



Orchidaceae in the Parque Natural Municipal da Restinga de Praia do Forte, Bahia, Brazil

Orchidaceae en el Parque Natural Municipal da Restinga de Praia do Forte, Bahía, Brasil

Felipe Fajardo Villela Antolin Barberena^{1,2,5} , Tainan da Silva Sousa³ , Nádia Roque⁴ 

Abstract:

Background and Aims: Bahia is one of the Brazilian states with the greatest diversity of orchids. Species restricted to microhabitats or forming small populations, being subject to local suppression, have been reported for restingas of the state. The north coast of Bahia has recently been exposed to intense anthropic pressures, including disordered occupation of land and predatory tourism. In order to encourage the adoption of regional conservation strategies, we carried out a survey of the orchid flora in the Parque Natural Municipal da Restinga de Praia do Forte (PNMR Praia do Forte), a fragment of restinga on the north coast of the state.

Methods: Field work was conducted monthly from September 2016 to December 2017, and in July 2020 and August 2022, by employing the walking survey method. We consulted collections of the herbaria ALCB, HRB, HUEFS, and RB in person, as well as digital images of type specimens deposited in European herbaria and the Environmental Information Reference Center database. Phenological and distribution data of the species in the phytophysiognomies of PNMR Praia do Forte were mostly obtained in the field.

Key results: Orchidaceae is represented by 14 genera and 16 species in the PNMR Praia do Forte, most of which are native to the Neotropics (14 spp., including eight endemic to Brazil), mainly terrestrial (six spp.), occurring exclusively in restinga forest formations (eight spp.). *Epistephium williamsii*, *Gomesa barbata*, *Oeceoclades maculata*, *Pachygenium parvum*, *Polystachya concreta* and *Prescottia leptostachya* (restricted to Bahia state) form small populations (<50 individuals).

Conclusions: The orchid flora of the PNMR Praia do Forte, especially the aforementioned species, requires the attention from managers, in order to implement possible management and conservation actions and prevent them from being suppressed locally. We suggest greater surveillance actions in the park and environmental education actions among local residents and tourists.

Key words: Atlantic Forest, Mata de São João, orchids, taxonomy, urban park.

Resumen:

Antecedentes y Objetivos: Bahía es uno de los estados brasileños con mayor diversidad de orquídeas. Para restingas del estado se han reportado especies restringidas a microhábitats o que forman pequeñas poblaciones, estando sujetas a supresión local. La costa norte de Bahía ha estado expuesta recientemente a intensas presiones antrópicas, incluida la ocupación desordenada de la tierra y el turismo depredador. Con el fin de fomentar la adopción de estrategias de conservación regionales, llevamos a cabo un estudio de la flora de orquídeas en el Parque Natural Municipal da Restinga de Praia do Forte (PNMR Praia do Forte), un fragmento de restinga en la costa norte del estado.

Métodos: El trabajo de campo se realizó mensualmente desde septiembre 2016 a diciembre 2017, así como en julio 2020 y agosto 2022, empleando el método de caminata libre. Consultamos personalmente las colecciones de los herbarios ALCB, HRB, HUEFS y RB, así como la base de datos del Centro de Referencia de Información Ambiental e imágenes digitales de especímenes tipo depositados en herbarios europeos. Los datos fenológicos y de distribución de las especies en las fitofisonomías del PNMR Praia do Forte se obtuvieron principalmente en el campo.

Resultados clave: Orchidaceae está representada por 14 géneros y 16 especies en el PNMR Praia do Forte, en su mayoría nativas del Neotropico (14 spp., incluidas ocho endémicas de Brasil), principalmente terrestres (seis spp.), ocurriendo exclusivamente en formaciones forestales de restinga (ocho spp.). *Epistephium williamsii*, *Gomesa barbata*, *Oeceoclades maculata*, *Pachygenium parvum*, *Polystachya concreta* y *Prescottia leptostachya* (restringida al estado de Bahía) forman poblaciones pequeñas (<50 individuos).

Conclusiones: La flora orquidológica del PNMR Praia do Forte, especialmente las especies antes mencionadas, requiere la atención de los gestores, para implementar posibles acciones de manejo y conservación y evitar su supresión local. Sugerimos mayores acciones de vigilancia en el parque y educación ambiental entre residentes locales y turistas.

Palabras clave: Bosque Atlántico, Mata de São João, orquídeas, parque urbano, taxonomía.

¹Universidade Federal Rural da Amazônia-campus Capitão Poço, Núcleo de Pesquisas em Epífitas (Nupéfitas), Rua Professora Antônia Cunha de Oliveira s.n., 68650-000, Vila Nova, Capitão Poço, Pará, Brazil.

²Museu Paraense Emílio Goeldi, Coordenação de Botânica, Avenida Perimetral 1901, 66077-830, Terra Firme, Belém, Pará, Brazil.

³Spizaetus Ambiental, Avenida Mestre Manoel 68, 41705-715, Boca do Rio, Salvador, Bahia, Brazil.

⁴Universidade Federal da Bahia, Instituto de Biologia, Rua Barão de Jeremoabo 668, 40170-115, Ondina, Salvador, Bahia, Brazil.

⁵Author for correspondence: felipe.fajardo@ufra.edu.br

Received: October 25, 2023.

Reviewed: November 15, 2023.

Accepted by Marie-Stéphanie Samain: November 30, 2023.

Published Online first: December 6, 2023.

Published: Acta Botanica Mexicana 130(2023).

To cite as: Barberena, F. F. V. A., T. da Silva Sousa and N. Roque. 2023. Orchidaceae in the Parque Natural Municipal da Restinga de Praia do Forte, Bahia, Brazil. Acta Botanica Mexicana 130: e2271. DOI: <https://doi.org/10.21829/abm130.2023.2271>



This is an open access article under the Creative Commons 4.0 Attribution-NonCommercial Licence (CC BY-NC 4.0 Internacional).

Introduction

Bahia is one of the Brazilian states with the greatest diversity of orchids, with 118 genera and 522 species, numerically surpassing several American countries such as Argentina and Chile (Johnson, 2001; Lehnebach, 2003; FFB, 2023). Floristic-taxonomic surveys of Orchidaceae in the state are concentrated in the Chapada Diamantina region, and in the Caatinga phytogeographic domain (see Azevedo and van den Berg, 2007; Vieira et al., 2014), although recently they have also been carried out in areas of transition between the Atlantic Forest and the Caatinga phytogeographic domains (e.g., Marinho and Azevedo, 2013; Rêgo and Azevedo, 2017; Azevedo et al., 2021). These surveys revealed new occurrences of orchid species in northeastern Brazil (e.g., Rêgo and Azevedo, 2017; Santos and Azevedo, 2022; Lima and Azevedo, 2023) and have encouraged the continuity of field efforts. Nevertheless, the orchidological flora of the remainder of the Atlantic Forest in Bahia, which today is reduced to just 6% of the state's area (originally corresponding to 36%; MPEB, 2023), requires greater conservation attention. The presence of species, including ornamental ones, which are restricted to microhabitats or forming small populations, being subject to local suppression, was reported for a fragment of restinga in the municipality of Salvador, capital of the state (Barberena et al., 2019a, 2021).

Restingas constitute a vegetation type associated with coastal sandy deposits from Quaternary and coastal rocky environments, and range from herbaceous-shrub to forest formations (CONAMA, 2009), occurring in the Atlantic Forest phytogeographic domain in the state of Bahia. The municipality of Salvador is adopted as a geopolitical divide, delimiting the north coast of the state, which has approximately 200 km, and the south coast, with more than 800 km (Menezes, 2007). The ecosystems of the north coast have been exposed to more intense anthropic pressures due to the recent improvement of the road network and growing population density (INEMA, 2023). In return, these regional changes resulted in the establishment of Conservation Units, among them the Área de Proteção Ambiental Litoral Norte do Estado da Bahia (APA Litoral Norte), aiming at the ecological-economic planning of this coastal portion (INEMA, 2023), as

well as the intensification of botanical research (Gomes and Guedes, 2014). Comprehensive inventories of vascular plants carried out in the restingas on the north coast of the state made it possible to highlight Orchidaceae as one of the families with the greatest local species richness (Queiroz et al., 2012; Gomes and Guedes, 2014). Nonetheless, the APA Litoral Norte suffers from environmental conflicts, notably the disordered occupation of land, lack of basic sanitation, environmental impacts caused by pine and eucalyptus plantation areas, indiscriminate intensification of livestock farming, predatory fishing, degradation of mangroves, and the predatory tourism in coastal districts (Gomes and Guedes, 2014; INEMA, 2023).

In order to disseminate consistent and updated data on the flora of Brazilian restingas and encourage the adoption of regional conservation strategies, we carried out a survey of orchid flora in the Parque Natural Municipal da Restinga de Praia do Forte (PNMR Praia do Forte), which is completely included in the APA Litoral Norte, comprising an identification key, photographs, and information on population size, substrate and phenology of the species in the study area.

Material and Methods

Study area

The Parque Natural Municipal da Restinga de Praia do Forte is an integral protection Conservation Unit, with ca. 253 hectares, and is situated at coordinates 12°50'-12°57'S and 37°98'-38°01'W in the municipality of Mata de São João on the northern coast of Bahia, northeastern Brazil (DOMMSJ, 2008; Fig. 1). The vegetation comprises marshy areas and well-conserved fragments of shrub and restinga forest formations, the latter phytophysognomy being mainly composed by *Elaeis guineensis* Jacq. and *Syagrus schizophylla* (Mart.) Glassman (Fig. 2). The local climate is 'Af' (tropical, without a dry season) and the annual precipitation is 1600-1900 mm, with an average temperature equal to or greater than 18 °C in the coldest month (Alvares et al., 2013).

Data collection and analysis

Field work was conducted monthly from September 2016 to December 2017, and in July 2020 and August 2022, by employing the walking survey method (Filgueiras et al.,



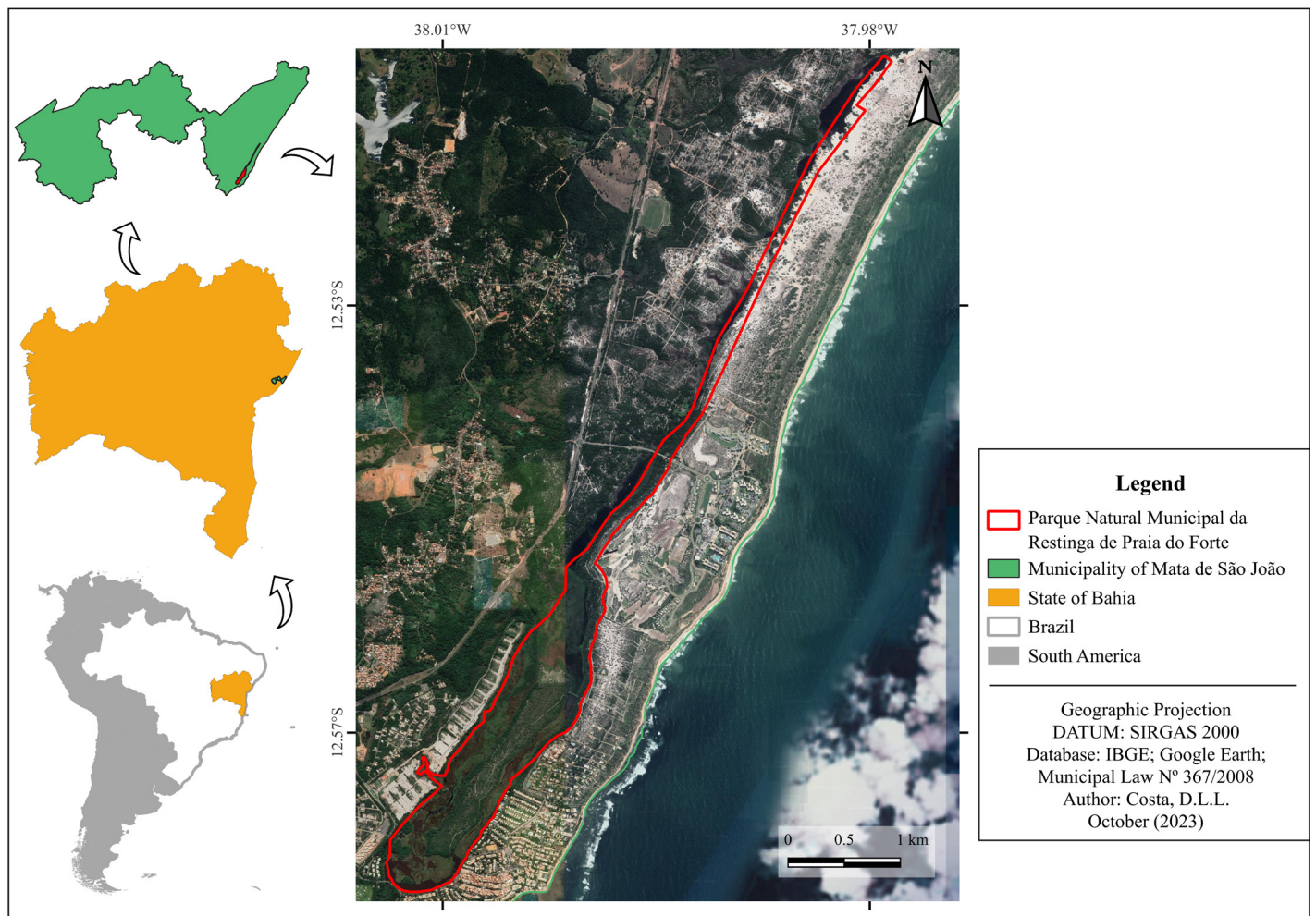


Figure 1: Map showing Parque Natural Municipal da Restinga de Praia do Forte (PNMR Praia do Forte) in the municipality of Mata de São João, Bahia, Brazil. Map produced by Deivid Lucas de Lima da Costa.

1994). Collected specimens were deposited in the herbarium ALCB, with duplicates in the herbaria MBM, MG, RB (including RB spirit) and UPCB. Collections of the herbaria ALCB, HRB, HUEFS and RB were examined in person (acronyms according to Thiers, 2023, continuously updated), as well as digital images of type specimens deposited in European herbaria (JSTOR, 2023). The Environmental Information Reference Center (database CRIA, 2023) was also consulted in the search for possible other orchid specimens from the park. The analyzed specimens were identified by comparison with specimens deposited in the ALCB herbarium and based on floristic-taxonomic articles on Orchidaceae. The morphological terminology followed Radford et al. (1974) and Dressler (1981).

Phenological and distribution data of the species in the phytophysiognomies of PNMR Praia do Forte were mostly obtained in the field and complemented by information available on specimen labels. Species with stems with five or more leaves were considered multifoliate, and inflorescences with 10 or more flowers were treated as multi-flowered (Barberena et al., 2022). Populations with less than 50 individuals were considered small (Barberena et al., 2019a). Details of specimens and habitats were recorded using a Nikon Coolpix P600 camera (Nikon Corporation, Tokyo, Japan) and a LG Joy cell phone (LG Corporation, Seoul, South Korea). The accepted name and threat categories of the species are in line with Flora e Funga do Brasil (FFB, 2023). The geographic distribution of species was based

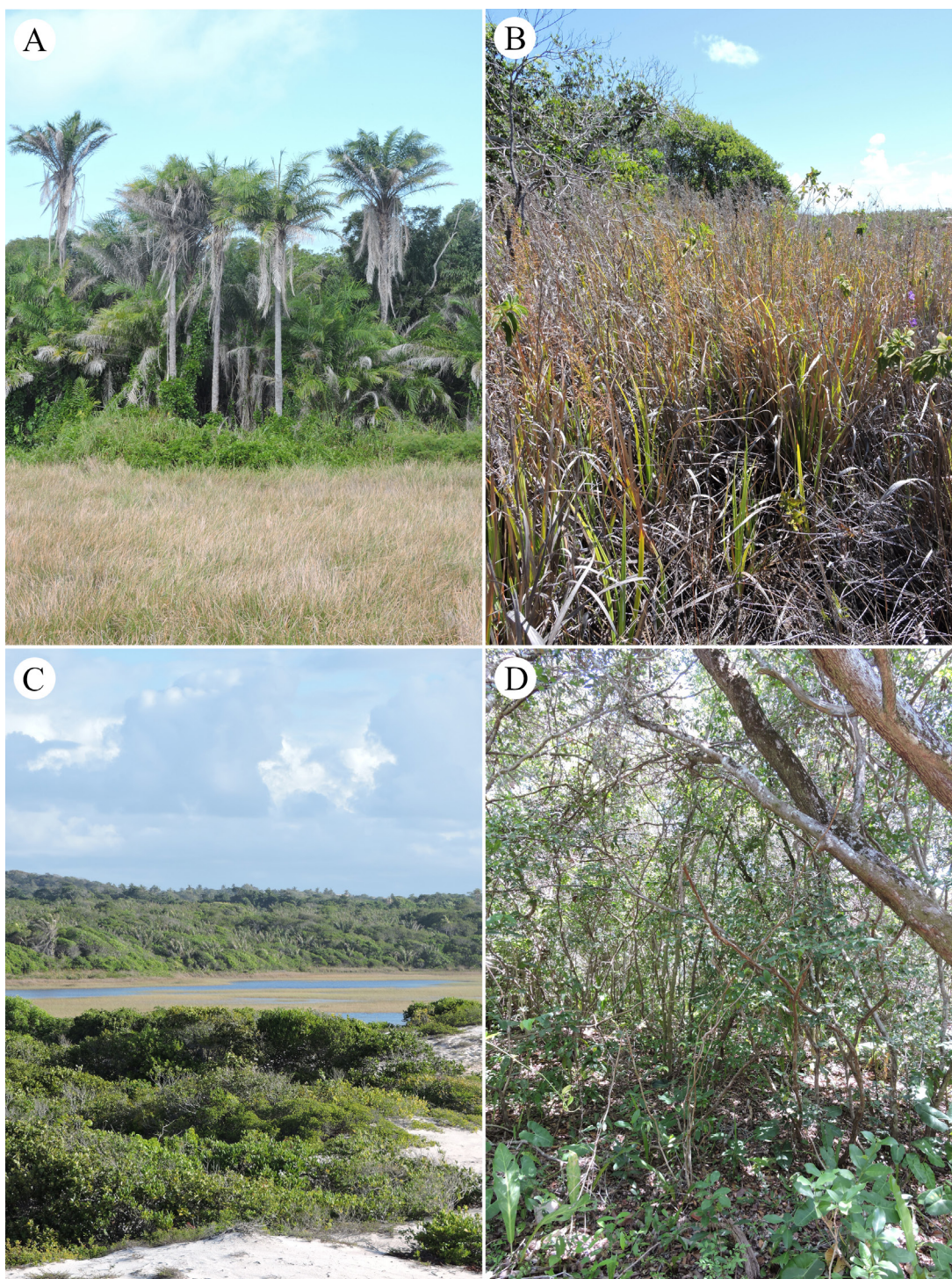


Figure 2: Parque Natural Municipal da Restinga de Praia do Forte (PNMR Praia do Forte) in the municipality of Mata de São João, Bahia, Brazil. A. marshy area and restinga forest formation (figure originally published in Barberena et al. (2018b)); B. details of a marshy area; C. shrub formation and lagoon; D. interior of a fragment of restinga forest formation. Photographs by Felipe Fajardo Villela Antolin Barberena.

primarily on the studies of authors who contributed to Flora and Funga do Brasil (FFB, 2023) and complemented with relevant literature (Barberena et al., 2019b; Karremans et al., 2020; Barberena et al., 2021), and with data obtained from

POWO (2023) for species with extra-Brazilian distributions. We adopted the ecological categories proposed by Benzing (1990) for the epiphytic species, and elaborated a map of the area using QGIS software v. 3.30 (QGIS, 2023).





Figure 3: Species of Orchidaceae of Parque Natural Municipal da Restinga de Praia do Forte (PNMR Praia do Forte) in the municipality of Mata de São João, Bahia, Brazil. A. *Brassavola tuberculata* Hook.; B. *Campylocentrum robustum* Cogn.; C. *Catasetum gardneri* Schltr.; D. *Cyrtopodium flavum* Link & Otto ex Rchb.f.; E. *Eltroplectris calcarata* (Sw.) Garay & Sweet.; F. *Encyclia oncidoides* (Lindl.) Schltr.; G. *Epidendrum cinnabarinum* (Salzm.) Lindl.; H. *Epidendrum orchidiflorum* (Salzm.) Lindl.; I. *Epistephium williamsii* Hook.f.; J. *Gomesa barbata* (Lindl.) M.W. Chase & N.H. Williams.; K. *Oeceoclades maculata* (Lindl.) Lindl.; L. *Pachygenium parvum* (Cogn.) Szlach., R. González & Rutk.; M. *Polystachya concreta* (Jacq.) Garay & Sweet.; N. *Prescottia leptostachya* Lindl.; O. *Vanilla palmarum* (Salzm. ex Lindl.) Lindl.; P. *Vanilla phaeantha* Rchb.f. Photographs by Felipe Fajardo Villela Antolin Barberena (A, C, E-P) and Tainan da Silva Sousa (B, D). Figures originally published in Barberena et al. (2018b).

Results

Orchidaceae is represented by 14 genera and 16 species in the PNMR Praia do Forte (Fig. 3), most of which are native to the Neotropics (87%; 14 spp.), including eight restricted to Brazil, highlighting *Catasetum gardneri* Schltr. and *Cyrtopodium flavum* Link & Otto ex Rchb.f., which are also endemic to the Atlantic Forest. The two other species (*Oeceoclades maculata* (Lindl.) Lindl. and *Polystachya concreta* (Jacq.) Garay & Sweet.) are pantropical. *Epidendrum* L. and *Vanilla* Mill. are the only genera represented by two species each.

Campylocentrum robustum Cogn., *Eltroplectris calcarata* (Sw.) Garay & Sweet, *Epistephium williamsii* Hook.f., *Gomesa barbata* (Lindl.) M.W. Chase & N.H. Williams, *O. maculata*, *P. concreta*, *Prescottia leptostachya* Lindl., and *Vanilla palmarum* (Salzm. ex Lindl.) Lindl. occur only in restinga forest formations (50%), while the others are either exclusive to shrub formations (*Cyrtopodium flavum* Link & Otto ex Rchb.f., and *Epidendrum orchidiflorum* (Salzm.) Lindl.) or occur in both phytophysiognomies (*Brassavola tuberculata* Hook., *C. gardneri*, *Encyclia oncidioides* (Lindl.) Schltr., *Epidendrum cinnabarinum* (Salzm.) Lindl., *Pachygenium parvum* (Cogn.) Szlach., R. González & Rutk., and *Vanilla phaeantha* Rchb.f.). The species found are mainly terrestrial (44%; 6 spp.), although there are also characteristic holo-epiphytic species (25%), facultative holo-epiphytes (19%), accidental holo-epiphytes (6%) and secondary hemi-epiphytes (6%). We also highlight that *Cyrtopodium holstii* L.C. Menezes was collected in the district of Praia do Forte (A.M. Miranda et al. 5387 (UB0015899, digital image!)), but not found within the park.

Orchid species from PNMR Praia do Forte can be primarily distinguished by growth type (monopodial or sympodial); thickening of the stem (thickened or not in pseudobulbs); leaves characteristics, notably number (1-4 or multifoliate) and position (apical or distributed along the stem); form (cylindrical, flat or concave) and consistency of leaf blades (membranaceous, papyraceous, subcoriaceous or coriaceous); position (lateral, terminal or axillary) and type of inflorescence (raceme or panicle); in addition to the resupination of the flower (resupinate or non-resupinate) and division of the lip (entire or trilobed), as can be seen in the following key.

Taxonomic treatment

Key to the species of Orchidaceae of the PNMR Praia do Forte, Bahia, Brazil

- 1a. Herb with monopodial growth; inflorescence axillary ..
..... 2
- 1b. Herb with sympodial growth; inflorescence lateral or
terminal 4
- 2a. Leaf blades conduplicate, with apex emarginate, no-
ticeably asymmetrical; flowers calcarate; sepals and
petals white *Campylocentrum robustum* Cogn.
- 2b. Leaf blades convolute, with apex acute, acuminate or
obtuse, symmetrical; flowers non-calcarate; sepals
and petals yellow or green 3
- 3a. Characteristic holo-epiphyte; leaves petiolate, blades
ovate to oval-lanceolate; sepals and petals yellow
..... *Vanilla palmarum* (Salzm. ex Lindl.) Lindl.
- 3b. Secondary hemi-epiphyte; leaves sessile, blades ob-
long; sepals and petals green
..... *Vanilla phaeantha* Rchb.f.
- 4a. Stem thickened in pseudobulb 5
- 4b. Stem not thickened in pseudobulb 10
- 5a. Leaves distributed along the stem 6
- 5b. Leaves apical 8
- 6a. Leaf blades conduplicate; inflorescence terminal
..... *Polystachya concreta* (Jacq.) Garay & Sweet
- 6b. Leaf blades plicate; inflorescence lateral 7
- 7a. Leaf blades narrow-elliptical; inflorescence in raceme;
flowers non-resupinate; lip entire, margin noticeably
fimbriate *Catasetum gardneri* Schltr.
- 7b. Leaf blades linear; inflorescence in panicle (rarely ra-
ceme); flowers resupinate; lip trilobed, central lobe
with entire margin
..... *Cyrtopodium flavum* Link & Otto ex Rchb.f.
- 8a. Leaf blades maculate; inflorescence in raceme; flow-
ers calcarate *Oeceoclades maculata* (Lindl.) Lindl.
- 8b. Leaf blades non-maculate; inflorescence in panicle;
flowers non-calcarate 9
- 9a. Apical leaf 1; inflorescence lateral
.. *Gomesa barbata* (Lindl.) M.W. Chase & N.H. Williams
- 9b. Apical leaves 2-3; inflorescence terminal
..... *Encyclia oncidioides* (Lindl.) Schltr.
- 10a. Leaf blades cylindrical ... *Brassavola tuberculata* Hook.

- 10b. Leaf blades flat to concave 11
- 11a. Stem with 1-4 leaves; leaves petiolate, blade membranaceous to papyraceous 12
- 11b. Stem multifoliate; leaves sessile, blade subcoriaceous to coriaceous 14
- 12a. Leaf blades silvery-green; inflorescence glabrous; flowers non-resupinate, non-calcarate
..... *Prescottia leptostachya* Lindl.
- 12b. Leaf blades dark green to green; inflorescence pilose; flowers resupinate, calcarate 13
- 13a. Leaf blades oblong to linear-lanceolate; flowers pilose; lip entire, margin entire to slightly undulate *Pachygenium parvum* (Cogn.) Szlach., R. González & Rutk.
- 13b. Leaf blades narrow elliptical to ovate; flowers glabrous; lip trilobed, central lobe with noticeably fimbriate margin
..... *Eltroplectris calcarata* (Sw.) Garay & Sweet
- 14a. Leaf blades reticulate-veined; sepals and petals lilac to lilac-white *Epistephium williamsii* Hook.f.
- 14b. Leaf blades obscurely parallel-veined; sepals and petals green or orange to red-orange 15
- 15a. Leaf blades oblong; flowers non-resupinate; lip trilobed, central lobe with noticeably fimbriate margin
..... *Epidendrum cinnabarinum* (Salzm.) Lindl.
- 15b. Leaf blades ovate to lanceolate; flowers resupinate; lip entire, margin sinuate
..... *Epidendrum orchidiflorum* (Salzm.) Lindl.

1. ***Brassavola tuberculata*** Hook., Bot. Mag. 56: t. 2878. 1829. Fig. 3A.

≡ *Bletia tuberculata* (Hook.) Rchb.f., in W.G. Walpers, Ann. Bot. Syst. 6: 434. 1862.

TYPE: BRAZIL. Rio Janeiro, Rio de Janeiro, at the entrance of Botafogo Bay, s.d., *H. Harrison s.n.* (holotype: K000583999? (digital image!)).

Facultative holo-epiphytic herb with sympodial growth; stems not thickened in pseudobulbs; leaf 1, sessile, apical; blade dark green to green, non-maculate, rare maculate, fleshy, cylindrical, conduplicate, linear, apex acute; inflorescence in raceme, terminal, 1-3-flowered, glabrous;

flowers resupinate, non-calcarate; sepals and petals yellowish to brownish-yellow, non-maculate; lip white, greenish-yellow at the base, entire, margin entire.

Distribution and notes: northeastern Argentina, Bolivia, northern, northeastern, southern, southeastern and west-central Brazil, Paraguay (POWO, 2023; van den Berg, 2023). In PNMR Praia do Forte, *Brassavola tuberculata* occurs in shrub and restinga forest formations, and has a population of more than 100 individuals. The species has been observed with flowers and fruits from September to January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 16.IX.2016, fl, fr, F.F.V.A. Barberena et al. 374 (ALCB, UPCB).

2. ***Campylocentrum robustum*** Cogn., Fl. Bras. 3(6): 509. 1906. Fig. 3B.

TYPE: BRAZIL. Rio de Janeiro, Copacabana, 1871, A. Glaziov 5490 (holotype not indicated, lectotype designated by Pessoa and Alves (2019): C, isoelectotypes: P00361631 (digital image!), W).

Characteristic holo-epiphytic herb with monopodial growth; stem not thickened in pseudobulb, multifoliate; leaves sessile, distributed along the stem; blade green, non-maculate, coriaceous, flat, conduplicate, oblong to narrow elliptical, apex emarginate, noticeably asymmetrical; inflorescence in raceme, axillary, 8-14-flowered, glabrous; flowers resupinate, calcarate; sepals and petals white, non-maculate; lip white, entire, margin entire.

Distribution and notes: northeastern and southeastern Brazil (Pessoa, 2023a). In PNMR Praia do Forte, *Campylocentrum robustum* occurs exclusively in restinga forest formations, its population being made up of more than 100 individuals. The species has been observed with flowers and fruits in September.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, s.d., fl, T. S. Sousa 69 (ALCB).



3. ***Catasetum gardneri*** Schltr., *Orchis* 8: 84. 1914. Fig. 3C.

≡ *Monachanthus fimbriatus* Gardner, *Bot. Mag.* 65: t. 3708. 1839.

≡ *Catasetum fimbriatum* (Gardner) Rchb.f., in W. W. Saunders, *Refug. Bot.* 2: t. 83. 1872, nom. illeg.

TYPE: BRAZIL. Pernambuco, s.d., *G. Gardner 1160* (holotype: K000294030 (digital image!)).

Facultative holo-epiphytic herb with sympodial growth; stems thickened in pseudobulbs; leaves 2-4, sessile, distributed along the stem; blade green, non-maculate, chartaceous, flat, plicate, narrow-elliptical, margin entire, apex acute to acuminate; inflorescence in raceme, lateral, multiflowered, glabrous; flowers non-resupinate, non-calcarate; sepals and petals yellowish-green, non-maculate; lip yellowish-green, yellow at the center, entire, margin noticeably fimbriate.

Distribution and notes: northeastern and southeastern Brazil (Petini-Benelli, 2023). In PNMR de Praia do Forte, *Catasetum gardneri* occurs in shrub and restinga forest formations, and has a population of more than 100 individuals. It has been observed with flowers and fruits in December and January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 16.XII.2016, fl, *F. F. V. A. Barberena and T. S. Sousa 393* (ALCB).

4. ***Cyrtopodium flavum*** Link & Otto ex Rchb.f., *Iconogr. Bot. Exot.* 3: 7, t. 214. 1830. Fig. 3D.

TYPE: BRAZIL. Without any other locality, "Hort. Berol.", s.d., *s.leg.* (holotype: not found).

Terricolous herb with sympodial growth; stems thickened in pseudobulbs, multifoliate; leaves sessile, distributed along the stem; blade pale green to green, non-maculate, chartaceous, flat, plicate, linear, apex acute to acuminate; inflorescence in panicle, rare raceme, lateral, multiflowered, glabrous; flowers resupinate,

non-calcarate; sepals and petals yellow to greenish-yellow, non-maculate; lip yellow, trilobed, central lobe with entire margin.

Distribution and notes: northeastern, southern and southeastern Brazil (Batista and Bianchetti, 2023). In PNMR Praia do Forte, *Cyrtopodium flavum* occurs in shrub formations, and has a population of more than 100 individuals. It has been observed with flowers from November to January and fruits from September to January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 8.XI.2016, fl, *T. S. Sousa 23* (ALCB).

5. ***Eltroplectris calcarata*** (Sw.) Garay & Sweet, *J. Arnold Arbor.* 53(3): 390. 1972. Fig. 3E.

≡ *Neottia calcarata* Sw., *Fl. Ind. Occid.* 3: 1413. 1806.

≡ *Stenorhynchos calcaratum* (Sw.) Rich., *De Orchid. Eur.* 37. 1817.

≡ *Collea calcarata* (Sw.) Lindl., *Bot. Reg.* 9: t. 760. 1823.

≡ *Pelexia calcarata* (Sw.) Cogn., *I. Urban, Symb. Antill.* 6: 328. 1909.

≡ *Centrogenium calcaratum* (Sw.) Schltr., *Beih. Bot. Centralbl.* 37(2): 452. 1920.

≡ *Spiranthes calcarata* (Sw.) Jiménez, *Phytologia* 8: 326. 1962.

TYPE: DOMINICAN REPUBLIC. Without any other locality, s.d., *O. P. Swartz s.n.* (holotype: S-R-3752 (digital image!)).

Terricolous herb with sympodial growth; stems inconspicuous, not thickened in pseudobulbs; leaves 1-2(-3), petiolate, basal; blade dark green, non-maculate, membranaceous, flat, convolute, narrow-elliptical to ovate, apex acute to slightly acuminate; inflorescence in raceme, terminal, multiflowered, pilose; flowers resupinate, calcarate; sepals and petals white to greenish-white, non-maculate; lip white, trilobed, central lobe with noticeably fimbriate margin.

Distribution and notes: Bahamas, Bolivia, northeastern, southern and southeastern Brazil, Cayman Island,



Colombia, Cuba, Dominican Republic, Ecuador, Haiti, Jamaica, Paraguay, Peru, Puerto Rico, Suriname, Trinidad and Tobago, United States of America (Florida), Venezuela, Windward Islands (Guimarães, 2023; POWO, 2023). In PNMR Praia do Forte, *Eltroplectris calcarata* occurs exclusively in restinga forest formations, and has a population of more than 100 individuals. It has been observed with flowers and fruits in September and October.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 16.IX.2016, fl, fr, F. F. V. A. Barberena et al. 376 (ALCB, MBM, MG, RB spirit).

6. *Encyclia oncidoides* (Lindl.) Schltr., Orchideen 210. 1914. Fig. 3F.

≡ *Epidendrum oncidoides* Lindl., Edwards's Bot. Reg. 19: t. 1623. 1833.

TYPE: BRAZIL. Rio de Janeiro, s.d., A. Harrison s.n. (holotype: K000583895 (digital image!)).

Facultative holo-epiphytic herb with sympodial growth; stems thickened in pseudobulbs; leaves 2-3, sessile, apical; blade green, non-maculate, coriaceous, flat, conduplicate, oblong to linear, apex acute to rounded; inflorescence in panicle, terminal, multiflowered, glabrous; flowers resupinate, non-calcarate; sepals and petals brownish-yellow to brownish, maculate; lip white to yellow, trilobed, central lobe with entire to undulate margin.

Distribution and notes: northern, northeastern, southern and southeastern Brazil (Bastos et al., 2023). In PNMR Praia do Forte, *Encyclia oncidoides* occurs in shrub and restinga forest formations, and has a population of more than 100 individuals. It has been observed with flowers from September to December and with fruits from October to January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 16.IX.2016, fl, F. F. V. A. Barberena and T. S. Sousa 377 (ALCB, MBM, MG, RB).

7. *Epidendrum cinnabarinum* (Salzm.) Lindl., Gen. Sp. Orchid. Pl. 106. 1830-1840 (1831). Fig. 3G.

TYPE: BRAZIL. Bahia, "in fruticetis sabulosis", s.d., P. Salzmänn s.n. (holotype: K000293879 (digital image!), isotypes: FI011800, G00168900 (digital image!), K000293528 (digital image!), K00293553 (digital image!), LE00001439 (digital image!), LE00006535 (digital image!), MPU017820 (digital image!), MPU017821 (digital image!), MPU017822 (digital image!), MPU017823 (digital image!), P00467527 (digital image!), TUB009605).

Accidental holo-epiphytic herb with sympodial growth; stems not thickened in pseudobulbs, multifoliate; leaves sessile, distributed along the stem; blade green to yellowish-green, non-maculate, coriaceous, flat, conduplicate, oblong, obscurely parallel-veined, apex obtuse to acute; inflorescence in raceme, terminal, multiflowered, glabrous; flowers non-resupinate, non-calcarate; sepals and petals orange to red-orange, non-maculate; lip orange-yellow to orange, trilobed, central lobe with noticeably fimbriate margin.

Distribution and notes: northeastern Brazil (Pessoa, 2023b). In PNMR Praia do Forte, *Epidendrum cinnabarinum* occurs mainly in shrub and infrequently in restinga forest formations and has a population of more than 100 individuals. It has been observed with flowers from October to January and with fruits in December and January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 19.I.2017, fl, F. F. V. A. Barberena and T. S. Sousa 396 (ALCB).

8. *Epidendrum orchidiflorum* (Salzm.) Lindl., Gen. Sp. Orchid. Pl. 103. 1830-1840 (1831). Fig. 3H.

TYPE: BRAZIL. Bahia, "in fruticetis sabulosis", s.d., P. Salzmänn s.n. (holotype: K000293877 (digital image!), isotypes: FI011826, G168860 (digital image!), K00293555 (digital image!), K00293556 (digital image!), LE00006551 (digital image!), MPU 013726 (digital image!), MPU 013727 (digital image!), MPU 013728 (digital image!), P00484658 (digital image!), W0027678 (digital image!)).



Terricolous herb with sympodial growth; stems not thickened in pseudobulbs, multifoliate; leaves sessile, distributed along the stem; blade green to purple, non-maculate, coriaceous, flat, conduplicate, ovate to lanceolate, obscurely parallel-veined, apex acute to rounded; inflorescence in raceme, terminal, 9-10-flowered, glabrous; flowers resupinate, non-calcarate; sepals and petals green, non-maculate to maculate; lip green, entire, margin sinuate.

Distribution and notes: northern, northeastern, southeastern and west-central Brazil, Colombia, Guyana, Peru, Venezuela (Pessoa, 2023b; POWO, 2023). In PNMR Praia do Forte, *Epidendrum orchidiflorum* occurs exclusively in shrub formations, and has a population of more than 100 individuals. It has been observed with flowers and fruits from October to January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 16.XII.2016, fl, F. F. V. A. Barberena and T. S. Sousa 392 (ALCB).

9. *Epistephium williamsii* Hook.f., Bot. Mag. 90: t. 5485. 1865. Fig. 3I.

TYPE: BRAZIL. Bahia, *William s.n.* (not found). Lectotype (designated by Carvalho et al., 2016): original drawing reproduced in t. 5485 in Curtis's Botanical Magazine.

Terricolous herb with sympodial growth; stems not thickened in pseudobulbs, multifoliate; leaves sessile, distributed along the stem; blade green, non-maculate, subcoriaceous to coriaceous, flat to concave, conduplicate, ovate to elliptical, reticulate-veined, apex acute; inflorescence in raceme, terminal, multiflowered, glabrous; flowers resupinate, non-calcarate; sepals and petals lilac to lilac-white, non-maculate; lip white with lilac veins, trilobed, central lobe with undulate margin.

Distribution and notes: northern, northeastern, southeastern and west-central Brazil, Guyana, Paraguay, Venezuela (Meneguzzo, 2023a; POWO, 2023). In PNMR

Praia do Forte, *Epistephium williamsii* occurs exclusively in a marshy area near the borders of the park associated with restinga forest formations, and has a population of less than 50 individuals. It has been observed with flowers and fruits in January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 19.I.2017, fl, F. F. V. A. Barberena and T. S. Sousa 398 (ALCB).

10. *Gomesa barbata* (Lindl.) M.W. Chase & N.H. Williams, Ann. Bot. (Oxford) 104(3): 395. 2009. Fig. 3J.

≡ *Oncidium barbatum* Lindl., Coll. Bot.: t. 27. 1821.

≡ *Alatiglossum barbatum* (Lindl.) Baptista, Colet. Orquídeas Brasil. 3: 87. 2006.

TYPE: BRAZIL. s.d., *Gardner s.n.* (holotype: K000501739 (digital image!)).

Characteristic holo-epiphytic herb with sympodial growth; stems thickened in pseudobulbs; leaf 1, sessile, apical; blade green, non-maculate, chartaceous, flat, conduplicate, oblong, apex acute to slightly retuse; inflorescence in panicle, lateral, multiflowered, glabrous; flowers resupinate, non-calcarate; sepals and petals yellow, maculate; lip yellow, trilobed, central lobe with noticeably ciliate margin.

Distribution and notes: northeastern and southern Brazil (Meneguzzo, 2023b). In PNMR Praia do Forte, *Gomesa barbata* occurs exclusively in restinga forest formations, and has a population of less than 50 individuals. It has not been observed with flowers or fruits. However, there are regional records of the species flowering in October (L. P. Queiroz 883).

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 6.VIII.2022, st, T.S. Sousa 51 (ALCB).

Additional specimen examined: BRAZIL. Bahia, Mata de São João, arredores da cidade, fl, 24.X.1984, L. P. Queiroz 883 (HUEFS).



11. *Oeceoclades maculata* (Lindl.) Lindl., Gen. Sp. Orchid. Pl. 237-238. 1830-1840 (1833). Fig. 3K.

≡ *Angraecum maculatum* Lindl., Coll. Bot. 3: t. 15. May 1821.

≡ *Limodorum maculatum* (Lindl.) G. Lodd., Bot. Cab. 5: t. 496. Jun 1821.

≡ *Aerobion maculatum* (Lindl.) Spreng., Syst. Veg., ed. 16. 3: 718. 1826.

≡ *Eulophia maculata* (Lindl.) Rchb.f., in W.G. Walpers, Ann. Bot. Syst. 6: 647. 1863.

≡ *Eulophidium maculatum* (Lindl.) Pfitzer, Entwurf. Anordn. Orch.: 87. 1887.

≡ *Graphorkis maculata* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 662. 1891.

TYPE: BRAZIL. Cult. in England, without data (lectotype designated by Turner (2016): Lindley, Coll. Bot. 3: t. 15. 1821).

Terricolous herb with sympodial growth; stems thickened in pseudobulbs; leaf 1, sessile, apical; blade green, maculate, coriaceous, flat to slightly concave, conduplicate, oblong to slightly elliptic, apex acute; inflorescence in raceme, lateral, 4-9-flowered, glabrous; flowers resupinate, calcarate; sepals and petals brownish, non-maculate; lip white, pink at the lateral margins, trilobed, central lobe with slightly undulate margin.

Distribution and notes: native to Central Africa and Gulf of Guinea Island, introduced into Southeastern Mexico, Florida, and several countries of Central and South America, including all regions of Brazil (Machnicki-Reis and Smidt, 2023; POWO, 2023). In PNMR Praia do Forte, *Oeceoclades maculata* occurs exclusively in restinga forest formations, and has a population of less than 50 individuals. It has been observed with flowers and fruits in July.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 27.VII.2020, fr, F. F. V. A. Barberena et al. 416 (ALCB).

12. *Pachygenium parvum* (Cogn.) Szlach., R. González & Rutk., Polish Bot. J. 46(1): 5. 2001. Fig. 3L.

≡ *Stenorrhynchos parvum* Cogn., in C. F. P. von Martius & auct. suc. (eds.), Fl. Bras. 3(6): 537. 1906.

≡ *Pelexia parva* (Cogn.) Schltr., Beih. Bot. Centralbl. 37(2): 404. 1920.

TYPE: BRAZIL. Minas Gerais, Serra do Cipó, 22.IV.1892, C. Schwacke 8404 (holotype: BR0000006585457 (digital image!), isotype: RB00542665 (digital image!)).

Terricolous herb with sympodial growth; stems inconspicuous, not thickened in pseudobulbs; leaves 1-4, petiolate, distributed along the stem; blade green, non-maculate, papyraceous, flat, convolute, oblong to linear-lanceolate, apex acute to acuminate; inflorescence in raceme, terminal, multiflowered, pilose; flowers resupinate, calcarate; sepals green to white-greenish, non-maculate; petals white, non-maculate; lip white, with a green longitudinal stripe, entire, margin entire to slightly undulate.

Distribution: northeastern and southeastern Brazil (Barberena et al., 2021; Meneguzzo, 2023c). In PNMR Praia do Forte, *Pachygenium parvum* occurs in shrub and restinga forest formations, and has a population of less than 50 individuals. It has been observed with flowers and fruits in September.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 18.IX.2016, fl, F. F. V. A. Barberena and T. S. Sousa 386 (ALCB, RB spirit).

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

≡ *Epidendrum concretum* Jacq., Enum. Syst. Pl.: 30. 1760.

TYPE: MARTINIQUE. Bois du Pl. Larcher, 2.VIII.1936, M. Privault 136 (neotype designated by Mytnik-Ejsmont & Baranow 2010: P00419738 (digital image!)).



Characteristic holo-epiphytic herb with sympodial growth; stems thickened in pseudobulbs; leaves 2-3, sessile, distributed along the stem; blade green, non-maculate, subcoriaceous, flat to slightly concave, conduplicate, oblong, apex acute; inflorescence in panicle, terminal, multiflowered, glabrous; flowers non-resupinate, non-calcarate; sepals and petals pale green, non-maculate; lip white to greenish-white, trilobed, central lobe with slightly undulate margin.

Distribution and notes: pantropical, including northern and west-central Brazil (Meneguzzo, 2023d; POWO, 2023). In PNMR Praia do Forte, *Polystachya concreta* occurs exclusively in restinga forest formations, and has a population of less than 50 individuals. It has been observed with flowers and fruits in February.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 12.II.2017, fr, F. F. V. A. Barberena and T. S. Sousa 401 (ALCB).

14. *Prescottia leptostachya* Lindl., Edwards's Bot. Reg. 22: sub t. 1915 (err. typ. t. 1916). 1836. Fig. 3N.

TYPE: BRAZIL. Bahia, "in fruticetis sabulosis", s.d., *P. Salzmann s.n.* (holotype K-L000293872 (digital image!), isotypes: K000293363 (digital image!), K000293364 (digital image!), P00366657 (digital image!), W646 (digital image!)).

Terricolous herb with sympodial growth; stems inconspicuous, not thickened in pseudobulbs; leaves 1-3, petiolate, basal; blade silvery-green, non-maculate, membranaceous, flat, convolute, elliptical to oblong, apex acute to acuminate; inflorescence in raceme, terminal, multiflowered, glabrous; flowers non-resupinate, non-calcarate; sepals and petals green, non-maculate; lip green, entire, margin entire.

Distribution and notes: northeastern Brazil, restricted to the state of Bahia (Meneguzzo, 2023e). In PNMR Praia do Forte, *Prescottia leptostachya* occurs exclusively in restinga forest formations, and has a population of less than 50

individuals. It has been observed with flowers and fruits in January and February.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 12.II.2017, fr, F.F.V.A. Barberena and T.S. Sousa 400 (ALCB).

15. *Vanilla palmarum* (Salzm. ex Lindl.) Lindl., Gen. Sp. Orchid. Pl. 436. 1830-1840 (1840). Fig. 3O.

≡ *Epidendrum palmarum* Salzm. ex Lindl., Gen. Sp. Orchid. Pl.: 436. 1840.

TYPE: BRAZIL. Bahia, s.d., *P. Salzmann s.n.* (holotype: K000293881 (digital image!), isotypes: G00190804 (digital image!), G00190913 (digital image!), K000293255 (digital image!), LE00006463 (digital image!), MPU013457 (digital image!), MPU018359 (digital image!), MPU018360 (digital image!)).

Characteristic holo-epiphytic with monopodial growth; stems not thickened in pseudobulbs, multifoliate; leaves petiolate, distributed along the stem; blade green to yellowish-green, non-maculate, coriaceous, flat, convolute, ovate to oval-lanceolate, apex acute to obtuse, symmetrical; inflorescence in raceme, axillary, multiflowered (flowers open one by one consecutively), glabrous; flowers resupinate, non-calcarate; sepals and petals yellow, non-maculate; lip yellow, entire, margin undulate.

Distribution and notes: northern, northeastern, southeastern and west-Central Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, Venezuela (Barberena et al., 2019b; FFB, 2023; POWO, 2023). In PNMR Praia do Forte, *Vanilla palmarum* occurs exclusively in restinga forest formations, and has a population of more than 100 individuals. It has been observed with flowers and fruits from September to January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 22.X.2016, fl, F. F. V. A. Barberena and T. S. Sousa 390 (ALCB).



16. *Vanilla phaeantha* Rchb.f., Flora 48(18): 274. 1865. Fig. 3P.

TYPE: CUBA. s.d., *C. Wright 3351* (lectotype designated by Karremans et al. (2020): K000463762 (digital image!), specimen on the left; isolectotypes: W43472 (W0253997 digital image!), illustration; AMES 00090738, specimen on the left; MO 2056007, segment in top left corner; G 00190805, specimen on the far right; GOET 008712, flower; MA 607142, top, center segment; BM 000062803).

Secondary hemi-epiphytic with monopodial growth; stems not thickened in pseudobulbs, multifoliate; leaves sessile, distributed along the stem; blade green, non-maculate, coriaceous, flat, convolute, oblong, apex acute to acuminate, symmetrical; inflorescence in raceme, axillary, multiflowered (flowers open one by one consecutively), glabrous; flowers resupinate, non-calcarate; sepals and petals green, non-maculate; lip white, with longitudinal yellow veins, yellow-green to yellow at the apex, entire, margin undulate.

Distribution: Bahamas, northern, northeastern, southeastern and west-central Brazil, Colombia, Costa Rica, Cuba, Dominican Republic, El Salvador, Jamaica, southeastern Mexico, Panama, Trinidad-Tobago, United States of America (Florida), Venezuela, Windward Islands (Karremans et al., 2020; FFB, 2023; POWO, 2023). In PNMR Praia do Forte, *Vanilla phaeantha* occurs in shrub and restinga forest formations, and has a population of more than 100 individuals. It has been observed with flowers in January.

Specimen examined: BRAZIL. Bahia, PNMR Praia do Forte, 12.II.2017, fl, F. F. V. A. Barberena and T. S. Sousa 399 (ALCB).

Discussion

A preliminary checklist of the Angiosperm flora of the PNMR Praia do Forte included nine species of Orchidaceae (DOMMSJ, 2013). However, the nomenclature of these taxa is outdated and there is no voucher associated with the list presented, making it impossible to confirm taxonomic identities. Thus, this is the first work to present a taxonomic

study of Orchidaceae in the PNMR Praia do Forte, with photos, diagnostic descriptions and testimonial material for the species.

Five species of orchids from the PNMR Praia do Forte (*Cyrtopodium flavum*, *Eltroplectris calcarata*, *Encyclia oncidioides*, *Epidendrum cinnabarinum* and *Gomesa barbata*) had their status for conservation evaluated at the national level and were classified as Least Concern (FFB, 2023). The other species have not yet been evaluated, but, as they have wide geographic distributions, it is likely that they are also not at imminent risk of extinction. Nonetheless, many Orchidaceae species are subject to predatory collection due to their high ornamental value, often resulting in population reduction or local suppression, this scenario being more likely in areas where the plants are more easily accessed (Cruz et al., 2003; Barberena et al., 2018a), as is the case with restingas. In the PNMR Praia do Forte, we observed that some species have small populations (<50 individuals) and restricted local distribution, and, therefore, require the attention of managers, in order to implement possible management and conservation actions and prevent them from being suppressed locally. This is the case of *Epistephium williamsii*, *Gomesa barbata*, *Oeceoclades maculata*, *Pachygenium parvum*, *Polystachya concreta* and *Prescottia leptostachya*.

The other species occur in several localities or throughout the park and have populations of more than 100 individuals, which is why, for the moment, we consider them not to be locally threatened. Even so, we have records of predatory collections of flowering individuals of the ornamental species *Cyrtopodium flavum* and *Encyclia oncidioides* in the PNMR Praia do Forte, which also reinforces the need for greater surveillance and environmental education actions among local residents and tourists. The orchid flora of the PNMR Praia do Forte is very similar to that of the Área de Proteção Ambiental das Lagoas e Dunas do Abaeté - a Conservation Unit for Sustainable Use in Bahia and also a restinga fragment - with which it shares 12 species (Barberena et al., 2019a; 2021). This floristic similarity may be related to the relative proximity between the areas, which are approximately 60 km apart each other. In this way, joint conservation and ecosystem protection strategies can be planned regionally.



Author contributions

FFVAB and TSS collected the field data and provided photos. FFVAB identified and described the specimens. NR guided the work and provided significant suggestions during the study. All authors contributed to preparation and critical revision of the manuscript, and had the opportunity to read and approve the final manuscript.

Funding

FFVAB thanks the Fundação de Amparo à Pesquisa do Estado da Bahia (FAPESB) for financial support to the project “Estudos florísticos, taxonômicos e ecológicos em Orchidaceae em remanescentes florestais e de restinga na região metropolitana de Salvador, Bahia, Brasil” (DCR0028/2015). FFVAB and NR thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico for the fellowship grants (313237/2015-8(FFVAB) and 311379/2022-2(NR)).

Acknowledgments

We are grateful to Fabio Lima Braga de Jesus, manager of the Parque Natural Municipal da Restinga de Praia do Forte, for granting permission to conduct the fieldwork, to Paulo Limoncic for providing us with accommodation during some field expeditions, and to Deivid Lucas de Lima da Costa for producing the map of the study area.

Literature cited

- Alvares, C. A., J. L. Stape, P. C. Sentelha, J. L. M. Gonçalves and G. Sparovek. 2013. Köppen's climate classification map for Brazil. *Meteorologische Zeitschrift* 22(6): 711-728. DOI: <https://doi.org/10.1127/0941-2948/2013/0507>
- Azevedo, C. O. and C. van den Berg. 2007. Análise comparativa de áreas de campo rupestre da Cadeia do Espinhaço (Bahia e Minas Gerais, Brasil) baseada em espécies de Orchidaceae. *Sitientibus Série Ciências Biológicas* 7(3): 199-210.
- Azevedo, C. O., M. C. Santos and L. C. Marinho. 2021. Orchidaceae no município de Vitória da Conquista, Bahia: lista de espécies e similaridade florística entre áreas da Bahia e Minas Gerais. *Paubrasilia* 4: e0065. DOI: <https://doi.org/10.33447/paubrasilia.2021.e0065>
- Barberena, F. F. V. A., J. F. A. Baumgratz and F. Barros. 2018a. Ecological data for an orchid diversity hotspot show that the subtribe Laeliinae may be endangered in the Brazilian Atlantic Forest. *Nordic Journal of Botany* 36(7): e01728. DOI: <https://doi.org/10.1111/njb.01728>
- Barberena, F. F. V. A., T. S. Sousa and N. Roque. 2018b. Orchidaceae of Parque Natural Municipal da Restinga de Praia do Forte. *Field Museum Field Guide*. <https://fieldguides.fieldmuseum.org/guides/guide/1036/> (consulted October, 2023).
- Barberena, F. F. V. A., T. S. Sousa and J. A. L. Rocha Junior. 2019a. Mapping threats to the orchid populations in an environmental protection area in Bahia, Northeast Brazil. *Oecologia australis* 23(2): 346-356. DOI: <https://doi.org/10.4257/oeco.2019.2302.12>
- Barberena, F. F. V. A., T. S. Sousa, B. S. Ambrosio-Moreira and N. Roque. 2019b. What are the species of phorophytes of *Vanilla palmarum* (Orchidaceae) in Brazil? An assessment of emblematic specificity with palm tree species. *Rodriguésia* 70: e02732017. DOI: <https://doi.org/10.1590/2175-7860201970037>
- Barberena, F. F. V. A., T. S. Sousa and N. Roque. 2021. Orchidaceae in a fragment of restinga on the north coast of Bahia, Brazil. *Rodriguésia* 72: e00852020. DOI: <https://doi.org/10.1590/2175-7860202172078>
- Barberena, F. F. V. A., R. Silva and R. C. Lopes. 2022. Copacabana is more than a beach in Rio de Janeiro, Brazil: the orchid flora of Parque Estadual da Chacrinha. *Caldasia* 44(1): 30-40. DOI: <https://doi.org/10.15446/caldasia.v41n1.88156>
- Bastos, C. A., T. E. C. Meneguzzo and C. van den Berg. 2023. *Encyclia*. In: *Flora e Funga do Brasil*. Jardim Botânico do Rio de Janeiro. <https://floradobrasil.jbrj.gov.br/FB11498/> (consulted October, 2023).
- Batista, J. A. N. and L. B. Bianchetti. 2023. *Cyrtopodium*. In: *Flora e Funga do Brasil*. Jardim Botânico do Rio de Janeiro. <https://floradobrasil.jbrj.gov.br/FB11443/> (consulted October, 2023).
- Benzing, D. H. 1990. *Vascular epiphytes, general biology and related biota*. Cambridge University Press. Cambridge, UK. 354 pp.
- Carvalho, D. N., T. E. C. Meneguzzo and C. van den Berg. 2016. Orchidaceae of Bahia, Brazil: notes on taxonomy and



- nomenclature. *Phytotaxa* 272(3): 231-234. DOI: <https://doi.org/10.11646/phytotaxa.272.3.10>
- CONAMA. 2009. Resolução Conama nº 417, de 23 de novembro de 2009. Conselho Nacional do Meio Ambiente. <https://www.ibama.gov.br/sophia/cnia/legislacao/CONAMA/RE0417-231109.PDF> (consulted November, 2023).
- CRIA. 2023. Centro de Referência em Informação Ambiental. Orchidaceae. <https://specieslink.net/search/> (consulted, October 2023).
- Cruz, D. T., E. L. Borba and C. van den Berg. 2003. O gênero *Cattleya* Lindl. no estado da Bahia, Brasil. *Sitientibus série Ciências Biológicas* 3(1/2): 26-34.
- DOMMSJ. 2008. Lei nº 367/2008. Cria o Parque Natural Municipal da restinga de Praia do Forte e dá outras providências. Diário Oficial do Município de Mata de São João. <https://www.matadesaojoao.ba.gov.br/Site/DiarioOficial> (consulted October, 2023).
- DOMMSJ. 2013. Decreto nº 59 de 18 de janeiro de 2013. Aprova o Plano de Manejo do “Parque Natural Municipal da Restinga de Praia do Forte” e dá outras providências. Diário Oficial do Município de Mata de São João. <https://www.matadesaojoao.ba.gov.br/Site/DiarioOficial> (consulted October, 2023).
- Dressler, R. L. 1981. *The Orchids, natural history and classification*. Harvard University Press. Cambridge, United Kingdom. 332 pp.
- FFB. 2023. Orchidaceae. Flora e Funga do Brasil. <http://floradobrasil.jbrj.gov.br> (consulted October, 2023).
- Filgueiras, T. S., P. E. Nogueira, A. L. Brochado and G. F. Guala II. 1994. Caminhamento: um método expedito para levantamentos florísticos qualitativos. *Cadernos de Geociências* 12: 39-43.
- Gomes, F. S. and M. L. S. Guedes. 2014. Flora vascular e formas de vida das formações de restinga do litoral norte da Bahia, Brasil. *Acta Biológica Catarinense* 1: 22-43.
- Guimarães, L. R. S. 2023. *Eltroplectris*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. <https://floradobrasil.jbrj.gov.br/FB11491/> (consulted October, 2023).
- INEMA. –2023. APA Litoral Norte do Estado da Bahia. Instituto do Meio Ambiente e Recursos Hídricos. <http://www.inema.ba.gov.br/gestao-2/unidades-de-conservacao/apa/apa-litoral-norte-do-estado-da-bahia> (consulted October, 2023).
- Johnson, A. E. 2001. *Las Orquídeas del Parque Nacional Iguazú*. L.O.L.A. Buenos Aires, Argentina. 296 pp.
- JSTOR. 2023. JSTOR Global Plants. <https://plants.jstor.org/> (consulted November, 2023).
- Karremans, A. P., I. F. Chinchilla, G. Rojas-Alvarado, M. Cedeño-Fonseca, A. Damian and G. Léotard. 2020. A reappraisal of Neotropical *Vanilla*, with a note on taxonomic inflation and the importance of alpha taxonomy in biological studies. *Lankesteriana* 20(3): 395-497. DOI: <https://doi.org/10.15517/lank.v20i3.45203>
- Lehnebach, C. A. 2003. Preliminary checklist of the orchids of Chile. *Botanical Journal of the Linnean Society* 143(4): 449-451. DOI: <https://doi.org/10.1111/j.1095-8339.2003.00240.x>
- Lima, C. E. O. and C. O. Azevedo. 2023. Orchidaceae em um fragmento de Mata de Cipó em Poções, Bahia. *Paubrasilia* 6: e0107. DOI: <http://dx.doi.org/10.33447/paubrasilia.2023.e0107>
- Machnicki-Reis, M. and E. C. Smidt. 2023. *Oeceoclades*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. <https://floradobrasil.jbrj.gov.br/FB11941/> (consulted October, 2023).
- Marinho, L. C. and C. O. Azevedo. 2013. Orchidaceae na Reserva do Poço Escuro, Vitória da Conquista, Bahia, Brasil. *Sitientibus Série Ciências Biológicas* 13: 10.13102/scb213. DOI: <https://doi.org/10.13102/scb213>
- Meneguzzo, T. E. C. 2023a. *Epistephium*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB11583/> (consulted October, 2023).
- Meneguzzo, T. E. C. 2023b. *Gomesa*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB11608/> (consulted October, 2023).
- Meneguzzo, T. E. C. 2023c. *Pachygenium*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB68509/> (consulted October, 2023).
- Meneguzzo, T. E. C. 2023d. *Polystachya*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB12067/> (consulted October, 2023).
- Meneguzzo, T. E. C. 2023e. *Prescottia*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil.



- <https://floradobrasil.jbrj.gov.br/FB12077/> (consulted October, 2023).
- Menezes, C. M. 2007. A vegetação de restinga no litoral norte da Bahia, influência da evolução quaternária da zona costeira: estudo de caso Fazenda Riacho das Flores, Mata de São João, Bahia. M.S. thesis. Instituto de Geociências. Universidade Federal da Bahia. Salvador, Brasil. 96 pp.
- MPEB. 2023. A Mata Atlântica na Bahia. Ministério Público do Estado da Bahia. <http://www.ceama.mp.ba.gov.br/mata-atlantica.html?id=1353/> (consulted October, 2023).
- Mytnik-Ejsmont, J. and P. Baranow. 2010. Taxonomic study of *Polystachya* Hook. (Orchidaceae) from Asia. *Plant Systematics and Evolution* 290: 57-63. DOI: <https://doi.org/10.1007/s00606-010-0348-4>
- Pessoa, E. M. 2023a. *Campylocentrum*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB11267/> (consulted October, 2023).
- Pessoa, E. M. 2023b. *Epidendrum*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB11518/> (consulted October, 2023).
- Pessoa, E. M. and M. Alves. 2019. Taxonomic Revision of *Campylocentrum* sect. *Laevigatum* E. M. Pessoa & M. W. Chase (Orchidaceae-Vandae-Angraecinae). *Systematic Botany* 44(1): 115-132. DOI: <https://doi.org/10.1600/036364419X697967>
- Petini-Benelli, A. 2023. *Catasetum*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB11312/> (consulted October, 2023).
- POWO. 2023. Orchidaceae. Plants of the World Online (POWO). Kew, UK. <https://powo.science.kew.org/> (consulted October, 2023).
- QGIS. 2023. QGIS Development Team 3.30. Geographic Information System User Guide. QGIS Association, Open Source Geospatial Foundation. https://docs.qgis.org/3.30/en/docs/user_manual/index.html (consulted October, 2023).
- Queiroz, E. P., D. B. O. S. Cardoso and M. H. S. Ferreira. 2012. Composição florística da vegetação de restinga da APA Rio Capivara, litoral norte da Bahia, Brasil. *Sitientibus série Ciências Biológicas* 12(1): 119-141.
- Radford, A. E., W. C. Dickison, J. R. Massey and C. R. Bell. 1974. *Vascular plant systematics*. Harper & Row. New York, USA. 891 pp.
- Rêgo, H. T. and C. O. Azevedo. 2017. Sinopse das Orchidaceae do Parque Nacional de Boa Nova, BA, Brasil. *Hoehnea* 44(1): 70-89. DOI: <https://doi.org/10.1590/2236-8906-44/2016>
- Santos, M. G. and C. O. Azevedo. 2022. New records of Orchidaceae for the Northeast of Brazil. *Paubrasilia* 5: e0088. DOI: <https://doi.org/10.33447/paubrasilia.2022.e0088>
- Thiers, B. 2023. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/science/ih/> (consulted September, 2023).
- Turner, I. M. 2016. Rather for the nomenclaturist than for the scientific botanist: The Botanical Cabinet of Conrad Loddiges & Sons. *Taxon* 65(5): 1136. DOI: <https://doi.org/10.12705/655.13>
- van den Berg, C. 2023. *Brassavola*. In: Flora e Funga do Brasil. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brasil. <https://floradobrasil.jbrj.gov.br/FB11228/> (consulted October, 2023).
- Vieira, T. L., F. Barros and N. Roque. 2014. Orchidaceae no município de Jacobina, estado da Bahia, Brasil. *Hoehnea* 41(3): 469-482. DOI: <https://doi.org/10.1590/S2236-89062014000300012>

