



Nymphaea vanildae (Nymphaeaceae): A new species from the Caatinga in Brazil

CARLA TEIXEIRA DE LIMA¹ & ANA MARIA GUILIETTI^{1,2}

¹ Programa de Pós-graduação em Botânica da Universidade Estadual de Feira de Santana. Av. Transnordestina, s/n, Novo Horizonte, 44036-900, Feira de Santana-BA, Brasil. E-mail: carlabotanica@yahoo.com.br

² Royal Botanic Gardens, Kew, TW93AB, England. E-mail: anagiulietti@hotmail.com

Abstract

Nymphaea vanildae (Nymphaeaceae) is described and illustrated as a new species from the Caatinga region in Brazil, and placed in *Nymphaea* subg. *Hydrocallis*. This species is characterized by having nocturnal flowers, elliptic and delicate leaves, a clear distinction between the perianth and androecium, linear carpellary appendages and four or more series of proliferate pseudanthia, which distinguishes it from all species in the genus.

Key words: Aquatic plants, carpellary appendages, proliferate pseudanthium, water lily

Resumo

Nymphaea vanildae (Nymphaeaceae) é descrita e ilustrada como uma nova espécie do Brasil, do Bioma Caatinga, e incluída em *Nymphaea* subg. *Hydrocallis*. É caracterizada por ter flores noturnas, pelo limbo foliar elíptico e membranáceo; distinção evidente entre o perianto e o androceu, apêndices carpelares lineares e a presença de quatro ou mais séries de pseudanto-proliferantes, o que a distingue de qualquer outra espécie dentro do gênero.

Palavras-chave: Apêndice carpelar, nenúfar, pseudanto-proliferante, planta aquática

Introduction

The genus *Nymphaea* Linnaeus (1753: 510) includes ca. 50 species with a cosmopolitan distribution. This number represents more than half of the species in Nymphaeales, which comprise the Nymphaeaceae, Cabombaceae and Hydatellaceae (Bosch et al. 2008, APG III 2009).

Species of *Nymphaea* are aquatic, perennial plants, with erect or horizontal underground stems, and floating, elliptic to orbicular leaf blades with a sagittate base. The solitary flowers are emergent, with many sepals, petals, stamens and carpels, united or free, and parietal or laminar placentation. Anthesis is diurnal or nocturnal. Fruits are berrylike, developing under water (Caspery 1878, Conard 1905, Wiersema 1987, Lima 2011, Lima et al. 2012).

In Brazil 18 species of *Nymphaea* are currently recognised (Amaral 2010). Nine of these species occur in the Caatinga of the Northeast, and six of them in Bahia (Lima et al. 2012). During fieldwork for a revision of the Brazilian species of *Nymphaea*, a new species was collected in the Caatinga Biome in the southwestern part of Pernambuco State.

Taxonomic treatment

Nymphaea vanildae C.T. Lima & Giul., *sp. nov.* (Figs. 1–4).

A new species characterised by nocturnal flowers, elliptic and delicate leaves, a clear distinction between the perianth and androecium, linear carpellary appendages and four or more series of proliferate pseudanthia.

Type: —BRAZIL. Pernambuco: Lagoa Grande, BR 122 road, about 50 km from Petrolina.

9°59'29"S, 40°16'7"W. Small lake on the right side of the road, 23 April 2011 (fl.), C.T. Lima & S.G. Lima 500 (holotype HUEFS!, isotypes HUEFS!, K!, NY!, RB!).

Aquatic herbs, floating-fixed; *stems* tuberous, cylindrical; *roots* contractile, white. *Petioles* 30–150 × 0.3–0.5 cm, green to chestnut-brown, glabrous, median air canals four, surrounded by eight minor peripheral air canals; very brittle. *Leaf* blades membranaceous to subcoriaceous, elliptic, apices obtuse, adaxial surfaces green with red tonality and vinaceous spots, abaxial surfaces slightly chestnut-brown, 18.5–25.3 × 13.2–14.8 cm, basal lobes 8.4–8.9 cm long, margins entire, central veins slightly prominent, lateral veins not prominent. *Peduncles* 40–120 × 0.57–0.65 cm, chestnut-brown, very brittle, median air canals five, surrounded by ten minor peripheral air canals. *Flowers* closed 6.2–8.3 × 2.9–3.5 cm, ovoid, apices acute, bases truncate; *sepals* 3–4, 7.8–8.3 × 3.3–3.7 cm, lanceolate, apices acute, green with vinaceous spots, veins not evident; *petals* 18–21, lower ones elliptic, 6.7–6.8 × 2.6–2.9 cm, changing upward to narrowly elliptic, 5.3–5.6 × 1.5–1.8 cm, white, apices acute, veins evident; *stamens* 98–100, external series 4.2–4.4 × 1.0–1.1 cm, filaments white, terminal prolonged connectives 0.2–0.4 mm, white to cream, anthers 4–5 mm, cream to light-yellow; internal series 2.1–2.4 × 0.19–1.22 cm, filaments vinaceous, terminal prolonged connective absent, anthers 5–7 mm, cream to light-yellow; *carpels* 21–25, carpellary appendages 7.5–9.0 × 2.0–2.8 mm, linear, flat, apices rounded, vinaceous with cream apices and bases. *Fruits* not seen. *Proliferate pseudanthia* includes a primary proliferate pseudanthium with 3–4 sepals green to chestnut-brown with red spots, with a short central stem, to the apex with a new proliferate pseudanthium of second, third, fourth, fifth and/or sixth order.

Phenology and Floral Biology:—Collected in flower between January and March, in the area where the type collection was made. In April a long drought affected the region and the lake completely dried up. Fruit were not seen. The second collection of the species was in June in an area close to where the type collection was made. The small lake was almost dry and the plants were dwarfed, due to the drought that continued at least up to the end of the year. Each of these small plants developed from a single proliferate pseudanthium that commenced vegetative growth.

Nymphaea vanildae has protogynous flowers with two nights of anthesis. On the first night the flowers open around 8:00 pm and close at 11:00 pm. The flower emits a strong odour of acetone and the receptive stigmatic region appears bright and moist. The carpel appendages and the stamens are perpendicular to the surface of the water, and the anthers are closed. On the second night of anthesis the sepals and petals of the flowers open at 7:00 pm, but the anthers remain closed and the carpel appendages cover the stigmatic region, which appears dull and dry. At 8:00 pm the three series of the outer stamens are perpendicular to the water surface and the anthers begin to release pollen grains. Also there is a change in the position of the inner series of stamens and the anthers begin to release the pollen. Around midnight all the flowers are closed and they tumble over the water, starting the process of decomposition. This procedure is indicative of the absence of pollination, since in all species of *Nymphaea* subg. *Hydrocallis* (Planchon) Conard (1905: 200) the flower closes after pollination and the peduncle bends and submerges the flower, after which the fruit will develop.

Habitat and distribution:—*Nymphaea vanildae* is restricted to a small area in a temporary small lake near the São Francisco River, in Pernambuco State (Fig. 3). The two other species of the genus common in the same region are *Nymphaea lasiophylla* Mart. & Zucc. in Zuccarini (1832: 364) and *N. pulchella* De Candolle (1821: 51), the first occurring sympatrically with *N. vanildae*.

Etymology:—The specific epithet was chosen to commemorate the late Maria Vanilda Morais Oliveira, technician in the Plant Taxonomy Laboratory of the Universidade Estadual de Feira de Santana, who, for many years, supported teachers and students taking various botany courses. She was an enthusiastic amateur botanist and took a special interest in plants of medicinal use.

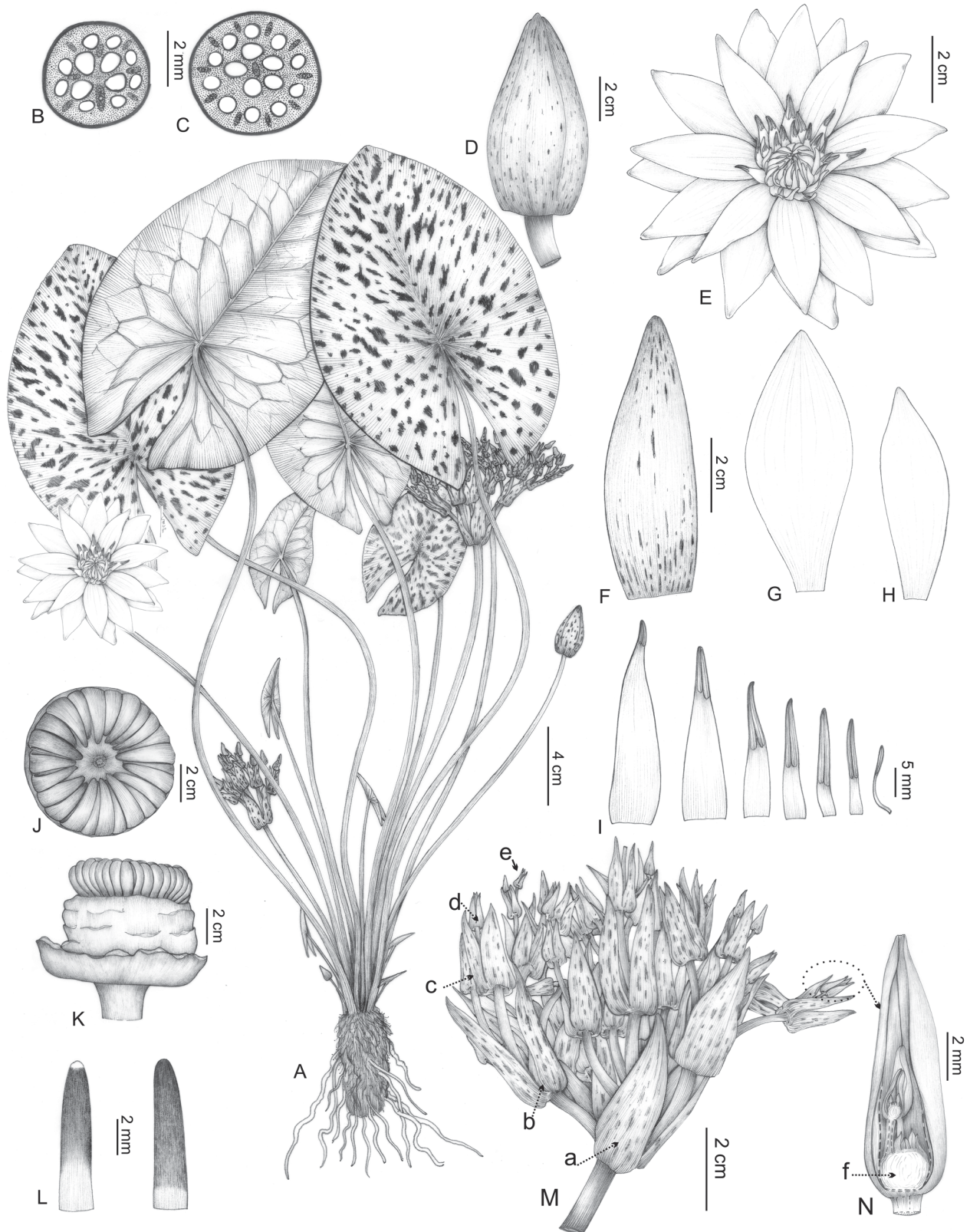


FIGURE 1. *Nymphaea vanildae* A. Habit; B. Detail of transverse section of the petiole; C. Detail of transverse section of the peduncle; D. Closed flower; E. Open flower; F. Sepal; G. Larger petal; H. Smaller petal; I. Stamen sequence; J. Gynoecium; view from the top; K. Gynoecium; side view; L. Carpellary appendages; M. Complete proliferate pseudanthium; a. Primary proliferate pseudanthium; b. Proliferate pseudanthium of second order; c. Proliferate pseudanthium of third order; d. Proliferate pseudanthium of fourth order; e. Proliferate pseudanthium of fifth order; N. Longitudinal section of the isolated proliferate pseudanthium; f. the arrow indicates the stem. (From C.T. Lima & S.G. Lima 500). Drawn by Carla de Lima.

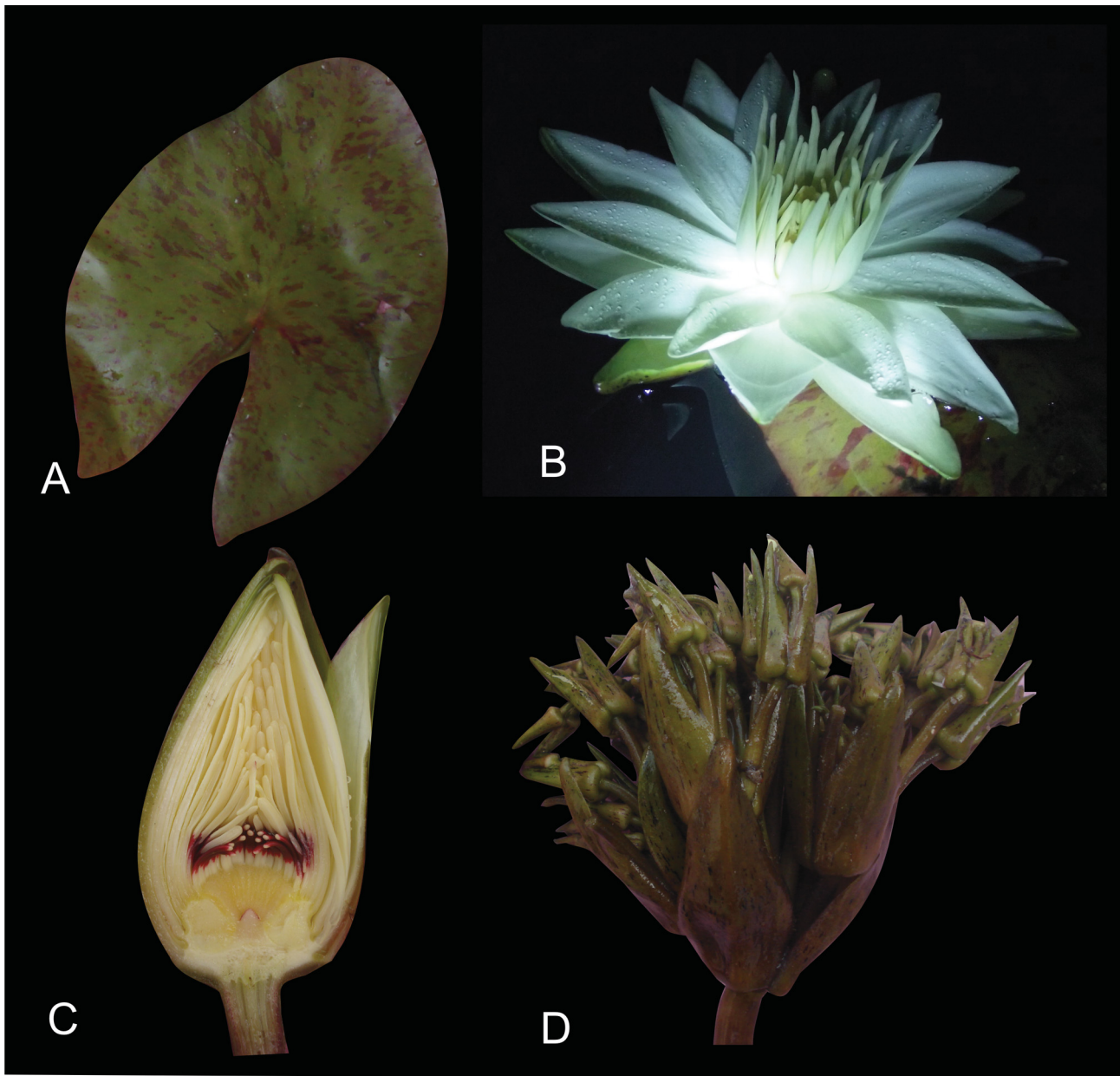


FIGURE 2. *Nymphaea vanildae* **A.** Leaf; **B.** Flower in anthesis; **C.** Longitudinal section of the flower; **D.** Complete proliferate pseudanthium (from *C.T. Lima & S.G. Lima 500*).

Additional specimens examined (paratypes):—Brazil. Pernambuco: Santa Maria da Boa Vista, BR 122 road, about 80 km from Petrolina. 8°47'17"S, 39°49'22"W, 12 June 2011 (st.), *C.T. Lima & S.G. Lima 506* (HUEFS!, B!, K!, CEPEC!). Pernambuco: Santa Maria da Boa Vista, BR 428 road, Km 76. 25 June 1982 (st.), *J. Wiersema et al. 2296* (IPA!).

Affinities and notes on critical characters:—*Nymphaea vanildae* has flowers with nocturnal anthesis, the petals are not spirally arranged, the ovary is syncarpic and has a Neotropical distribution, therefore it is included in *Nymphaea* subg. *Hydrocallis*, sensu Wiersema (1987). The species can be characterized by the vegetative morphology, with elliptic, membranaceous to subcoriaceous leaves that have a green chestnut-brown coloration and vinaceous spots, and brittle petiole. Such characters differentiate this species from the two other water lilies occurring in this semiarid region.

The clear distinction between perianth and androecium and the presence of a proliferating pseudanthium associates *N. vanildae* with *N. lasiophylla* and *N. lingulata* Wiersema (1984: 214). Both species are widely

distributed in the semiarid region (Fig. 4). *Nymphaea vanildae* presents 18–21 petals which distinguish it from *N. lingulata* with 8–14 petals, but *N. lasiophylla* presents 16–26 petals. *Nymphaea vanildae* is distinguished from these species by the presence of a primary proliferating pseudanthium with four to six secondary proliferating pseudanthia, while *N. lasiophylla* and *N. lingulata* present only one or two secondary proliferating pseudanthia. *Nymphaea vanildae* also has linear carpellary appendages, unlike other species of *Nymphaea* subg. *Hydrocallis*, where the appendages are lingulate or clavate.

Due to the presence of proliferating pseudanthia with more than three series, *N. vanildae* is similar to *N. prolifera* Wiersema, a species described as occurring from northern Argentina to Central America (Wiersema 1984). Both have similar coloration and numbers of sepals, in both the flowers and the pseudanthia. Analysis of the specimens *Walter 136* (K), *Pedersen 8094* (K), *7743* (K) and *8335* (K), all cited by Wiersema (1984), showed that *N. prolifera* possesses flowers with strongly clavate carpellary appendages and 3 to 4 series of proliferating pseudanthia alternating spirally with series of leaves, as well as ovate leaves lacking spots on the lamina, whereas *N. vanildae* has elliptic leaves, the lamina strongly spotted and with linear carpellary appendages.

The combination of the above-mentioned characters makes *N. vanildae* a unique species from any other in the genus.



FIGURE 3. Distribution map of ●*Nymphaea vanildae*, △*N. lasiophylla* and □*N. lingulata*.

Note:—*Wiersema et al.* 2296 (IPA) was collected in SW Pernambuco and was identified as a natural hybrid between *Nymphaea amazonum* subsp. *amazonum* and *N. lasiophylla*. Wiersema (1987) stated that this conclusion was based on morphological and chemical evidence. Our analysis of *Wiersema et al.* 2296 shows it is conspecific with *Nymphaea vanildae*. In our morphological analyses, few characters of *Nymphaea vanildae* matched those of *N. amazonum* subsp. *amazonum*. Furthermore, no populations of *N. amazonum* subsp. *amazonum* and *N. lasiophylla* occur sympatrically in the Caatinga. However, new studies on the reproductive biology and molecular analyses are in progress to identify whether *Nymphaea vanildae* is of hybrid origin, and if so, which parental species would be involved.

Conservation status:—This species is estimated to be Critically Endangered (CR B1 ab), with occurrence estimated to be less than 100 km² in an extremely fragmented area. The lakes in the semiarid region, particularly in the Caatinga, are a priority for conservation in Northeast Brazil, especially with the current level of ongoing anthropogenic disturbance.

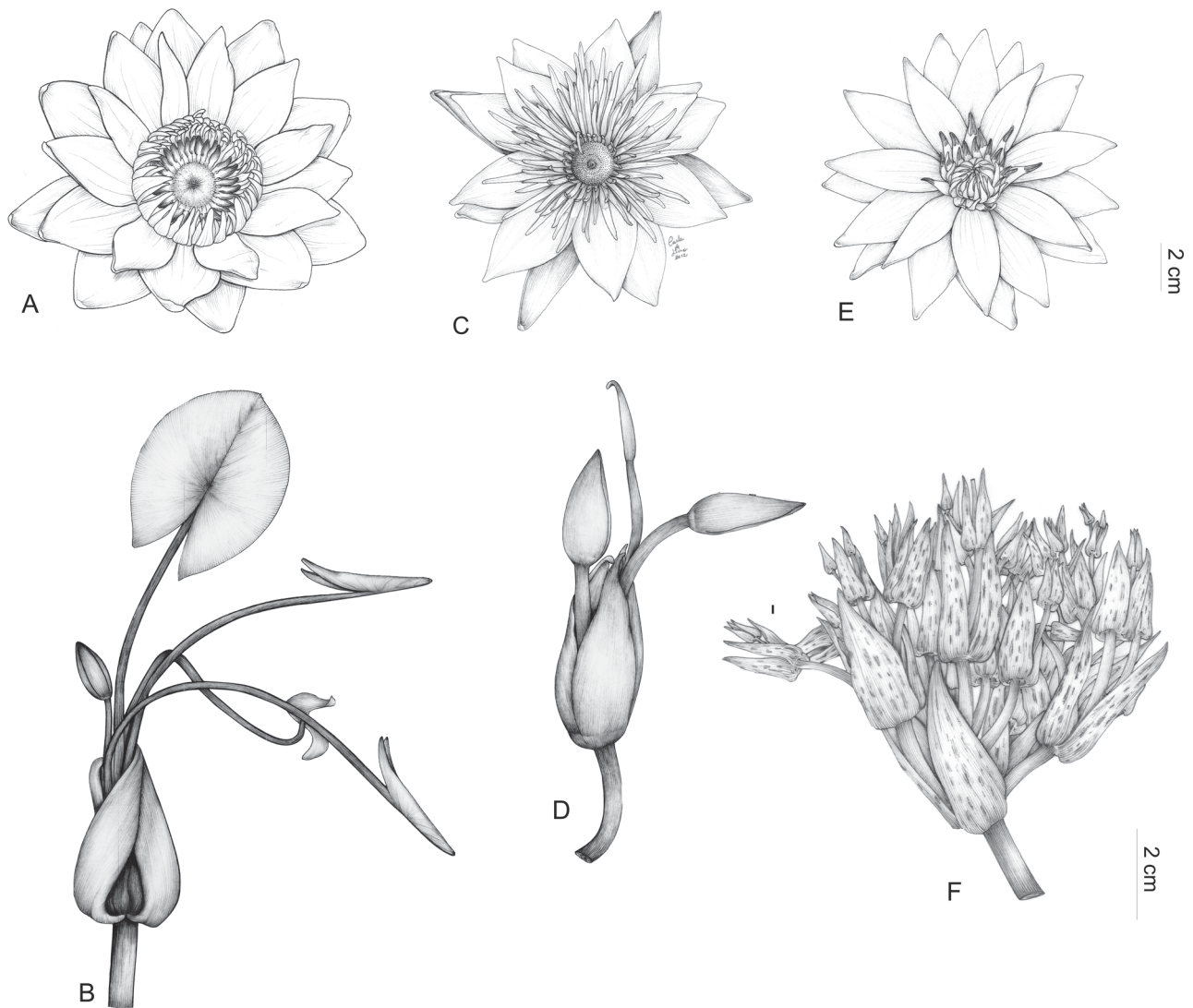


FIGURE 4. Flowers and proliferate pseudanthium in the following species: *N. lasiophylla*: A–B. *N. lingulata*: C–D. *N. vanildae*: E–F. Drawn by Carla de Lima

Acknowledgements

To the keeper of HUEFS, Luciano P. Queiroz, and at K, David Simpson who facilitated our study of their collections. Flávio França for help in choosing the name of the species. Leandro Soares for editing the figures. Cíntia Sothers and Raymond Harley for the revision of the English. J. H. Wiersema, M. Christenhusz and an anonymous referee for providing valuable comments on the manuscript. To CAPES for PhD and sandwich scholarship to C.T. de Lima. To CNPq, for a productivity grant to A.M.Giulietti. To the PPBio/MCT (Semiarid) Project; PROTAX/CNPq Proc. 562278/2010-9 and REFLORA/CNPq (Proc. 563858/2010-5) for financial support of fieldwork. This work is part of the first author's PhD thesis in the Botany Graduate Program (PPGBot-UEFS).

References

- Amaral, M.C. (2010) Nymphaeaceae. *In*: Forzza, R.C., Baumgratz, J.F.A., Bicudo, C.E.M., Carvalho Jr, A.A., Costa, A., Costa, D.P., Hopkins, M., Leitman, P.M., Lohmann, L.G., Maia, L.C., Martinelli, G., Menezes, M., Morim, M.P., Coelho, M.A.N., Peixoto, A.L., Pirani, J.R., Prado, J., Queiroz, L.P., Souza, V.C., Stehmann, J.R., Sylvestre, L.S., Walter, B.M.T. & Zappi, D. (eds.), *Catálogo de Plantas e Fungos do Brasil*. Volume 2. Instituto de Pesquisas Jardim Botânico do Rio de Janeiro, Rio de Janeiro, 1332 pp.
- APG III. (2009) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. *Botanical Journal of the Linnean Society* 161: 105–121.
<http://dx.doi.org/10.1111/j.1095-8339.2009.00996.x>
- Bosch, T., Löhne, C. & Wiersema, J.H. (2008) Phylogeny and evolutionary patterns in Nymphaeales: integrating genes, genomes and morphology. *Taxon* 57: 1052–1081.
- Caspey, R. (1878) Nymphaeaceae. *In* Martius, C.F.P. von (ed.) *Flora Brasiliensis*. Volume 4(1/2). R. Oldenbourg, Munich & Leipzig, pp. 120–184.
- Conard, H.S. (1905) The water lilies: A monograph of the genus *Nymphaea*. *Publications of the Carnegie Institution of Washington* 4: 1–279.
<http://dx.doi.org/10.1086/328681>
- De Candolle, A.P. (1821) *Nymphaea*, p. 49–59, in: *Regni vegetabilis systema naturale*, vol. 2. Treuttel & Würtz, London.
- Lima, C.T. (2011) *A ordem Nymphaeales no Estado da Bahia, Brasil*. MSc Thesis, Programa de Pós-Graduação em Botânica. Univ. Estadual de Feira de Santana. Feira de Santana, Brazil. pp. 1–157.
- Lima, C.T., Giulietti, A.M. & Santos, F.A.R. (2012) Flora da Bahia: Nymphaeaceae. *Sitientibus. Série Ciências Biológicas* 12(1): 69–82.
- Linnaeus, C. (1753) *Species Plantarum*, vol. 2. L. Salvius, Stockholm.
- Zuccarini, J.G. (1832) Plantarum novarum vel minus cognitarum, quae in horto botanico herbarioque regio Monacensi servantur. *Abhandlungen der Mathematisch-Physikalischen Classe der Königlich Bayerischen Akademie der Wissenschaften* 1: 290–380.
<http://dx.doi.org/10.5962/bhl.title.9506>
- Wiersema, J.H. (1987) A monograph of *Nymphaea* subgenus *Hydrocallis* (Nymphaeaceae). *Systematic Botany Monographs* 16: 46–101.
- Wiersema, J.H. (1984) Systematics of *Nymphaea* subgenus *Hydrocallis* (Nymphaeaceae). I. Four new species from the Neotropics. *Brittonia* 36: 213–222.
<http://dx.doi.org/10.2307/2806510>