

Orchidaceae in Reserva São Geraldo Majela, Belém Endemism Center, Pará State, Brazilian Amazon¹

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ABSTRACT – (Orchidaceae in Reserva São Geraldo Majela, Belém Endemism Center, Pará State, Brazilian Amazon). The Brazilian Amazon encompasses about 29% of the orchid species in Brazil. With the aim of contributing to the knowledge of the Amazonian flora, a taxonomic study of Orchidaceae was carried out in a forest fragment in the municipality of Capitão Poço, located in the Belém Endemism Center, the most deforested area in the Amazon. The fragment is locally referred to as Reserva São Geraldo Majela (RSGM) and is entirely surrounded by agricultural lands. Specimens were collected from February 2020 to April 2022 and deposited in the HCP herbarium, the analysis being complemented by consulting the collections of relevant herbaria. We provide descriptions and an identification key for the eight species of Orchidaceae recorded in RSGM, all of them showing a wide geographic distribution. Seven of them are epiphytes: *Campylocentrum fasciola*, *Campylocentrum micranthum*, *Catasetum macrocarpum*, *Erycina pusilla*, *Notylia lyrata*, *Polystachya concreta*, *Rodriguezia lanceolata*; and one is terrestrial: *Oeceoclades maculata*. These findings represent 65% of the previously recorded orchid species for the municipality of Capitão Poço and reinforce the importance of conserving the forest remnants in the region. **Keywords:** Eastern Amazon, forest fragment, Orchids, Pará State, Taxonomy

RESUMO – (Orchidaceae na Reserva São Geraldo Majela, Centro de Endemismo Belém, Estado do Pará, Amazônia Brasileira). A Amazônia Brasileira abrange cerca de 29% das espécies de orquídeas do Brasil. Visando contribuir para o conhecimento sobre a flora amazônica, realizou-se um estudo taxonômico de Orchidaceae em um fragmento florestal do município de Capitão Poço, localizado no Centro de Endemismo Belém, o mais desflorestado da Amazônia. O fragmento é denominado localmente de Reserva São Geraldo Majela (RSGM) e está totalmente circundado por matriz agrícola. Espécimes foram coletados de fevereiro de 2020 a abril de 2022 e depositados no herbário HCP, sendo a análise complementada por consultas às coleções de herbários relevantes. São fornecidas descrições e uma chave de identificação para as oito espécies de Orchidaceae registradas na RSGM, todas apresentando ampla distribuição geográfica. Sete destas espécies são epífitas: *Campylocentrum fasciola*, *Campylocentrum micranthum*, *Catasetum macrocarpum*, *Erycina pusilla*, *Notylia lyrata*, *Polystachya concreta*, *Rodriguezia lanceolata*, e uma é terrícola: *Oeceoclades maculata*. Esses achados representam 65% das espécies de orquídeas previamente registradas para o município e reforçam a importância de conservar remanescentes florestais na região.

Palavras-chave: Amazônia Oriental, Estado do Pará, Fragmento Florestal, Orquídeas, Taxonomia

Introduction

Orchidaceae is one of the largest and most well-known plant families, highly appreciated and cultivated by populations from diverse cultural backgrounds (Hew

2001, Salgado & Gonzalez 2019). The family is distributed throughout the world, with the exception of Antarctica, and the highest number of species is found in tropical and subtropical regions (Chase 2005). Due to their high specificity to habitats and complex interactions with the environment,

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orchids can be considered indicators of the degree of conservation of the vegetation (Newman et al. 2007).

Brazil has a remarkable orchid flora, with 2,677 species, of which the majority (1,485 species) are endemic (Flora e Funga do Brasil 2023). The Amazon stands out in Brazil as a phytogeographic domain with a large territorial extension, encompassing eight endemism centers (Belém, Xingu, Tapajós, Rondônia, Inambari, Napo, Imeri, and Guiana) as well as various types of vegetation (Braz et al. 2016). As a result of these characteristics, the Amazon region has approximately 29% of Brazil's orchid species (Flora e Funga do Brasil 2023).

In the State of Pará, which is almost entirely covered by the Amazonian phytogeographic domain (IBGE, 2022), the first comprehensive checklist of Orchidaceae was presented by Pabst & Dungs (1975), who recognized 77 genera and 245 species. Subsequent studies on orchids in Pará have generated a remarkable growth in volume and detail of information (e.g., Cardoso et al. 1995, Atzingen et al. 1996, Ilkiu-Borges & Cardoso 1996, Afonso et al. 2016, Koch et al. 2018, Ferreira Filho et al. 2021). New species have been described (e.g., Ferreira Filho & Barberena 2020, Engels & Smidt 2023) and new occurrences reported from the State in recent years (Ferreira Filho & Barberena 2022). Nearly 50 years after Pabst and Dungs' work, a total of 98 genera and 378 species are listed from Pará (Flora e Funga do Brasil 2023).

The Belém Endemism Center extends from the east of the Tocantins River to the Maranhense Amazon, occupying 243,000 km², and is the most threatened in the Amazon, having lost about 70% of its primary vegetation (Almeida & Vieira 2010). Deforestation has slowed down in Pará in the last three years, but the rates still remain highly alarming ($\geq 1,887$ km² were deforested per year in the period 2013-2022; INPE 2023), particularly in the Northeastern mesoregion, which is almost completely located within the Belém Endemism Center (Almeida & Vieira 2010, Braz et al. 2016).

In this context, considering that deforestation is directly associated with habitat destruction and fragmentation, major threats to biodiversity (Haddad et al. 2015), a taxonomic study of Orchidaceae was conducted in a forest fragment within this Center aiming to contribute to the expansion of knowledge about the Amazonian flora.

Material and methods

Study area – The study was carried out in Reserva São Geraldo Majela (RSGM), which has approximately 43 hectares and is located in the rural community of Barro Vermelho, in the municipality of Capitão Poço, in the Northeastern mesoregion of Pará, in the Belém Endemism

Center, Brazilian Amazon (figure 1). Although RSGM is not an official reserve, this term is commonly used by the local population and academic community, and therefore adopted in this study. The vegetation in the region is classified as Ombrophilous Forest, with predominance of secondary vegetation in different successional stages (IBGE, 2022). The prevalent soil type is latosol, and the climate is classified as Am according to Köppen's classification (1948), with an average annual rainfall of 2,370 mm (Silva et al. 1999, Pacheco & Bastos 2001, Andrade et al. 2017).

Areas of secondary forest predominate in RSGM, resulting from past human interference such as house construction and planting of fruit trees (figures 2a-d). The vegetation in RSGM has been undergoing regeneration for 29 years, but the area is completely surrounded by agricultural lands, including plantations of *Citrus* spp. (Rutaceae), black pepper (*Piper nigrum* L., Piperaceae), and oil palm (*Elaeis* spp., Arecaceae) (Silvério et al. 2022).

Data collection – Field collections were made in RSGM from February 2020 to April 2022, using the random walk method (Filgueiras et al. 1994). Fertile specimens were collected manually or using pruning shears or pole pruners and deposited in the HCP Herbarium (acronym according to Thiers 2023). Sterile specimens were collected and kept in *ex situ* cultivation at the Nupéfita Orchidarium of UFRA – Campus Capitão Poço until they flowered and then the fertile parts were herborized. Whenever possible, a portion of the specimen was maintained in cultivation for future studies. The exsiccates were identified with the aid of specialized literature, comparisons with Orchidaceae materials deposited in the HCP and MG herbaria, and by consulting experts. Details of *in situ* specimens and habitats were recorded using a digital camera. A stereoscopic microscope and an electronic digital caliper or a millimeter ruler were used for identifications and measurement of vegetative and reproductive structures.

Complementarily, in order to better understand the regional geographical distribution of the collected species, the collections of the herbaria HBRA, HCJS, HCP, HF, HIFPA, HSTM, IAN, MFS, and MG (acronyms according to Thiers 2023) in Pará, and the electronic platforms of SpeciesLink [<https://specieslink.net/>] (CRIA 2023), Jabot [<http://rb.jbrj.gov.br/v3/>] (JBRJ 2023), and the Herbarium of the Museu Paraense Emílio Goeldi [<http://colectoesbio.museu-goeldi.br/herbario.html>] (MPEG 2023) were consulted. For some species, additional materials deposited in the HCP and MG Herbaria from other localities in Capitão Poço or from other municipalities in the northeastern region of Pará were analyzed to complement the morphological information for taxonomic descriptions.

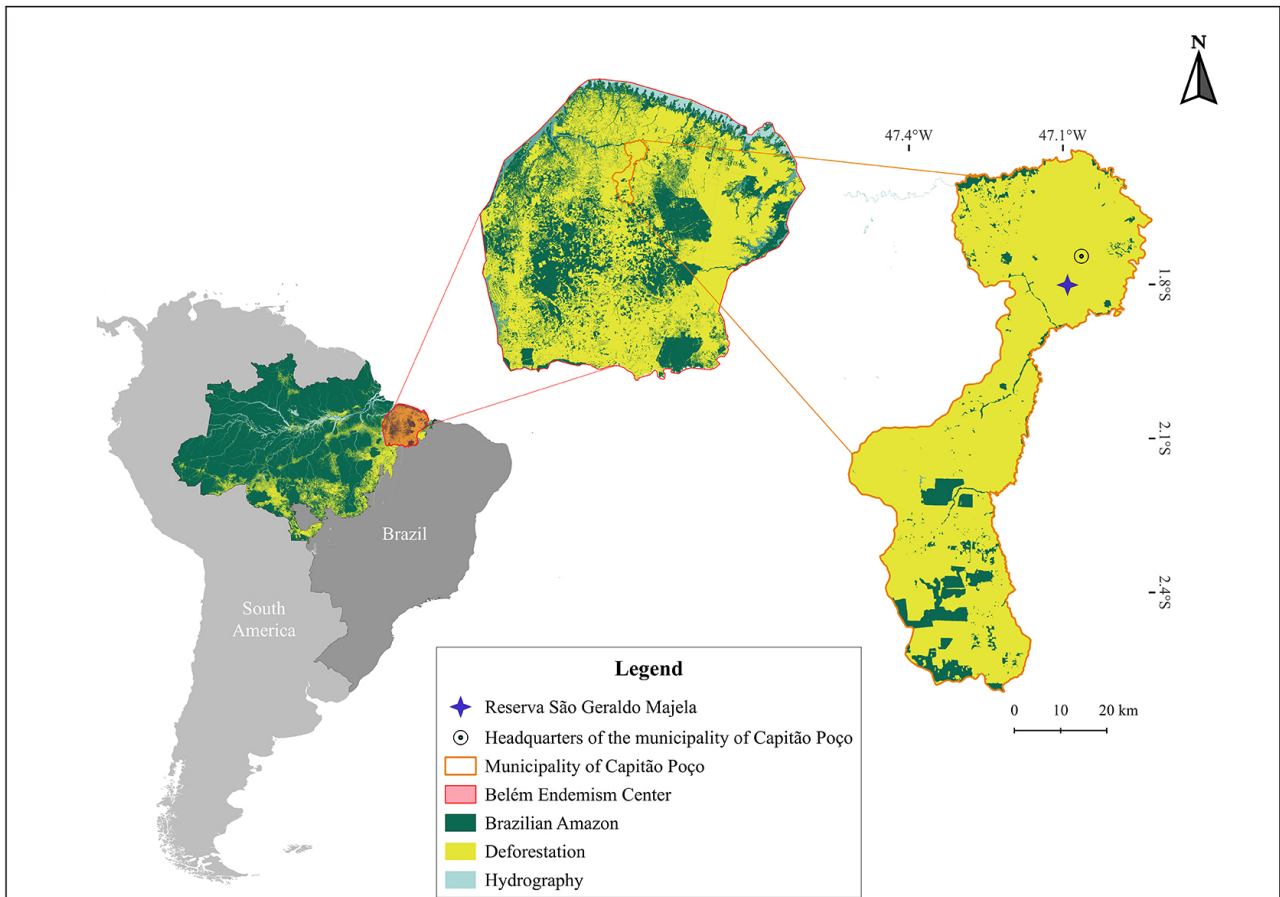


Figure 1. Location of Reserva São Geraldo Majela in the Belém Endemism Center, Pará State, Brazil. Adapted from INPE (2022).

Data Analysis – The data collected in the field and those obtained through virtual databases were organized and interpreted in tables and graphs using Excel 2016 software. For descriptions of the taxa, the morphological concepts of Pridgeon et al. (1999) were adopted. The accepted names and geographic distribution data of the species are in accordance with Flora e Funga do Brasil (2023) and Tropicos (2023). The species identification key was developed based on synthesized taxonomic knowledge, primarily relying on vegetative and reproductive macromorphological characters.

Results and discussion

We found eight species of Orchidaceae in RSGM, of which seven are epiphytic: *Campylocentrum fasciola* (Lindl.) Cogn.; *Campylocentrum micranthum* (Lindl.) Rolfe; *Catasetum macrocarpum* Rich. ex Kunth; *Erycina pusilla* (L.) N.H. Williams & M.W. Chase; *Notylia lyrata* S. Moore; *Polystachya concreta* (Jacq.) Garay & Sweet; *Rodriguezia lanceolata* Ruiz & Pav; and one is terrestrial: *Oeceoclades maculata* (Lindl.) Lindl. All eight species have

a wide distribution in Brazil, with *O. maculata* being the most widely distributed species, occurring throughout the country except in the States of Acre and Amapá (Flora e Funga do Brasil 2023). In turn, *C. fasciola* and *P. concreta* were the species with the most restricted distribution in the country, each one occurring in five States (Afonso et al. 2016, Costa et al. 2020, Ferreira Filho et al. 2021, Flora e Funga do Brasil 2023). Among the species found, none is restricted to the Amazon or Brazil, and all have been previously documented in the literature and recorded in herbaria for the State of Pará (table 1). The recorded species form part of the preliminary list of Orchidaceae for the municipality of Capitão Poço and are distinguished primarily by the substrate on which they occur, growth type, pseudobulb type, presence or absence of leaves, leaf blade shape, inflorescence position and type, and flower coloration. Additionally, apart from the native species, two individuals of *Vanilla* sp. and one of *Epidendrum* sp. were found in the study area. These plants were introduced near the RSGM headquarters by local residents for ornamental purposes and were not considered in the taxonomic treatment of this study.



Figure 2. Landscapes of Reserva São Geraldo Majela in the State of Pará, Brazil. a. Edge area. b-c. Interior areas. d. Aerial view of part of the Reserve. Photographs by Deivid Lucas de Lima da Costa (a) and Felipe Fajardo Villela Antolin Barberena (b-d).

Table 1. Orchid species recorded in Reserva São Geraldo Majela (RSGM) and their occurrence in the municipalities of the mesoregion of Northeast Pará State, Brazil, according to published studies. ¹Afonso *et al.* (2016) and Ferreira Filho *et al.* (2021); ²Costa *et al.* (2020); ³Ferreira Filho and Barberena (2022). *Records.

Orchids recorded in RSGM	Abaetetuba ¹	Capitão Poço ²	Igarapé-Mirim ³
<i>Campylocentrum fasciola</i> (Lindl.) Cogn.		*	*
<i>Campylocentrum micranthum</i> (Lindl.) Rolfe	*	*	
<i>Catasetum macrocarpum</i> Rich. ex Kunth	*	*	*
<i>Erycina pusilla</i> (L.) N.H.Williams & M.W.Chase		*	
<i>Notylia lyrata</i> S.Moore		*	
<i>Oeceoclades maculata</i> (Lindl.) Lindl.		*	*
<i>Polystachya concreta</i> (Jacq.) Garay & Sweet	*		
<i>Rodriguezia lanceolata</i> Ruiz & Pav.	*	*	*

Six studies encompassing Orchidaceae, including this one, were conducted in the northeastern region of Pará (table 1). Afonso *et al.* (2016) and Ferreira Filho *et al.* (2021) investigated the orchid flora in different vegetation types in Abaetetuba, including várzea islands, and found 28 species. Quaresma & Jardim (2014) recorded four orchid species in the coastal sand dunes of the Algodão-Maiandeuá Environmental Protection Area, located in the municipality of Maracanã, during a phytosociological study of vascular epiphytes in the region, and Pacheco & Barberena (2021) also found four species when studying the composition and vertical distribution of epiphytes in an urban park in the municipality of São Miguel do Guamá (none of the species cited in these phytosociological studies were found in the present study).

According to the analysis of the Orchidaceae collection of the HCP Herbarium conducted by Costa *et al.* (2020), 13 orchid species occurred in Capitão Poço. Although the species richness of RSGM corresponds to only about 2% of the richness listed for the State of Pará (Flora e Funga do Brasil 2023), it represents 65% of those listed for the municipality of Capitão Poço (Costa *et al.* 2020).

Our findings are significant when considering that the municipality of Capitão Poço is located within the Belém Endemism Center, one of the most fragmented and threatened regions in the Amazon (Castro *et al.* 2020). Given the past and current status of regional deforestation (figure 1, INPE 2022), it is assumed that changes in the local landscape have affected the richness of Orchidaceae in RSGM over the past years, favoring the occurrence of species that are less ecologically demanding and have a wide geographical distribution, as observed in this study.

Nevertheless, it is worth noting that despite the fragmented condition of the landscape of Capitão Poço, Barberena *et al.* (2020) rediscovered the species *Catasetum mojuense* A.T.Oliveira & J.B.F.Silva in this municipality. This species was previously known only from the type specimen collected in 1996 in the municipality of Moju, Pará. Therefore, although smaller and more subjected to anthropogenic pressures, the forest fragments in Capitão Poço still represent important refuges for extant orchid species. These recent discoveries, including the ones from the present study, emphasize the importance of conserving these areas and addressing the knowledge gaps regarding the regional flora.

Key to the native species of Orchidaceae in Reserva São Geraldo Majela

- 1. Terrestrial herb; leaf blades maculate 6. *Oeceoclades maculata*
- 1. Epiphytic herb; leaf blades non-maculate
 - 2. Herb with sympodial growth; caulomes thickened in pseudobulbs
 - 3. Pseudobulbs homoblastic; flowers non-resupinate
 - 4. Pseudobulbs fusiform; leaf blades plicate; inflorescence a lateral raceme 3. *Catasetum macrocarpum*
 - 4. Pseudobulbs ovoid; leaf blades conduplicate; inflorescence a terminal panicle 7. *Polystachya concreta*
 - 3. Pseudobulbs heteroblastic; flowers resupinate
 - 5. Leaf blades lanceolate; flowers pink 8. *Rodriguezia lanceolata*
 - 5. Leaf blades narrow-elliptical to elliptical; flowers white-greenish 5. *Notylia lyrata*
 - 2. Herb with monopodial growth; caulomes vestigial or not thickened in pseudobulbs

6. Aphyllous herb 1. *Campylocentrum fasciola*
 6 Foliated herb
 7. Leaf blades plane, not equitant; inflorescence 8-12 flowered; flowers white, non-maculate
 2. *Campylocentrum micranthum*
 7. Leaf blades equitant; inflorescence 1-flowered; flowers yellow, maculate 4. *Erycina pusilla*

1. *Campylocentrum fasciola* (Lindl.) Cogn., Fl. Bras. 3(6): 520. 1906.

Figure 3 a-b

Epiphytic herb with monopodial growth. Caulomes vestigial, not thickened in pseudobulbs, aphyllous. Inflorescence a lateral raceme, 3.2-6.4 cm long, 4-20-flowered; floral bracts 0.1-0.2 cm long. Flowers bisexual, resupinate, calcarate; calcar 0.1-0.2 cm long; pedicel+ovary 0.1-0.2 cm long; sepals and petals white-pinkish, oval, apex acute; dorsal sepal ca. $0.2 \times 0.1-0.2$ cm; lateral sepals ca. $0.1 \times 0.1-0.2$ cm; petals ca. 0.2×0.1 cm; lip trilobed; lateral lobes ca. 0.1×0.2 cm, white, ovate, apex acute; central lobe ca. 0.1×0.2 cm, white, ovate, apex acute; gynostemium ca. 0.1 cm long, pale yellow. Capsules $0.3-0.5 \times 0.1-0.2$ cm, green, ellipsoid.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 19.XII.2019 (fr.), *D.L.L. Costa et al.* 38 (HCP); 19.XII.2019 (fr.), *J.R.V. Pacheco et al.* (HCP 404); 08.XII.2020 (fl.), *F.F.V.A. Barberena et al.* 418 (HCP).

It is distributed from Central America to the northern part of South America (Tropicos 2023). In Brazil, *C. fasciola* occurs in the North, Northeast and Central-West regions and is found in the Amazon and Atlantic Forest phytogeographic domains, in the vegetation types of Campinarana, Riparian Forest or Gallery Forest, Terra Firme Forest, and Ombrophilous Forest (Flora e Funga do Brasil 2023). In RSGM, *C. fasciola* is the only orchid species with an aphyllous caulome (figures 3 a-d.), being mainly found growing on *Citrus* sp. trees planted near the reserve's headquarters.

2. *Campylocentrum micranthum* (Lindl.) Maury, J. Bot. (Morot) 3(16): 273. 1889.

Figure 3 c-d

Epiphytic herb with monopodial growth. Caulomes 13-21 cm long, not thickened in pseudobulbs. Leaf blades $3.2-6.6 \times 0.8-1.8$ cm, dark green, plane, not equitant, narrow-elliptical to elliptical, apex acute. Inflorescence a lateral raceme, 13.6-2.1 cm long, 8-12-flowered; floral bracts ca. 0.1 cm long. Flowers bisexual, resupinate, calcarate; calcar 0.1-0.2 cm long; pedicel+ovary ca. 0.2 long; sepals and petals white, apex acuminate; dorsal sepal $0.4-0.6 \times 0.1-1.7$ cm, oblanceolate; lateral sepals $0.5-0.6 \times$ ca. 0.1 cm, lanceolate; petals $0.4-0.5 \times$ ca. 0.1 cm, oblanceolate; lip $0.4-0.6 \times 0.1-$

0.2 cm, white, entire, trullate, apex acuminate; gynostemium ca. 0.1 cm long, white. Capsules $0.5-0.9 \times 0.2-0.3$ cm, green, ellipsoid.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 29.V.2021 (fr.), *D.L.L. Costa et al.* 136 (HCP).

Additional examined material: BRASIL. PARÁ: Capitão Poço, CITROPAR, 1ª fazenda, 3.XII.2018 (fl. and fr.), *F. F. Teixeira* 13 (HCP). Irituia, Vila de Açaiteua, 21.III.2020 (fl.), *D.L.L. Costa et al.* 83 (HCP).

It is distributed from Florida to the northern part of South America (Tropicos 2023). In Brazil, it occurs in the North and Northeast regions, in the Amazon and Atlantic Forest phytogeographic domains, and in the vegetation types of Ombrophilous Forest, Semideciduous Seasonal Forest, Terra Firme Forest, and Várzea Forest (Flora e Funga do Brasil 2023). In RSGM, *C. micranthum* was found as an epiphyte with little adherence to the host tree, so that the roots, caulome portions, and leaves are "aerial", as can be observed in Figure 3 c. It can be easily differentiated from *C. fasciola* by its foliated caulome.

3. *Catasetum macrocarpum* Rich. ex Kunth, Syn. Pl. 1: 331. 1822.

Figure 3 e-f

Epiphytic herb with sympodial growth. Caulomes $4-22 \times 2-4$ cm, thickened in pseudobulbs, homoblastic, fusiform. Leaf blades $7-40 \times 3.2-7.5$ cm, green, elliptic, plicate, apex acuminate. Inflorescence a lateral raceme, 15-28 cm long, 5-7 male flowers; floral bracts 0.5-1.2 cm long. Flowers unisexual; male flowers non-resupinate, ecalcarate; pedicel+ovary 1.5-2.3 cm long; sepals and petals discolored, apex acuminate; dorsal sepal $4.7-5.3 \times 0.9-1.2$ cm, adaxial face green, abaxial face yellow, narrow-elliptical; lateral sepals $4.7-5.6 \times 1.3-2.9$ cm, adaxial face green, abaxial face yellow, elliptical; petals $4.6-5.5 \times 1.7-2$ cm, face adaxial yellowish green, face abaxial yellow, with several red macules, elliptical; lip ca. 1.9×2.9 cm, yellowish green, trilobed; lateral lobes $1.2-2.2 \times 0.7-1.2$ cm, deltate, apex acute; central lobe $1.8-2.4 \times 1-1.5$ cm, ovate, apex acute; female flowers not seen; gynostemium 1.6-2.3 cm long, yellow-green. Capsules not seen.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 19.XII.2019 (fl.), *D.L.L. Costa et al.* 40 (HCP).

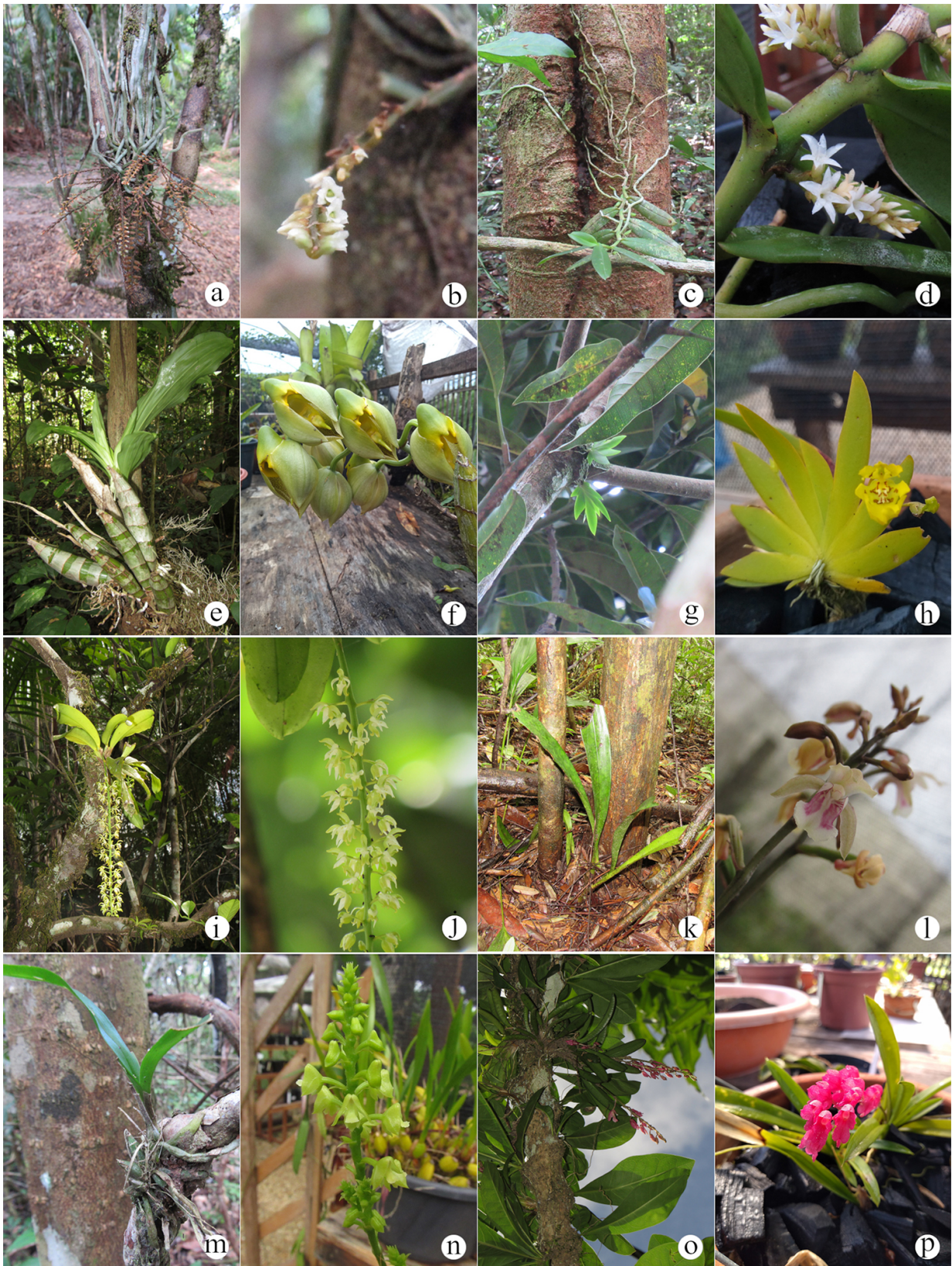


Figure 3. Species of Orchidaceae of the Reserva São Geraldo Majela in the State of Pará, Brazil. a-b. *Campylocentrum fasciola* (Lindl.) Cogn. c-d. *Campylocentrum micranthum* (Lindl.) Rolfe. e-f. *Catasetum macrocarpum* Rich. ex Kunth. g-h. *Erycina pusilla* (L.) N.H. Williams & M.W. Chase. i-j. *Notylia lyrata* S. Moore. k-l. *Oeceoclades maculata* (Lindl.) Lindl. m-n. *Polystachya concreta* (Jacq.) Garay & H.R. Sweet. o-p. *Rodriguezia lanceolata* Ruiz & Pav. Photographs by Deivid Lucas de Lima da Costa.

Additional examined material: BRASIL. PARÁ: Capitão Poço, Fazenda São João, 18.II.2018 (fl.), *F. F. Teixeira* 1 (HCP); CITROPAR, 1ª Fazenda, 02.II.2019 (fl.), *D.L.L. Costa et al.* 2 (HCP); 26.VI.2019 (fl.), *D.L.L. Costa et al.* 13 (HCP).

It is widely distributed in South America, from Venezuela to Argentina (Tropicos 2023). In Brazil, it occurs in the North, Northeast, Central-West and Southeast regions and is found in the Amazon, Atlantic Forest and Cerrado phytogeographic domains, in Anthropogenic Areas and the following vegetation types: Amazonian Savanna, Campinarana, Cerrado (*lato sensu*), Igapó Forest, Ombrophilous Forest, Restinga, Riparian Forest or Gallery Forest, Rocky Outcrops, Semideciduous Seasonal Forest, Terra Firme Forest, and Várzea Forest (Flora e Funga do Brasil 2023). In RSGM, *C. macrocarpum* is distinguished from other Orchidaceae species by its fusiform pseudobulbs, plicated leaf blades, and unisexual flowers (figure 3 e-f).

4. *Erycina pusilla* (L.) N.H. Williams & M.W. Chase, *Lindleyana* 16(2): 136. 2001.

Figure 3 g-h

Epiphytic herb with monopodial growth. Caulomes 0.3-0.4 × 0.2-0.3 cm, not thickened in pseudobulbs. Leaf blades 1.3-4.3 × 0.2-0.5 cm, green, narrow-elliptical, equitant, apex acute. Inflorescence a lateral raceme, 2.5-3.5 cm long, 1-flowered; floral bracts 0.2-0.4 cm long; Flowers bisexual, resupinate, ecalcarate; pedicel+ovary 0.4-0.6 cm long; sepals and petals yellow, apex acute; dorsal sepal ca. 0.4 × 0.2 cm, ovate; lateral sepals ca. 0.3 × 0.1, narrow-elliptical; petals ca. 0.5 × 0.2 cm, narrow-elliptical; lip 0.8-1.3 × 0.7-1.2 cm, yellow, with brown macules, trilobed, obovate, apex emarginate; gynostemium ca. 0.2 cm long, yellow. Capsules not seen.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 18.VIII.2018 (fl.), *T.L.E. Albuquerque et al.* 7 (HCP).

Additional examined material: BRASIL. PARÁ: Garrafão do Norte, Sede da Aldeia Tembê Tenetehara, 01.IX.2019 (fl.), *P.A.A. Souza* (HCP 359).

It is distributed from Central America to South America (Tropicos 2023). In Brazil, it occurs in the North, Northeast, Central-West, and Southeast regions, in the Amazon, Atlantic Forest and Cerrado phytogeographic domains, in Anthropogenic Areas and the following vegetation types: Igapó Forest, Ombrophilous Forest, Riparian or Gallery Forest, and Rocky Outcrops (Flora e Funga do Brasil 2023). In RSGM, *E. pusilla* is distinguished from other Orchidaceae species by its equitant leaves, 1-flowered inflorescences, and yellow flowers with brown macules (figure 3 g-h).

5. *Notylia lyrata* S. Moore, *Trans. Linn. Soc. London, Bot.* 4: 477. 1895.

Figure 3 i-j

Epiphytic herb with sympodial growth. Caulomes 1.5-2.4 × 0.5-1.2 cm, thickened in pseudobulbs, heteroblastic, ellipsoid. Leaf blades 4-10 × 1.2-2.8 cm, green, narrow-elliptical to elliptical, apex acute. Inflorescence a lateral raceme, 9-17 cm long, 22-43-flowered; floral bracts 0.3-0.5 cm long. Flowers bisexual, resupinate, ecalcarate; pedicel+ovary 0.2-0.8 cm long; sepals and petals white-green; dorsal sepal 0.6-0.8 × 0.1-0.2 cm, narrow-elliptical, apex acuminate; lateral sepals 0.5-0.7 × 0.1-0.2 cm, narrow-elliptical, adnate to each other only 2/3-basally, apex acuminate; petals 0.4-0.8 × 0.1-0.8 cm, with two yellow macules on each petal, oblanceolate, apex acuminate; lip 0.3-0.7 × 0.1-0.3 cm, white, entire, trullate, apex acuminate; gynostemium ca. 0.3-0.4 × 0.1 cm, white. Capsules 1.1-1.3 × 0.5-0.6 cm, light green, ellipsoid.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 27.IX.2018 (fl.), *D.L. Braz et al.* 17 (HCP); 19.XII.2019 (fl.), *D.L.L. Costa et al.* 36 (HCP).

Additional examined material: BRASIL. PARÁ: Capitão Poço, CITROPAR, 1ª Fazenda, 11.VIII.2018 (fl.), *F. F. Teixeira* 3 (HCP); 15.V.2019 (fl.), *D.L.L. Costa et al.* 12 (HCP); Área urbana, próxima ao Riacho Doce, *T.L.E. Albuquerque* 9 (HCP). Irituia, Vila Brasileira, 04.VI.2018 (fl.), *J.R.V. Pacheco* 33 (HCP); Vila de Açaitéua, 21.III.2020 (fl.), *D.L.L. Costa et al.* 82 (HCP).

It is restricted to Paraguay and Brazil (Tropicos 2023). In Brazil, it occurs in all five geopolitical regions of the country, and is found in the Amazon, Atlantic Forest and Cerrado phytogeographic domains, and in the vegetation types of Cerrado (*lato sensu*), Ombrophilous Forest, Restinga, Riparian or Gallery Forest, Seasonal Semideciduous Forest, and Terra Firme Forest (Flora e Funga do Brasil 2023). In RSGM, *N. lyrata* is characterized by its narrow-elliptic to elliptic leaves, inflorescence with 22 flowers or more, and greenish-white sepals and petals, with each petal having two yellow macules (figure 3 i-j).

6. *Oeceoclades maculata* (Lindl.) Lindl., *Gen. Sp. Orchid.* Pl.: 237. 1830-1840 [1833].

Figure 3 k-l

Terrestrial herb with sympodial growth. Caulomes 1.3-2.1 × 0.6-1.8 cm, thickened in pseudobulbs, heteroblastic, narrow-elliptical. Leaf blades 9-19 × 2.5-4.3 cm, green, with light green macules, narrow-elliptical, apex acuminate. Inflorescence a lateral raceme, 19.5-36 cm long, 4-7-flowered; floral bracts 0.6-1.4 cm long. Flowers bisexual, resupinate, calcarate; calcar 0.2-0.4 cm long; pedicel+ovary 0.8-1.3 cm; sepals and petals cream, narrow-elliptical; dorsal sepal

0.9-1.2 × 0.1-2 cm, apex acuminate; lateral sepals 0.9-1 × 0.2-0.3 cm, apex acute; petals 0.7-1.3 × 0.2-0.3 cm, apex acute; lip trilobed, lateral lobes 4.7-5 × 0.2-3 cm, white with pinkish veins, deltate, apex acute; central lobe 0.8-0.9 × 0.8-0.9 cm, white with pinkish macules, ovate, apex acute; gynostemium ca. 0.3 cm long, greenish cream. Capsules ca. 3 × 0.8 cm, dark green, ellipsoid.

Examined Material: BRASIL. PARÁ: Capitão Poço, RSGM, 08.XII.2020 (fl. and fr.), *F.F.V.A. Barberena et al.* 419 (HCP).

Additional examined material: BRASIL. PARÁ: Capitão Poço, Capoeira da UFRA, *campus* Capitão Poço, 20.IX.2018 (fl.), *F.F.V.A. Barberena* 407 (HCP); Colônia São José, 21.IX.2018 (fl.), *F.F.V.A. Barberena et al.* 408 (HCP).

It is distributed in central regions of Africa, Central America and South America (Tropicos 2023). In Brazil, the species is considered naturalized and occurs in all five geopolitical regions, in the Amazon, Atlantic Forest, Caatinga and Cerrado phytogeographic domains (Flora e Funga do Brasil 2023). It is found in all states of the country (except in Acre and Amapá States), in Anthropogenic Areas and the vegetation types of Campinarana, Cerrado (*lato sensu*), Mixed Rainforest, Ombrophilous Forest, Restinga, Riparian or Gallery Forest, Seasonal Deciduous Forest, Seasonal Semideciduous Forest, Terra Firme Forest, and Várzea Forest (Flora e Funga do Brasil 2023). In RSGM, *O. maculata* is the only terrestrial orchid and can be easily recognized by its maculate leaf blades (figure 3 k.).

7. *Polystachya concreta* (Jacq.) Garay & Sweet, *Orquideología* 9(3): 206. 1974.

Figure 3 m-n

Epiphytic herb with sympodial growth. Caulomes 0.9-2.28 × 0.4-0.75 cm, thickened in pseudobulbs, homoblastic, ovoid. Leaf blades 1.7-11.6 × 0.5-1.8 cm, green, narrow elliptical, conduplicate, apex acute. Inflorescence a terminal panicle, 10-38 cm long, 16-flowered; floral bracts 0.2-0.3 cm long. Flowers bisexual, non-resupinate, ecalcarate, pedicel+ovary 0.3-0.6 cm long; sepals and petals yellowish green, apex acuminate; dorsal sepal 0.3-0.4 × 0.1-0.2 cm, oval; lateral sepals 0.3-0.4 × 0.2-0.4 cm, oval; petals 0.2-0.3 × ca. 0.1 cm, narrow-lanceolate; lip 0.3-0.4 × 0.2-0.3 cm, yellowish green, trilobed, ovate, apex emarginate; gynostemium 0.1-0.2 cm long, yellowish green. Capsules not seen.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 7.IV.2018 (fl.), *T.L.E. Albuquerque et al.* (HCP 361).

Additional examined material: BRASIL. PARÁ: Vigia, Campo do Caimbé, 27.V.1967 (fl.), *M. Silva* 1006 (MG); 30.III.1980 (fl.), *G. Davidse et al.* (MG 104720).

It has a pantropical distribution and is widely distributed in East Asia, North America and northern South America (Tropicos 2023). In Brazil, it occurs in the North and Central-West regions, and is found in the Amazonia and Cerrado

phytogeographic domains, in the following vegetation types: Evergreen Seasonal Forest, Igapó Forest, Mixed Rainforest, Ombrophilous Forest, Restinga, Riparian or Gallery Forest, Rocky Outcrops, Seasonal Deciduous Forest, Seasonal Semideciduous Forest, Terra Firme Forest, and Várzea Forest (Afonso et al. 2016, Costa et al. 2020, Ferreira Filho et al. 2021, Flora e Funga do Brasil 2023). In RSGM, *P. concreta* is recognized mainly by its ovoid pseudobulbs and paniculate inflorescence.

8. *Rodriguezia lanceolata* Ruiz & Pav., *Syst. Veg. Fl. Peruv. Chil.*: 219. 1798.

Figure 3 o-p

Epiphytic herb with sympodial growth. Caulomes 1.2-3.6 × 0.5-1.2 cm, thickened in pseudobulbs, heteroblastic, ellipsoid. Leaf blades 3.5-9 × 0.6-1 cm, green, lanceolate, apex acuminate. Inflorescence a lateral raceme, 10-13 cm long, 5-15-flowered; floral bracts 0.2-0.6 cm long. Flowers bisexual, resupinate, ecalcarate; pedicel+ovary 1-1.2 cm long; sepals and petals pinkish; dorsal sepal 1.1-1.2 × 0.6-0.7 cm, elliptical, apex acute; lateral sepals 0.9-1.3 × 0.2-0.3 cm, lanceolate, adnate to each other up to the apex, apex acuminate; petals 1-1.1 × 0.5-0.6 cm, elliptical, apex acute; lip 1-1.2 × 0.5-0.6 cm, pinkish, entire, ovate, apex emarginate; gynostemium 0.4-0.6 cm, pinkish white, with yellow macules. Capsules 1.2-1.5 × 0.5-0.7 cm, light green, ellipsoid.

Examined material: BRASIL. PARÁ: Capitão Poço, RSGM, 19.XII.2019 (fl. and fr.), *D.L.L. Costa et al.* 37 (HCP); 8.XII.2020 (fl.), *F.F.V.A. Barberena* 417 (HCP).

Additional examined material: BRASIL. PARÁ: Capitão Poço, CITROPAR, 1ª fazenda, 3.XII.2018 (fl.), *F.F. Teixeira* 12 (HCP). Igarapé-Miri, Rio Anapú, 16.XII.2019 (fl.), *R.L. Ferreira Filho* 293 (HCP).

It is widely distributed in northern South America (Tropicos 2023). In Brazil, it occurs in the North, Northeast and Central-West regions and is found in the Amazon and Cerrado phytogeographical domains, in Anthropogenic Areas and the following vegetation types: Campinarana, Cerrado (*lato sensu*), Igapó Forest, Riparian Forest or Gallery Forest, Rocky Outcrops, Seasonal Semideciduous Forest, Terra Firme Forest, and Várzea Forest (Flora e Funga do Brasil 2023). In RSGM, *R. lanceolata* is recognized by its lanceolate leaf blades and pinkish flowers.

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Conflict of interests

There is no conflict of interest.

Author contributions

Deivid Lucas de Lima da Costa: performed the collection, processing, analysis and description of specimens; wrote the manuscript with the help of Felipe Fajardo Villela Antolin Barberena.

Felipe Fajardo Villela Antolin Barberena: conceived the idea and supervised the findings of this work; wrote the manuscript with the help of Deivid Lucas de Lima da Costa.

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