



Flora of Espírito Santo, Brazil

Cactaceae in a priority area for conservation in Espírito Santo state

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Abstract

The Central Mountain Region of Espírito Santo state is located in the Atlantic Forest domain in eastern Brazil, which is the third largest center of diversity and endemism for Cactaceae. The state has 42 native species and 13 genera of this family. The aim of this study was to conduct a floristic-taxonomic study of Cactaceae in the Central Mountain Region of Espírito Santo, an area of extreme priority for conservation of Atlantic Forest biodiversity. Field trips were carried out between November 2013 and February 2016, with some additional collections and herbarium specimens were assessed. Twenty-two native species of Cactaceae were recorded for the region, which belong to the genera *Coleocephalocereus* (2), *Epiphyllum* (1), *Hatiora* (2), *Lepismium* (2), *Pereskia* (1), *Rhipsalis* (12), *Schlumbergera* (1) and *Selenicereus* (1). Of these species, 18 are epiphytes, 12 are rupicolous and 2 are climbers, some of them exhibiting more than one life-form. Two species are endemic to the state and eleven are assessed as threatened species regionally. This study contributes to improve what is known about Cactaceae in Espírito Santo state.

Key words: Atlantic Forest, Central Mountain Region, Eastern Brazil, flora, Rhipsalideae, taxonomy.

Resumo

A Região Serrana Central do estado do Espírito Santo está localizada no domínio Floresta Atlântica, no leste do Brasil, o terceiro maior centro de diversidade e endemismo de Cactaceae. O estado possui 42 espécies e 13 gêneros nativos desta família. O objetivo deste estudo foi conduzir um estudo florístico-taxonomico sobre Cactaceae na Região Serrana Central do Espírito Santo, uma área de extrema prioridade para a conservação da biodiversidade da Floresta Atlântica. Expedições a campo foram realizadas entre novembro de 2013 a fevereiro de 2016, com algumas coletas posteriores, e espécimes depositados em herbários foram analisados. Vinte e duas espécies nativas de Cactaceae foram registradas para a região, pertencentes aos gêneros *Coleocephalocereus* (2), *Epiphyllum* (1), *Hatiora* (2), *Lepismium* (2), *Pereskia* (1), *Rhipsalis* (12), *Schlumbergera* (1) e *Selenicereus* (1). Dessas espécies, 18 são epífitas, 12 são rupícolas e duas são trepadeiras, algumas delas apresentando mais de uma forma de vida. Duas espécies são endêmicas do estado e onze são avaliadas como ameaçadas de extinção regionalmente. Este estudo contribui para aprimorar o conhecimento de Cactaceae no estado do Espírito Santo.

Palavras-chave: Floresta Atlântica, Região Serrana Central, leste do Brasil, flora, Rhipsalideae, taxonomia.

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Introduction

The family Cactaceae is monophyletic, which is strongly supported by morphological characters and molecular data, such as the presence of areoles, a region where lateral buds are clustered, and the inversion of 6 kb in a region of the chloroplast genome (Buxbaum 1950; Wallace 1995). Cactaceae are predominantly restricted to the New World, occur extensively in this region, and are found in diverse habitats as a wide variety of life-forms (Mutke 2015). The family comprises ca. 1,400 species distributed in ca. 120 genera (Hunt *et al.* 2006) and five subfamilies: the traditionally recognized Maihuenioideae, Opuntioideae, Cactoideae and Pereskioideae (Nyffeler & Egli 2010); and the more recently described Leuenbergerioideae (Mayta & Molinari-Novoa 2015).

In Brazil, Cactaceae are represented by four subfamilies (except for Maihuenioideae), 292 native species and 38 genera (Zappi & Taylor 2020). The third largest center of diversity and endemism of the family is in eastern Brazil, where 11% of all Cactaceae genera are endemic (Taylor 1997). The flora of cacti in this region has been comprehensively treated by Taylor & Zappi (2004) and there are also some regional taxonomic treatments, such as local (Gonzaga *et al.* 2017; Vasconcelos *et al.* 2019; Cardoso *et al.* 2020) and state monographs, such as those of Ceará (Menezes *et al.* 2013), Paraná (Soller *et al.* 2014), Rio de Janeiro (Freitas *et al.* 2020), Rio Grande do Sul (Carneiro *et al.* 2016) and São Paulo state (Zappi *et al.* 2007).

Espírito Santo state is located in the Atlantic Forest domain and has 42 native species and 13 genera of Cactaceae (Zappi & Taylor 2020). For this state, studies about Cactaceae are very scarce, especially taxonomic studies, which has resulted in a gap in the knowledge about the family (Cardoso *et al.* 2018). The first and only so far taxonomic study on Cactaceae published to Espírito Santo recorded a threatened cactus to the state after a gap of approximately a century in an urban forest fragment (Cardoso *et al.* 2020). Thus, regional and local studies in Espírito Santo are extremely important. This work is a floristic-taxonomic study of Cactaceae in the Central Mountain Region of Espírito Santo state, an area of extreme priority for the conservation of Atlantic Forest biodiversity (IPEMA 2011).

Material and Methods

Study Area

The Central Mountain Region of Espírito Santo state (CMR), located between the latitudes 19°45'19"S and 20°48'53"S and longitudes 40°17'55"W and 41°10'58"W, is covered by submontane (50–500 m of elevation), montane (500–1,500 m) and high-altitude (> 1,500 m) dense ombrophilous forest (Magnago *et al.* 2007; IBGE 2012; Fig. 1). It is one of the 28 areas of priority for the conservation of Atlantic Forest biodiversity in Espírito Santo, as classified by IPEMA (2011) and implemented by the government of the state (Governo do Estado do Espírito Santo 2010), and encompasses areas of the cities of Alfredo Chaves, Anchieta, Aracruz, Cachoeiro de Itapemirim, Cariacica, Castelo, Domingos Martins, Fundão, Guarapari, Ibirapu, João Neiva, Marechal Floriano, Rio Novo do Sul, Santa Leopoldina, Santa Maria de Jetibá, Santa Teresa, Serra, Vargem Alta and Viana (Fig. 2). This classification in priority areas does not follow a political delimitation because most of the time it does not cover the total area of these cities, but rather takes into account the distribution and richness of species in the state, especially those that are endemic and rare, in regions with characteristic environments and abiotic factors (IPEMA 2011). The CMR encompasses 4,352 km², which corresponds to about 25% of the total area that is a priority for conservation in the state (IPEMA 2011). The climate is subtropical, oceanic, lacks a marked dry season and has a hot or temperate summer (Alvares *et al.* 2013).

Biological material

Field trips to the CMR were carried out between November 2013 and February 2016, and some additional collections were made after this time. The material collected was processed according to the methodology in Groot (2011) and deposited in the R and VIES herbaria (acronyms according to Thiers, continuously updated). The CVRD, MBML, R, RB, SAMES, SPF, UPCB and VIES collections were also visited to examine specimens relevant to this research. Additionally, other collections were assessed using virtual herbaria (INCT 2020; Re flora 2020).

Identifications were made by comparing collections with type material, protologues and

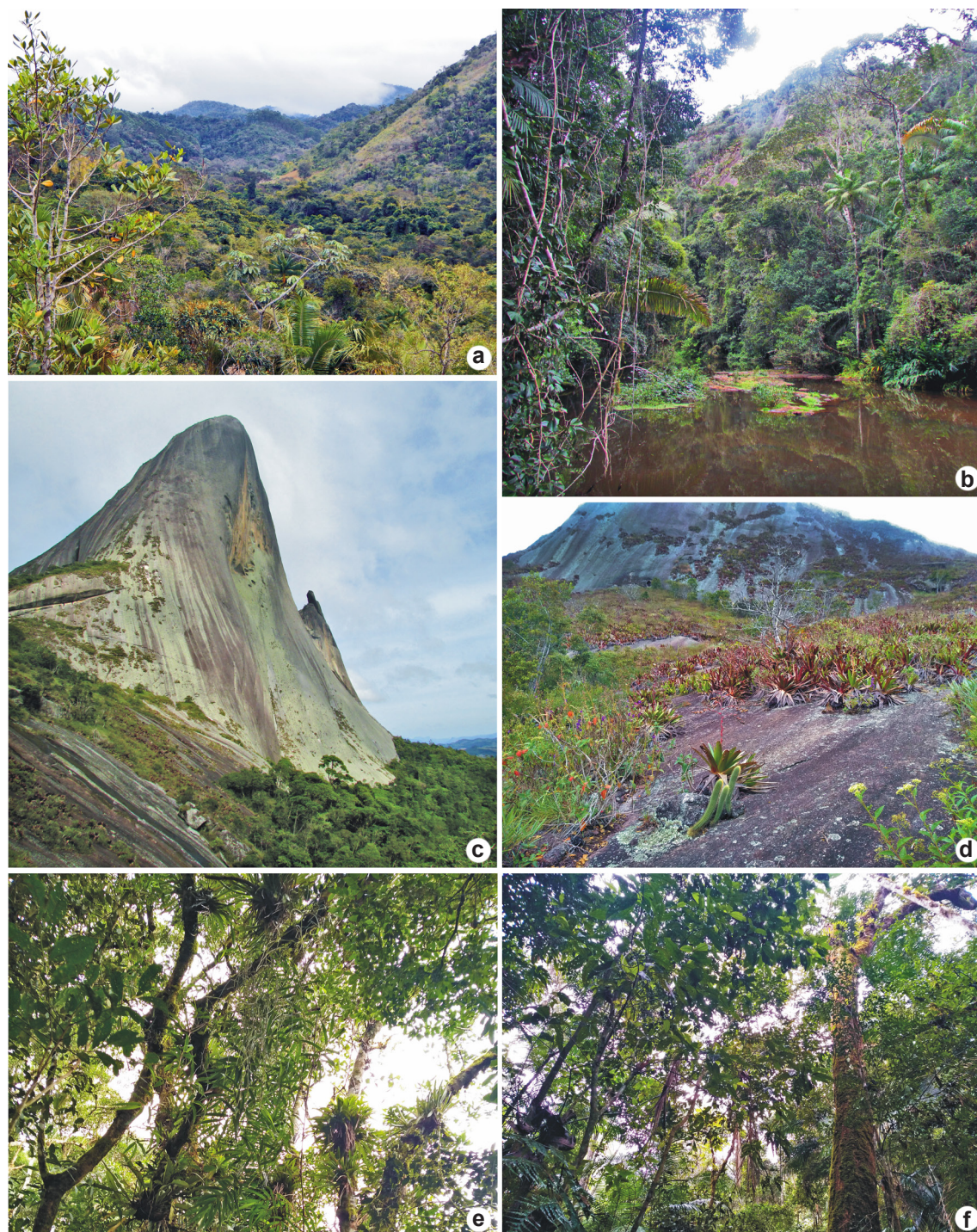


Figure 1 – a-f. Fragments of dense ombrophilous forest at the Central Mountain Region of Espírito Santo state – a-b. Estação Biológica de Santa Lúcia; c. Parque Estadual de Pedra Azul; d-e. Pedra do Garraão; f. Reserva Biológica Augusto Ruschi. Photo credits: a. J.F. Barbosa; b-f. W.C. Cardoso).

literature (Barthlott & Taylor 1995; Taylor & Zappi 2004; Calvente 2010). The descriptions were made from observations of the collected material; measurements were made with a caliper. For terminology, Radford *et al.* (1974) was used for structure shapes, Barthlott & Hunt (2000) for seed morphology, Taylor & Zappi (2004) for specialized morphological nomenclature and Beentje (2016) for colors.

Results and Discussion

Within the CMR, we recorded 22 native species in eight genera of Cactaceae, which are from eleven of the 19 cities in the region. Among these, 18 are endemic to Brazil, 15 are endemic to the Atlantic Forest and two are endemic to Espírito Santo state. For life-forms, 18 species are

epiphytic, 12 are rupicolous and two are climbers, although some of these species exhibit more than one life-form. Eleven are assessed as threatened species regionally. Of these, four are regionally assessed as Critically Endangered (CR), six as Endangered and one as Vulnerable (VU) species.

Some species were recorded in cities that are partially in the CMR but at lower elevations outside the study region. These species were not included in this study. Two cultivated species were found and also excluded from the taxonomic treatment but compared to its most similar species. This study increases the number of species recorded in the CMR by 41%, compared to Taylor & Zappi (2004; according to the material examined cited), and what is known about Cactaceae in the state.

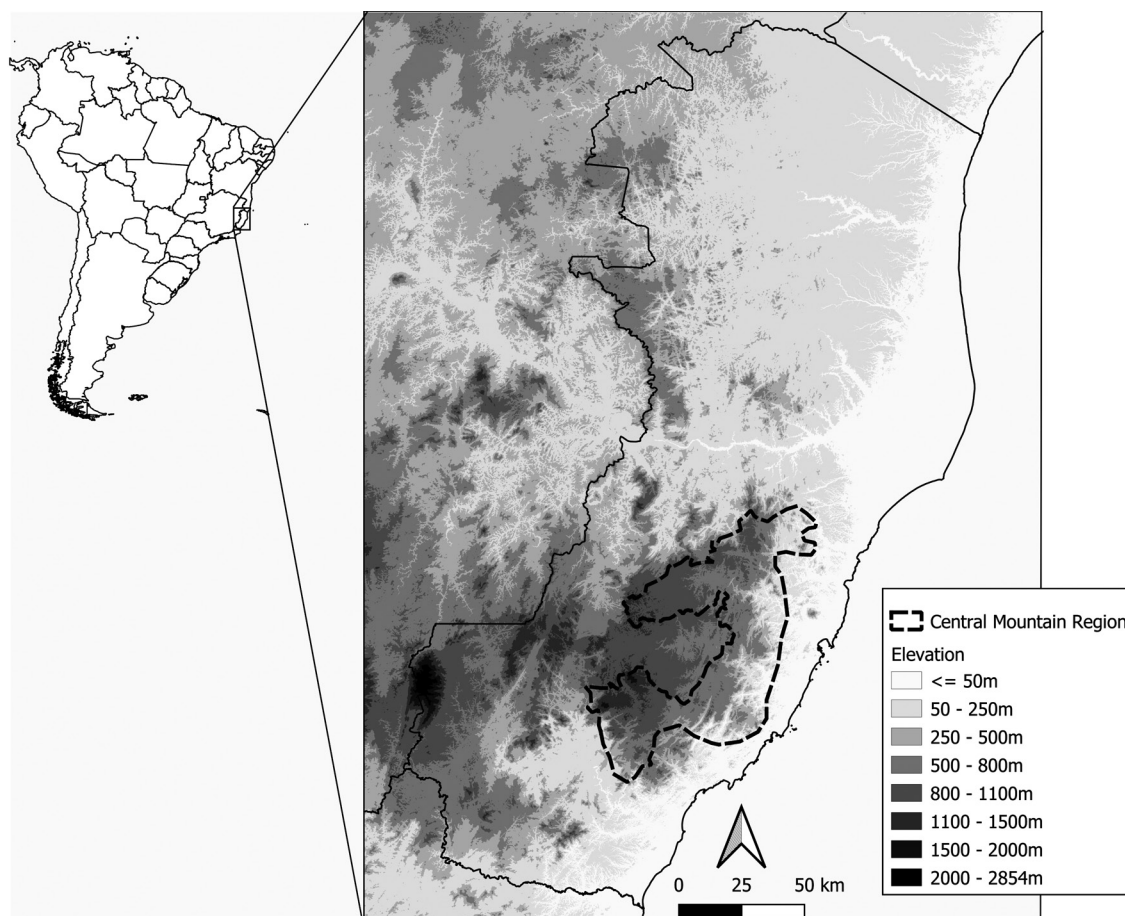


Figure 2 – Limits of the study area. The Central Mountain Region of Espírito Santo state, Brazil.

Identification key to the species of Cactaceae in the Central Mountain Region, Espírito Santo state

1. True broad leaves present. Flowers pedicellate 8. *Pereskia aculeata*
- 1'. Leaves reduced or modified into spines. Flowers sessile..... 2
 2. Stem segments ribbed, branches decumbent. Areoles with acicular spines; cephalium lateral. Fruits dehiscent by a basal pore (*Coleocephalocereus*) 3
 3. Spines longer at the stem base. Sepaloid tepals with greenish apex 1. *Coleocephalocereus braunii*
 - 3'. Spines with the same length along the stem. Sepaloid tepals with reddish-brown apex 2. *Coleocephalocereus fluminensis*
 - 2'. Stem segments cylindrical, clavate, winged or angular, branches erect, pendent, semi-erect or prostrate. Areoles unarmed or with conical spines; cephalium absent. Fruits dehiscent by lateral or irregular slits or indehiscent..... 4
 4. Plant epiphytic or a climber. Stem segments 15–35 mm diam., angulated, with 3-angled, continuous angles; stem surface covered with conical spines. Pericarpel covered by podaria and acicular spines 22. *Selenicereus setaceus*
 - 4'. Plant epiphytic or rupicolous. Stem segments cylindrical, clavate, 2–3-winged or angulated, if angulated, with 7–12 mm diam., 3–4-angulated, discontinuous and alternating angles; stem surface unarmed. Pericarpel naked or covered with minute lanceolate bract scales 5
 5. Stem segments 20–40 cm wide, winged. Pericarpel covered with minute lanceolate bract scales. Fruits dehiscent by lateral slits..... 3. *Epiphyllum phyllanthus*
 - 5'. Stem segments cylindrical, clavate, angulated or winged, if winged, 11–55 mm wide. Pericarpel naked. Fruits indehiscent 6
 6. Stem segments with determinate growth, 11–55 mm long, branching strictly acrotonic 7
 7. Stem segments 2-winged. Flowers zygomorphic, tepals pink to magenta, pericarpel 4–6-angled..... 21. *Schlumbergera kautskyi*
 - 7'. Stem segments cylindrical or clavate. Flowers actinomorphic, tepals yellow, orange-yellow to orange, pericarpel sub-cylindrical (*Hatiora*)..... 8
 8. Stem segments cylindrical. Sepaloid and petaloid tepals spreading 4. *Hatiora cylindrica*
 - 8'. Stem segments cylindrical or clavate. Sepaloid tepals spreading and petaloid tepals erect 5. *Hatiora salicornioides*
 - 6'. Stem segments with determinate or indeterminate growth, at least the basal segments greater than 70 cm long, branching acrotonic, subacrotonic or mesotonic..... 9
 9. Stem segments winged, branching mesotonic, with campanulate flowers (*Lepismium*)..... 10
 10. Stem segments with crenate margin. Areoles sunken in the stem. Tepals yellow to pink, filaments entirely whitish. Fruits rounded..... 6. *Lepismium cruciforme*
 - 10'. Stem segments with toothed margin. Areoles on the stem surface. Tepals whitish, filaments whitish, reddish at the base. Fruits angled 7. *Lepismium houlettianum*
 - 9'. Stem segments clavate, cylindrical, angulated or winged, but if winged with rotate flowers, branching acrotonic or subacrotonic (*Rhipsalis*)..... 11
 11. Stem segments winged 12
 12. Stem segments slightly succulent. Areoles 0.5–0.7 mm diam. 10. *Rhipsalis elliptica*
 - 12'. Stem segments succulent to stiff. Areoles 2–4 mm diam. 13
 13. Flowers 13–20 mm diam. Pericarp white to pinkish..... 16. *Rhipsalis pachyptera*
 - 13'. Flowers 5–7 mm diam. Pericarp magenta 19. *Rhipsalis russellii*

- 11'. Stem segments clavate, cylindrical or angulated 14
14. Stem segments always more than 2.5 mm diam. 15
15. Stem segments with determinate growth, to 25.5 cm long 16
16. Stem segments angulated. Pericarp whitish 17. *Rhipsalis paradoxa*
- 16'. Stem segments cylindrical. Pericarp magenta 17
17. Areoles 2–2.7 mm diam., with diameter smaller than the stem, elevated on podaria. Fruits 4.2–6.6 mm diam. 11. *Rhipsalis floccosa*
- 17'. Areoles 3–5 mm diam., with diameter as wide as the stem, podaria absent. Fruits 9.5–9.7 mm diam. 15. *Rhipsalis neves-armondii*
- 15'. Stem segments with indeterminate growth, segments greater than 26 cm long always present 18
18. Areoles emerge on the stem surface. Pericarp emerge on the stem 14. *Rhipsalis lindbergiana*
- 18'. Areoles sunken in the stem, revealed after the disruption of the epidermis by the eruptent floral bud. Pericarp immerse or half-immersed in the stem 19
19. Tepals whitish. Pericarp shiny brownish red to orange 18. *Rhipsalis puniceodiscus*
- 19'. Tepals carmine, cerise to crimson. Pericarp pink 12. *Rhipsalis hoelleri*
- 14'. Stem segments 0.8–2.5 mm diam. present at least at the apical branches 20
20. Flowers rotate, lateral to subterminal, patent 20. *Rhipsalis teres*
- 20'. Flowers campanulate, terminal, pendent 21
21. Filaments completely white. Fruit whitish 9. *Rhipsalis clavata*
- 21'. Filaments white with yellowish base. Fruit vinaceous 13. *Rhipsalis juengeri*

1. *Coleocephalocereus braunii* Diers & Esteves, *Kakteen And. Sukk.* 36(2): 34. 1985. Fig. 3a-c

Rupicolous, decumbent, branching basitonic. Stem segments 50–70 mm diam., with indeterminate growth, succulent, 12–22-ribbed, ribs 4–5(–10) × 6–9 mm, epidermis green. Areoles ca. 2 mm diam., on the stem surface, 6–10 mm apart, trichomes present, leaves modified into spines, acicular spines yellowish, longer at the stem base, radial spines 5–10 mm long, central spines 13–19 mm long; cephalium present, lateral, with woolly trichomes densely grouped and intermixed with yellowish bristle spines. Flowers 17–25 mm diam., infundibular, lateral, patent, on cephalium areoles, actinomorphic, 1 per areole, solitary, sessile; tube conspicuous, ca. 17 mm long, tepals spreading, sepaloid tepals lanceolate, cream with greenish apex, semi-succulent, petaloid tepals triangular, whitish, delicate; filaments whitish; pericarpel 2–3.5 × 3.5–5 mm, globose to subglobose, smooth, naked, emerge, style 15–23 mm long, stigma 8–10-lobed, spreading. Fruits ca. 25 × 20 mm, obovoid, dehiscent by basal pore; pericarp magenta, rounded, naked; floral remnants persistent. Seeds ca. 1.3 mm long, broadly oval, dark, glossy.

Material examined: Santa Maria de Jetibá, Pedra do Garrafão, 26.XI.2015, fl. and fr., *W.C. Cardoso & W.S.*

Borges 406 (R); 7.X.2016, fl. and fr., *W.C. Cardoso & C.A. Royer 436* (R).

Additional material: BRAZIL. ESPÍRITO SANTO: Afonso Cláudio, Pedra dos Três Pontões, 1983, *E. Esteves-Pereira 172* (UFG-Paratype); 26.XI.2015, fl., *W.C. Cardoso & W.S. Borges 408* (R).

This species is endemic to Espírito Santo state (Zappi & Taylor 2020). We recorded the species in a second locality since it was described, within the CMR, on a rock outcrop in montane dense ombrophilous forest. *Coleocephalocereus braunii* is categorized as CR (Goettsch *et al.* 2015; Fraga *et al.* 2019b) and occurs in unprotected areas, of which one is indicated as a priority area for the creation of a conservation unit (IPEMA 2011).

The species has been recorded with flowers and fruits in October and November.

It differs from *C. fluminensis* and most other species of the genus in the state, except for *C. buxbaumianus*, by the presence of longer spines at the stem base. At Pedra do Garrafão, the species generally grows in association with *Alcantarea vinicolor* (E.Pereira & Reitz) J.R. Grant (1995: 14) that covers the base of the *C. braunii* stem, making it difficult to see the basal spines. While the apex of the sepaloid tepals of flowers of *C. braunii* is greenish, that of *C. buxbaumianus* and *C. fluminensis* is reddish brown.

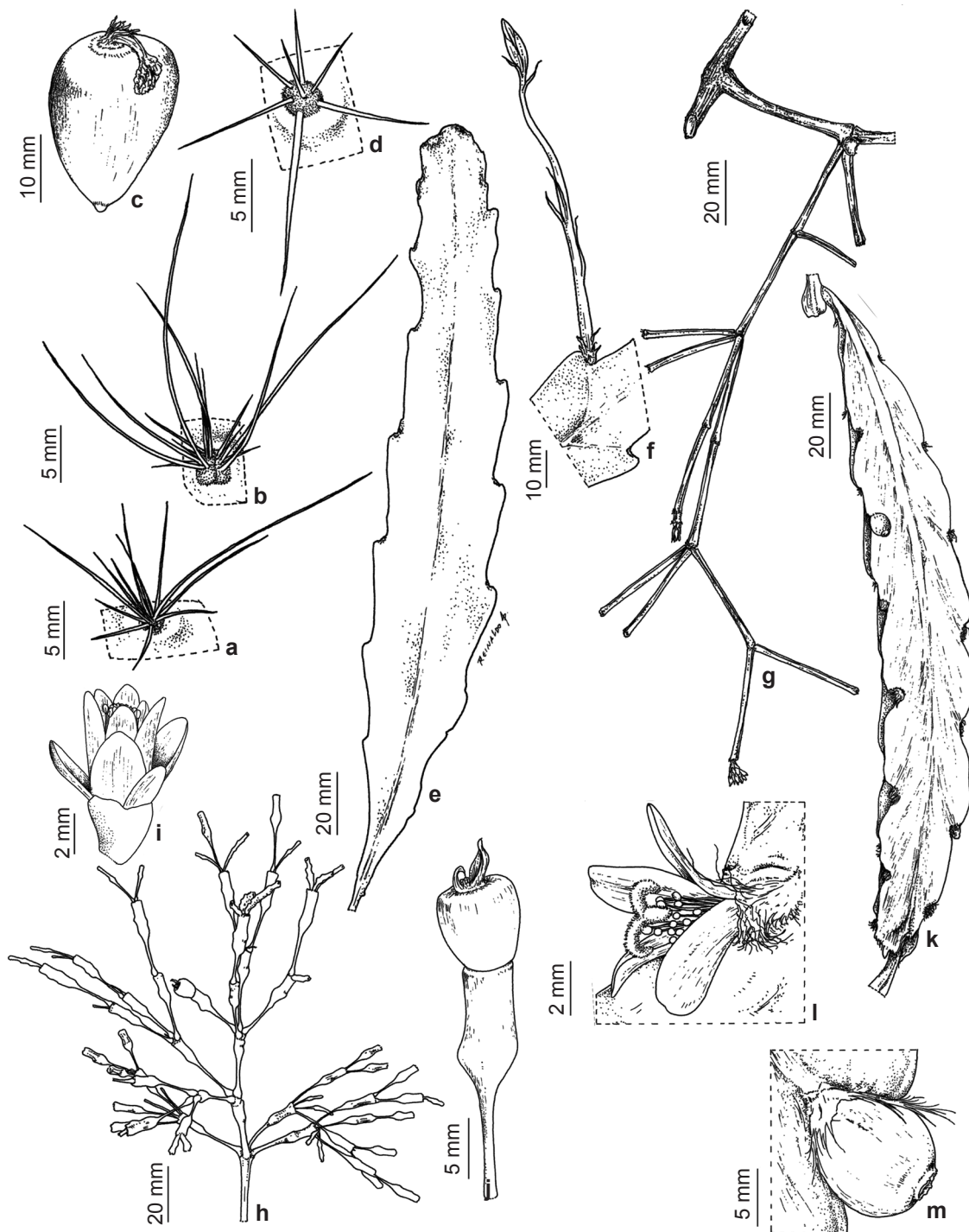


Figure 3 – a-c. *Coleocephalocereus braunii* – a. apical areole with acicular spines; b. basal areole with acicular spines; c. fruit. d. *C. fluminensis* – areole with acicular spines. e-f. *Epiphyllum phyllanthus* – e. stem segment; f. flower bud. g. *Hatiora cylindrica* – stem segments. h-j. *H. salicornioides* – h. stem segments; i. flower; j. fruit. k-m. *Lepismium cruciforme* – k. stem segment; l. flower; m. fruit. Illustrated by Reinaldo A. Pinto (a-c. Cardoso 436; d. Kollmann 11472; e. Cardoso 321; f. Pereira 4571; g. Forzza 5433; h-j. Cardoso 279; k, m. Cardoso 343; l. Cardoso 424b).

2. *Coleocephalocereus fluminensis* (Miq.) Backeb., Jahrb. Deutsch. Kakteen-Ges. 1941(2): 53. 1942.

Fig. 3d

Rupicolous, decumbent, branching basitonic. Stem segments 55–80 mm diam., with indeterminate growth, succulent, 9–14-ribbed, ribs 4–12 × 5–10 mm, epidermis light green. Areoles 2–3 mm diam., on the stem surface, 7–9 mm apart, leaves modified into spines, acicular spines with regular length along the stem, radial spines 6–11 mm long, central spine 12–16(–25) mm long; cephalium present, lateral, with woolly trichomes densely grouped and intermixed with yellowish bristle spines. Flowers 20–25 mm diam., infundibular, lateral, patent, on cephalium areoles, actinomorphic, 1 per areole, solitary, sessile; tube conspicuous, ca. 25 mm long, tepals patent to spreading, sepaloid tepals lanceolate, cream to pale light red, with reddish-brown apex, semi-succulent, petaloid tepals ovate, whitish, delicate; filaments whitish; pericarpel ca. 4 × 5 mm, subglobose, smooth, naked, emerge, style ca. 30 mm long, stigma ca. 10-lobed, spreading. Fruits ca. 14 × 14 mm, obovoid, dehiscent by basal pore; pericarp magenta, rounded, naked; floral remnants persistent. Seeds 1.1–1.2 mm long, broadly oval, dark, glossy.

Material examined: Cariacica, Reserva Biológica de Duas Bocas, estrada para a localidade de Alegre, 11.I.2007, fl., *A.P. Fontana et al.* 2590 (RB); 18.I.2009, fl., *L. Kollmann et al.* 11472 (MBML, RB); 16.II.2008, fr., *R.C. Forzza et al.* 5047 (MBML, RB). Castelo, Parque Estadual de Forno Grande, mirante, 7.IV.2009, fl., *R.C. Forzza et al.* 5484 (CEPEC, MBML, RB, UPCB). Santa Maria de Jetibá, Sítio Renascer, 4.VII.2009, fl., *T.S. Lorencini et al.* 310 (VIES).

Additional material: BRAZIL. ESPÍRITO SANTO: Santa Teresa, São João de Petrópolis, Escola Agrotécnica Federal, 11.XII.1985, fl., *H.Q. Boudet Fernandes* 1724 (MBML).

This species is endemic to the Atlantic Forest of southeastern Brazil (Zappi & Taylor 2020). In Espírito Santo, it occurs from restinga to submontane and montane dense ombrophilous forest. This species is assessed globally as LC because of its wide distribution and presence in protected areas (Goettsch *et al.* 2015). Regionally, it is NT because of the projected population reduction caused by effects of pathogens or parasites that affect its growth and probably its reproduction (Fraga *et al.* 2019b; W.C. Cardoso, personal observation).

The records from the CMR indicate that the species flowers from January to April and fruits in January.

It is distinguished from *C. braunii* by the absence of differentiated spines along the extension of the stems and by the sepaloid tepals with reddish-brown apex.

3. *Epiphyllum phyllanthus* (L.) Haw., Syn. Pl. Succ. 197. 1812. Fig. 3e-f

Epiphyte, semi-erect to pendent, branching mesotonic. Stem segments with indeterminate growth, 50–60 × 20–40 cm, succulent, 2-winged, wings 10–20 mm wide, margin crenate, projections 0.5–1.5 mm wide, epidermis light green. Areoles ca. 2 mm diam., on the stem surface, between margin projections, 2.8–4.7 mm apart, leaves reduced, unarmed, cephalium absent. Flowers 30–45 mm diam., salverform, lateral, actinomorphic, 1 per areole, solitary, sessile; tube conspicuous, 70–200 mm long, tepals patent to reflexed, sepaloid tepals lanceolate, greenish, semi-succulent, petaloid tepals lanceolate, whitish, delicate; filaments whitish; pericarpel ca. 16 × 4 mm, ellipsoid, ridged, covered with minute lanceolate bracteal scales, emerge. Fruits 6–8 × 3–4 mm, ellipsoid, dehiscent by lateral slit; pericarp magenta, naked, ridged; floral remnants deciduous. Seeds 3.3–3.5 mm long, narrowly oval, black-brown, glossy.

Material examined: Santa Leopoldina, Timbuí Seco, propriedade da família Balbino, 26.XI.2005, fl., *A.M. Assis et al.* 1080 (MBML). Santa Maria de Jetibá, terreno de R. Berger, 13.III.2003, fr., *L. Kollmann & M.V.S. Berger* 6046 (MBML). Santa Teresa, pátio do Museu Mello Leitão, 26.VII.2001, fr., *L. Kollmann* 4207 (MBML). Vargem Alta, estrada para o Morro de São Carlos, 4.II.2015, fl. and fr., *W.C. Cardoso et al.* 321 (VIES).

Additional material: BRAZIL. ESPÍRITO SANTO: Linhares, Reserva Natural Vale, estrada Parajú, 9.VI.1993, fl., *O.J. Pereira* 4571 (CVRD).

This species is widely distributed in Latin America (Barthlott *et al.* 2015) and Brazil (Zappi & Taylor 2020). In the CMR, the species occurs in montane dense ombrophilous forest, but also occurs in restinga and lowland dense ombrophilous forest throughout the state. It is categorized as LC (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

In the CMR, collections with flowers have been made in February and November and with fruits in February, March and July.

The species differs from other cacti in the region by the winged stems with indeterminate growth and flowers longer than 12 cm after completely developing, with a pericarpel that is ellipsoid, ridged, and covered with minute

lanceolate bracteal scales. It differs from *E. oxypetalum* Haworth. (1829: 109), a cultivated species in CMR, by its flowers that are 30–45 mm in diam.

4. *Hattoria cylindrica* Britton & Rose, Cactaceae 4: 219. 1923. Fig. 3g

Epiphyte or rupicolous, erect, 0.3–0.5 m long, branching acrotonic. Stem segments with determinate growth, 1.7–4.7 cm long, lateral segments 2–3 mm diam., basal segments 3–7 mm diam., lignified, succulent, cylindrical, ribs, angles and wings absent, epidermis light to pale green. Areoles 3–5 mm diam., on the stem surface, clustered at the stem segment apex, trichomes and acicular scales present, leaves reduced, unarmed, cephalium absent. Flowers 4–9 mm diam., campanulate, terminal, pendent or erect, actinomorphic, sessile; tube inconspicuous, tepals orange-yellow to reddish, ovate to oblong, sepaloïd and petaloïd tepals spreading; filaments whitish; pericarpel 2–4 × 2–3 mm, sub-cylindrical, yellowish green to reddish, smooth, naked, emerge. Fruits not seen. Seeds not seen.

Material examined: Castelo, Parque Estadual de Forno Grande, VI.1949, *A.C. Brade 19978* (RB); 2.III.2013, fl., *P.H.D. Barros 2016* (VIES); trilha para as piscinas, 12.II.2008, fl., *A.P. Fontana 4801* (RB); trilha do Rio Manso, 20.VII.2008, fl., *P.H. Labiak 4880* (RB, SPF); mata de brejo próxima da sede, 20.I.2009, fl., *R.C. Forzza 5433* (MBML, RB).

This species is endemic to the Brazilian Atlantic Forest and occurs in the states of Bahia, Rio de Janeiro and Espírito Santo. In the latter, it has been recorded only in montane dense ombrophilous forest. This species is globally assessed as EN because it has only been recorded in a few locations and its population is severely fragmented and in continuing decline (Goettsch *et al.* 2015), while regionally it is assessed as CR due to the very small and restricted population (Fraga *et al.* 2019b).

This species has only been recorded with flowers, in January, February, March and July.

Hattoria cylindrica differs from *H. salicornioides* by the spreading petaloïd tepals, while those of the latter are erect. The cylindrical stem segments characteristics of this species can also be presented by forms of *H. salicornioides*, usually clavated. This species can be distinguished from species of *Rhipsalis* by the stem segments 17–47 mm long, while longer stem segments are always present in *Rhipsalis*.

5. *Hattoria salicornioides* Britton & Rose, L.H. Bailey, Stand. Cycl. Hort. 1433. 1915. Fig. 3h-j

Epiphyte or rupicolous, pendent to semi-erect, branching acrotonic. Stem segments with determinate growth, 1.1–2.9 cm long, lateral segments 2–3 mm diam., basal segments 2–6 mm diam., lignified, succulent, clavate to cylindrical, ribs, angles and wings absent, epidermis green. Areoles 1–3 mm diam., on the stem surface, clustered at the stem segment apex, trichomes and acicular scales present, leaves reduced, unarmed, cephalium absent. Flowers ca. 9 mm diam., campanulate, terminal, pendent or erect, actinomorphic, sessile; tube inconspicuous, tepals yellow to orange, sepaloïd tepals ovate to depressed-ovate, spreading, petaloïd tepals narrowly elliptic, erect; filaments whitish; pericarpel ca. 4 × 3.5 mm, sub-cylindrical, yellowish green, smooth, naked, emerge. Fruits 4–8 × 3–6 mm, subglobose to obovoid, indehiscent; pericarp white to pinkish, rounded, naked; floral remnants persistent. Seeds 1–1.1 mm long, narrowly oval to oval, black-brown, glossy.

Material examined: Castelo, Parque Estadual de Forno Grande, 18.IV.2009, fr., *J.M.L. Gomes 3281* (VIES). Cariacica, Reserva Biológica de Duas Bocas, localidade de Alegre, trilha do Pau-Oco, 22.VII.2008, *R.C. Forzza et al. 5287* (CEPEC, MBML, RB). Domingos Martins, Parque Estadual de Pedra Azul, trilha das piscinas, 20.XI.2013, fr., *W.C. Cardoso et al. 279* (R, VIES). Santa Leopoldina, Cachoeira Véu de Noiva, propriedade de E. Pitol, 7.X.2000, fl. and fr., *A.P. Fontana & J.R. Silva 43* (MBML). Santa Maria de Jetibá, distrito de Garrafão, Sítio Renascer, 19.VI.2009, fl., *T.S. Lorencini et al. 223* (VIES). Santa Teresa, Estação Biológica de Santa Lúcia, 25.IX.1999, fr., *D.C. Zappi et al. 440* (UEC); trilha Indaiá-Açu, 16.IX.2002, fl., *R.R. Vervloet et al. 919* (MBML); às margens do Rio Timbuí, 16.IX.2015, fl., *W.C. Cardoso & J.F. Barbosa 359* (R); Reserva Biológica Augusto Ruschi, 18.IX.2001, fl., *L. Kollmann et al. 4633* (MBML); trilha da Cachoeira, 25.I.2007, fr., *A. Calvente & L.M. Versieux 292* (SPF); estrada de Alto Goiapaba-Açu, 10.I.2002, fr., *L. Kollmann & E. Bausen 5298* (MBML); 17.IX.2002, fl., *R.R. Vervloet et al. 865* (MBML); estrada partindo da Casa da Pedra, 11.XII.2002, fr., *R.R. Vervloet et al. 1529* (MBML); estrada para João Neiva, 24.IX.2002, fl., *R.R. Vervloet et al. 1037* (MBML); 5.IX.2003, fl., *J. Rossini & E. Bausen 545* (MBML); reserva particular do patrimônio natural Macaco Barbado, trilha Radical, 15.IX.2018, fl., *A.D. Ferreira 405* (MBML); reserva particular do patrimônio natural Vale do Sol, trilha divisa virada para o leste, 6.VI.2014, fr., *A.D. Ferreira & P.J. Coelho 23* (MBML).

This species is endemic to Brazil where it occurs from the state of Bahia to the state of Santa

Catarina in the Caatinga, Cerrado and Atlantic Forest domains (Zappi & Taylor 2020). In the CMR, it has been recorded in many localities in montane dense ombrophilous forest. It is categorized as LC because of its wide distribution and presence in many protected areas (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

This species has been recorded with flowers in February, June, September and October and with fruits from September to January and in April and June.

Unlike *H. cylindrica*, *H. salicornioides* has erect petaloid tepals. Its stem segments are clavate but can also be cylindrical in rupicolous specimens.

6. *Lepismium cruciforme* (Vell.) Miq., Bull. Sci. Phys. Nat. Néerl. 49. 1838. Fig. 3k-m

Epiphyte or rupicolous, pendent, branching mesotonic. Stem segments 13–28 mm diam., with indeterminate growth, 9.8–41.3 cm long, succulent, 3-winged, narrowly elliptical to lanceolate, apex truncate, base cuneate, margin crenate, projections 3–5 mm wide, epidermis green. Areoles 2–6 mm diam., sunken in the stem, between margin projections, 10–32 mm apart, trichomes present, leaves reduced, unarmed, cephalium absent. Flowers 6–8 mm diam., campanulate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals spreading, elliptic, yellow to pink; filaments whitish; pericarpel 2.2–4 × 1.4–1.9 mm, obconic to ellipsoid, smooth, naked, immerse, style 5.1–5.5 mm long, stigma 3–4-lobed, reflexed. Fruits 4.6–7 × 4.6–6.5 mm, subglobose to obovoid, indehiscent; pericarp magenta, rounded, naked; floral remnants deciduous. Seeds 1.3–1.5 mm long, narrowly oval to oval, black-brown, glossy.

Material examined: Alfredo Chaves, São Bento de Urânia, 20.IV.2011, *A.P. Fontana & L. Kollmann* 7295 (MBML, RFA). Castelo, Parque Estadual de Forno Grande, 12.VII.2005, fr., *L. Kollmann & R.L. Kollmann* 7992 (MBML, RFA). Domingos Martins, Reserva Kautsky, estrada principal, 7.VIII.2015, fr., *W.C. Cardoso et al.* 343 (R). João Neiva, distrito de Demétrio Ribeiro, 8.VI.2019, fl., *W.C. Cardoso & P. Soares* 463 (R, VIES). Santa Teresa, Estação Biológica de Santa Lúcia, 31.VIII.2005, fr., *L. Kollmann & A.P. Fontana* 8264 (MBML); Reserva Biológica Augusto Ruschi, estrada para Nova Lombardia, 20.II.2002, fl., *L. Kollmann et al.* 5587 (MBML); trilha da Divisa, saída para Goiapaba-açu, 16.IV.2002, fr., *R.R. Vervloet et al.* 125 (MBML, RFA). Vargem Alta, Morro de São Carlos, 20.II.2016, fl., *W.C. Cardoso et al.* 424b (R, VIES).

This species is distributed in Argentina, Brazil, Paraguay and Uruguay (Barthlott *et al.*

2015). In Brazil, it occurs from Pernambuco state to Rio Grande do Sul state in the Atlantic Forest and Pampa domains (Zappi & Taylor 2020). In Espírito Santo state, the species occurs in submontane and montane dense ombrophilous forest, within and outside of the CMR. It is categorized as LC because of its wide distribution (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

Specimens with flowers have been collected in February and with fruits in April, July and August.

This species differs from the winged species of *Rhypsalis* by the mesotonic branching, sunken areoles, and flowers with an immerse pericarpel. The margins of the stem segments of the species are crenate, while those of *L. houlettianum* are toothed.

7. *Lepismium houlettianum* (Lem.) Barthlott, Bradleya 5: 99. 1987. Fig. 4a-c

Epiphyte or rupicolous, pendent to semi-erect, branching mesotonic. Stem segments with indeterminate growth, 15–24.5(–32) × 2.1–4.4 cm, succulent, 2-winged, elliptical to narrow elliptical, apex acute to obtuse, basal region 2–4 mm wide, cylindrical, apical region flattened, margin toothed, projections 3–7 mm wide, epidermis green, stem margin reddish when growing in direct sunlight. Areoles 0.6–1.2 mm diam., on the stem surface, between margin projections, 7–22 mm apart, glabrate, leaves reduced, unarmed, cephalium absent. Flowers 8–12 mm diam., campanulate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals spreading, lanceolate, whitish; filaments whitish, reddish at the base; pericarpel 2.5–3 × 1.5–2 mm, ellipsoid, ridged, naked, emerse, style ca. 6 mm long, stigma ca. 3-lobed, spreading to reflexed. Fruits 5–8 × 3–5 mm, globose to ellipsoid, indehiscent; pericarp magenta, 5-angled, naked; floral remnants persistent. Seeds 1.4–1.5 mm long, oval, black-brown, glossy.

Material examined: Castelo, Parque Estadual de Forno Grande, 12.X.2000, fr., *L. Kollmann & C.N. Fraga* 3164 (MBML); 29.IV.2006, fl., *L. Kollmann & R.L. Kollmann* 8972 (MBML); trilha para as piscinas, 17.VII.2008, fl., *M.M. Saavedra et al.* 788 (MBML, RB); 17.VII.2008, fl. and fr., *L. Kollmann et al.* 11110 (MBML, UPCB, RB); trilha do Mirante, 2.X.2015, fr., *Turma de Taxonomia de Campo 15* (VIES); 2.X.2016, fr., *W.C. Cardoso et al.* 437 (R). Domingos Martins, distrito de Pedra Azul, propriedade do Canal, 12.VII.2006, fl., *A.P. Fontana* 2236 (MBML, RB). Santa Maria de Jetibá, Pedra do Garrafão, 2.X.2002, fr., *L. Kollmann & M. Berger* 5723 (MBML); 7.X.2016, fr., *W.C. Cardoso & C.A. Royer* 435 (R, VIES).

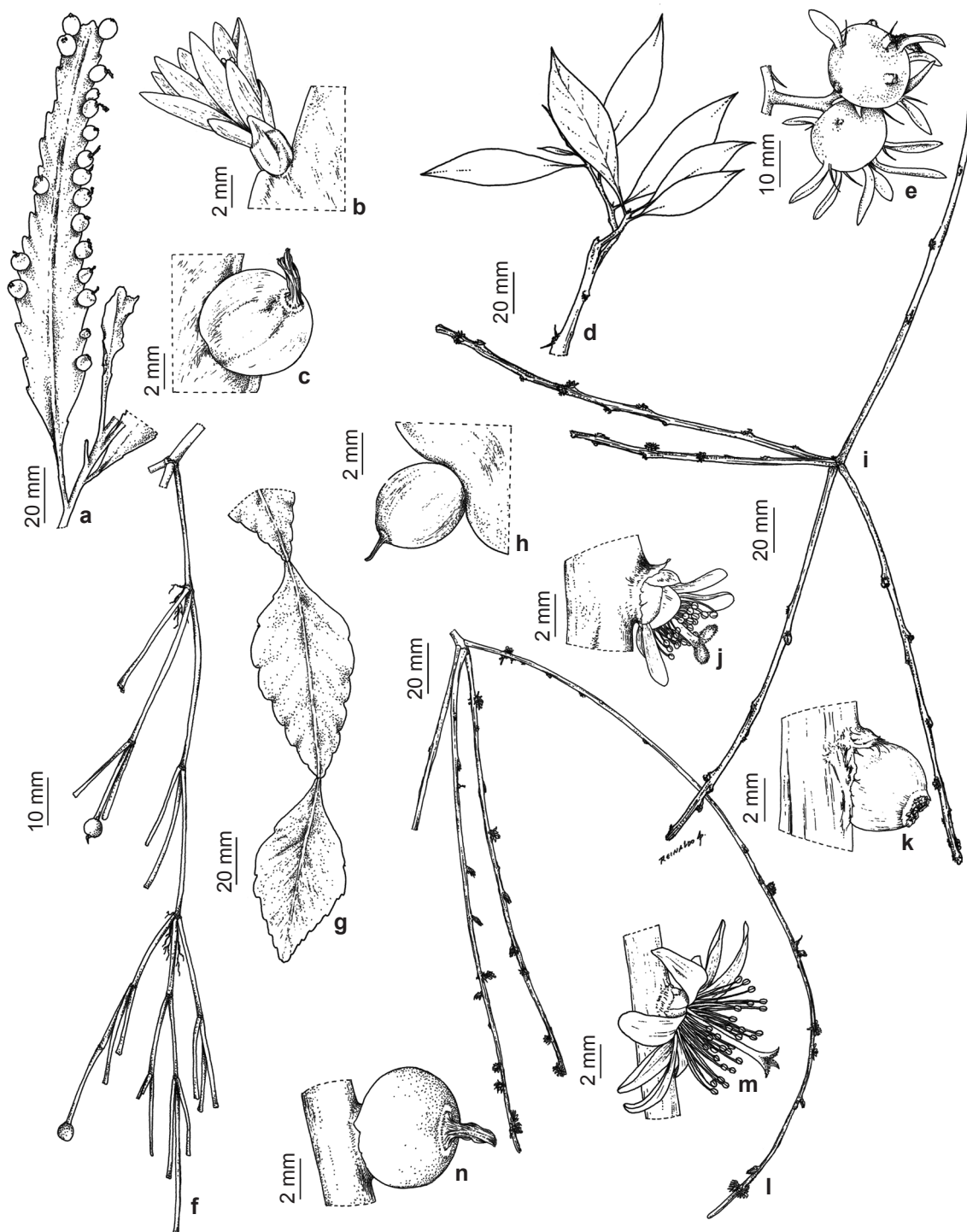


Figure 4 – a-c. *Lepismium houletianum* – a. stem segment; b. flower; c. fruit. d-e. *Pereskia aculeata* – d. branch; e. fruits. f. *Rhipsalis clavata* – stem segments with fruits. g-h. *R. elliptica* – g. stem segments; h. fruit. i-k. *R. floccosa* – i. stem segments; j. flower; k. fruit. l-n. *R. hoelleri* – l. stem segments; m. flower; n. fruit. Illustrated by Reinaldo A. Pinto (a, c. Cardoso 437; b. Saavedra 788; d. Assis 3161; e. Cardoso 5; f. Kollmann 5384; g-h. Cardoso 361; i-k. Cardoso 381; l-m. Cardoso 278; n. Cardoso 288).

This species is reported for Argentina and Brazil (Barthlott *et al.* 2015), where it occurs from Espírito Santo state and Minas Gerais state to Rio Grande do Sul state, in the Atlantic Forest and Pampa domains (Zappi & Taylor 2020). In Espírito Santo state, it has been recorded in montane and high-altitude dense ombrophilous forest, but only in the montane phytophysiology in the CMR. Due to its wide distribution, the species is globally assessed as LC (IUCN 2013). However, in Espírito Santo state it is only known from a few localities and is estimated to be in decline, being regionally assessed as EN (Fraga *et al.* 2019b).

In the CMR, this species has been recorded with flowers in April and July and with fruits in July and October.

The winged stem segments with a toothed margin is characteristic of this species, as well as the cylindrical basal portion of the stem segment, which makes it easy to identify the species, even in the vegetative phase.

8. *Pereskia aculeata* Mill., Gard. Dict. 8. 1768.

Fig. 4d-e

Climber, rupicolous or terrestrial, prostrate to semi-erect, to 6 m long, branching mesotonic. Stem to 6 mm diam., with indeterminate growth, woody, cylindrical, ribs, angles and wings absent, epidermis green. Areoles ca. 3 mm diam., on the stem surface, 6–15 mm apart, true broad leaves 3.9–8.2 × 1.2–3.9 cm, elliptic, semi-succulent, petiole 3–5 mm long, 2 claw-like spines located at the leaf and lateral branch base, acicular spines present on older branches, trichomes present, cephalium absent. Flowers 30–35 mm diam., rotate, lateral, patent, actinomorphic, 1–many per areole, solitary or grouped in true inflorescences, pedicellate, pedicels 3–15(–40) mm long, tube inconspicuous, tepals patent; filaments whitish to orange-red; pericarpel 3–4 × 4–5 mm, obconic, smooth, covered by lanceolate bracteal scales and acicular spines, stigma ca. 5-lobed, erect. Fruits ca. 12 × 11 mm, globose to globose-depressed, indehiscent; pericarp yellow-orange to shiny brownish red, rounded, spinescent areoles and bracteal scales present; floral remnants deciduous. Seeds ca. 3.5 mm long, orbicular, dark, glossy.

Material examined: Cariacica, Área de Proteção Ambiental Monte Mochuara, Roças Velhas, 27.VI.2012, fr., *A.M. Assis & J. Santos 3161* (MBML); Reserva Biológica de Duas Bocas, margem da represa, 23.VII.2008, fl. and fr., *C.N. Fraga & P.H. Labiak 2200* (CEPEC, MBML, UPCB). Fundão, Três Barras,

1.VIII.1984, fr., *R.M. Pizzolo 220* (MBML, HRCB). Santa Leopoldina, afloramento rochoso na margem esquerda do Rio Santa Maria da Vitória, próximo ao Sumidouro, 10.IX.2009, fr., *A.M. Assis & F.M. Flores 2048* (MBML, RFA). Bragança, Rancho Chapadão, propriedade de João Emílio, 30.III.2006, fl., *V. Demuner et al. 2111* (MBML, RFA). Suiça, 13.IV.2008, fr., *M. Simonelli et al. 1546* (MBML).

This species is distributed in Argentina, Brazil and Paraguay (Barthlott *et al.* 2015). In Brazil, it occurs from the Northeast Region to the South Region, in the Atlantic Forest, Caatinga, Cerrado and Pampa domains (Zappi & Taylor 2020). In the CMR, the species has been recorded in submontane dense ombrophilous forest. The conservation status of the species is assessed as LC due to its distribution (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

Specimens have been collected with flowers in March and July and with fruits from April to September.

Among the cacti in the region, this species is the only one with broad leaves, and pedicellate flowers in true inflorescences. It differs from *P. grandifolia*, which occurs outside the CMR, by its subshrub habit and whitish to cream tepals, while the latter has a shrubby to arboreal habit and pink tepals.

9. *Rhipsalis clavata* F.A.C. Weber, Rev. Hort. 64: 429. 1892.

Fig. 4f

Epiphyte, pendent, ca. 3 m long, branching acrotonic. Stem segments 1–1.2 mm diam., all segments usually with determinate growth, decreasing toward the branch apex, 18–45 mm long at the apical segments, succulent, clavate, ribs, angles and wings absent, margin entire, epidermis green. Areoles 1.3–1.8 mm diam., on the stem surface, glabrate, leaves reduced, unarmed, cephalium absent. Flowers 5–9 mm diam., campanulate, terminal, actinomorphic, 1–2 per areole, solitary, sessile; tube inconspicuous, tepals spreading to semi-erect, lanceolate, white; filaments completely white; pericarpel ca. 3 × 1.5 mm, triangular, smooth, naked, emerge, style ca. 5.5 mm long, stigma 2–3-lobed, spreading. Fruits 4.5–6 × 4–5 mm, globose to ellipsoid, indehiscent; pericarp whitish, rounded, naked; floral remnants deciduous. Seeds 1.5–1.6 mm long, narrowly oval, black-brown, glossy.

Material examined: Castelo, Parque Estadual de Forno Grande, 13.X.2000, fl., *L. Kollmann & C.N. Fraga 3156* (MBML, SPF); Rio Manso, 3.V.2008, fr., *R. Goldenberg et al. 1080* (MBML, RB, SPF). Santa

Teresa, Reserva Biológica Augusto Ruschi, trilha da Cachoeira, 29.I.2002, fr., *L. Kollmann & E. Bausen 5384* (MBML, SPF).

This species is endemic to the Atlantic Forest of southeastern Brazil (Zappi & Taylor 2020). In Espírito Santo, it occurs only in the CMR, in montane dense ombrophilous forest. The species is globally assessed as NT due to its small area of occupancy and continuing projected decline if the status of any of the protected areas where the species occurs changes (Goettsch *et al.* 2015). Regionally, the species is assessed as EN because of its geographic range, severely fragmented population and estimated continuing decline (Fraga *et al.* 2019b).

Specimens have been collected with flowers in October and with fruits in January and May.

The species differs from the other *Rhipsalis* in the CMR by its acrotonic branching and clavate, apical segments less than 1.2 mm in diameter. The flowers are campanulate and terminal with completely white filaments.

10. *Rhipsalis elliptica* G.Lindb. ex K.Schum., *Fl. bras.* 4(2): 293. 1890. Fig. 4g-h

Epiphyte, pendent, ca. 2.5 m long, branching acrotonic to subacrotonic. Stem segments with determinate growth, 6.9–15 × 2.0–5.4 cm, slightly succulent, 2-winged, elliptical, apex attenuate, base widely attenuate to cuneate, margin slightly crenate, projections 2–6 mm wide, epidermis dark green. Areoles 0.5–0.7 mm diam., on the stem surface, between margin projections, 4–24 mm apart, acicular scales present, leaves reduced, unarmed, cephalium absent. Flowers 7–9 mm diam., rotate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals patent to reflexed, elliptic, yellowish; filaments whitish; pericarpel 1.9–2.4 × 1.2–1.5 mm, ellipsoid, greenish, smooth, naked, emerge, style ca. 3.5 mm long, stigma 3–4-lobed, spreading. Fruits 3.6–4.4 × 3.6–3.8 mm, globose to ellipsoid, indehiscent; pericarp whitish, rounded, naked; floral remnants persistent. Seeds not seen.

Material examined: Cariacica, Reserva Biológica de Duas Bocas, 7.VIII.1999, fl., *J.M.L. Gomes 2547* (VIES). Castelo, Parque Estadual de Forno Grande, 12.X.2000, fr., *L. Kollmann & C.N. Fraga 3140* (MBML). Santa Teresa, Estação Biológica de Santa Lúcia, trilha do Rio, 16.IX.2015, *W.C. Cardoso & J.F. Barbosa 361* (R, VIES); Parque do Museu de Biologia Mello Leitão, 21.I.2005, fl., *L. Kollmann 7273* (MBML, RFA, SPF); Reserva Biológica Augusto Ruschi, trilha da divisa, saída para Goiapaba-Açu, 14.IV.2002, fr., *R.R. Vervloet et al.*

118 (MBML, SPF); 18.II.2003, fr., *R.R. Vervloet et al. 1847* (MBML, RFA, SPF).

This species is endemic to the Brazilian Atlantic Forest, where it occurs from Bahia to Rio Grande do Sul (Zappi & Taylor 2020). In Espírito Santo state, it is apparently restricted to montane dense ombrophilous forest. The species is categorized as LC due to its wide distribution and occurrence in protected areas (Goettsch *et al.* 2015); however, regionally it is VU due to an estimated continuing decrease in the population (Fraga *et al.* 2019b).

Specimens have been collected with flowers in January and August and with fruits in February, April and October.

It differs from the other cacti in the region by the following set of characters: winged stem segments with a crenate margin, acrotonic or subacrotonic branching, areoles less than 1 mm in diameter and flowers with an emerged pericarpel. *Rhipsalis elliptica* can also be distinguished from other *Rhipsalis* of the winged-stem clade (according to Calvente *et al.* 2011) from the CMR by the slightly succulent (*vs.* succulent to stiff in *R. pachyptera* and *R. russellii*), 2-winged (*vs.* 2–3-winged), slightly crenate margin (*vs.* margin crenate or lobate margin).

11. *Rhipsalis floccosa* Salm-Dyck ex Pfeiff., Enum. cact. 134. 1837. Fig. 4i-k

Epiphyte or rupicolous, pendent to semi-erect, ca. 1 m long, branching acrotonic, rarely subacrotonic. Stem segments 3–5.5 mm diam., with determinate growth, 12–25 cm long, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis green to yellowish green. Areoles 2–2.7 mm diam., sunken in the stem, elevated on podaria, revealed after the disruption of the epidermis by the erumpent floral bud, trichomes present, leaves reduced, unarmed, cephalium absent. Flowers 9–11 mm diam., rotate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals spreading, ovate to lanceolate, yellowish; filaments whitish; pericarpel 2.7–3.3 × 2.6–3 mm, obconic, reddish, smooth, naked, immerse, style ca. 5 mm long, stigma 2–3-lobed, spreading. Fruits 4.2–8 × 4.2–6.6 mm, globose to ellipsoid, indehiscent; pericarp magenta, rounded, naked; floral remnants persistent. Seeds 1–1.1 mm long, narrowly oval, black-brown, glossy.

Material examined: Castelo, Parque Estadual de Forno Grande, 13.X.2000, fr., *L. Kollmann & C.N. Fraga*

3199 (MBML, SPF). Domingos Martins, Reserva Kautsky, 7.VIII.2015, fl., *W.C. Cardoso et al.* 346 (R, VIES). Santa Maria de Jetibá, Caramuru, propriedade de Ademival e Gildo Adeodato, 24.VI.2003, fl., *L. Kollmann & M.V.S. Berger* 6251 (MBML, SPF). Santa Teresa, Estação Biológica de Santa Lúcia, próxima ao alojamento, 13.X.2015, fl. and fr., *W.C. Cardoso et al.* 381 (R); divisa da porteira, 2.VIII.2001, fl., *L. Kollmann & E. Bausen* 4230 (MBML); Reserva Biológica Augusto Ruschi, sede, 7.VI.2019, fl. and fr., *W.C. Cardoso & L.S. Brasil* 462 (R).

This species is widely distributed in neotropical forests (Barthlott *et al.* 2015). In Espírito Santo state, it occurs from restinga to montane dense ombrophilous forest. The species is categorized as LC due to its wide distribution and abundance (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

This species has been recorded with flowers in June, August, October and December and with fruits in June and October.

It differs from the other cacti in the region by the cylindrical stem segments with determinate growth, acrotonic branching, sunken areoles elevated on podaria, yellowish flowers with whitish filaments and magenta fruits.

12. *Rhipsalis hoelleri* Barthlott & N.P.Taylor, *Bradleya* 13: 50. 1995. Fig. 4l-n

Epiphyte or rupicolous, pendent, 1–3.5 m long, branching acrotonic to subacrotonic. Stem segments 3–5 mm diam., with indeterminate growth, to 87 cm long, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis light green to pale green. Areoles ca. 4 mm diam., sunken in the stem, revealed after the disruption of the epidermis by the erumpent floral bud, 8–28 mm apart, trichomes present, leaves reduced, unarmed, cephalium absent. Flowers 8.5–15 mm diam., rotate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals patent to semi-reflexed, rarely semi-erect, ovate to lanceolate, carmine to crimson, at least the middle and apex with a darker tone; filaments whitish, rarely crimson; pericarpel ca. 1 × 1 mm, subglobose, smooth, naked, immerse, style ca. 4–6 mm long, stigma 3–4-lobed, reflexed. Fruits 3–6 × 4–9 mm, subglobose, indehiscent; pericarp pink, rounded, naked; floral remnants persistent. Seeds 1.2–1.4 mm long, narrowly oval, black-brown, glossy.

Material examined: Castelo, próximo ao Parque Estadual de Forno Grande, 23.V.2014, fr., *J.P.F. Zorzanelli* 1035 (VIES); Parque Estadual de Forno Grande, 12.X.2000, fl. and fr., *L. Kollmann & C.N. Fraga*

3139 (MBML); 2.X.2015, fl., *Turma de Taxonomia de Campo* 10 (VIES); 2.X.2016, fl., *W.C. Cardoso et al.* 441 (R); 2.X.2016, fl., *W.C. Cardoso et al.* 442 (VIES); 1.XI.2004, fr., *L. Kollmann et al.* 7226 (MBML). Domingos Martins, II.1988, *B. Orssich* (SPF 160102, from vegetative propagation of the same source of the holotype); 21.IV.2004, fl., *B. Orssich* (ZSS 23405, from vegetative propagation of the same source of the holotype); Parque Estadual de Pedra Azul, 20.XI.2013, fl., *W.C. Cardoso et al.* 278 (VIES); 22.V.2014, fr., *W.C. Cardoso et al.* 288 (VIES); 19.II.2016, fr., *W.C. Cardoso et al.* 423 (R, VIES). Santa Maria de Jetibá, Pedra do Garrafão, 25.XI.2015, fr., *W.C. Cardoso & W.S. Borges* 395 (R, VIES); 25.XI.2015, fr., *W.C. Cardoso & W.S. Borges* 397 (R); 25.XI.2015, fr., *W.C. Cardoso & W.S. Borges* 401 (R, VIES); 7.X.2016, fl., *W.C. Cardoso & C.A. Royer* 433 (R, VIES); 8.IV.2017, fr., *W.C. Cardoso et al.* 456 (R, VIES); 8.IV.2017, fr., *W.C. Cardoso et al.* 457 (R, VIES). Santa Teresa, Estação Biológica de Santa Lúcia, 3.XII.2014, fr., *J. Freitas et al.* 319 (VIES); Trilha Indaiá-Açu, 16.IX.2015, fl., *W.C. Cardoso & Barbosa* 370 (R); trilha do Saguí, próximo ao encontro com a trilha Indaiá-açu, 13.X.2015, fl., *W.C. Cardoso et al.* 377 (R, VIES); 13.X.2015, fl., *W.C. Cardoso et al.* 379 (R, VIES); Reserva Biológica Augusto Ruschi, 16.X.2001, fl., *L. Kollmann & E. Bausen* 4841 (MBML); trilha para a cachoeira, 25.I.2007, fr., *A.M. Calvente & L.M. Versieux* 294 (SPF). Vargem Alta, estrada para o Morro de São Carlos, 4.II.2015, fl., *W.C. Cardoso et al.* 313 (R, VIES).

This species is endemic to the CMR and occurs in montane dense ombrophilous forest (Cardoso *et al.* 2021). It was previously categorized as DD (Goettsch *et al.* 2015) and then as EN (Fraga *et al.* 2019b); however, the species is now assessed as CR due to its severely fragmented population and small population size (Cardoso *et al.* 2021).

The species has been recorded with flowers from September to November, and in February, and with fruits from September to May.

This species is vegetatively very similar to *R. puniceodiscus* but differs by the carmine to crimson flowers and pink ripe fruits, while *R. puniceodiscus* has whitish flowers and yellow-orange ripe fruits.

13. *Rhipsalis juengeri* Barthlott & N.P.Taylor, *Bradleya* 13: 50. 1995. Fig. 5a-c

Epiphyte, pendent, ca. 3.5 m long, branching acrotonic. Stem segments 0.8–2.5 mm diam., basal segments with indeterminate growth, apical segments with determinate growth, 16–55 mm long, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis green. Areoles ca. 1 mm diam., on the stem surface, glabrate, leaves reduced, unarmed, cephalium absent. Flowers ca. 6 mm diam., campanulate, terminal,

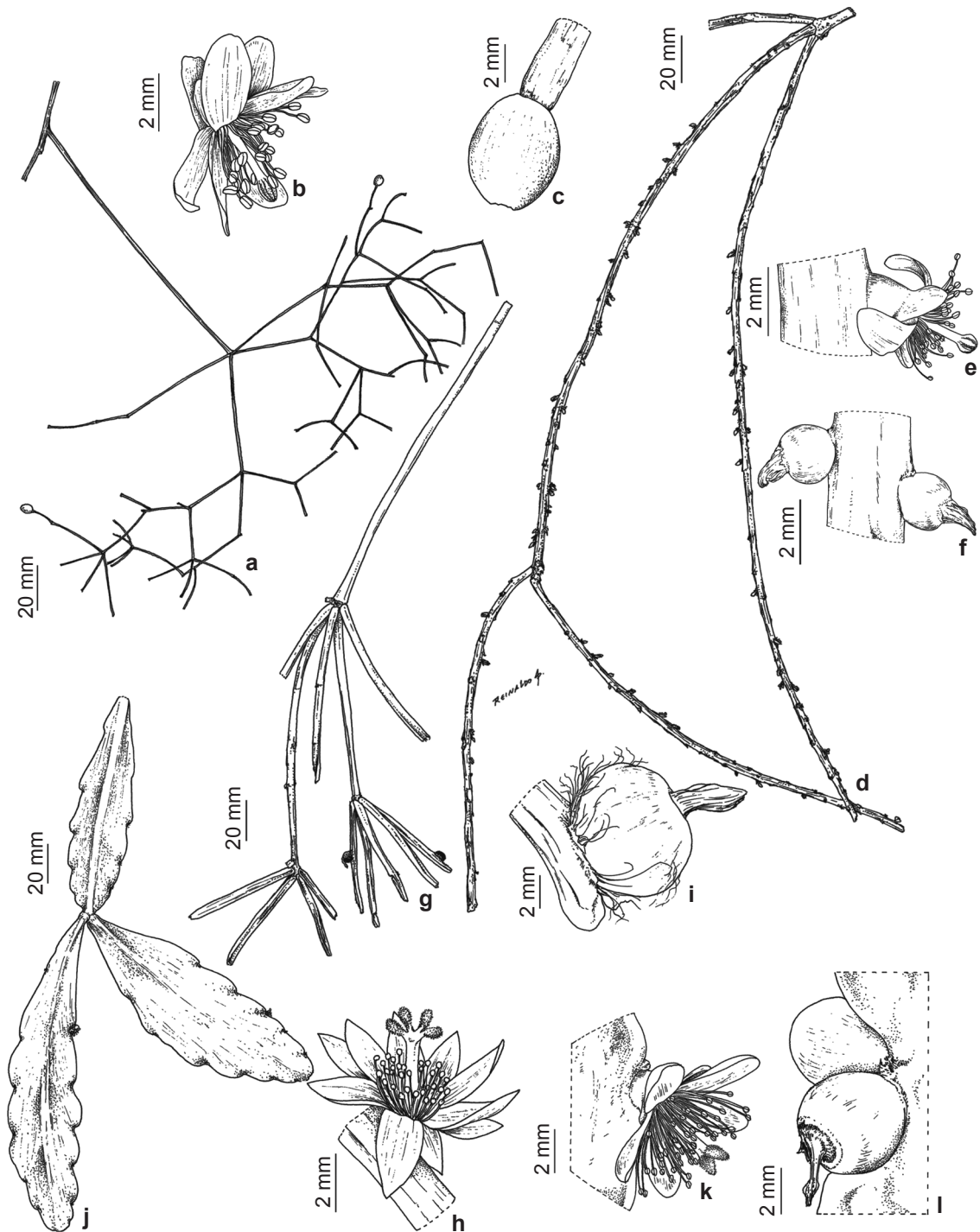


Figure 5 – a-c. *Rhipsalis juengeri* – a. stem segments; b. flower; c. fruit. d-f. *R. lindbergiana* – d. stem segments; e. flower; f. fruits. g-i. *R. neves-armondii* – g. stem segments; h. flower; i. fruit. j-l. *R. pachyptera* – j. stem segments; k. flower; l. fruit. Illustrated by Reinaldo A. Pinto (a, c. Cardoso 294; b. Kollmann 7014; d-e. Cardoso 339; f. Cardoso 386; g. Cardoso 341; h. Barbosa-Silva 97; i. Cardoso 382; j-k. Cardoso 305; l. Cardoso 338).

pendent, actinomorphic, 1–2 per areole, solitary, sessile; tube inconspicuous, tepals spreading, ovate, cream; filaments white with yellowish base; pericarpel ca. 2.5×1 mm, obconic, greenish, smooth, naked, emerge, style ca. 3.5 mm long, stigma ca. 5-lobed. Fruits $5\text{--}6 \times 4\text{--}5$ mm, ellipsoid, indehiscent; pericarp vinaceous, rounded, naked; floral remnants persistent. Seeds 1–1.2 mm long, oval, black-brown, glossy.

Material examined: Domingos Martins, Parque Estadual de Pedra Azul, trilha das Piscinas, 27.I.2014, fr., *W.C. Cardoso et al.* 293 (VIES); 27.I.2014, fr., *W.C. Cardoso et al.* 294 (VIES). Castelo, Parque Estadual de Forno Grande, 10.VII.2004, fr., *L. Kollmann & R.L. Kollmann* 6859 (MBML, SPF); Forninho, 5.IX.2004, fl. and fr., *L. Kollmann & R.L. Kollmann* 7014 (MBML, SPF).

This species is endemic to the Brazilian Atlantic Forest and occurs from the states of Espírito Santo and Minas Gerais to the state of Santa Catarina (Zappi & Taylor 2020). In Espírito Santo state, it is associated with elevated areas in montane and high-altitude dense ombrophilous forest. The species is categorized as LC due to its occurrence in protected areas (Goettsch *et al.* 2015). Regionally, it is categorized as EN because of a decrease in its estimated population and geographic range (Fraga *et al.* 2019b).

This species has been recorded with flowers in September and fruits in July, September and January.

This species has long basal stem segments that allow it to become more than three meters long. Before reaching the reproductive phase, the species is at least 2 meters long (Barthlott & Taylor 1995). Its apical and campanulate flowers have filaments that are yellowish at the base.

14. *Rhipsalis lindbergiana* K.Schum. in *Fl. bras.* 4(2): 271 1890. Fig. 5d-f

Epiphyte, pendent, 2–3 m long, branching subacrotonic. Stem segments 3.5–5 mm diam., with indeterminate growth, 2–6.6 cm long, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis light green. Areoles 0.4–1 mm diam., on the stem surface, ca. 6 mm apart, glabrate, leaves reduced, unarmed, cephalium absent. Flowers ca. 3.5 mm diam., rotate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals spreading to reflexed, triangulate, cream to pinkish; filaments whitish; pericarpel ca. 2.5×1.5 mm, globose, greenish to reddish, naked, emerge, style ca. 2–3 mm long, stigma 2–3-lobed, erect. Fruits ca. 1.8×1.8 mm,

globose, indehiscent; pericarp white to deep purple-red, rounded, naked; floral remnants persistent. Seeds 0.7–0.8 mm long, narrowly oval to oval, black-brown, glossy.

Material examined: Alfredo Chaves, beira da estrada de chão, próximo a habitações, 5.III.2015, fr., *W.C. Cardoso & L.A. Silva* 328 (R, VIES). Domingos Martins, Reserva Kautsky, 7.VIII.2015, fl., *W.C. Cardoso et al.* 339 (R, VIES); 21.X.2015, fr., *W.C. Cardoso et al.* 386 (R). Santa Leopoldina, sede, 10.IX.2009, fl. and fr., *A.M. Assis & F.M. Flores* 2052 (MBML). Santa Maria de Jetibá, às margens do Rio Santa Maria, 30.X.2000, fl., *O.J. Pereira & E. Espindula* 6534 (VIES). Santa Teresa, alto Rio Perdido, 1.XI.2010, fl., *L. Kollmann & R.L. Kollmann* 12068 (MBML).

This species is endemic to Brazil and occurs from the state of Paraíba to the state of Paraná, in the Caatinga and Atlantic Forest domains (Zappi & Taylor 2020). In Espírito Santo, it occurs from lowland to montane dense ombrophilous forest. It is widely distributed and occurs in urbanized environments. Due to this and to being tolerant to habitat loss, it is categorized as LC (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

The species has been recorded with flowers from August to November and with fruits in October and March.

The species is distinguished from other cacti in the region by the stem segments with indeterminate growth and subacrotonic branching, and for producing a large number of branches that hang from trees. Its flowers have an emerged pericarpel on the stem.

15. *Rhipsalis neves-armondii* K.Schum. in *Fl. bras.* 4(2): 284. 1890. Fig. 5g-i

Epiphyte, occasionally rupicolous, pendent, 0.5–0.7 m long, branching acrotonic. Stem segments 3–5 mm diam., with determinate growth, basal segments to 24 cm long, apical segments 5.5–10 cm long before fully grown, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis dark green. Areoles 3–5 mm diam., sunken in the stem, revealed after the disruption of the epidermis by the erumpent floral bud, leaves reduced, unarmed, cephalium absent. Flowers 11–17 mm diam., rotate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals spreading to reflexed, elliptic to lanceolate, whitish; filaments orange-yellow; pericarpel ca. 2.5×2.3 mm, obconic, greenish, smooth, naked, immerse, style ca. 4.2 mm long, stigma 4–6-lobed, reflexed. Fruits $8.3\text{--}9 \times 9.5\text{--}9.7$ mm, subglobose, indehiscent; pericarp magenta,

rounded, naked; floral remnants persistent. Seeds 1.1–1.3 mm long, narrowly oval to oval, black-brown, glossy.

Material examined: Castelo, Parque Estadual de Forno Grande, 5.IX.2004, fl., *L. Kollmann & R.L. Kollmann 7002* (MBML); alto do Pico do Forno, 7.VIII.2013, fl., *R.G. Barbosa-Silva et al. 97* (RB, VIES). Domingos Martins, Campinho, área urbana, 15.X.2015, fr., *W.C. Cardoso et al. 382* (R, VIES); Reserva Kautsky, estrada principal, 7.VIII.2015, fr., *W.C. Cardoso et al. 341* (R, VIES). Santa Leopoldina, paredão rochoso à beira da rodovia ES-264, 26.XI.2015, fr., *W.C. Cardoso & W.S. Borges 412* (R). Santa Teresa, Estação Biológica de Santa Lúcia, trilha da divisa, 16.IX.2015, fr., *W.C. Cardoso & J.F. Barbosa 365* (R, VIES).

This species is endemic to the Brazilian Atlantic Forest and occurs from the state of Bahia to the state of Santa Catarina (Zappi & Taylor 2020). In the CMR, it occurs in montane and high-altitude dense ombrophilous forest, but outside the region it has also been recorded in montane seasonal semideciduous forest (Couto *et al.* 2016). The species is categorized as LC due to its geographic range and occurrence in protected areas (Goetsch *et al.* 2015; Fraga *et al.* 2019a).

In the CMR, this species has been recorded with flowers from August to September and with fruits from August to October.

Rhipsalis neves-armondii differs from other epiphytic cacti in the region by its cylindrical, exclusively determinate stem segments, areoles immersed in the stem, and flowers in the apical region. This species can be distinguished from *R. floccosa* by the areoles with 3–5 mm diam. (2–2.7 mm diam. in *R. floccosa*) and flowers with orange-yellow filaments (whitish in *R. floccosa*).

16. *Rhipsalis pachyptera* Pfeiff., Enum. Diagn. Cact.: 132. 1837. Fig. 5j-l

Epiphyte, occasionally rupicolous, pendent, 0.3–2 m long, branching acrotonic to subacrotonic. Stem segments with determinate growth, 11–26 × 2.8–5 cm, succulent to stiff, 2–3-winged, elliptical, apex truncate or rounded, base cuneate, margin crenate, projections 4–12 mm wide, epidermis green. Areoles 2–4 mm diam., on the stem surface, between margin projections, 10–44 mm apart, leaves reduced, unarmed, cephalium absent. Flowers 12–20 mm diam., rotate, lateral, patent, actinomorphic, 1–3 per areole, solitary, sessile; tube inconspicuous; tepals spreading, elliptic to widely ovate, yellow; filaments whitish; pericarpel 3.4–4.4 × 3.3–3.6 mm, obconic to subglobose, yellowish to reddish, smooth, naked, emerge, style 4.3–6 mm

long, stigma 3–4-lobed, erect. Fruits ca. 7 × 7 mm, globose, indehiscent; pericarp white to pinkish, rounded, naked; floral remnants persistent. Seeds 1.1–1.2 mm long, narrowly oval to oval, black-brown, glossy.

Material examined: Castelo, próximo ao Parque Estadual de Forno Grande, 19.I.2007, fr., *A. Calvente et al. 272* (SPF); 19.I.2007, fl. and fr., *A. Calvente et al. 277* (SPF); Parque Estadual de Forno Grande, trilha para as piscinas, 12.II.2008, fl., *C.N. Fraga et al. 1819* (MBML, RB, RFA, SPF, UPCB); 12.VI.2004, fr., *L. Kollmann & R.L. Kollmann 6755* (MBML); trilha para o mirante, 2.X.2016, *W.C. Cardoso et al. 440b* (R). Domingos Martins, próximo a Campinho, 27.VIII.1974, fr., *G. Martinelli 419* (RB); Reserva Kautsky, 7.VIII.2015, fr., *W.C. Cardoso et al. 338* (VIES); 7.VIII.2015, fr., *W.C. Cardoso et al. 345* (VIES). Marechal Floriano, distrito de Victor Hugo, Sítio do Sabiá, 10.II.2013, fl., *W.C. Cardoso 305* (R, VIES); 16.I.2016, fl., *W.C. Cardoso et al. 429* (R). Santa Maria de Jetibá, Caramuru, Sítio Jetibá, 24.VI.2003, fl., *L. Kollmann & M.V.S. Berger 6236* (MBML, SPF); distrito de Garrafão, Sítio Renascer, 18.IV.2009, fl., *T.S. Lorencini et al. 234* (VIES); Pedra do Garrafão, 25.XI.2015, fr., *W.C. Cardoso & W.S. Borges 396* (R).

This species is endemic to the Brazilian Atlantic Forest and occurs from the state of Espírito Santo to the state of Rio Grande do Sul (Zappi & Taylor 2020). In the CMR, it occurs at montane dense ombrophilous forest. It also occurs in coastal areas in Espírito Santo state. The species is assessed as LC due to its wide distribution (Goetsch *et al.* 2015; Fraga *et al.* 2019a).

This species has been collected with flowers in January, February, April and June and with fruits in January, June, August and November.

Rhipsalis pachyptera is characterized by the winged, thick stem segments with an apex that is usually truncate. Its fruits vary from whitish to pink (Calvente 2010). Pink fruits and flowers with a reddish pericarpel were observed on individuals exposed to full sun. It is similar to *R. russellii*, differing by the flowers with 12–20 mm diam. (5–7 mm diam. in *R. russellii*) and white to pinkish fruits (vs. magenta fruits); and to *R. elliptica*, differing by the areoles with 2–4 mm diam. (0.5–0.7 mm diam. in *R. elliptica*).

17. *Rhipsalis paradoxa* (Salm-Dyck ex Pfeiff.) Salm-Dyck, Cact. Hort. Dyck. 1849: 228. 1850.

Fig. 6a-b

Epiphyte, pendent, ca. 1.5 m long, branching usually acrotonic, rarely subacrotonic. Stem segments 7–12 mm diam., with determinate growth, 11–25.5 cm long, succulent, 3–4-angulated, angles

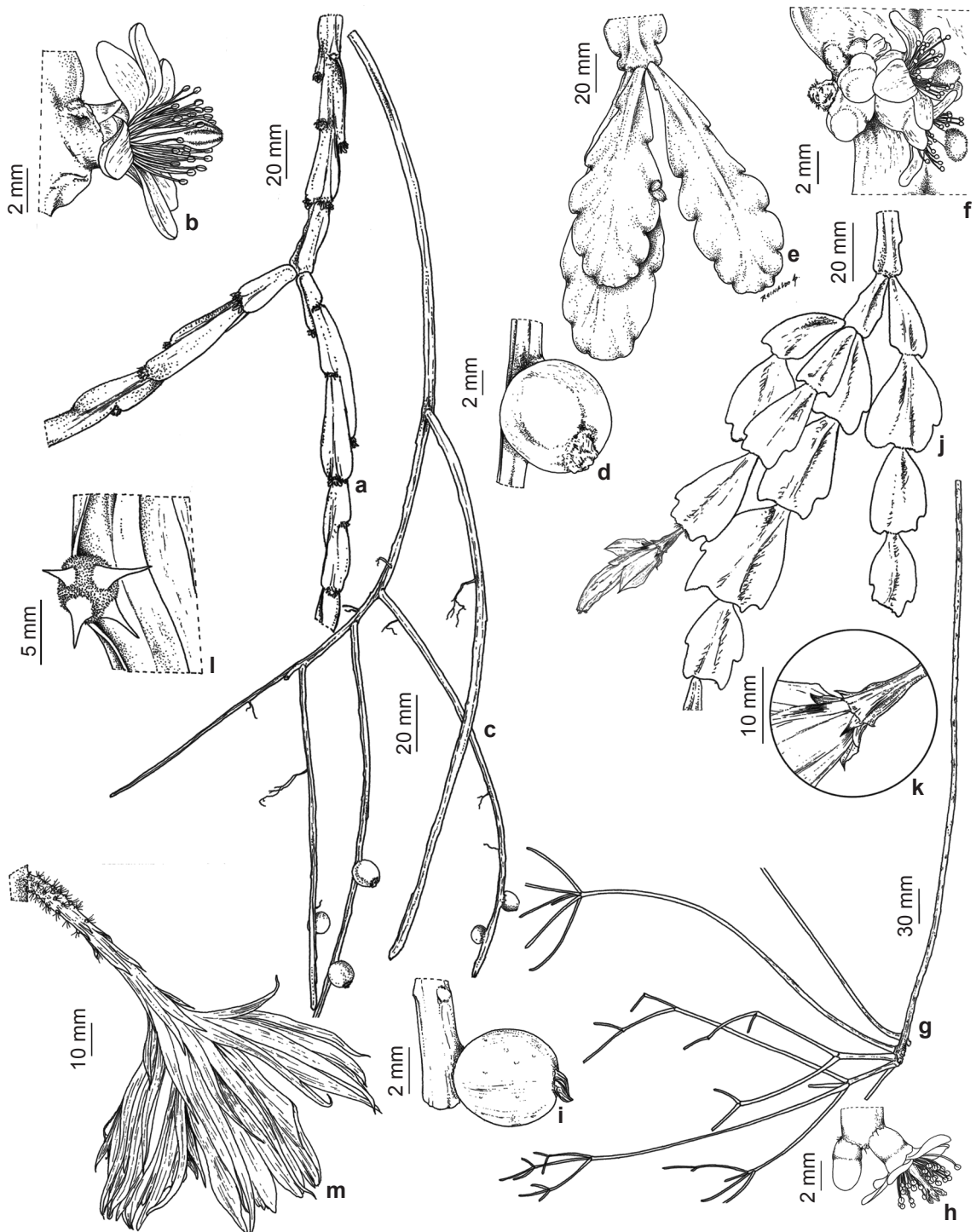


Figure 6 – a-b. *R. paradoxa* – a. stem segments; b. flower. c-d. *R. puniceodiscus* – c. stem segments; d. fruit. e-f. *R. russellii* – e. stem segments; f. flowers. g-i. *R. teres* – g. stem segments; h. flower and floral bud; i. fruit. j-k. *Schlumbergera kautskyi* – j. stem segments; k. detail of the pericarpel. l-m. *Selenicereus setaceus* – l. areole with conical spines; m. flower. Illustrated by Reinaldo A. Pinto (a-b. Cardoso 336; c. Cardoso 360; d. Cardoso 376; e. Fontana 2726; f. Cardoso 277; g-h. Cardoso 298; i. Cardoso 319; j-k. Kollmann 8947; l. Cardoso 415; m. Hatschbach 71506).

discontinuous and alternate, epidermis green to yellowish green, reddish when growing in direct sunlight. Areoles 4–6 mm diam., sunken in the stem, revealed after the disruption of the epidermis by the erumpent floral bud, 18–45 mm apart, leaves reduced, unarmed, cephalium absent. Flowers 7–12 mm diam., rotate, lateral, patent, actinomorphic, 1–2 per areole, sessile; tube inconspicuous, tepals patent to spreading, elliptic to lanceolate, yellowish to pinkish; filaments whitish; pericarpel ca. 3.5 × 3.5, obconic, yellowish, smooth, naked, immerse, style ca. 3.5 mm long, stigma ca. 6-lobed, erect. Fruits 5–6 × 6–7 mm, globose to subglobose, indehiscent; pericarp whitish, rounded, naked; floral remnants persistent. Seeds ca. 1.2 mm long, narrowly oval, black-brown, glossy.

Material examined: Domingos Martins, Reserva Kautsky, 7.VIII.2015, fr., *W.C. Cardoso et al.* 336 (R, VIES). João Neiva, distrito de Demétrio Ribeiro, 8.VI.2019, fl., *W.C. Cardoso & P. Soares* 467 (R, VIES). Santa Leopoldina, Colina Verde, propriedade de I.E. Ramos, 30.VI.2006, fl., *V. Demuner et al.* 2545 (MBML, SPF).

This species is endemic to Brazil and occurs from the state of Pernambuco to the state of Rio Grande do Sul, in the Caatinga and Atlantic Forest domains (Zappi & Taylor 2020). In the CMR, it has been recorded in submontane and montane dense ombrophilous forest, but also occurs in lowland dense ombrophilous forest in Espírito Santo state. The species is categorized as LC at the global and national levels due to its wide distribution and occurrence in conservation units (Goettsch *et al.* 2015). However, regionally it is assessed as EN due to the estimated continuing decline in geographic range and number of mature individuals (Fraga *et al.* 2019b).

The few specimens of this species from the region were collected with flowers in June and with fruits in August.

This species differs from other epiphytic cacti in the region by the angled and determinate stem segments, with discontinuous and alternate angles, and sunken areoles.

18. *Rhipsalis puniceodiscus* G.Lindb., *Gartenflora* 42: 233. 1893. Fig. 6c-d

Epiphyte, pendent, ca. 2 m long, branching acrotonic to subacrotonic. Stem segments ca. 3 mm diam., with indeterminate growth, to 70 cm long, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis light green to pale green. Areoles ca. 4 mm diam., sunken in the stem, revealed after the disruption of the epidermis by

the erumpent floral bud, leaves reduced, unarmed, cephalium absent. Flowers ca. 10 mm diam., rotate, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals spreading, elliptic to ovate, whitish; filaments white, slightly orange-yellow at the base; pericarpel ca. 2.1 × 2.5 mm, subglobose, red, smooth, naked, half-immerse. Fruits 5–5.6 × 5–7 mm, subglobose to globose, indehiscent; pericarp shiny brownish red to orange, rounded, naked; floral remnants persistent. Seeds 1–1.2 mm long, narrowly oval to oval, black-brown, glossy.

Material examined: Santa Teresa, Estação Biológica de Santa Lúcia, trilha do Túmulo, 16.IX.2015, fr., *W.C. Cardoso & J.F. Barbosa* 358 (R, VIES); trilha da divisa, 16.IX.2015, fr., *W.C. Cardoso & J.F. Barbosa* 363 (R, VIES); Praça Vereador Solimar Merlo, 13.X.2015, fr., *W.C. Cardoso et al.* 376 (R, VIES).

Additional material: BRAZIL. SANTA CATARINA: Joinville, Serra Dona Francisca, 10.XII.2009, fl., *T.J. Cadorin et al.* 838 (FURB).

This species is endemic to Brazilian Atlantic Forest and distributed from the Espírito Santo to the Rio Grande do Sul states (Cardoso *et al.* 2018; Zappi & Taylor 2020). In the CMR, the species occurs in montane dense ombrophilous forest. It is globally assessed as LC (Goettsch *et al.* 2015) and regionally assessed as EN due to the estimated continuing decline in its geographic range and number of mature individuals (Fraga *et al.* 2019b).

This species has been recorded with immature fruits in September and with mature fruits in October.

This species is similar to *R. hoelleri*, differing by the whitish tepals (*vs.* carmine to crimson tepals in *R. hoelleri*) and brownish red to orange fruits (*vs.* pink fruits in *R. hoelleri*).

19. *Rhipsalis russellii* Britton & Rose in *Cactaceae* 4: 242. 1923. Fig. 6e-f

Epiphyte, pendent, ca. 1 m long, branching acrotonic. Stem segments with determinate growth, 7–14.5 × 2–5.5 cm, succulent to stiff, 2–3-winged, elliptical, apex truncate or rounded, base cuneate, margin crenate to lobate, projections 4–8 mm wide, epidermis green. Areoles 2–3 mm diam., on the stem surface, between margin projections, 18–28 mm apart, leaves reduced, unarmed, cephalium absent. Flowers 5–7 mm diam., rotate, lateral, patent, actinomorphic, 1–3(–many) per areole, solitary, sessile; tube inconspicuous, tepals patent, shallowly triangular to ovate, greenish; filaments whitish; pericarpel ca. 3 × 3 mm, globose, greenish, smooth, naked, emerge, style ca. 2.5 mm long,

stigma ca. 6-lobed, erect. Fruits 4–6 × 4–5 mm, globose, indehiscent; pericarp magenta, rounded, naked; floral remnants persistent. Seeds 0.9–1 mm long, oval, black-brown, glossy.

Material examined: Santa Leopoldina, Cachoeira Recanto da Mata, 26.I.2007, fr., *A.P. Fontana et al.* 2726 (RB).

Additional material: BRAZIL. ESPÍRITO SANTO: Linhares, Reserva Natural Vale, próximo ao antigo marco de ferro, 20.IX.1994, fl., *D.A. Folli 2375* (CVRD, RB, SPF). Vila Velha, Morro do Moreno, topo do morro, 30.VI.2013, fl. and fr., *W.C. Cardoso & V.B. Sarnaglia Jr.* 277 (VIES).

This species is endemic to Brazil and occurs in the states of Bahia, Minas Gerais, Espírito Santo, Paraná, Goiás and Mato Grosso, in the Caatinga, Cerrado and Atlantic Forest domains (Zappi & Taylor 2020). In Espírito Santo state, it occurs in lowland, submontane and dense montane ombrophilous forest. This species is categorized as VU at the global level (Goettsch *et al.* 2015) and EN at the regional level (Fraga *et al.* 2019b).

The only material of the species in the area was collected with fruits in January.

Vegetatively, it is similar to *R. pachyptera* but differs mainly by the smaller flowers, 5–7 mm diam., and fruits with a magenta pericarp, while *R. pachyptera* has 13–20 mm diam. flowers and fruits with a white to pinkish pericarp.

20. *Rhipsalis teres* (Vell.) Steud., Nomencl. Bot. ed. 2, 2: 449. 1841. Fig. 6g-i

Epiphyte, pendent, to 2 m long, branching subacrotonic. Stem segments with indeterminate growth, basal segments 2–4 mm diam., to 60 cm long, apical segments 0.8–2.4 mm diam., 3–4.9(–11.5) cm long, succulent, cylindrical, ribs, angles and wings absent, margin entire, epidermis green. Areoles 0.7–1.2 mm diam., on the stem surface, 7–8 mm apart, leaves reduced, unarmed, cephalium absent. Flowers 7–8.5 mm diam., rotate, lateral to subterminal, patent, actinomorphic, 1 per areole, solitary, sessile; tube inconspicuous, tepals patent, elliptic, greenish white; filaments whitish; pericarpel 2–2.4 × 1.5–2.5 mm, ellipsoid to subglobose, green, smooth, naked, emerge, style ca. 3 mm long, stigma 2–3-lobed, spreading. Fruits 5–5.7 × 4.8–6.1 mm, globose, indehiscent; pericarp whitish, rounded, naked; floral remnants persistent. Seeds 1–1.1 mm long, narrowly oval, black-brown, glossy.

Material examined: Cachoeiro de Itapemirim, Burarama, Alto Canta Galo, 4.X.2010, fl., *D.R. Couto et al.* 1659 (UFRN, VIES). Castelo, Parque Estadual de

Forno Grande, 1.XI.2004, fr., *L. Kollmann et al.* 7222 (MBML, SPF). Santa Teresa, Estação Biológica de Santa Lúcia, 27.V.2000, fl., *L.M. Versieux 190* (RB); 14.X.2003, fr., *L. Kollmann 6295* (MBML); 11.V.2006, fr., *L. Kollmann & S. Krauser 9116* (MBML, SPF). Vargem Alta, Morro de São Carlos, 4.II.2015, fr., *W.C. Cardoso et al.* 319 (R, VIES).

Additional material: BRAZIL. ESPÍRITO SANTO: Iúna, Parque Nacional do Caparaó, Mata da Cachoeira Bonita, 3.XII.2010, fr., *A.K.L. Venda et al.* 36 (BHCB, RB). Serra, Área de Proteção Ambiental Mestre Álvaro, 13.IV.2014, fl., *W.C. Cardoso et al.* 298 (VIES).

This species is endemic to the Brazilian Atlantic Forest and occurs from the states of Espírito Santo and Minas Gerais to the state of Rio Grande do Sul (Zappi & Taylor 2020). In the CMR, the species has been recorded in montane dense ombrophilous forest, and outside the region it has been recorded in montane seasonal semideciduous forest (Couto *et al.* 2016) and high-altitude dense ombrophilous forest in the state. It is assessed as LC due to its wide distribution (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

In the CMR, the species has been recorded with flowers in May and October and with fruits in February, May, October and November.

It can be distinguished from other epiphytic cacti in the region by the presence of cylindrical stem segments, with indeterminate growth and subacrotonic branching, flowers 7–8.5 mm diam. that are rotate and lateral to subterminal, and a pericarpel emerged on the stem.

21. *Schlumbergera kautskyi* (Horobin & McMillan) N.P.Taylor, Bradleya 9: 90. 1991.

Fig. 6j-k

Epiphyte or rupicolous, pendent or semi-erect, 0.4–0.7 m long, branching acrotonic. Stem segments with determinate growth, 2.1–5.5 × 1.1–3.1 cm, succulent, 2-winged, obtriangular, apex truncate, base cuneate, wings 8–12 mm wide, margin toothed, projections 2–8 mm long, epidermis green. Areoles 1–2 mm diam., on the stem surface, between margin projections and segment apex, 8–17 mm apart, trichomes and acicular scales present, leaves reduced, unarmed, cephalium absent. Flowers ca. 20 mm diam., infundibular, lateral, semi-patent, zygomorphic, solitary, sessile; tube conspicuous, 25–29 mm long, tepals spreading to reflexed, ovate to lanceolate, pink to magenta; filaments whitish; pericarpel 9–13 × 2–4 mm, obconic, green, 4–6-angled, naked, emerge, style and stigmas not seen. Fruits ca. 15 × 7 mm, turbinate, indehiscent; pericarp

yellow-green to reddish, 4–6-angled, naked; floral remnants persistent. Seeds ca. 2 mm long, oval, black-brown, glossy.

Material examined: Alfredo Chaves, 7.5 km ao sul do distrito de São Bento de Urânia, sul da rodovia BR-262, 31.VII.1986, fr., *T.B. Croat 61854* (R, MO). Castelo, Parque Estadual de Forno Grande, 20.IV.2006, fl., *L. Kollmann & R.L. Kollmann 8947* (MBML).

Additional material: BRAZIL. ESPÍRITO SANTO: Divino de São Lourenço, 23.I.2008, fl., *L. Kollmann et al. 10412* (MBML). MINAS GERAIS: Araponga, Parque Estadual Serra do Brigadeiro, trilha do Muriqui, 18.I.2015, fr., *D.R. Gonzaga et al. 427* (RB); 8.VI.2015, fl., *D.R. Gonzaga 555* (RB).

Until recently, *Schlumbergera kautskyi* was cited as endemic to Espírito Santo state (Taylor & Zappi 2004) and recorded only for the CMR, in dense montane ombrophilous forest. Currently, the species has also been recorded outside this region in the state, in high-altitude dense ombrophilous forest, and in some localities in Minas Gerais state (Gonzaga *et al.* 2020). The species is assessed as EN due to its severely fragmented distribution and estimated continuing decline in geographic range, number of subpopulations and mature individuals (Goettsch *et al.* 2015). Regionally, it is categorized as CR due to its small population size and estimated continuing decline in number of mature individuals (Fraga *et al.* 2019b).

The few specimens from CMR have been collected with flowers in April and with fruits in July.

Vegetatively, *S. kautskyi* can be confused with *S. truncata* (Haw.) Moran (1953: 329), but it differs from the latter by the angulated pericarpel and fruits. Although *S. truncata* is cited for Espírito Santo state (Zappi & Taylor 2020), we did not find any material of this species from natural areas.

22. *Selenicereus setaceus* (Salm-Dyck *ex* DC.) A. Berger *ex* Werderm., Bras. Säulenkakt. 87. 1933. Fig. 6l-m

Epiphyte or climber, prostrate to semi-erect, branching mesotonic. Stem segments 15–35 mm diam., with indeterminate growth, succulent, 3-angled, angles 6–20 mm long, continuous, margin linear to slightly sinuous, epidermis green. Areoles 4–5 mm diam., on the stem surface, 25–46 mm apart, trichomes present, conical spines 4–5, ca. 4 × 3 mm, yellowish brown, cephalium absent. Flowers ca. 130 mm diam., infundibular, lateral, patent, actinomorphic, 1 per areole, solitary, sessile; tube conspicuous, 80–100 mm long, sepaloid tepals lanceolate, greenish, spreading, semi-succulent,

petaloid tepals lanceolate to oblong, whitish, reflexed, delicate; filaments whitish; pericarpel 24–33 × 13 mm, ellipsoid, covered by podaria and acicular spines, emerse, style ca. 200 mm long, stigma ca. 18-lobed, spreading. Fruits ca. 65 × 50 mm, ovoid, dehiscent by irregular slits or indehiscent; pericarp dark red, tuberculate, spinescent areoles present, spines deciduous; floral remnants deciduous. Seeds 3.4–3.5 mm long, oval, black-brown, glossy.

Material examined: Alfredo Chaves, fragmento em propriedade particular, 5.III.2015, *W.C. Cardoso & L.A. Silva 327* (VIES). Castelo, Alto Caxixe, 22.X.2000, fl., *G. Hatschbach & J.M. Silva 71506* (HUEFS, HUFU, MBM, SPF). Santa Leopoldina, paredão rochoso à margem da BR, 26.XI.2015, *W.C. Cardoso & W.S. Borges 415* (VIES). Santa Teresa, propriedade de D. Demuner, 2.XI.1999, fl., *V. Demuner 211* (MBML, RFA); alto Rio Perdido, 1.XI.2010, fl., *L. Kollmann & R.L. Kollmann 12078* (MBML).

Additional material: BRAZIL. ESPÍRITO SANTO: Vila Velha, Morro do Moreno, 2.X.2011, fl., *W.C. Cardoso 124* (VIES). Vitória, Campus da UFES, próximo à quadra do Departamento de Educação Física e Desportos, 17.XI.2011, fr., *W.C. Cardoso & T.O. Pesente 45* (VIES).

This species occurs in Argentina, Bolivia, French Guiana, Guyana, Paraguay, Suriname and Brazil and is widely distributed in the latter country (Barthlott *et al.* 2015; Zappi & Taylor 2020). In Espírito Santo state, it occurs from restinga to montane dense ombrophilous forest. Due to the high frequency of *S. setaceus* and its occurrence in protected areas, its conservation status is LC, even though its population is in decline (Goettsch *et al.* 2015; Fraga *et al.* 2019a).

In the CMR, it has been recorded with flowers from October to November. Plants with fruits have not been observed in the study area.

The species is easily distinguished by the following set of characters: 3-angled stems, areoles producing 3–4 conical spines and flowers 80–100 mm long with a spiny pericarpel.

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