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A taxonomic overview of *Notylia platyglossa* Schltr. and related species (Orchidaceae)

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Abstract

In this study, through a review of the literature, analysis of protologues, field collections and consultations of herbariums, we elucidated the *Notylia platyglossa* species complex. We propose the synonymization of the names *N. peruviana*, *N. morenoi* under *N. platyglossa*. Additionally, we designated lectotypes for *N. peruviana* and *N. morenoi* as well as neotypes for *N. platyglossa* and *N. boliviensis*. We also distinguished *N. boliviensis* from *N. platyglossa* and validated the first record of this species for Brazil. Descriptions, taxonomic comments, distribution maps, photographic plates and the conservation status of these species are also presented.

Key words: Amazon, orchid, typification, synonymization, new occurrence, taxonomy

Introduction

Notylia Lindley (1825: sub t. 930) is a Neotropical genus that has about 60 species (Chase 2003, 2009). For Brazil, 26 accepted species have been registered (Flora e Funga do Brasil 2024), many of these known only in a few publications of local floristic surveys (Pessoa *et al.* 2013, Carneiro-Silva *et al.* 2015, Krahl *et al.* 2015, Queiroz *et al.* 2015, Petini-Benelli *et al.* 2015, Melo *et al.* 2016, Mancinelli & Esemann-Quadros 2016, Rêgo & Azevedo 2017, Azevedo *et al.* 2021, Silva *et al.* 2022, Pessoa *et al.* 2022, Lima & Azevedo 2023). These species are often incorrectly identified, as the genus lacks a contemporary taxonomic review; the last one for the Brazilian species was carried out more than 40 years ago (Pabst & Dungs 1977).

Notylia platyglossa Schltr. (1914: 125) was collected by Ernst Ule in 1911, in Brazil, during a field expedition in the Seringal (rubber tree plantation) named São Francisco, on the banks of the Acre River in the state of Amazonas (Schlechter 1914). Later, other morphologically similar species were described or combined, in Bolivia *N. boliviensis*

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Schlechter (1922: 53), *N. morenoi* Christenson in Bennett & Christenson (2001: t. 722) and in Peru *N. peruviana* (Schltr.) Schweinfurth (1946: 205). Although these names have already been considered distinct biological entities (POWO 2024), after careful review of their protologues and illustrations, it was observed that the characters used by the authors were imprecise and even overlapping, with the presence or absence of the longitudinal carina on the lip, the main structure to differentiate them was disregarded, resulting in a complex of species that are difficult to delimit, generating several subsequent identification mistakes, thus highlighting the need for synonymization of some names.

Moreover, it was found that some of these names that make up the *N. platyglossa* complex require type designation, since some holotypes were destroyed in the Botanical Museum Berlin-Dahlem (herbarium B) during World War II, or have been lost or were not designated by the authors in the protologue (Ames 1944, Butzin 1978, 1980, Barringer 1986, Ossenbach & Jenny 2019).

The aim of this study is to elucidate which species make up the *N. platyglossa* species complex, as well as carry out the nomenclatural review of all the related names. We also present descriptions, taxonomic comments, maps of the geographical distribution, photographic evidence and an assessment of the conservation status of the species.

Materials and methods

The protologues of *N. platyglossa* (1914: 125), *N. peruviana* (1916: 187), *N. boliviensis* (1922: 53) and *N. morenoi* related to the *N. platyglossa* complex, including the basionym in the genus *Dipteranthus* Schlechter (1916: 187), *N. peruviana* (1916: 187) were analyzed, as well as the materials deposited in the collections of the herbariums BOLV, INPA, HSB, K, LPB (including the Herbarium Vasquezianum), HB, HUAM, HERBAM, MG, R, RB (includes GFJP, ITA and RUSU), SLUI, US, USZ and the databases of Flora e Funga do Brasil (2024), JABOT (2024), POWO (2024), Specieslink (Canhos *et al.* 2024) and Tropicos (2024). The specimens of *N. boliviensis* collected during this study were herborized following Fidalgo & Bononi (1989), their voucher materials being deposited in the HUAM herbarium (acronyms according to Thiers 2024).

The designation of nomenclatural types follows the International Code of Nomenclature for Algae, Fungi and Plants (Turland *et al*. 2018). For the assessment of the conservation status, the area of occupation (AOO) and the extent of occurrence (EOO) were calculated using the Geospatial Assessment Tool (GeoCAT; http://geocat.kew.org, Bachman *et al.* 2011). AOO was based on a defined cell width of 2 × 2 km (Bachman *et al.* 2011). The criteria used are according to the IUCN (2012, 2022). The distribution maps of the species were produced using the QGIS V. 3.30. 1 software and the SIRGAS 2000 datum.

Results

The names of *N. platyglossa* (1914: 125), *N. peruviana* (1916: 187), *N. boliviensis* (1922: 53) and *N. morenoi* (2001: t. 722) have been validly published and have been treated as distinct species (Flora e Funga do Brasil 2024, POWO 2024, Tropicos 2024). After the analysis of the protologues, illustrations and type materials, it was found that *N. platyglossa*, *N. peruviana*, *N. morenoi* are conspecific names, whose type materials share diagnostic characteristics, such as yellowish flower coloration, briefly unguiculate lip with obtuse apex, with the presence of longitudinally extended carina from the base to the middle of the lamina. Therefore, we hereby synonymize the names of *N. peruviana* and *N. morenoi* under *N. platyglossa*, which in turn is distinct from *N. boliviensis*.

Notylia platyglossa resembles *N. boliviensis* by the size and yellow color of the flowers. However, it differs by the lanceolate dorsal sepal with an acute apex (*vs.* elliptic with an obtuse apex), oblong lateral sepals (*vs.* lanceolate), falcate petals (*vs.* lanceolate) and mainly by the ecarinate rhomboid lip (*vs.* cordate carinate) (Table 1). Schlechter (1922: 53) was explicit in the description of *N. boliviensis* by reporting in the protologue that the species' lip had no callus or "ecarinate" keel. *N. boliviensis* has also been confused with *N. morenoi* Christenson due to an illustration published by Dodson & Vásquez Chávez (1989: t. 264) that was mistakenly identified as *N. boliviensis*, based on the collection of Vásquez 189 (Herb. Vasquezianum; actualmente LPB) in Bolivia.

TABLE 1. Comparison between *N. boliviensis*, *N. morenoi*, *N. peruviana* and *N. platyglossa*.

	Taxa			
Features	***Notylia boliviensis***	***Notylia morenoi***	***Notylia peruviana***	***Notylia platyglossa***
Dorsal sepal shape	elliptical, apex obtuse	lanceolate, apex acute	obtuse, apex falcate	lanceolate, apex acute
Lateral sepal shape	lanceolate	lanceolate	obtuse	oblong
Petal shape	lanceolate	lanceolate	oblong	falcate
Lip shape	chordate	expanded	suborbicularis	rhomboid
Longitudinal carina on the adaxial surface of lip	absent	present	present	present

New Amazonian populations of *N. boliviensis* we found, which represents the first record of this species for the states of Pará and Roraima and also the rediscovery of this species for Brazil, fifty-seven years since the first collection occurred in Serra do Navio. In addition, we recorded *N. platyglossa* for the first time for the state of Maranhão. These findings reinforce the need for investments in the sampling of the flora of the Amazon and in the training of human resources specialized in the taxonomy of Amazonian plants. The conservation status of the two species addressed in this study also reveals the need for implementation of actions that directly and indirectly promote their conservation.

Taxonomy

1. ***Notylia platyglossa*** Schlechter (1914: 125). (Figure 1).

Type:—BRAZIL. Amazonas: São Francisco rubber tree plantation, Upper Acre River, September 1911, *E. Ule 9264* (B destroyed). Neotype (***designated here***): BRAZIL. Amazonas: Humaitá, Floresta Nacional de Humaitá, 12 October 2014, *T.E. Almeida & R.S. Oliveira 3549* (INPA 263164!).

= *Dipteranthus peruvianus* Schlechter (1916: 187). ≡ *Notylia peruviana* (Schltr.) Schweinfurth (1946: 205). Type:—PERU. *s. loc*., *ex hort*., May 1912, *F. Sander & Sons s.n*. (B destroyed). Lectotype (***designated here***): original illustration published in the protologue by Schlechter (1916): 189, t. 44, figures 8–16! ***syn. nov.***

= *Notylia morenoi* Christenson in Bennett & Christenson (2001: t. 722). Type:—BOLIVIA. Santa Cruz: Ñuflo de Chaves, San Javier, 25 September 1979, *L. Moreno & R. Vásquez 189* (LPB not found, ex Herbarium Vasquezianum). Lectotype (***designated here***): original illustration published by Dodson & Vásquez Chávez (1989): t. 264! ***syn. nov.***

Description—Epiphytic, cespitose. Rhizome inconspicuous. Pseudobulb 1.0–2.0 × 1.0–2.0 cm, cylindrical, unifoliate, green. Leaf 11.0–13.0 × 2.0–2.2 cm, oblong-linear, conduplicate, entire margin, apex acute. Inflorescence 4.5–27.0 cm length, lateral, pendent, raceme, multiflora, 14–90 flowers; bracteole ca. 3.0 mm × 1.0 mm, linear, apex acute to acuminate. Flowers yellow, pedicelled, glabrous, pedicel + ovary ca. 5 mm length; dorsal sepal 3.0–4.0 × 1.0–2.0 mm, oblong, concave, acute apex; lateral sepals 3.0–4.0 × 2.0–3.0 mm, 2/3 adnate, oblong, concave, acute apex; petals 3.0–4.0 × 1.0–2.0 mm, falcate, acute apex; lip 3.0–4.0 × 3.0 mm, entire, rhomboid, apex obtuse, unguiculate ca. 1.0 mm length, longitudinal carena 2/3 of the blade. Column ca. 2.0 mm length, greenish, glabrous; pollinium 2, yellow. Fruit not observed.

Distribution and ecology:—*Notylia platyglossa* (Figure 1) is a species that is endemic to South America, which occurs in Bolivia, Brazil, Ecuador, Peru and Venezuela (Tropicos 2024). In Brazil, it occurs exclusively in the phytogeographic domain of the Amazon, in the states of Amazonas, Mato Grosso and Pará (Flora e Funga do Brasil 2024) (Figure 2). Silveira (2008) cited the occurrence of the species for the state of Acre based on the collection of Ule 9264; however, when examining the protologue of the species and the field collection records of Ule (book No. 7, collection numbers 13.321 to 15.585) at MG, it was found that the collection carried out in the Seringal São Francisco on the margins of the Acre River is within the territory of the state of Amazonas. In addition, we make the first record of the species occurrence in the state of Maranhão (Figure 2).

Conservation status:—The EOO was estimated at 5,098,118.584 km^2 (corresponding to "Least Concern (LC)" according to criterion B1) and AOO was 92 km^2 (corresponding to "Endangered (EN)" according to criterion B2), presenting continuous decline in its area of occupation and fragmentation of its habitats located in areas subject to threat (subcriterion B2b (ii,iii, iv)). The record of this species in the Humaitá National Forest is the only one within a

conservation unit in Brazil. Therefore, applying the IUCN criteria (2012, 2022), the taxon can be considered EN [B2b (ii, iii,iv)].

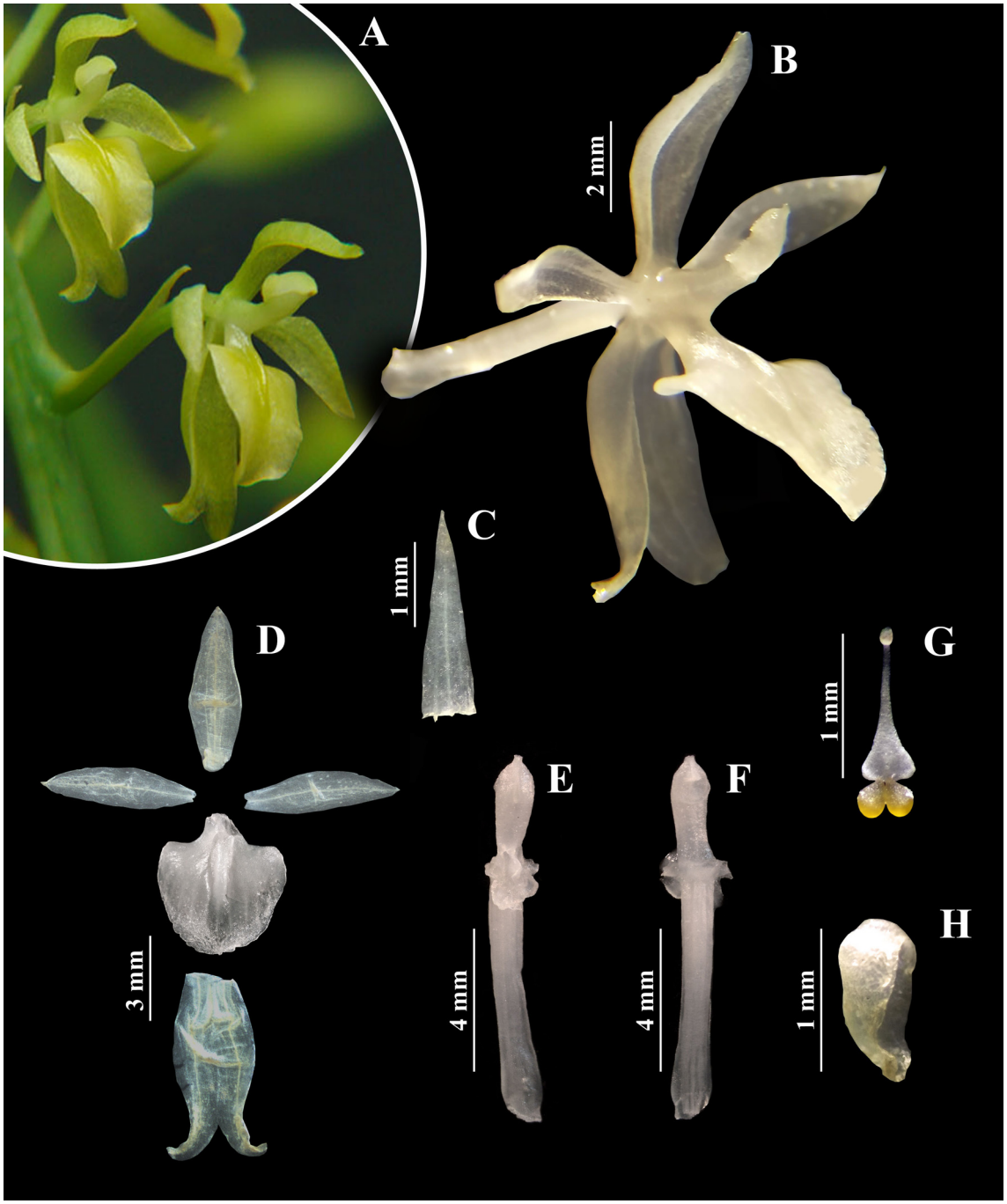

FIGURE 1. *Notylia platyglossa*. **A.** Habit. **B.** Flower in oblique view. **C.** Bracteole. **D.** Flower dissected. **E.** Pedicel, ovary and column in ventral view. **F.** Pedicel, ovary and column in dorsal view. **G.** Pollinarium. **H.** Anther. Photo of habit by Sérgio Queiroz.

Additional specimens examined:—BOLIVIA. Santa Cruz: Parque Noel Kempff Mercado, Los Fierros a Lago Bella Vista, August 1995, *Justiniano H. et al. s.n.* (LPB). Ñuflo de Chaves, San Javier, 25 September, *Moreno L. & Vásquez C. 189* (holotype: LPB not found). Beni: Province of Vaca Diez, 25 Setember 1981, *Solomon 6411* (MO). Santa Cruz: BRAZIL. Amazonas: Humaitá, Floresta Nacional de Humaitá, 12 October 2014, *Almeida & Oliveira 3549* (INPA). São Gabriel da Cachoeira, Rio Iá-Mirim, December 1995, *Silva 522* (MG). Maranhão: Axixá, Centro Grande community, stream near the street behind the Catholic church, 14 November 2020, *Ferreira 129* (SLUI); Bacabeira, margin of the highway MA-402, near the Mata Fome creek, 17 October 2020, *Ferreira & Lima 126* (SLUI); Cachoeira Grande, tributary stream of the Munin River, near the cemetery, 17 October 2020, *Ferreira & Lima 125* (SLUI); Morros, near the pousada Pedra Grande, margin of the Una River, 17 September 2020, *Ferreira & Lima 123* (SLUI); Morros, Balneário Una dos Moraes, margin of the Una River, 17 October 2020, *Ferreira & Lima 124* (SLUI). Mato Grosso:

Colíder, 27 August 2011, *Soares 3905* (HERBAM). Castanheira Juara, 12 July 2014, *Sadii 1006* (RB). Paranaíta, 10. July 2008, *Dias-Melo 464* (RB), Paranaíta, 22 August 2012, *Soares et al. 6960* (HERBAM); Paranaíta 19 June 2012, *Soares et al. 196718a* (HERBAM); Paranaíta, *Soares et al. 196718b* (HERBAM). Pará: Jacareacanga, 29 May 2012, *Soares et al. 2566491* (HERBAM); Jacareacanga, 29 May 2012, *Soares et al. 2566491* (HERBAM); Jacareacanga, 21 May 2012, *Soares et al. 2436406a* (HERBAM); Jacareacanga, 21 May 2012, *Soares et al. 2436406b* (HERBAM). Vitória do Xingu, Sitio Pimental, 28 March 2012, *Piacentini PSACF 135* (MG); Vitória do Xingu, Canais e Diques ranch, 3 March 2012, *Raul PSACF 116* (MG), Vitória do Xingu, 28 February 2015, *Narimatsu PSACF_EX05168* (RB). ECUADOR. Zamora-Chinchipe, Near Zamora, Yacuambi River towards El Progresso to Guadalupe, 23 November 1988, *Dodson et al. 17868* (MO). PERU. Loreto, Requena, Quistacocha, 12 km SW of Iquitos, mature and disturbed forest,13 March 1981, *Gentry et al. 32156* (MO). Madre dos Rios: Manu, Manu Park, Cashu uplands, 25 August 1986, *Nunez P. 5936* (MO). VENEZUELA. Bolívar, Piar, Amaruay-tepui. South side, near and along wall and up ridge to SE corner of west half of Tepui, 28 Abril 1986, *Ronald L. Liesner|Bruce K. Holst Liesner 20475* (MO).

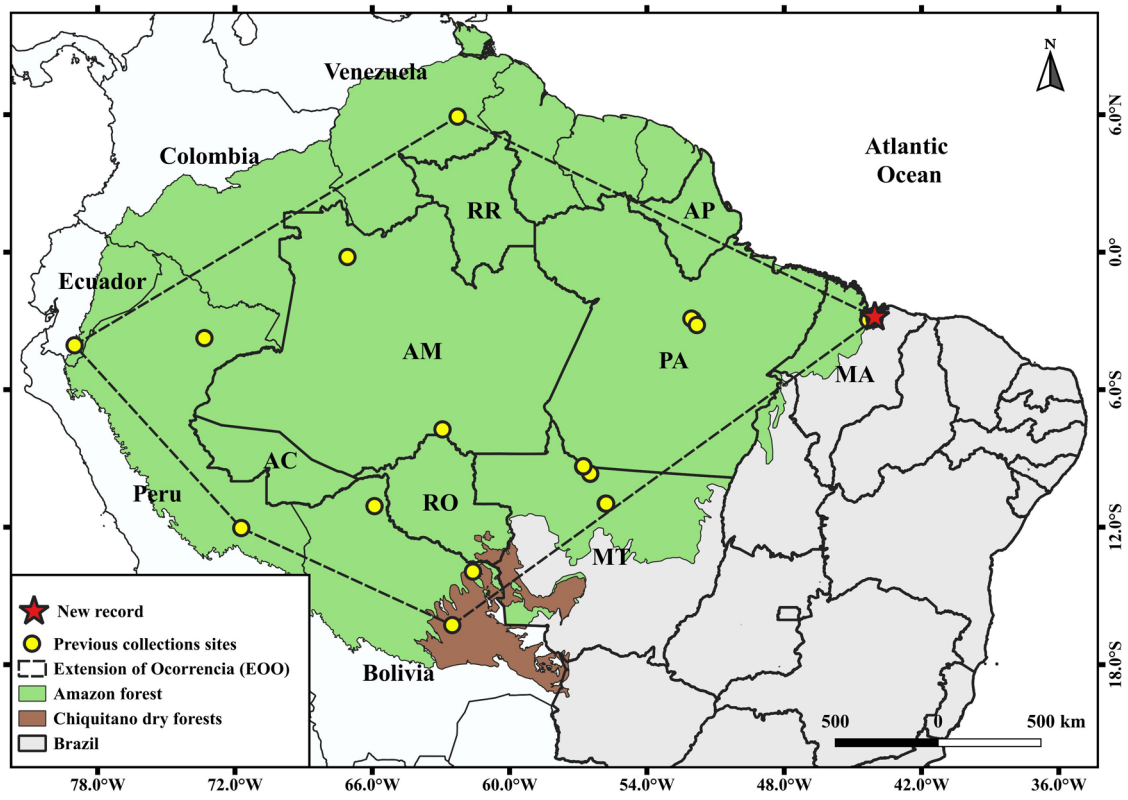

FIGURE 2. Location of occurrence points for *Notylia platyglossa*. Brazilian states: AP—Amapá, AM—Amazonas, AC—Acre, MA—Maranhão, PA—Pará, RO—Rondônia, RR—Roraima.

Taxonomic discussion:—Schlechter (1914) described *N. platyglossa* based on the collection *E. Ule 9264*, though did not inform the herbarium where it was deposited. Herbaria B and HBG are known as the most representative in E. Ule's collections (Borges *et al*. 2018). No corresponding materials have been located in the HBG herbarium collection. Therefore, it is believed that the original material was destroyed in the Berlin herbarium during the Second World War (Butzin 1978, 1980). The specimen INPA no. 263164 was analyzed and has the characteristics described in the protologue by Schlechter. Therefore, it is herein designated as a neotype because it comes from the type locality. The type designation also follows the recommendations of Borges *et al*. (2018) for the typification of Ule materials.

Schlechter (1916) described *Dipteranthus peruvianus* (1916: 187) without informing the protologue of the holotype or herbarium where it was deposited. Schweinfurth transferred the species from the genus *Dipteranthus* to *Notylia* (1946: 205). It is believed that the holotype was destroyed in the bombings during World War II (Butzin 1978, 1980). Therefore, we designate here an illustration published in the protologue by Schlechter, based on the original material, as the lectotype.

Christenson (2001: plate 722) described *N. morenoi* based on the collection of Vásquez 189 after noting that it had been misidentified in an illustration of *N. boliviensis* published by Dodson & Vásquez Chávez (1989: t. 264). The holotype was deposited in the herbarium of Roberto Vasquez at his own home, which, after his death, was donated in

its entirety to the National Herbarium of Bolivia (LPB). After an intense search for the holotype in the LPB herbarium, it was reported lost/missing by the curatorship. Therefore, we chose here, in accordance with Turland *et al*. (2018) art. 38 and 38.13, the illustration published by Dodson & Vasquez 1989 based on the original material of the collection of Vásquez 189 as the lectotype.

2. ***Notylia boliviensis*** Schlechter (1922: 53). (Figure 3).

Type:—BOLIVIA. Santa Cruz: Río Branco, August 1907, *T. Herzog 235* (B destroyed). Neotype (***designated here***): BRAZIL. Pará: Oriximiná, Porto Trombetas, Floresta Nacional de Saracá-Taquera, Teófilo plateau, 15 September 2022, *J.B.F. da Silva 5518* (HUAM 12536!).

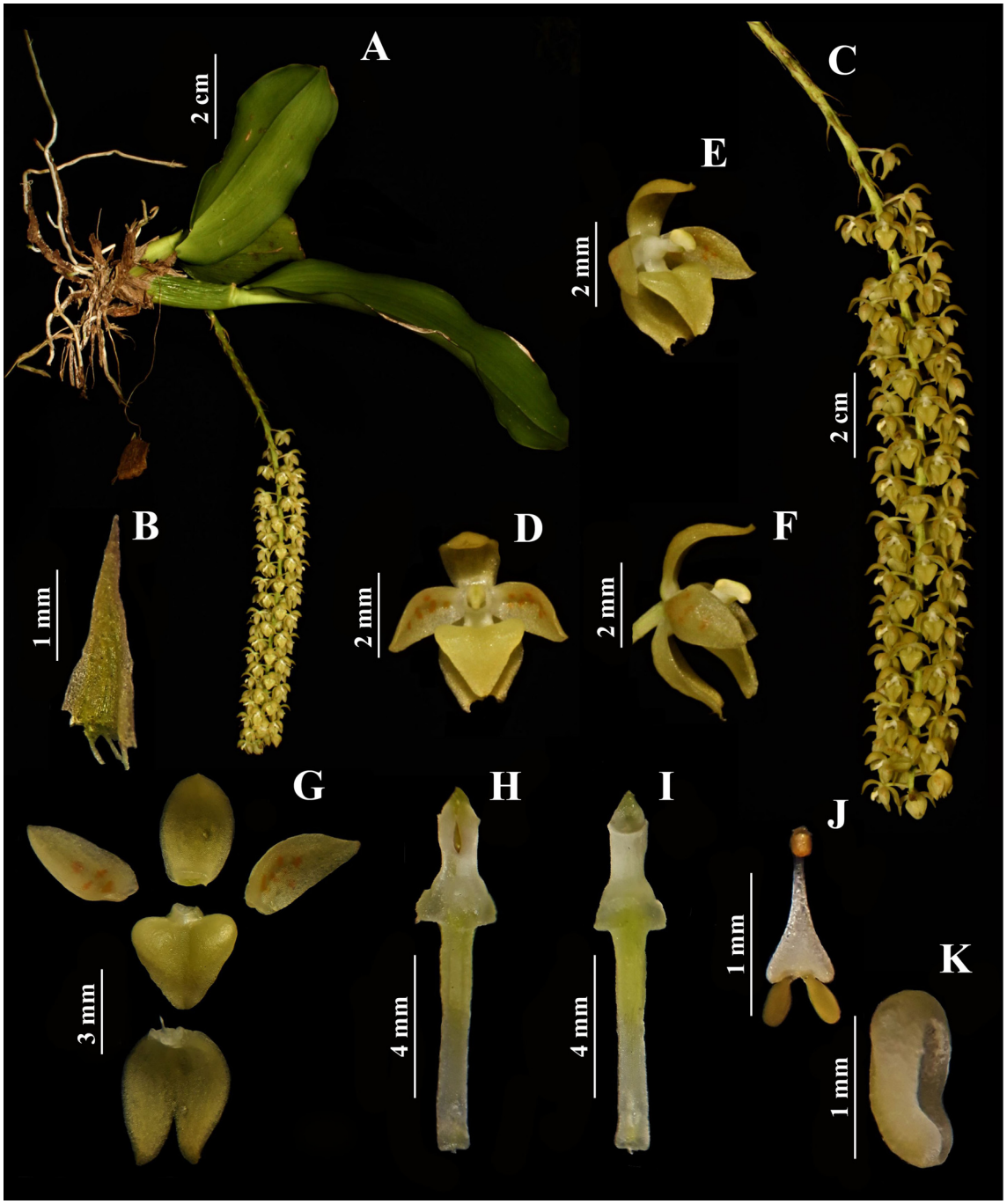

FIGURE 3. *Notylia boliviensis*. **A.** Habit. **B.** Bracteole. **C.** Inflorescence. **D.** Flower in front view. **E.** Flower in oblique view. **F.** Flower in side view. **G.** Flower dissected. **H.** Pedicel, ovary and column in ventral view. **I.** Pedicel, ovary and column in dorsal view. **J.** Pollinarium. **K.** Anther. Photos by A.H. Krahl.

Description—Epiphytic, cespitose. Rhizome inconspicuous. Pseudobulb 2.2–3.3 × 0.2–0.8 cm, oblong, unifoliate at the apex, green. Leaf 8.3–11.7 × 3.2–4.5 cm, broadly elliptic, conduplicate, entire margin and slightly wavy, apex obtuse. Inflorescence 15.1–20.3 cm length, lateral, pendent, raceme, multiflora, 55–75 flowers; bracteole ca. 0.3× 0.1 cm, lanceolate, apex acute. Flowers yellowish with orange spots on the petals, glabrous, pedicelled; pedicel + ovary ca. 3.0 mm length; dorsal sepal ca. 5.0 mm × 2.0 mm, elliptic, concave, apex obtuse; lateral sepals ca. 5.0 × 2.0 mm, 2/3 adnate, lanceolate, concave, apex obtuse; petals ca. 0.4 × 0.2 cm, lanceolate, concave, apex obtuse; lip ca. 4.0 ×4.0 mm, entire, chordate, apex obtuse, curtly unguiculate, ecarinate. Column ca. 0.3 cm length, greenish, glabrous; pollinium 2, yellow. Fruit not observed.

Distribution and ecology:—*Notylia boliviensis* (Figure 3) is an endemic species of South America with confirmed occurrence in Bolivia and Brazil (Tropicos 2024). Was mentioned for Peru by Schweinfurth, however, the species described by the author was *N. platyglossa* (Schweinfurth 1961). In Brazil, it occurs exclusively in the phytogeographic domain of the Amazon, in the state of Amapá (Flora e Funga do Brasil 2024) (Figure 4). However, the species *N. boliviensis* is listed as not occurring in Brazil, due to it being erroneously treated as *Notylia platyglossa* Schltr. (Flora e Funga do Brasil 2024). The specimen gathered by H. Sick without a collection number in Serra do Navio in the state of Amapá, was mistakenly identified by Pabst in 1966 as *N. platyglossa* (Pabst 1967: 184) due to him neglecting the absence of the carena on the adaxial face of the lip. Here, we update the indication of the voucher material and recognize it as the first record of *N. boliviensis* for Brazil. In addition, two other new records are also recognized within the Brazilian territory, namely for the states of Pará and Roraima (Figure 4).

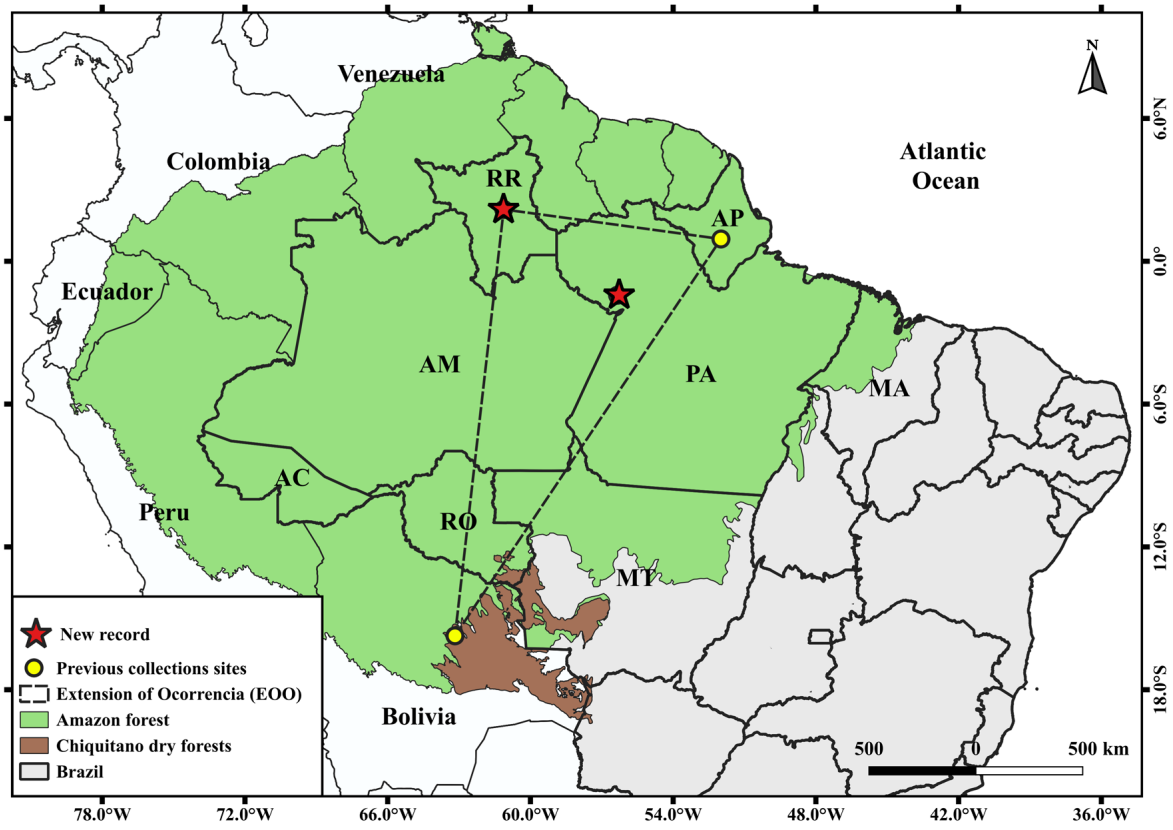

FIGURE 4. Location of occurrence points of *Notylia boliviensis* Schltr. Brazilian states: AP—Amapá, AM—Amazonas, AC—Acre, MA—Maranhão, PA—Pará, RO—Rondônia, RR—Roraima.

Conservation status:—The EOO was estimated at 1,039,545.012 km^2 (corresponding to "Least Concern (LC)" according to criterion B1) and AOO was 16 km^2 (corresponding to "Endangered (EN)" according to criterion B2), with less than five known populations (corresponding to "Endangered (EN)" according to subcriterion B2a). It presents continuous decline in area of occupation and fragmentation of its habitats located in areas subject to threat (subcriterion B2b (ii,iii, iv)). The record of this species in the Saracá-Taquera National Forest is only known within one conservation unit in Brazil. Therefore, applying the IUCN criteria (2012, 2022), the taxon can be considered EN [B2ab (ii, iii,iv)].

Additional specimens examined:—BRAZIL. Amapá: Serra do Navio 1966, ex hort., 13 January 1966, *Sick s.n.* (HB 40870); Roraima: Mucajaí, Apiaú, vicinal 26, 21 February 2022, *Silva 5510* (HUAM).

Taxonomic discussion: Schlechter (1922) described *N. boliviensis* based on the material collected by Theodor Herzog under collection number 235 in the year 1907, which was deposited in the Berlin herbarium and subsequently destroyed during the bombings of World War II (Butzin 1978, 1980; Barringer 1986). In the protologue, Schlechter does not inform the exact place of collection of *N. boliviensis*. However, it is known that Theodor Herzog carried out expeditions in 1907 in the department of Santa Cruz, in the province of Guarayos, where he carried out collections in the cities of Urubichá and Ascension de Guarayos, on both banks of the Blanco River where *N. boliviensis* was probably collected (Herzog 1910, 1923). After consulting all the herbariums in Bolivia (BOLV, HSB, LPB (including the Herbarium Vasquezianum) and USZ), no material that corresponds to the characteristics described in the protologue by Schlechter was found. All examined materials identified as *N. boliviensis* correspond to *N. platyglossa*, mistakenly identified by Vásquez based on Dodson & Vásquez Chávez (1989: t. 264). Therefore, in the absence of original materials or corresponding to those described in the protologue deposited in Bolivian herbaria, we designate *Silva 5518* the HUAM sample that has all the characteristics described in the protologue by Schlechter (1922) as the neotype.

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