurrence within the same biogeographical context of the proposed taxon; (ii) member of the same infrageneric classification, i.e. subgenus *Catasetum*, section *Isoceras*, subsection *Isoceras* (Bicalho & Barros, 1988; Senghas, 1990, 1991); and (iii) morphological affinities that allow for a critical evaluation of diagnostic features. Accordingly, *C. barbatum*, *C. ariquemense*, and *C. teixeiranum* were selected as comparative species to provide a broader analysis.

The comparisons with the new taxon are based on specialized literature, including original descriptions and secondary descriptions (*e.g.*, Lindley, 1836; Cogniaux, 1904; Hoehne, 1942; Miranda & Lacerda, 1992; Campacci & Silva, 2008; Oliveira *et al.*, 2021; Petini-Benelli, 2025), complemented by the examination of heterotypic types historically associated with *C. barbatum* deposited at K (K000293764! [= *Myanthus spinosus* Hooker (1840: t. 3802)]; K000294039! [= *C. proboscideum* Lindley (1839: Misc. 86)]). In addition, the holotypes of *C. ariquemense* (HB88757!) and *C. teixeiranum* (MG198267!) were analyzed to ensure a broader and more integrative comparison. We emphasize, however, that the interpretation of these specimens was approached with caution, given the difficulties of evaluating delicate characters in dried material as mentioned above.

Taxonomic treatment

Catasetum binarum D.R.P.Krahl, Krahl, Cantuária & J.B.F.Silva ***sp. nov.***

Type: BRAZIL: Pará: Oriximiná, Porto Trombetas, Floresta Nacional de Saráca-Taquera, Platô Monte Branco, 23-IV-2023, *J.B.F. da Silva 5489* (holotype HUAM).

Etymology: The specific epithet honors the family “Bina” who greatly encouraged the collector of the new species to study the Amazonian Orchidaceae.

Catasetum binarum, Catasetum barbatum simile est sed labelli structura differt. Labellum trilobatum subtriangulareque (vs. integrum oblongumque), marginis fimbriae aeque dispositae (vs. ad basim aeque dispositae tum in partem distalem aggregatae), labelli callus basalis simplex acuminatus ad filiformem cum basi utrinque duobus spiculis (vs. callus basalis tripartitus), et labelli apex cum 2-3 fimbriis distinguibilibus basi connatis (vs. labelli apex cum callo dentiforme rigido acutoque).

Description (Fig. 1)**:** Plant epiphytic caespitose. Rhizome inconspicuous. Pseudobulb 5.1–7.8 × 1.4–1.9 cm, elliptic to fusiform, 5–6-leaved, covered by the leaf sheaths. Leaf 6.8–24.1 × 2.1–3.7 cm, oblanceolate, plicate, with 3 to 5 evident nerves on the abaxial side, margin entire and undulate, apex acute, green. Staminate inflorescence 22.1–26.7 cm long, arched, lateral, racemose, 7–10-flowered; peduncle cylindrical, green in the basal ¼ and purplish in the distal ¾; floral bract ca. 1.1 × 0.4 cm, lanceolate, greenish, margin entire, apex acute. Staminate flowers yellowish to lightly greenish with brownish spots, pedicelled; pedicel 1.5 cm long, cylindrical, purplish, erect to lightly curved; sepals ca. 3.2 × 0.8 cm, elliptical, symmetrical, margin entire, bent inwards, apex acute; petals ca. 3.1 × 0.6 cm, narrowly elliptical, discreetly asymmetrical, margin entire, bent inwards, apex acute; lip ca. 2.1 × 1.2 cm (fimbriae excluded), subtrilobed, outline subtriangular, surface glabrous, margin with evenly spaced fimbriae, with a basal callus, apex provided with a set of 2–3 distinguishable fimbriae fused at the base; lateral lobes ca. 0.4 × 0.3 cm (fimbriae excluded), sub-rounded, bent inwards; midlobe ca. 1.6 × 0.4 cm (fimbriae excluded), narrowly subtriangular, lightly flat, apex acute; fimbriae 0.5–0.8 cm long, thread-like, simple, thin, first brownish turning whitish towards the apex; basal callus ca. 0.7 cm long, simple, acuminate to thread-like, with two spicules at each side of the base; sac ca. 0.4 cm deep, conical, placed on the proximal third; column ca. 2.5 × 0.5 cm, oblanceolate, contracted at the base, thick, greenish yellow with brownish spots, apex rostrate; antennae ca. 0.7 cm long, brownish yellow, parallel, symmetrical, curved in side view, thread-like, acute; anther cap ca. 1.2 × 0.25 cm, subtriangular, reddish at base and greenish yellow at apex, apex acuminate; viscidium ca. 0.15 × 0.15 cm, rounded, whitish, sticky; stipe ca. 0.4 cm

long, oblong, yellowish, bent inwards; pollinia 2, 0.3 × 0.1 cm, oblong, hard, compressed, sulcate, yellowish. Pistillate inflorescence and flower not seen; fruit not seen.

Distribution and habitat (Fig. 2)**:** Up to now *Catasetum binarum* is only known from a restricted population of about 50 individuals. The plants are epiphytic and occur in plateau formations — typical topographical elevations of Central Amazon with a height above sea level around 50 m, located in areas far from streams. This environment corresponds to the dense rain forest of "terra firme" characterized for not suffering seasonal flooding. This population grows in the National Forest (FloNa) Saracá-Taquera, within the limits of the Brazilian Amazon.

Preliminary conservation status: *Catasetum binarum* is hitherto only known from the type of population (ca. 50 individuals in an area less than 1 km²). Given the spatial limitation of the sampling and the absence of additional records, it was not possible to estimate its extension of occurrence (EOO) as well as its area of occupation (AOO). Therefore, according to the IUCN criteria (2024), the species should be placed in the Data Deficient (DD) category (inadequate data on population size and geographical distribution). Although it occurs within the limits of the FloNa Saracá-Taquera, a sustainable-use conservation unit where protection is only partial (where sustainable multiple use of resources is permitted and the permanence of traditional populations can be regulated and provided for in the unit's Management Plan), the species remains highly vulnerable due to its very restricted known population. Potential threats include direct habitat alteration, infrastructure expansion, and selective forest management, which may cause loss of host trees and microhabitats essential for the maintenance of epiphytic orchids. These factors highlight the urgent need for targeted conservation measures to safeguard the only currently known population of the species. Possible actions include the establishment of long-term monitoring programs, rescue and reintroduction of individuals and the development of *ex situ* conservation initiatives (*e.g.*, cultivation in botanical gardens).

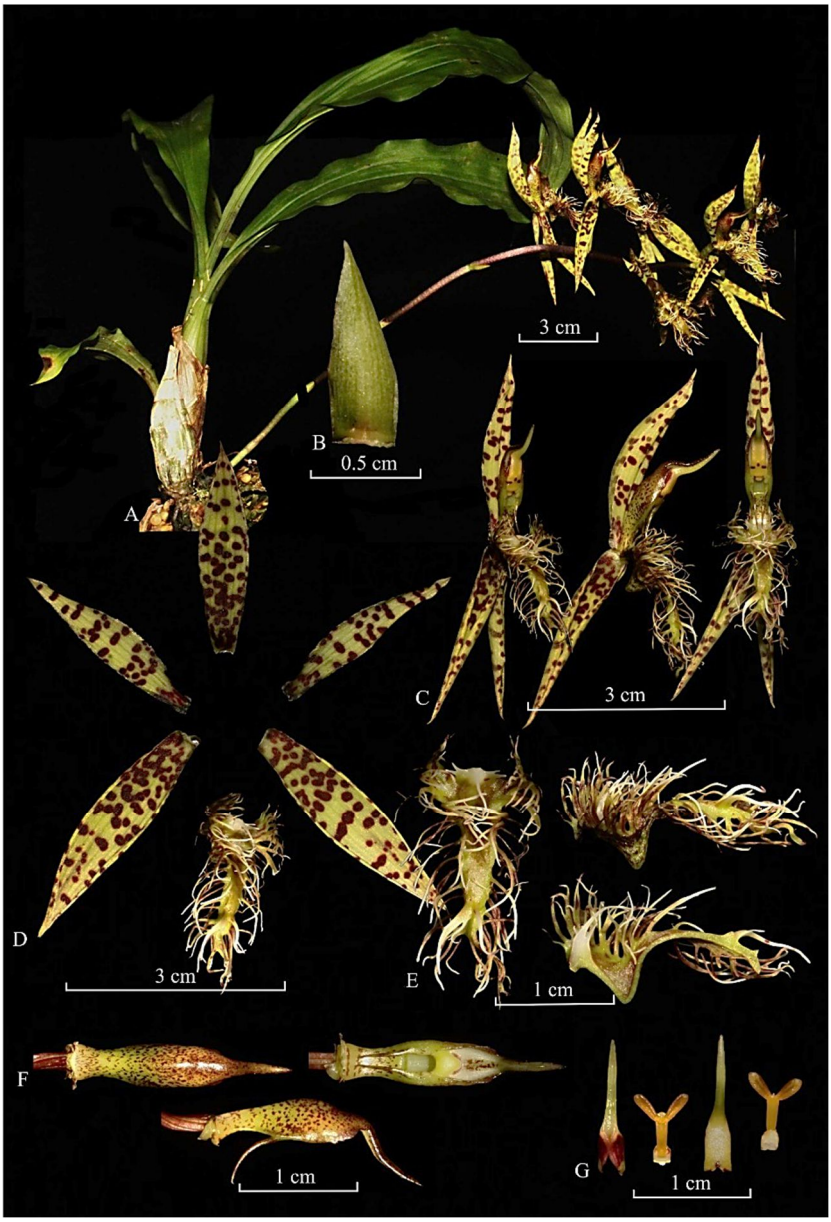

Figure 1: Composite color plate of *Catasetum binarum*. A – Habit; B – Floral bract; C – Flower in different views; D – Perianth; E – Lip in front view, side view and longitudinal section; F – Column in dorsal view, ventral view and lateral view; G – Anther cap and pollinarium in dorsal and ventral views. Photography based on *J.B.F. da Silva 5489* (HUAM). Plate by A.H. Krahl.

Phenology and floral visitors: The flowering of *C. binarum* was recorded in April, which corresponds to the rainy season in the Amazonian region. It is reasonable to hypothesize that the reproductive period of the species may also extend to months immediately before and after, but this assumption requires confirmation through systematic field observations. Likewise, we hypothesize that the species is visited by male Euglossa bees, which may collect volatile compounds (perfume) present on the lip, as documented in C. barbatum and several other congeneric species (Milet-Pinheiro & Gerlach, 2017; Krahl *et al.*, 2021a). These hypotheses remain to be tested by future ecological and pollination studies.

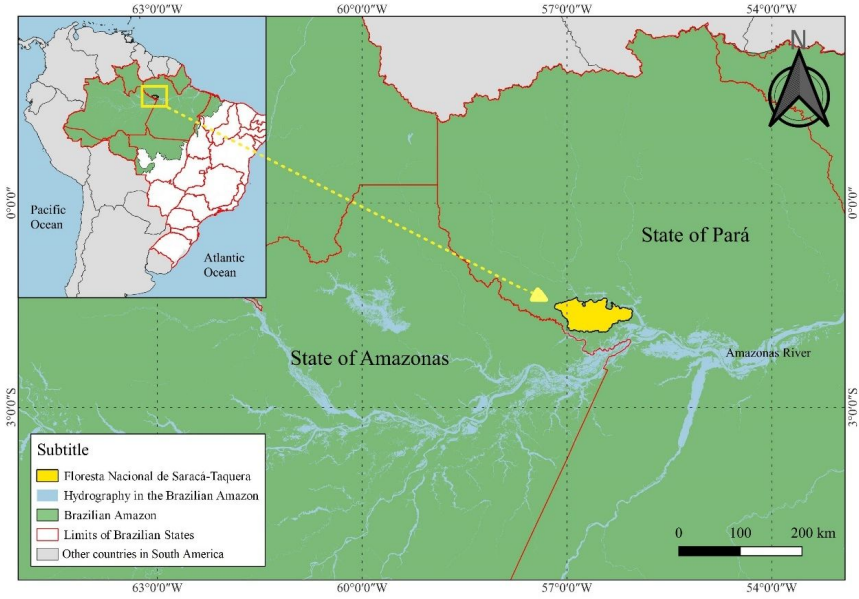

Figure 2: Location of Saracá-Taquera National Forest, type locality of *Catasetum binarum*.

Notes: *Catasetum binarum* presents morphological affinities with taxa having symmetrical parallel antennae and therefore members of the subgenus *Catasetum*, section *Isoceras*, subsection *Isoceras* (Bicalho & Barros, 1988; Senghas, 1991). It is part of the so-called "*Catasetum cristatum* alliance" (Bicalho & Barros, 1988; Lacerda, 1998), the members of which share diagnostic floral characteristics such as resupinate flowers, membranous petals and sepals mainly greenish with brown spots, a fleshy lip with fimbriate margins, the presence of a cavity before the median part

of the lip and the presence of two calli — basal and apical —, although this last feature may lack in some species (Franken *et al.*, 2016; Krahl *et al.*, 2024a, c). More precisely it belongs to a group of plants related to the "*Catasetum barbatum* complex" (Lindley, 1836; Lacerda, 1998), sharing several floral traits with *C. barbatum*, such as resupinate flowers, elliptical petals and sepals spotted with brown and a broadly fimbriated lip with a cavity before the median part.

In this context, *C. binarum* differs from *C. barbatum* (Fig. 3) by its trilobed triangular-shaped lip (vs. entire lip oblong-shaped or, more precisely, linear-ligulate), with a margin bearing evenly spaced fimbriae (*vs.* fimbriae first evenly spaced and then grouped at the distal end to form a structure resembling a "stiff and bristly beard"). The basal callus of the lip in *C. binarum* is also tripartite, but comparatively simpler: it consists of a central acuminate to thread-like projection flanked by two short spicules at the base. In contrast, the tripartite callus of *C. barbatum* is composed of three robust, well-developed, and clearly individualized parts. Furthermore, the lip apex of *C. binarum* bears a set of 2–3 distinguishable fimbriae fused at the base, contrasting with the rigid, tooth-like acute callosity observed in *C. barbatum*.

Catasetum binarum also differs from *C. ariquemense* (Fig. 4A, B) in that its flowers have smaller sepals and petals (sepals with 3.2 cm *vs.* 3.7 cm long; petals with 3.1 cm *vs.* 3.3 cm long), longer lip (2.1 cm *vs*. 1.2 cm long) and relatively longer and thinner fimbriae (0.5–0.8 cm *vs.* 0.2–0.3 cm long and thicker). In *C. binarum*, the basal callus consists of an acuminate to filiform central projection accompanied by two short lateral spicules, while in *C. ariquemense* the basal callus is formed by a sharp "tooth" somewhat flattened laterally with numerous irregular and sharp protuberances on the sides. Furthermore, the apex of the lip of *C. binarum* presents 2 to 3 fimbriae fused at the base, contrasting with the apex of *C. ariquemense*, which presents several short, fleshy, irregular protuberances. The flowers of *C. ariquemense* are also typically green, with dense reddish to wine-colored or brownish spots, while *C. binarum* has yellowish-green flowers with fewer and more dispersed brownish spots.

When compared to *C. teixeiranum*, *C. binarum* (Fig. 4A, C) can be distinguished by the proportionally smaller sepals (3.2 × 0.8 *vs.* 3.5 × 1.0 cm), narrower petals (0.6

vs. ≥ 1.0 cm width), shorter subtriangular lip (*vs.* subtriangular to subovate lip; 2.1 cm *vs.* 3.0 cm long), yellowish to brownish fimbriae evenly spaced along the entire margin of the lip (*vs.* whitish fimbriae evenly spaced proximally and fringed distally), by the presence of a yellowish, acuminate to filiform basal callus with two spicules at the base on each side (*vs.* a whitish, acute basal callus with a set of 3 to 4 spicules at the base on each side) and by the apex provided with 2 to 3 yellowish fimbriae fused at the base (*vs.* ending in a rigid, toothed, white tip with a long, thin, rigid appendage on each side).

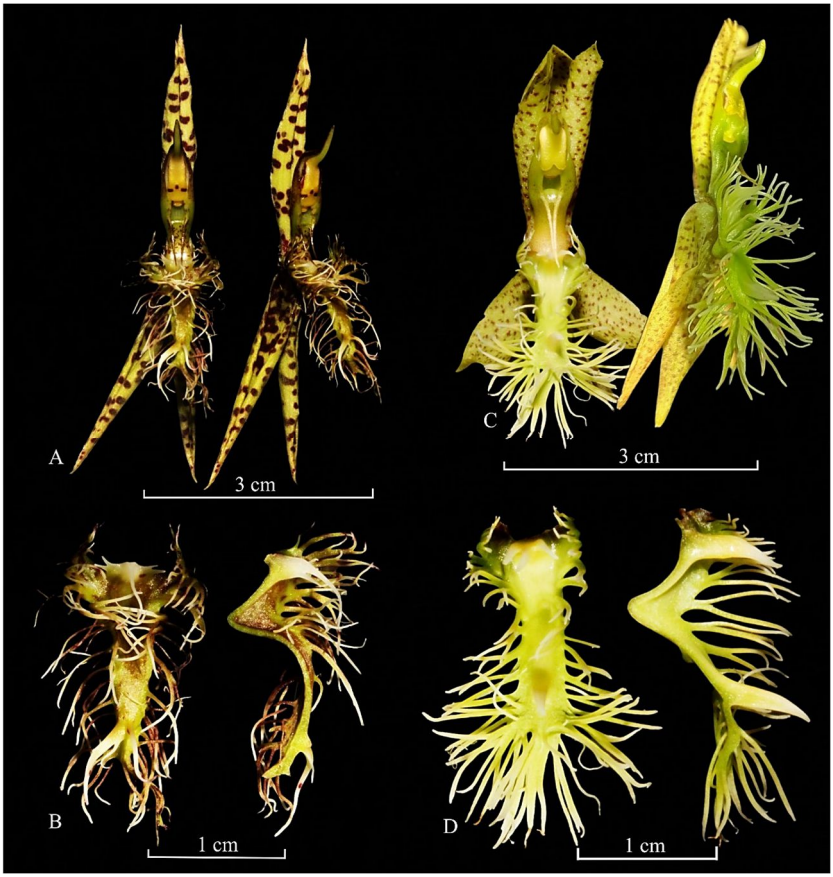

Figure 3: Comparison between *C. binarum* (A-B) and *C. barbatum* (C-D). A-C – Flowers; B-D – Lip in front view and longitudinal section. Photographs A and B based on *J.B.F. da Silva 5489* (HUAM!) and photographs C and D based on *J.B.F. da Silva s/n* (HUAM12627!). Plate by A.H. Krahl.

Figure 4: Comparison between *C. binarum* (A), *C. ariquemense* (B) and *C. teixeiranum* (C). Photographs A and B by A.H. Krahl and photograph C by S.A. Queiroz.

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