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Flora of Espírito Santo, Brazil

Flora of Espírito Santo: Lecythidaceae

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Abstract

The Lecythidaceae clade has a pantropical distribution and comprises 24 genera and 355 species. Ten genera and 121 species occur in Brazil, where species richness is highest in Amazonia. Four genera and 14 species were recorded in Espírito Santo, as well as two cultivated species. Important characters used to identify the species are the morphology of the bark, shape and size of the leaves, presence and shape of trichomes on the leaves and inflorescences, inflorescence type, morphology and color of the perianth (especially the petals), morphology of the androecium, shape and dimension of the fruits and seeds, and morphology of the arils. Identification keys, descriptions, illustrations, and comments for the taxa are provided.

Key words: Brazil, Ericales, *jequitibás*, *sapucaias*, taxonomy.

Resumo

Lecythidaceae tem distribuição pantropical com 24 gêneros e 355 espécies. No Brasil ocorrem 10 gêneros e 121 espécies, com predomínio de riqueza na Amazônia. Para o Espírito Santo foram encontrados quatro gêneros e 14 espécies. Caracteres importantes na identificação das espécies são a morfologia da casca, forma e dimensão foliar, presença e formato dos tricomas nas folhas e inflorescência, tipo de inflorescência, morfologia e coloração do perianto, especialmente das pétalas, morfologia do androceu, forma e dimensão dos frutos e sementes, e forma do arilo. Chave de identificação, descrições, ilustrações e comentários sobre os táxons são apresentados.

Palavras-chave: Brasil, Ericales, jequitibás, sapucaias, taxonomia.

Introduction

The Lecythidaceae clade (order Ericales) comprises 24 genera and 355 species (Prance & Mori 1979; Mori & Prance 1990a; Prance 2012; Mori & Cornejo 2013; Prance & Jongkind 2015; Mori *et al*. 2017). It has a pantropical distribution and occurs in Asia, Africa, Australia and tropical America. Currently, Lecythidaceae *sensu lato* comprise the subclades Napoleonaeaceae, Scytopetalaceae, Foetidioideae, Barringtonioideae and Lecythidoideae, of which the last three are in Lecythidaceae *sensu stricto* (Mori *et al*. 2017).

In the Neotropics, there is a single species of Scytopetalaceae called *Asteranthos brasiliensis* Desfontaines (1820: 9). All other *taxa* belong to Lecythidoideae, a subfamily exclusive to this biogeographic region with 10 genera and 213 species (Prance & Mori 1979; Mori & Prance 1990a; Mori *et al*. 2017). In Brazil, there are ten genera and 121 species of Lecythidaceae, which are predominantly found in the Amazon phytogeographic domain; some species occur the Atlantic Forest and the family is poorly represented in the Cerrado (BFG 2018). In the Atlantic Forest,

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65% of the Lecythidaceae species are endemic and some of these species have restricted distributions (Mori 1995; Ribeiro *et al*. 2016a; Smith *et al*. 2016a; BFG 2018). From this point on, when we mention Lecythidaceae in this paper, we are referring to subfamily Lecythidoideae.

Historically, Espírito Santo state was completely covered by Atlantic Forest. Today, however, only 12.6% of the original forest remains (Fundação SOS Mata Atlântica & INPE 2019). The state is one of the four centers of endemism recognized for the domain, called Rio Doce, and is part of the Central Corridor of the Atlantic Forest, a region with high levels of diversity of various taxonomic groups, groups that are threatened, and species with restricted distributions (Aguiar *et al*. 2005).

Studies of Lecythidaceae in Espírito Santo state recorded 11 species and two morphospecies (Ribeiro *et al*. 2014), of which one of the latter was described as a new species (Ribeiro *et al*. 2016a) and the other species was a new record of occurrence (Ribeiro *et al*. 2016b). This differs from Dutra *et al.* (2015), who provided an angiosperm checklist that cited 12 species for the state. Overall, this highlights the importance of Espírito Santo for the group, since it currently is the second richest Brazilian state in the Atlantic Forest domain for Lecythidaceae diversity; the first is Bahia (Ribeiro *et al*. 2014; Smith *et al*.2016a; BFG 2018).

Several publications note the need for additional studies about the family due to the lack of morphological and ecological data that limit our understanding and the delimitation of some taxa (Prance & Mori 1979; Mori 1990b; Mori & Prance 1990a; Matta & Scudeller 2012; Procópio *et al*. 2010). Mori (1995) and Smith *et al*. (2016a) point to a lack of information and collections from eastern Brazil. Therefore, the goals of this work were to inventory and characterize the taxa of Lecythidaceae in Espírito Santo, aiming to increase the amount information about them and contribute to the knowledge of the flora of the state.

Materials and Methods

Botanical expeditions were carried out from 2011 to 2014, and sporadic fieldwork was conducted until 2020, in different phytophysiognomies in the state (see table in Ribeiro *et al*. 2014). We conducted fieldwork in the municipalities of Baixo Guandu, Barra de São Francisco, Guarapari, Itaguaçu, Marilândia, Pedro Canário and Santa Maria de Jetibá. The collected material was processed according to Mori & Prance (1987), which has specific recommendations for the family, in addition to being photographed. Specimens were deposited in the RB herbarium and RBcarpo carpoteca. Duplicates were sent to VIES and SAMES. Collections from Espírito Santo in BHCB, CEPEC, CVRD, GUA, MBML, NY, R, RB, RBR, SAMES and VIES were examined (acronyms according to Thiers, continuously updated). *In sicco* or rehydrated material was examined using a stereomicroscope and structures were measured with a caliper. The illustrations were made by the first author from rehydrated or *in vivo* material.

Material was identified using literature (Prance & Mori 1979; Mori & Prance 1990a; Mori 1995) and comparing it with herbarium specimens, nomenclatural types, and online collections on the Lecythidaceae Pages (Mori *et al.* 2010).

Trunk, inflorescence, flower and fruit terminology is based on specific literature (Prance & Mori 1979; Mori *et al*. 2015; Huang *et al*. 2015). For aspects of the bark, Ribeiro *et al*. (1999), was used, especially for the definition of squamose bark. Ellis *et al*. (2009), Payne (1978) and Stearn (1983) were used for leaf characters, trichomes and indument, and general morphological descriptions, respectively.

For Lecythidaceae, sterile collections (st.) are needed to document the differences between immature and mature individuals. For example, bark may change from smooth to fissured with age and leaves of saplings are often larger and more membranaceous than those from the canopy of large trees. The phenology of fruits and seeds of Lecythidaceae needs to be observed carefully because most of the species have woody capsules that remain on the plant long after the seeds have been carried away by dispersal agents. Thus, we reported the phenology of fruits as follows: mature fruits (mat. fr.), *i.e.*, dehiscent fruits with seeds; and past fruits (pst. fr.), *i.e.*, fruits collected from the crown or from the ground without seeds. The latter were not counted as part of the fruiting period.

The descriptions of genera and species are based only on specimens from Espírito Santo. Bark characters are included in the descriptions and identification keys to help researchers during future floristic and/or phytosociological studies.

Results and Discussion

In Espírito Santo, we recorded four genera and 14 species of Lecythidaceae (Figs. 1-7): *Cariniana* and *Lecythis*, with four species each;

and *Couratari* and *Eschweilera*, with three species each. This comprises about 63% of the Lecythidaceae species richness in the Atlantic Forest. Most of the species occur in *tabuleiro* forest (coastal lowland forest) (13 species, 6 endemic) and hillside forest (seven species, 1 endemic). In *restinga* vegetation (coastal dune scrub forest) there is only one species, *Eschweilera ovata* (Cambess.) Mart. *ex* Miers (1874: 257).

Eschweilera complanata S.A. Mori (1995: 16) (Dutra *et al*. 2015) and *Lecythis* sp.1 (Ribeiro *et al*. 2014) were previously recorded to the state and are now treated as *E. sphaerocarpa* M.Ribeiro & S.A. Mori (2016: 268) and *L. marcgraaviana* Miers (1874: 210). The first species is newly described, and the second species was resurrected (Smith *et al*. 2016b). Two species native to Amazonian forest are cultivated in state: *Couroupita guianensis* Aublet (1775: 708), called *abricó-de-macaco* or the cannon-ball tree; and *Bertholletia excelsa* Bonpland (1807: 122), called *castanha-do-Brasil*, *castanha-do-Pará*, or the Brazil nut.

In addition to the more often used reproductive characters (especially the morphology of flowers, fruits and seeds), the family in the Espírito Santo state can generally be recognized by the following combination of vegetative characters: arboreal habit; bark usually fissured, squamose, fibrous (*embira*), the fibers resistant to breaking when stretched, remaining intact; and leaves simple, alternate, generally with the base slightly decurrent onto the petiole, and margins serrate to entire or crenulate.

Lecythidaceae

Small to large trees; trunk generally cylindrical, bark fibrous (*embira* or *envira*). Leaves alternate, simple, the margins entire to serrulate; stipules caducous, inconspicuous. Inflorescences racemes, spikes, panicle arrangements of racemes or spikes, ramified up to three orders, fasciculate or solitary flowers; axillary, terminal, cauliflorous, rarely ramiflorous; bract one and bracteoles two, generally caducous. Flowers bisexual, diclamids, actinomorphic (not in species in Espírito Santo) or zygomorphic; hypanthium campanulate; calyx lobes 2–6 and fused at base or free, or sometimes not defined; petals 4, 6, or 8(–18) (not in species in Espírito Santo); the androecium variable, actinomorphic with stamens connate at base (staminal ring) and forming a tube, obliquely zygomorphic through a staminal tube prolonged on one side and not forming a hood, or zygomorphic and prolonged into a ligule that terminates in a hood; stamens numerous, anther dehiscence poricidal (*Gustavia*) or lateral, the hood appendages with fertile anthers, sterile anthers (staminodes) or without anthers (vestigial stamens). Ovary inferior, 2–4–6-locular, ovules axillary, anatropous, ovules 2 to many per locule. Fruits dehiscent, circumscissile capsules, pericarp woody (pyxidium), or indehiscent with fibrous pericarp (berry-like, drupe; not in species in Espírito Santo). Seeds winged (*Cariniana* and *Couratari*), with trichomes on the seed coat (*Couroupita*) or with or without an aril; cotyledons absent or vestigial, plano-covex or leafy.

Key to Lecythidaceae genera in Espírito Santo

1. Leaves with tertiary veins perpendicular to the midrib. Flowers 0.7–1.6 cm diameter; androecia obliquely zygomorphic, staminal tube membranous. Pyxidia cylindrical. Seeds with unilateral wing..... .....1. *Cariniana*

1'. Leaves with reticulate tertiary veins. Flowers 2–6 cm diameter (except in *L. lanceolata*, 1.5–2 cm diam.); androecia zygomorphic, staminal ring fleshy. Pixidia not cylindrical. Seeds with circumferential wing or wing absent 2

2. Leaves and inflorescences with stellate trichomes. Androecial hood with external flap, stamens < 110, the filaments filiform, ovary 3-locular. Pyxidia campanulate. Seeds with circumferential wing, without fleshy aril.....2. *Couratari*

2'. Leaves and inflorescences glabrous or with simple trichomes. Androecial hood without external flap, stamens > 110 (except for *L. lanceolata* with 80–95), the filaments clavate; ovary 2 or 4(–5)-locular. Pyxidia turbinate, globose or cupuliform. Seeds not winged, with fleshy aril.....3

3. Leaves with 7–12 pairs of secondary veins. Androecial hood with single or double coil; ovary 2-locular. Pyxidia with erect supracalycine zone, operculum without columella. Seeds with lateral aril or poorly developed basal aril..... *3. Eschweilera*

3’. Leaves usually with 12–20 pairs of secondary veins. Androecial hood flat or with anterior extension; ovary 4(–5)-locular. Pyxidia with oblique supracalycine zone, operculum with columella (except in *L. lurida*). Seeds with well-developed basal aril or vestigial aril.....4. *Lecythis*

1. *Cariniana* Casaretto, Nov. Stirp. Bras. Dec. 4: 35-37, 1842.

Trees, emergent or canopy; trunk with superficial roots, rarely with well-developed buttresses. Outer bark laminated and thicker than inner bark. Leaves deciduous, present at flowering; petioles generally winged due to the decurrent leaf base; blades glabrous or puberulous, trichomes simple, margins serrate to crenulate, with or without domatia at junction of secondary vein and midrib, tertiary veins perpendicular to the midrib. Inflorescences in racemes, or once-branched panicle arrangements of racemes, terminal, rarely axillary, bract and bracteoles caducous at end of anthesis. Flowers 0.7–1.6 cm diam., 6-merous; calyx-lobes with concresced base, not carinate; staminal tube membranous, staminal ring with lateral extension not ending in hood (androecium obliquely zygomorphic), stamens 40–100, the filaments filiform; ovary with truncate apex, 3-locular, ovules many per locule. Pyxidia cylindrical, longer than broad, lenticellate, without persistent calyx lobe scars; operculum with triangular columella, straight to slightly curved. Seeds with a unilateral wing, semicircular in cross section; embryos with foliaceous cotyledons.

Cariniana comprises nine species found in non-flooded forests in Panama, Colombia, Venezuela and Brazil (Prance & Mori 1979; Mori *et al*. 2017). In Brazil, there are eight species, of which four are endemic (BFG 2018). In Espírito Santo, there are four species (Figs. 1a-d,g-j; 3; 7a-b; 8a-c).

Key to the species of *Cariniana* in Espírito Santo

1. Leaves with narrowly decurrent or non-decurrent base, not revolute. Inflorescences in racemes. Flowers with erect style 2
1’. Leaves with decurrent base, revolute. Inflorescences in panicle of racemes. Flowers with oblique style.....3
    2. Bark deeply fissured, phloem red. Petiole 5–8(–11) mm long, puberulous; blades with obtuse and puberulous to glabrate base, crenulate margins, and obtuse or short-acuminate apex, with domatia. Inflorescences puberulous. Flowers 0.8–1.1 cm in diam., stamens 43–52. Pyxidia 2.1–3.8 cm wide, lenticels small and dark brown, opercular rim muricate.....1.1. *Cariniana estrellensis*
    2’. Bark smooth to superficially fissured, phloem colorless. Petioles 15–20 mm long, glabrous; blades with cuneate and glabrous base, serrate to serrulate margins, and long-acuminate apex, without domatia. Inflorescences glabrous. Flowers 1.4–2 cm diam., stamens ca. 100. Pyxidia 4–5.7 cm wide, lenticels large and light brown, opercular rim not muricate..... 1.2. *Cariniana ianeirensis*
        3. Phloem dark red, inner bark light reddish brown, sapwood pale yellow. Leaves with serrate to serrulate margins, apex obtuse, or short- or long-acuminate. Pyxidia without prominent supracalycine zone .....1.3. *Cariniana legalis*
        3’. Phloem reddish pink, inner bark light yellowish brown, sapwood yellow. Leaves with crenulate margins, apex acute. Pyxidia with prominent supracalycine zone ....1.4. *Cariniana parvifolia*

1.1. *Cariniana estrellensis* (Raddi) Kuntze, Revis. Gen. 3(2): 89. 1898. Figs. 1g; 3a-d; 7a; 8a

Trees, to 38 m tall. Bark deeply fissured, outer bark dark brown, phloem red, inner bark light yellowish brown to light brown, sapwood pale yellow. Leaves: petioles 5–8(–11) × 1.5–2.5(–4) mm, semi-cylindrical, puberulous; blades (5.5–)7.7–11.5 × 3.6–7.7 cm, elliptic, coriaceous or chartaceous, puberulous to glabrate only at base and/or the midrib, base obtuse, rarely narrow decurrent, margins crenulate, apex obtuse or short-acuminate; secondary veins in 10–17 pairs, with domatia. Inflorescences in racemes, axillary or ramiflorous, puberulous, rachis 3.3–10 cm long, with 17–29 buds. Flowers 0.8–1.1 cm diam., pedicels 2–2.5 mm long; calyx lobes 0.7–1 × 0.7–1 mm, ovate, light green to reddish green; petals 5–6.5 × 2–3 mm, oblong, rarely obovate, white;

androecium white with inside base of the staminal tube vinaceous, stamens 43–52, the filaments 0.5–1 mm long, white, the anthers 0.3–0.5 mm long, yellow; ovules 6–7 per locule, style erect. Pyxidia (4.7–)6–10.2 × 2.1–3.8 cm, brown, with small and dark brown lenticels; pericarp 4–9 mm thick, supracalycine zone not prominent, opercular rim muricate; operculum 4–8.7 × 1.1–2.6 cm. Seeds 3.2–5.2 × 1–1.2 cm, ca. 21 per fruit, brown.

Selected specimens: Atílio Vivácqua, Moitão do Sul, 25.IV.2007, pst. fr., *A.P. Fontana 3158* (MBML). Colatina, 10.XII.2004, pst. fr., *A.A. Luz 263* (CVRD). Domingos Martins, Goiabeiras, 17.VIII.2013, pst. fr., *M. Ribeiro et al. 866* (RB, SPF). Guaçuí, Floresta do Rosal, 1.I.2012, fl., *C. Lage & A.E. Silva 63* (VIES). Ibitirama, Santa Marta, 13.VII.2012, fl., *H.M. Dias & E.A. Silva 852* (VIES). Jaguaré, Água Limpa, 8.II.2013, fl. and pst. fr., *M. Ribeiro & M. B. Costa 954* (CEPEC, NY, RB, SPF, VIES). Iúna, Beraba, 9.I.2014, fl. and pst. fr., *M. Ribeiro et al. 967* (CEPEC, NY, RB, SPF, VIES). Linhares, 1.VIII.2000, fr., *O.J. Pereira et al. 6297* (VIES). Marilândia, Alto Liberdade, 5.VIII.2014, pst. fr., *M. Ribeiro et al. 1129* (RB). Mimoso do Sul, Santa Luzia, 31.X.2004, fl., *D.R. Couto 199* (MBML). Muniz Freire, Serra do Guarani, 6.VII.2014, mat. fr., *A.C. Tuler et al. 514* (VIES). Pinheiros, Reserva Biológica de Córrego do Veado, 21.VIII.2013, pst. fr., *M. Ribeiro et al. 886* (RB). Santa Maria de Jetibá, Rio Bonito, 15.VI.2014, pst. fr., *M. Ribeiro et al. 1075* (MBML, NY, RB). Santa Leopoldina, Bragança, 31.X.2006, pst. fr., *L.F.S. Magnago 1555* (MBML). Viana, Jucuruaba, 4.IV.2014, pst. fr., *M. Ribeiro 995* (RB).

Cariniana estrellensis is distinguished from the other three species of *Cariniana* by the leaves with a puberulous base and petiole, presence of domatia, axillary or ramiflorous inflorescence in racemes, and pyxidium with a muricate (toothed), opercular rim. Regarding the inner bark, it differs from *C. ianeirensis* by the light yellowish brown to light brown color (*vs.* pale brown). It has been collected with flowers from October to February. Mature fruits have not been seen in the field or sampled. Deciduous individuals with developing new leaves have been registered in October and January and with all leaves newly flushed in December.

This species occurs in Bolivia and Brazil (Mori *et al*. 2017), in the Amazon and Atlantic Forest phytogeographic domains in the latter (Smith *et al*. 2016a). In Espírito Santo, *C. estrellensis* is found in hillside forest and *tabuleiro* forest (coastal lowland forest) (Ribeiro *et al*. 2014). It is known as *jequitibá-branco* (*I.A. Silva 40*, *J.G. Kuhlmann* RB 2494) and its wood is used in furniture and the civil construction industry. Mori (1995) states that it is one of the most valuable timber species in the family.

1.2. *Cariniana ianeirensis* R.Knuth, Repert. Spec. Nov. Regni Veg. Beih. 35: 340. 1934.

Figs. 1a-b,h; 3e-f; 8b

Trees, to 25 m tall. Bark smooth to superficially fissured, outer bark light brown, phloem colorless, inner bark pale brown. Leaves: petioles 15–20 × 1.5–2 mm, semi-cylindrical, glabrous; blades 7.3–10(–19.5) × 3.5–6(–8.5) cm, elliptic, rarely obovate, chartaceous, glabrous, base cuneate, narrowly decurrent, not revolute, margins serrate to serrulate, apex long-acuminate; secondary veins in 9–12 pairs, without domatia. Inflorescences in racemes, terminal, axillary, glabrous, rachis ca. 6 cm long, with 9–15 buds. Flowers 1.4–2 cm diam., pedicels 1–1.5 mm long; calyx lobes 1.5 × 1.5–2 mm, ovate, light green; petals 9 × 4–6 mm, obovate, white; androecium white with inside base of the staminal tube vinaceous, stamens ca. 100, the filaments 1–2 mm long, white, the anthers ca. 0.5 mm long, yellow; ovules 6–7 per locule, style erect. Pyxidia 9.9–13.7 × 4–5.7 cm, brown, with large and light brown lenticels; pericarp 7–10 mm thick, supracalycine zone not prominent, the opercular rim not muricate; operculum 8–10.5 × 2.6–3.4 cm. Seeds 4.3–7 × 1.7–2 cm, 7–21 per fruit, light brown.

Selected specimens: Baixo Guandu, área rural, 18.V.2014, mat. fr., *M. Ribeiro & N.P. Smith 1031* (CEPEC, NY, RB, SPF, VIES).

Cariniana ianeirensis is distinguished from other species of *Cariniana* by the following: bark smooth to superficially fissured in large individuals, with slightly conspicuous lamination; leaves glabrous, with a cuneate base, serrate to serrulate margins and long acuminate apex; inflorescences glabrous; flowers 1.4–2 cm in diameter, the largest among the species studied; and pyxidia broad (4–5.7 cm wide). Specimens from Espírito Santo have a narrowly winged petiole and fewer stamens than found by Prance (1979) (non-winged petiole and 150 stamens) and Justiniano & Fredericksen (1999) for Bolivia (non-winged petiole and 125 stamens). In Espírito Santo, this species is commonly found on rocky outcrops. This is probably because most of the hillside forests in the low and relatively flat parts of western Espírito Santo have been cut down over the years due to the expansion of livestock and agriculture. Thus, most of the forest remnants are currently isolated on hilltops or around rocky outcrops. Young individuals have different leaves

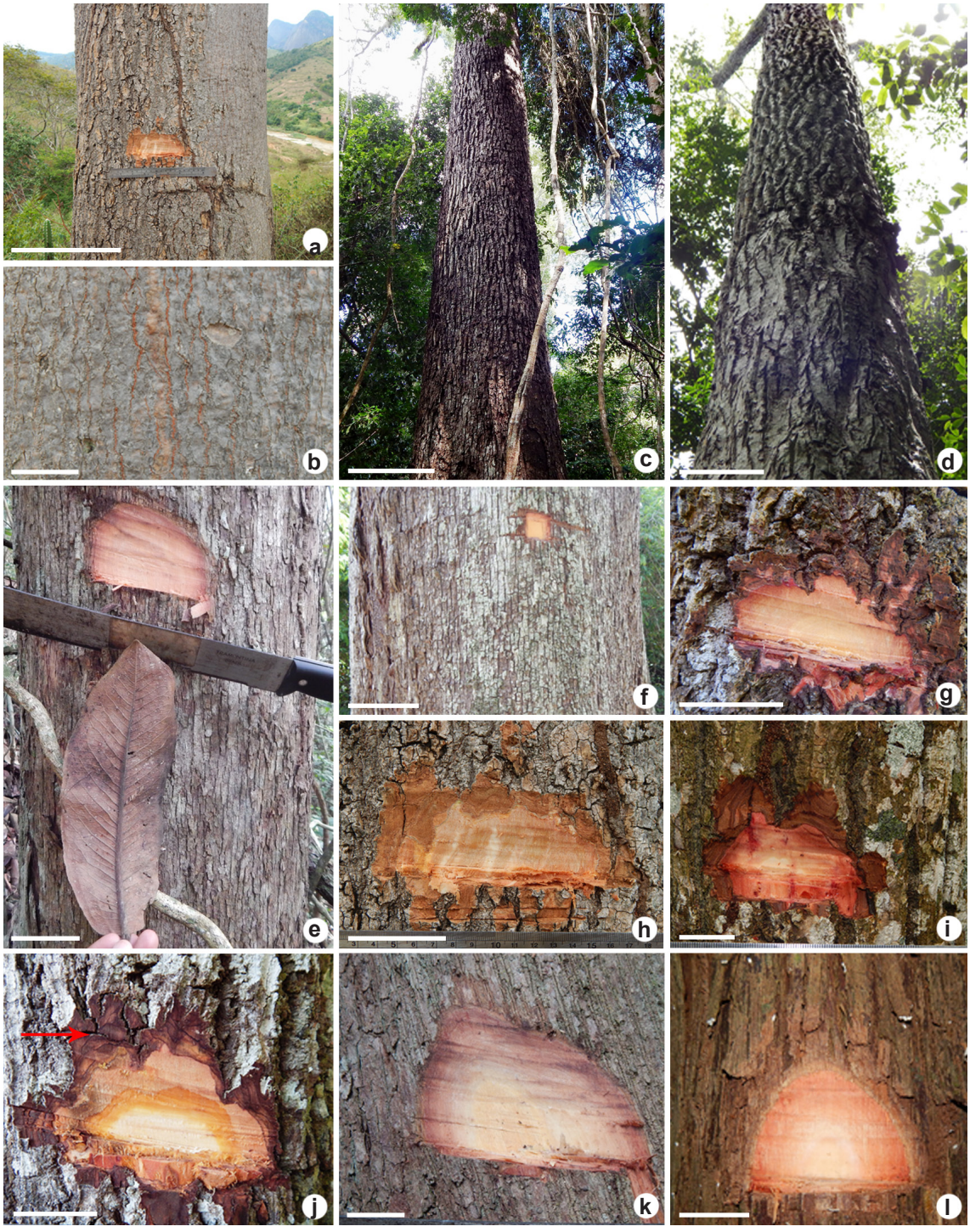

Figure 1 – a-l. Trunk and outer and inner bark of species of Lecythidaceae in Espírito Santo – a-b, h. *Cariniana ianeirensis*; c, i. *C. legalis*; d, j. *C. parvifolia*; e. *Couratari asterophora*; f, k. *C. asterotricha*; g. *Cariniana estrellensis*; l. *Couratari macrosperma.* Outer bark with laminations (see red arrow). Scale bars: a, d, f = 15 cm; b, e, g, h = 5 cm; i-l = 3 cm; c = 100 cm. (a-b, h. *M. Ribeiro & N.P. Smith 1031A*; c. photographic record; d. *M. Ribeiro & J.S. Penha 672*; e. *M. Ribeiro et al. 1104*; f. *M. Ribeiro et al. 896*; g. *M. Ribeiro et al.1075*; i. *M. Ribeiro et al. 854*; j. *D. Folli 5039*; k. *M. Ribeiro et al. 1106*; l. *M. Ribeiro et al. 899*). Photos by M. Ribeiro.

than adult individuals: petiole 15–20 mm, glabrous, blades ca. 19.5 × 8.5 cm, elliptic, with obtuse and non-decurrent base and short-acuminate apex. It has been collected with flowers in October and with mature fruits in April and May.

This species occurs in Bolivia and Brazil, in Amazonia and the Atlantic Forest in the latter. In Espírito Santo, it has been recorded only for hillside forest (Ribeiro *et al*. 2014) in the municipality of Baixo Guandu. It is also known from Aymorés, a municipality in Minas Gerais State that borders Baixo Guandu. This species is known as *jequitibá-açu* (*A.A. Luz 72*). There are no known uses; however, due to its arboreal size, it is possibly used for timber, like other *Cariniana*. In the forests of central-eastern Bolivia, it was identified as one of the most exploited species.

1.3. *Cariniana legalis* (Mart.) Kuntze, Revis. Gen. 3(23): 89. 1898. Figs. 1c,i; 3g-i; 7b; 8c

Trees, to 45 m tall. Bark deeply fissured, outer bark dark brown, phloem dark red, inner bark light reddish brown, sapwood pale yellow. Leaves: petioles 4–7 × 1.5–2.5 mm, semicylindrical, puberulous; blades 3.6–8 × 1.8–4.3 cm, elliptic, rarely ovate, coriaceous, puberulous on base (mainly abaxial surface), base cuneate, obtuse, decurrent and revolute, margins serrate to serrulate, apex obtuse, short- or long-acuminate; secondary veins in 7–11 pairs, without domatia. Inflorescences in a panicle of racemes, terminal, rarely axillary, puberulous, rachis 2.3–14 cm long, with 8–16 buds. Flowers 1–1.2 cm diam., pedicels 1–1.8 mm long; calyx-lobes 1–1.3 × 1–1.3 mm, ovate, greenish yellow; petals 4.5–7 × 2–4.5 mm, obovate or oblong, rarely obovate, cream; androecium light yellow with inside base of the staminal tube vinaceous, stamens 48–58, the filaments 1–2.3 mm long, white, the anthers ca. 0.3 mm long, yellow; ovules 5–8 per locule, style oblique. Pyxidia 3–7.5 × 1.5–3.1 cm, dark brown, with small and dark brown lenticels; pericarp 5–7 mm thick, supracalycine zone not prominent, the opercular rim not muricate; operculum 3.6–5.1 × 0.8–1.1 cm. Seeds 2.5–3.5 × 0.6–0.9 cm, 5–7 per fruit, brown. **Selected specimens**: Aracruz, 31.I.1994, fl., *R.N. Oliveira 693* (VIES). Cachoeiro de Itapemirim, Floresta Nacional de Pacotuba, 30.XI.2011, pst. fr., *H.M. Dias & A.E. Silva 775* (VIES). Castelo, Parque Estadual Mata das Flores, 10.I.2014, pst. fr., *M. Ribeiro et al. 969* (RB). Colatina, Itapina, 29.VIII.1991, pst. fr., *M.S. Menandro 286* (VIES). Conceição da Barra, Flona do Rio Preto, trilha da Lagoa Seca, 2.IV.2018, fl., *B.G. Sossai 149* (VIES). Conceição do Castelo, 29.VIII.2012, mat. fr., *D.A. Folli 6900* (CVRD). Domingos Martins, Goiabeiras, 17.VIII.2013, mat. fr., *M. Ribeiro et al*. *861* (RB). Fundão, Fazenda Irundi, 25.VIII.1991, pst. fr., *V.D. Souza 181* (CVRD). Ibituruna, 15.IX.1930, fr., *J.G. Kuhlmann* (RB carpo 2489). Jaguaré, Água Limpa, 8.II.2013, fl., *M. Ribeiro & A.A. Araújo 854* (SAMES, VIES, RB). Linhares, Povoação, 14.VII.2010, mat. fr., *L.F.T. Menezes et al. 1932* (VIES). Pancas, Pedra do Camelo, 2.VIII.1991, pst. fr., *J.M.L. Gomes 1604* (VIES). Santa Leopoldina, Suiça, 16.IV.2004, mat. fr., *L. Kollmann et al. 10865* (MBML, RB). Santa Teresa, Reserva Biológica Augusto Ruschi, 13.II.2003, fl., *R.R. Vervloet et al. 1819* (MBML, NY, RB). São Domingos do Norte, II.1954, fl., *G. Dalcolmo* (MBML 1254).

Cariniana legalis is characterized by the leaf blades with a decurrent and revolute base (also present in *C. parvifolia*), and serrate to serrulate margins, inflorescence in a panicle of racemes, and dark brown pyxidia, the oldest usually with deep cracks in the exocarp. Prance (1979) and Mori (1995) pointed out that *C. legalis* and *C. parvifolia* are the only species in the genus that have free and longer stamens at the base and apex of the androecium. It has been collected with flowers from February to April, and less often from October to January, and with mature fruits in October and November. Individuals have been observed with all new leaves (newly flushed, which are light green) in their crowns in October.

This species is endemic to the Brazilian Atlantic Forest (Smith *et al*. 2016a; BFG 2018). In Espírito Santo, it has been recorded in hillside and *tabuleiro* forests (Ribeiro *et al*. 2014). It is popularly known as *jequitibá-rosa* (*I.A. Silva 152*, *G. Dalcolmo*, *J.G. Kuhlmann* RB carpo 2489) and has been used to manufacture furniture, doors, boards and a wooden putter (*J. Spada 43*).

1.4. *Cariniana parvifolia* S.A.Mori, Prance & Menandro, Bol. Bot. Univ. São Paulo 14: 8. 1995. Figs. 1d,j; 3j-l

Trees, to 35 m tall. Bark deeply fissured, outer bark dark brown, phloem distinct, reddish pink, inner bark light yellowish brown, sapwood yellow. Leaves: petioles 3–6 × 0.7–1.5 mm, semi-cylindrical, puberulous; blades 2.1–4.7 × 1.2–2.1 cm, elliptic, rarely ovate, chartaceous, puberulous on base (mainly abaxial surface), base obtuse, decurrent and revolute, margins crenulate, apex acute, short- or long-acuminate; secondary veins in 7–11 pairs, without domatia. Inflorescences in a panicle of racemes, terminal, subterminal, puberulous, rachis 3.3–9 cm long, with ca. 100 buds. Flowers 0.7–0.9 cm diam., pedicels ca. 1 mm long; calyx lobes ca. 1 × 1 mm, ovate, light green;

petals 4 × 2–2.5 mm, obovate, white to cream; androecium white to cream, stamens 35–50, the filaments ca. 2.5 mm long, white, the anthers ca. 0.4 mm long, yellow; ovules 4–8 per locule, the style oblique. Pyxidia (3.5–)4.1–9.5 × 1.8–4 cm, brown, with small and dark brown lenticels; pericarp 5–10 mm thick, supracalycine zone prominent, the opercular rim not muricate; operculum 3.3–6 × 1.2–1.6 cm. Seeds 2.2–4.1 × 0.7–1.1 cm, 9–17 per fruit, brown.

Selected specimens*:* Conceição da Barra, Reserva Biológica de Córrego Grande, 12.XI.2011, pst. fr., *M. Ribeiro & J. Penha 672* (VIES). Linhares, Reserva Florestal da CVRD, 11.X.1991, fr., *D.A. Folli 1437* (CVRD).

Cariniana parvifolia is characterized by the leaves that are 2.1–4.7 × 1.2–2.1 cm (some of the smallest leaves in the genus), with a revolute base (also present in *C. legalis*), and fruits with a prominent supracalycine zone. It is morphologically similar to *C. legalis*, mainly due to the deeply fissured bark, similarity in leaf dimension, and inflorescence in a panicle of racemes; but it is distinguished by the reddish-pink phloem (*vs*. dark red), light yellowish-brown inner bark (*vs*. light reddish brown), yellow sapwood (*vs*. pale yellow), leaf blades with acute apex (*vs*. obtuse, short- or long-acuminate) and crenulate margins (*vs*. serrate to serrulate), and fruit with a prominent supracalycine zone (*vs*. not prominent). Mori (1995) highlighted the similarity of these two species but noted the more acute angled branches within the canopy, pink inner bark, smaller leaves and fruit with a truncate apex as distinctive characters of *C. parvifolia*. The mature individuals observed had a crown with few leaves compared to *C. legalis*. It has been collected with flowers from February to March and with mature fruits from August to October. An individual with a defoliated canopy that was starting to emit leaves was recorded in October.

This species is endemic to northern Espírito Santo and southern Bahia (Smith *et al*. 2016a; BFG 2018). In Espírito Santo, the species is restricted to *tabuleiro* forest (Ribeiro *et al*. 2014). *C. parvifolia* is known as *jequitibá-cravinho* (*D.A. Folli 428*). Its use was not reported on the labels, but due to its size and similarity to *C. legalis*, it possibly was and still is a source of wood on rural properties.

2. *Couratari* Aublet, Hist. Pl. Guiane 2: 723-724, 1775.

Trees, emergent or canopy, trunk usually with buttresses. Bark squamose, in vertical rectangular plates when mature; outer bark brown, not laminated, inner bark light reddish brown, sapwood pale to light yellow. Leaves deciduous, present at flowering; coriaceous, generally with indumentum of stellate trichomes. Inflorescences in racemes, or once-branched panicle arrangements of racemes, with rust-colored indumentum, trichomes stellate; bract and bracteoles subpersistent at end of anthesis. Flowers 3–6 cm diam., calyx lobes 6, imbricate, not carinate; petals 6, cucullate, imbricate, margins ciliate; androecium zygomorphic, fleshy, staminal ring with little stamens, the filaments filiform, hood with external flap, echinate on exterior surface (vestigial stamens), vestigial stamen nectaries at apex of coil; ovary 3-locular, ovules many per locule, the style erect with stylar collar. Pyxidia narrowly campanulate, brown to blackish brown, with persistent calyx scars; operculum with triangular columella. Seeds with a circumferential wing, oblong, brown; cotyledons foliaceous.

Couratari comprises 19 species that occur in lowland forest, predominantly in non-flooded areas from Costa Rica to eastern Brazil, with the greatest species richness in Amazonia and Guyana (Prance & Mori 2004; Mori *et al*. 2017). In Brazil, 14 species have been recorded, of which six are endemic (BFG 2018). Three species are found in Espírito Santo (Figs. 1e-f,k-l; 4; 7c-d; 8d-e).

Key to the species of *Couratari* in Espírito Santo

1. Leaves glabrous, without longitudinal striations, margins crenate. Hypanthium with conspicuous trichomes. Pyxidia triangular in cross section .....2.2. *Couratari asterotricha*

1’. Leaves pubescent, with longitudinal striations, margins crenulate or serrulate. Hypanthium with inconspicuous trichomes or trichomes absent. Pyxidia circular (rarely triangular in *C. asterophora*) in cross section ..... 2.

2. Leaves rigid-coriaceous, hirsutellous mainly on abaxial surface. Flowers 3–4 cm in diam., pedicel and hypanthium tomentose, hypanthium with tufted trichomes, petals white to light yellow with light pink apex, stamens 36–54. Pyxidia with smooth surface and conspicuous vestige of indumentum; operculum with thin columella, apex slightly umbonate .....2.1. *Couratari asterophora*

2'. Leaves chartaceous, sparsely puberulent mainly on abaxial surface. Flowers 4.5–6 cm in diam., pedicel and hypanthium tomentulose, hypanthium without tufted trichomes, petals totally white to light yellow, stamens 60–102. Pyxidia with conspicuously crustaceous surface and without vestige of indumentum; operculum with thick columella, apex convex..... 2.3. *Couratari macrosperma*

2.1. *Couratari asterophora* Rizzini, Rodriguésia 41: 177. 1976. Figs. 1e; 4a-f; 7c; 8d

Trees, to 36 m tall; outer bark thinner than inner bark. Leaves: petioles 4–14(–18) × 3–7 mm, canaliculate or semicylindrical, hirsutellous to puberulous; blades 14.3–34.5(–41.2) × (5.2–) 9–14.5(–17.5) cm, oblong, rarely elliptic, rigid-coriaceous, hirsutellous on both surfaces (mainly abaxially), with inconspicuous longitudinal striations, base obtuse to rounded, not decurrent, margins crenulate, apex obtuse, rarely rounded; secondary veins in (18–)22–30 pairs. Inflorescences in a panicle of racemes, terminal, axillary, rachis 10–34 cm long, densely tomentose, with 20–40 buds. Flowers 3–4 cm diam.; pedicel (2–)4–6 mm long, tomentose; hypanthium tomentose, trichomes tufted; calyx lobes 6–11 × 5–10 mm, ovate, abaxial surface tomentose, light green; petals 16–24(–30) × 13–18(–20) mm, obovate, rarely elliptic, abaxial surface tomentulose, white to light yellow, apex light pink; stamens 36–54, hood yellow; ovules 30–40 per locule. Pyxidia (3.8–) 4.4–7.8 × 3.2–6.5 cm diam., rounded or rarely triangular in cross section, surface smooth, with conspicuous vestige of indumentum; pericarp 2–4 mm thick; operculum 2.6–5 × 2.5–3.3 cm, columella thin, apex slightly umbonate. Seeds 3.6–4.2 × 1.5–2.2 cm, 10–16 per fruit.

Selected specimens: Jaguaré, comunidade São Jorge de Pádua, 26.X.2013, fl. and mat. fr., *M. Ribeiro et al. 928* (CEPEC, NY, RB, SPF, VIES). Pinheiros, Reserva Biológica de Córrego do Veado, 1.XI.2010, fl., *M. Ribeiro et al. 326* (VIES). Sooretama, Reserva Biológica de Sooretama, 26.X.2013, fl., *M. Ribeiro et al. 925* (NY, RB, VIES). Linhares, Reserva Natural Vale, 26.VII.2013, fl., *G.S. Siqueira 884* (CVRD, RB).

Couratari asterophora differs from the other two species of *Couratari* by the large (14.3–34.5 [–41.2] × [5.2]9–14.5[–17.5] cm *vs*. 7.8–18[–20.8] × 3.3–9 cm), rigid-coriaceous (*vs*. coriaceous) leaf blades, flowers 3–4 cm in diam. (*vs*. > 4 cm diam.), white to light yellow petals with a light pink apex (*vs*. totally white to light yellow), and smooth pyxidia (*vs*. crustaceous). It has been collected with flowers from July to November and with mature fruits in October and November.

This species is endemic to the Brazilian Atlantic Forest where it occurs only in southern Bahia and northern Espírito Santo (Mori 1995; Smith *et al*. 2016a; BFG 2018); in the latter, it only occurs in *tabuleiro* forest (Ribeiro *et al*. 2014). It is popularly called *imbirema-açú* (*D.A. Folli 591*) or *imbirema* (Prance 1990) and has no known uses; however, due to its size and similarity with other species of *Couratari*, it is possibly used for timber.

2.2. *Couratari asterotricha* Prance, Brittonia 33(1): 17. 1981. Figs. 1f,k; 4g-j

Trees, to 35 m tall; outer bark thinner than inner bark. Leaves: petioles 6–9(–12) × 2–3(–4.5) mm, canaliculate, semicylindrical, glabrous; blades 7.8–13.4 × 3.3–6.3 cm, elliptic, rarely oblong, coriaceous, glabrous on both surfaces, without longitudinal striations, base obtuse, rarely decurrent to half the petiole, sometimes revolute, margins crenate, apex short-acuminate or obtuse; secondary veins in 12–14(–17) pairs. Inflorescences in racemes or panicle of racemes, terminal, subterminal, rachis 5–18.5 cm long, tomentulose, with 8–18 buds. Flowers 4.5–5 cm diam.; pedicel tomentose; hypanthium tomentose, trichomes tufted, conspicuous; pedicels 3–7 mm long; calyx lobes 6.5–7 × 4–7 mm, ovate, exterior surface tomentulose, light green; petals 23–35 × 18–27 mm, obovate, exterior surface puberulous, yellow; stamens 40–48, hood yellow; ovules 28–40 per locule. Pyxidia 4.3–7.2(–8.6) × 2.1–5 cm, triangular in cross section, surface slightly crustaceous, without vestige of indumentum; pericarp 1.5–3 mm thick; operculum 3.3–5.4 × 2.1–4.3 cm, columella thin, apex slightly umbonate. Seeds not known.

Selected specimens: Governador Lindenberg, Pedra de Santa Luzia, 26.IV.2007, fl., *V. Demuner 3877* (MBML). Pinheiros, Reserva Biológica de Córrego do Veado, 21.VIII.2013, fr., *M. Ribeiro et al. 896* (RB). Sooretama, Reserva Biológica de Sooretama, 3.VII.2012, fl., *M. Ribeiro et al. 827* (SAMES, VIES). Linhares, Reserva Florestal da CVRD, 25.VII.1986, fl., *D.A. Folli 590* (CVRD).

Couratari asterotricha differs from the other two species by its leaf blades that are glabrous, without longitudinal striations and with crenate

margins, tomentose hypanthium with conspicuous tufted trichomes, and pyxidium that is triangular in cross section and generally smaller compared to the other collected *Couratari* species. It has been collected with flowers from April to July and immature fruits have been observed in July (possibly extending to August).

This species is endemic to northern Espírito Santo in *tabuleiro* forest (Ribeiro *et al*. 2014). It is known as *imbirema* (*I.A. Silva 01*) and has been reportedly used as a source of wood and for plywood (*A.M. Lino 65*).

2.3. *Couratari macrosperma* A.C.Sm., Bull. Torrey Bot. Club 60: 383. 1933. Figs. 1l; 4k-n; 7d; 8e

Trees, to 35 m tall; outer bark thicker than inner bark. Leaves: petioles 4–14(–20) × 2–4 mm, canaliculate, puberulent; blades (8–)11–18(–20.8) × (3.5–)4.5–9 cm, usually elliptic, sometimes obovate or oblong, chartaceous, sparsely puberulent on both surfaces (mainly on abaxial surface), with conspicuous longitudinal striations, base obtuse, cuneate, margins serrulate, apex obtuse, rounded; secondary veins in 16–22 pairs. Inflorescences in racemes, rarely panicle of racemes, terminal, axillary; rachis 4.5–18.5(–34) cm long, tomentulose, with 5–25 buds. Flowers 4.5–6 cm diam.; pedicel 3–6(–9) mm, tomentulose; hypanthium tomentulose, without tufted trichomes; calyx lobes 7–10 × 6–9 mm, ovate, exterior surface tomentulose, light green; petals 20–35(–40) × 19–25(–29) mm, obovate, rarely oblong, exterior surface puberulent, totally white to light yellow; stamens 60–102, hood light yellow; ovules 31–42 per locule. *Pyxidia* (3.8–)5–10.3 × (2.8–)3.5–6.3 cm, circular in cross section, surface conspicuously crustaceous, without vestige of indumentum; pericarp 4–7 mm thick; operculum (3.1–)4–7.5 × 2.4–4.1 cm, columella thick, apex convex. *Seeds* (2.5–)4–7.2 × (1.3–)2–2.8 cm, 12–30 per fruit.

Selected specimens: fr., *J.G. Kuhlmann* (RBcarpo 2508). Águia Branca, ao lado da rodovia, 17.V.2014, pst. fr., *M. Ribeiro & N.P. Smith 1030* (RB). Aracruz, Santa Cruz, fl., *R.N. Oliveira 502* (VIES). Boa Esperança, Bela Vista, 1.XII.2010, mat. fr., *A.M. Assis & V. Demuner 2604* (MBML). Castelo, Parque Estadual Mata das Flores, 10.I.2014, pst. fr., *M. Ribeiro et al. 968* (RB). Cachoeiro de Itapemirim, R.F.B. Norte, 4.V.1993, *G. Acácio 47* (VIES). Conceição da Barra, BR-101 norte, 27.V.2014, fl. and pst. fr., *M. Ribeiro & A. Alves-Araújo 1034* (RB). Linhares, Reserva Natural da Vale, 12.IV.2006, fl., *A.A. Luz 323* (CVRD). Marilândia, Alto Liberdade, 19.IV.2006, fl., *L.F.S. Magnago et al. 953* (MBML, RB). Mimoso do Sul, margem do Rio Itabapoana, 16.VII.2008, pst. fr., *R.A.X. Borges 906* (RB). Nova Venécia, Córrego da Volta, 1.IV.2013, fl., *L. Marcarini 109* (VIES). Pancas, Sítio Santa Inês, próximo a entrada do córrego Água Boa, 5.X.2016, pst. fr., *K. Santos et al. 4708* (UEC). Pedro Canário, BR-101, 23.X.2013, mat. fr., *M. Ribeiro et al. 898* (RB). Pinheiros, Reserva Biológica de Córrego do Veado, 2.XI.2010, pst. fr., *M. Ribeiro et al. 329* (VIES). Santa Teresa, 25 de Julho, 28.III.2000, fl. and pst. fr., *V. Demuner & W. Pizziolo 868* (MBML). São Gabriel da Palha, estrada para Barra Seca, 29.IX.2009, pst. fr., *A.M. Assis 2104* (MBML). São Mateus, Nova Aymorés, 27.I.2014, pst. fr., *M. Ribeiro & E. Rizzi 894* (RB). Sooretama, Reserva Biológica de Sooretama, 20.I.2010, fr., *A. Giaretta et al. 733* (VIES).

Couratari macrosperma is characterized by its oblong, obovate or elliptic leaf blades (usually the three forms on the same branch), with conspicuous longitudinal striations (a character shared with *C. asterophora*, but in this species the leaves are larger and more coriaceous), hypanthium without tufted trichomes, and pyxidia generally larger and thicker than in the other two species of *Couratari*. Prance (1990) reports that *C. macrosperma* is easily distinguished from other neotropical species, except for *C. stellata* Smith (1939: 410) (restricted to Amazonia and the Guianas), by the leaves with conspicuous longitudinal parallel lines. Prance (1990) recorded leaves with entire or ondulate margins, a character not observed in specimens from Espírito Santo, which have serrulate margins. It has been collected with flowers from April to July and with mature fruits from May to October.

This species occurs in Bolivia and Brazil, where it has a disjunct distribution between Amazonia and the Atlantic Forest (Prance 1990; Smith *et al*. 2016a; BFG 2018). In Espírito Santo, it occurs in *tabuleiro* and hillside forests (Ribeiro *et al*. 2014). It known as *imbirema* (*D.A. Folli 1112, G. Acacio 47*) or *embirama* (Prance 1990) and, although there are no reports of uses in the region, its wood is possibly used on a small scale on rural properties.

3. *Eschweilera* Mart. *ex* DC. Prodr. 3: 293, 1828.

Trees, understory or canopy, trunk without buttresses. Leaves present at flowering; coriaceous or chartaceous, glabrous, in general with indumentum of stellate trichomes, margins entire, serrulate or crenulate only in the upper third. Inflorescences in racemes, spikes or once-branched panicle arrangements of spikes, glabrous, bract and bracteoles caducous at end of anthesis. Flowers 2.5–5 cm diam.; calyx lobes 6 or not defined;

petals 4 or 6, cucullate, imbricate; androecium zygomorphic, fleshy, stamens numerous, the filaments clavate, the androecial hood formed by a once (single coil) or twice (double coil) coiled unilateral extension, vestigial stamens and/or staminodes on surface of coil present, sometimes with vestigial stamen nectaries at apex of coil; ovary 2-locular, the style without stylar collar. Pyxidia turbinate, cupuliform or globose, with erect supracalycine zone, operculum without columella. Seeds with fleshy aril, lateral or basal, poorly developed (small) in the latter; cotyledons undifferentiated.

Eschweilera is the largest genus in the family, with ca. 89 species found from Mexico to Brazil (Mori *et al*. 2017; Huang *et al*. 2015). In Brazil, 51 species have been recorded, including six in the Atlantic Forest (Smith *et al*. 2016a; BFG 2018). In Espírito Santo, there are three species (Figs. 2a-b,d-e; 5; 7e-g; 8f-h).

Key to the species of *Eschweilera* in Espírito Santo

1. Bark squamose, outer bark not laminated. Inflorescence rachis without horizontally oriented squamulae. Flower pedicel (5–)8–16 mm long; calyx lobes imbricate; petals 6; hood with double coil, staminodes absent. Pyxidia cupuliform, dark green, pericarp 2.5–3.5(–4) mm thick. Seeds with flat venation, aril lateral..... 3.2. *Eschweilera ovata*

1'. Bark fissured, outer bark laminated. Inflorescence rachis with horizontally oriented squamulae. Flower pedicel 3–5 mm long or sessile; calyx lobes not imbricate; petals usually 4; hood with single coil, staminodes present. Pyxidia globose or broadly turbinate, brown, pericarp > 4 mm thick. Seeds with impressed venation, aril basal..... 2

2. Leaf apex acute, rarely short-acuminate. Inflorescence in racemes. Stamens 108–120. Pyxidia broadly turbinate, pericarp 5–8.5 mm thick, operculum umbonate. Seeds (4–)6–10 per fruit, triangular in cross section ..... 3.1. *Eschweilera compressa*

2'. Leaf apex obtuse or rounded, rarely retuse. Inflorescence in spikes or a panicle of spikes. Stamens 150–170. Pyxidia globose, pericarp 11–20 mm thick, operculum convex. Seeds 1–2(–3) per fruit, circular in cross section..... 3.3. *Eschweilera sphaerocarpa*

3.1. *Eschweilera compressa* (Vell.) Miers, Trans. Linn. Soc. London 30(2): 248. 1874.

Figs. 2d; 5a-e; 7e; 8f

Trees, to 6 m tall. Bark shallowly fissured; outer bark dark brown, laminated, thicker than inner bark; inner bark yellow, sapwood pale yellow. Leaves deciduous; petioles 5–7(–10) × 1 mm, semicylindrical, glabrous; blades 6–7.5 (–10.3) × 1.8–2.5(–3.8) cm, elliptic, chartaceous to coriaceous, glabrous, base acute to slightly obtuse, margins entire to slightly serrulate, slightly revolute, apex acute, rarely short-acuminate; secondary veins in 7–9(–11) pairs. Inflorescences in racemes, terminal or subterminal, glabrous; rachis 0.3–1.5 cm long, with horizontally oriented squamulae, with 8–14 buds. Flowers 3–3.8 cm diam., pedicels 3–5 mm long; calyx lobes not defined, valvate, fused at base and forming calycine rim, ca. 2 mm wide, light green; petals 4, 13–20 × 11–18 mm, subequal, obovate or ovate, white; stamens 108–120, the filaments 1–1.8 mm long, light yellow, the anthers ca. 0.5 mm long, yellow, hood with single coil, yellow, with vestigial stamens and staminodes present on the surface of coil, yellow; ovules 5–7 per locule, style erect. Pyxidia 3.3–6.5 × 4–6.8 cm, broadly turbinate, brown, calyx persistent; the pericarp 5–8.5 mm thick; the operculum 2.1–2.9 × 4.2–5.5(–6.3) cm, umbonate. Seeds 2.3–3.3 × 1.6–1.8 cm, (4–)6–10 per fruit, ellipsoid to ovoid, triangular in cross-section, dark brown, veins impressed, light brown; aril basal, small, light yellow.

Selected specimens: Guarapari, Nova Guarapari, 31.V.2015, fl. and pst. fr., *M. Ribeiro & F. Bravim 1159* (CEPEC, MBM, NY, RB, S, US, VIES). Aracruz, Reserva da Santura, área limpa, 1.IV.1992, fl., *R.N. Oliveira 199* (VIES).

Eschweilera compressa is distinguished from the other two species of *Eschweilera* by the shallowly fissured bark (*vs*. deeply fissured or squamose), elliptic leaf blades that are generally proportionally longer than wide (*vs*. elliptic, wider than long or obovate) and generally have an acute apex (*vs*. obtuse, rounded, short-acuminate), broadly turbinate (*vs*. cupuliform or globose) pyxidia, and (4–)6–10 seeds per fruit (*vs*. up

Figure 2 – a-i. Trunk and outer and inner bark of species of Lecythidaceae in Espírito Santo – a, e. *Eschweilera ovata*; b. *E. sphaerocarpa*; c, f. *Lecythis lanceolata*; d. *Eschweilera compressa*; g. *Lecythis lurida*; h. *L. marcgraaviana*; i. *L. pisonis.* Outer bark with laminations (see red arrows). Scale bars: a, f, h, i = 5 cm; b, c = 10 cm; d, e, g = 3 cm. (a,e. *M. Ribeiro et al. 875*; b. *M. Ribeiro et al.* 927; c. photographic record; d. *M. Ribeiro & F. Bravim 1159*; g. *M. Ribeiro 856*; h. *M. Ribeiro 973*; i. *M. Ribeiro & A. Alves-Araújo 1036*). Photos by M. Ribeiro.

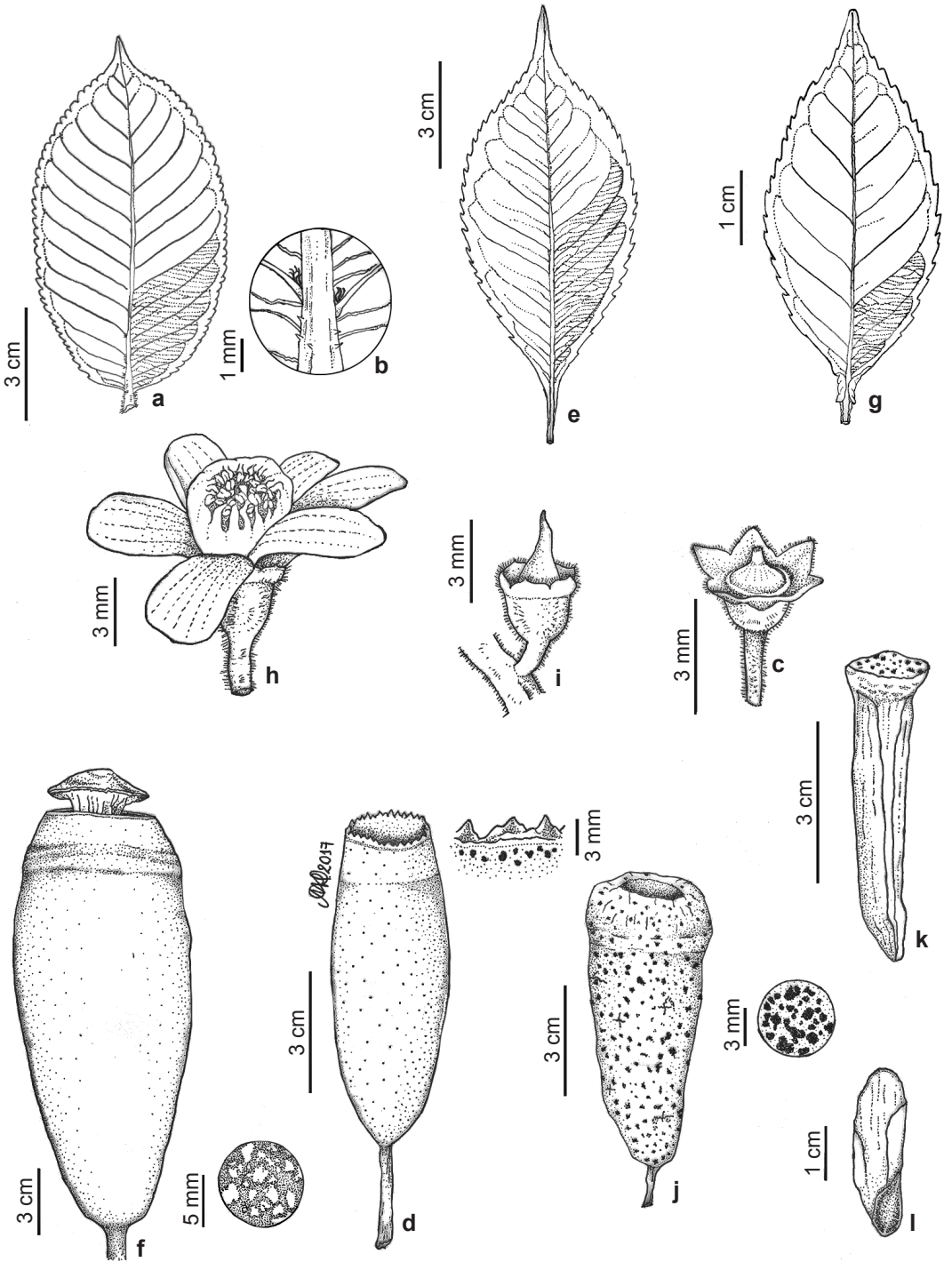

Figure 3 – a-d. *Cariniana estrellensis* – a. leaf; b. detail of leaf domatia; c. hypanthium, calyx lobes and style; d. capsule of pyxidium and detail of teeth on the opercular ring. e-f. *C. ianeirensis* – e. leaf; f. pyxidium and detail of lenticels on the exocarp. g-i. *C. legalis* – g. leaf; h. flower showing the staminal tube; i. hypanthium and style. j-l. *C. parvifolia* – j. pyxidium and detail of lenticels on the exocarp; k. operculum; l. seed with a unilateral wing. (a-c. *M. Ribeiro 853*; d. *M. Ribeiro 995*; e. *M. Ribeiro 1031*; f. *A.P. Fontana 7516*; g. *D.A. Folli 214*; h-i. *M. Ribeiro 854*; j-l. *D.A. Folli 1437*).

to 4 seeds per fruit). The collected specimens were short in stature compared to other species of Lecythidaceae, since they were found in the understory. Galls were observed on the branches. It has been collected with flowers in January and May and with mature and immature fruits in December and April.

This species is endemic to the states of Espírito Santo and Rio de Janeiro (Ribeiro *et al*. 2016b; BFG 2018). In Espírito Santo, it was recorded in *tabuleiro* forest south of the Doce River (Ribeiro *et al*. 2016b), where it is known as *sapucaípe* (*G.S. Siqueira & E. Pretti 1048*). There are no known uses.

3.2. *Eschweilera ovata* (Cambess.) Martius *ex* Miers, Trans. Linn. Soc. London 30(2): 257-258. 1874. Figs. 2a,e; 5f-j; 7f; 8g

Trees, to 23 m tall. Bark squamose in small, thin and vertical plates; outer bark brown, not laminated, thinner than inner bark; inner bark pale brown, sapwood pale to light yellow. Leaves persistent; petioles (4–)5–8 × (1.5–)2–2.5 mm, canaliculate, glabrous; blades 7.4–13(–16) × 3.4–7.6 cm, elliptic, rarely oblong, coriaceous, glabrous, base obtuse, rarely rounded, margins entire, slightly revolute, apex obtuse, short-acuminate; secondary veins in 8–12 pairs. Inflorescences in racemes, terminal, axillary; rachis 1.4–4.8(–10) cm long, without horizontally oriented squamulae, with 3–8 buds. Flowers 3.7–5 cm diam., pedicels (5–)8–16 mm long; calyx lobes (4.5–)5–7 × 3–5 mm, imbricate, ovate, not carinate, light green; petals 6, 15–25(–29) × 12–17(–21) mm, obovate or ovate, white to light yellow; stamens 150–200, the filaments 1.5–2.3 mm long, light yellow, the anthers 0.5–0.7 mm long, yellow, hood with double coil, light yellow to yellow, with vestigial stamens on the surface of coil and vestigial stamen nectaries in the end of coil, both yellow, staminodes absent; ovules 8–10 per locule, style oblique, rarely erect. Pyxidia 2–4.3 × 2.5–5 cm, cupuliform, dark green, calyx persistent; pericarp 2.5–3.5(–4) mm thick; operculum 1.1–2.2 × 2.3–4.3 cm, slightly umbonate. Seeds 1.8–2.3 × 1.3–1.8 cm, 1–3(–4) per fruit, ovoid to globose, triangular in cross section, brown, veins flat, light brown; aril lateral, yellow. **Selected specimens**: Anchieta, rodovia ES-060, 11.I.1985, fl., *J.R. Pirani 1055* (NY e SPF). Aracruz, Vila do Riacho, 10.II.1993, fl., *J.R. Pirani & J.A. Kallunki 2773* (NY, RB, SPF). Conceição da Barra, Reserva Biológica de Córrego Grande, 12.XI.2011, fl., *M. Ribeiro & J.S. Penha 664* (VIES). Fundão, Nova Almeida, 27.XI.1998, fl., *I.D. Rodrigues 8* (VIES). Guarapari, Rodovia ES-060, 4.XI.1991, fl., *P.C. Vinha 1364* (VIES). Linhares, Degredo, 15.VII.2012, mat. fr., *E.M. Saddi et al. 855* (RB). Marilândia, 22.X.2004, fr., *A.A. Luz 249* (CVRD). Pedro Canário, Rod. BR-101, 19.X.1983, fl., *G.G. Hatschbach 47003* (MBM, NY). Pinheiros, Reserva Biológica de Córrego do Veado, 21.X.2013, fl., *M. Ribeiro & N.P. Smith 875* (CEPEC, NY, RB). Santa Leopoldina, Mangaraí, 21.I.2006, fr., *M.O.S. Crepaldi & R.C.M. Batalha 74* (RB). São Mateus, Litorâneo, 20.I.2014, fl. and mat. fr., *M. Ribeiro 981* (NY, RB, VIES). Serra, Manguinhos, 2.IX.1985, fl., *M.A. Milanezi* (VIES 532). Sooretama, Reserva Biológica de Sooretama, 25.VIII.2012, fl., *T.B. Flores & G.O. Romão 1150* (RB). Vila Venha, Morada do Sol, 12.III.2006, mat. fr., *F.A.R. Matos 118* (VIES).

Eschweilera ovata is characterized by its squamose bark, hood with a double coil, cupuliform pyxidia that are green when mature, and seeds with a lateral aril. Mori & Prance (1990b) note that this species has a conical hypanthium with a well-defined pedicel and cup-shaped fruit with a generally rounded base. The authors state that the species is morphologically similar to *E. parvifolia* Mart. *ex* Candolle (1828: 293); however, the latter has ovate leaf blades, a turbinate pyxidium and occurs in periodically flooded habitats in Amazonia. It has been collected with flowers and mature fruits throughout the all year, with peak records from October to February and March to May, respectively.

This species occurs in Brazil, with a disjunct distribution between Amazonia and the Atlantic Forest (Smith *et al*. 2016a; Mori *et al*. 2017; BFG 2018). In Espírito Santo, it is found in *restinga* forest and *tabuleiro* forest (Ribeiro *et al*. 2014). It is known as *biriba* (*J. Spada 4, 8*), *embiriba* (*J.G. Kuhlmann 174*) or *imbiriba* (*D.A. Folli 1135*) and is used to make the berimbau (a percussion instrument), railroad ties, slats, boards, rafters and plywood, as well as in the production of charcoal (*J. Spada 4, 8, 54*).

3.3. *Eschweilera sphaerocarpa* M. Ribeiro & S.A. Mori, Phytotaxa 255(3): 267-273. 2016.

Figs. 2b; 7g; 8h; other images in Ribeiro *et al*. (2016a)

Trees, to 23 m tall. Bark deeply fissured; outer bark dark brown, laminated, thicker than inner bark; inner bark light yellow. Leaves deciduous; petioles 13–15 × 1–2 mm, semicylindrical, rarely canaliculate, glabrous; blades 5.8–7 × 2.6–5 cm, elliptic, obovate, rarely suborbiculate, coriaceous, glabrous, base cuneate, obtuse, rarely rounded,

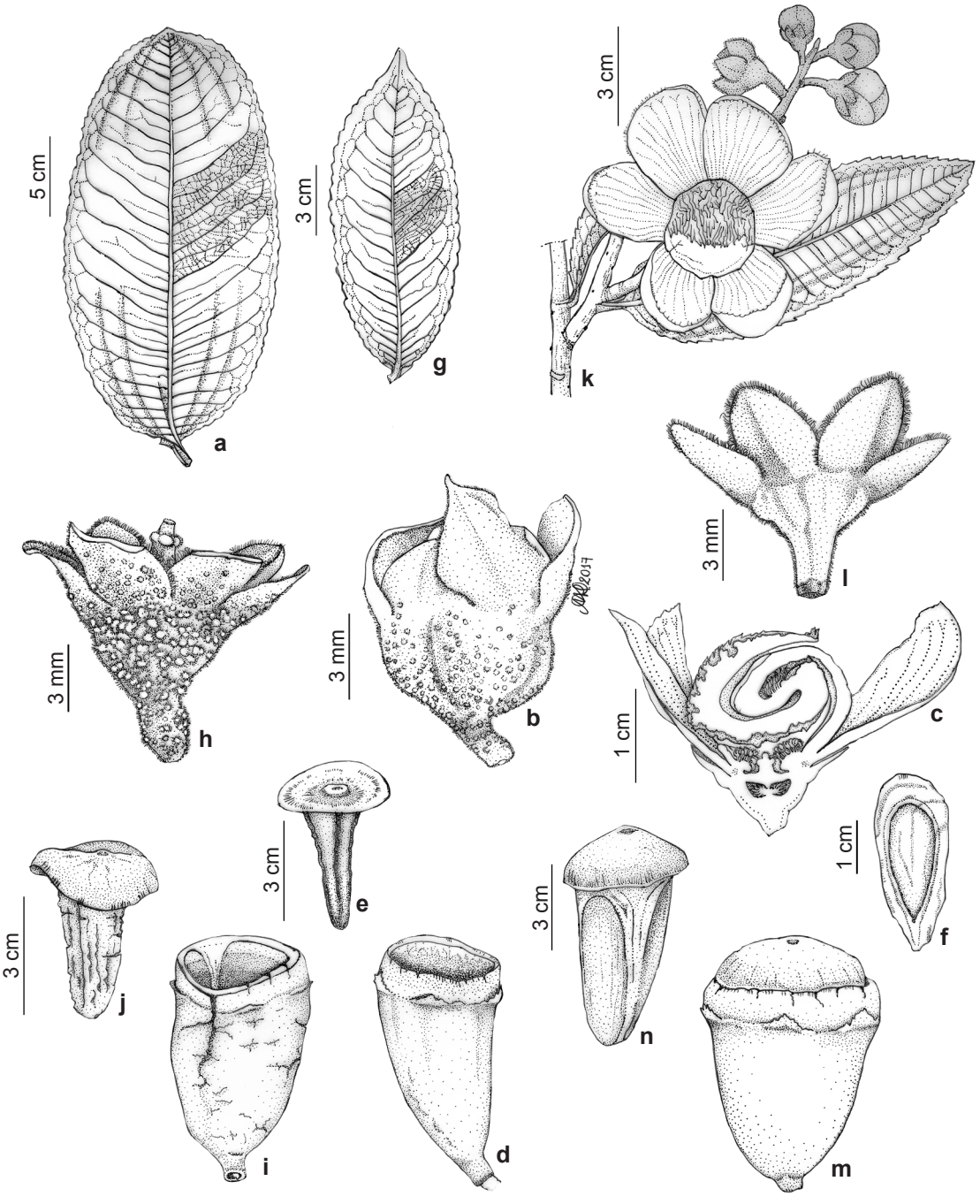

Figure 4 – a-f. *Couratari asterophora* – a. leaf; b. hypanthium and calyx lobes; c. medial longitudinal section of a flower, note the androecial hood with external flap; d-e. pyxidium; f. seed with circumferential wing. g-j. *C. asterotricha* – g. leaf; h. hypanthium and calyx lobes; i-j. pyxidium. k-n. *C. macrosperma* – k. stem with flower; l. hypanthium and calyx lobes; m-n. pyxidium. (a-c. *M. Ribeiro 925*; f. *M. Ribeiro 928*; d-e. *M. Ribeiro 878*; g-h. *M. Ribeiro 827*; i-j. *M. Ribeiro 896*; k. *M. Ribeiro 519*; l. *M. Ribeiro 1040*; m-n. *M. Ribeiro 898*).

margins entire to inconspicuously crenate in the upper third, slightly revolute, apex obtuse, rounded, rarely retuse; secondary veins in 7–12 pairs. Inflorescences in spikes, sometimes a panicle of spikes, terminal or axillary, glabrous; rachis 3.5–11 cm long, with horizontally oriented squamulae, with 8–12 buds. Flowers 2.5–3 cm diam., sessile; calyx lobes not defined, fused at base and forming calycine rim, ca. 2 mm wide, irregularly split around rim, light green; petals 4(–6), 12–20 × 10–20 mm, orbicular, oblong, elliptic, white; stamens 150–170, the filaments 1.3–3 mm long, unequal, largest next to ligule, clavate, few sigmoid, white, the anthers 0.5–0.7 mm long, yellow, hood with single coil, light yellow, with vestigial stamens and staminodes present on surface of coil, yellow; ovules 5–10 per locule, the style oblique. Pyxidia 3.8–5 × 5.9–7.4 cm, globose, brown, lenticellate, calyx not persistent; pericarp 11–20 mm thick; the infracalycine zone rounded, supracalycine zone erect; operculum ca. 2.7 × 4.4 cm, convex. Seeds 2.5–2.7 × 1.5–1.8 cm, 1–2(–3) per fruit, ellipsoid, circular in cross section, brown, veins impressed, reddish brown; aril basal, small.

Selected specimens: Jaguaré, estrada Jaguaré para Fátima, 28.XII.2010, fl., *D.A. Folli 6755* (CVRD, NY).

Eschweilera sphaerocarpa is distinguished from the other two species by its deeply fissured bark, sessile flowers, globose pyxidium and thick pericarp (11–20 mm). Flowers have been collected from October to December and mature fruits have been collected in February. Individuals were observed with all new leaves (newly flushed, which were light green) in their crowns in December.

This species is restricted to Brazil, endemic to the Atlantic Forest, and only known from *tabuleiro* forest in Espírito Santo (Ribeiro *et al*. 2016a). It is popularly called *sapucarana* (*D.A. Folli 6542*) and has no known uses; however, due to its size, it is possibly used as a source of wood.

4. *Lecythis* Loefling, Iter Hispan.: 189. 1758.

Trees, canopy or emergent; trunk without buttresses. Bark deeply fissured, laminated, outer bark reddish brown (brown in *L. lurida*), thicker than the inner bark, inner bark pale yellow (yellowish brown in *L. lurida*), sapwood light yellow. Leaves present at flowering, deciduous, glabrous or puberulous at the base, margins crenulate to crenate or serrulate. Inflorescence in racemes; bract and bracteoles caducous. Flowers 1.5–5 cm in diam., calyx and corolla 6-merous; androecium zygomorphic, fleshy, stamens numerous, the filaments clavate; hood expanded horizontally (flat) or separated into anterior and posterior regions (with anterior extension), with vestigial stamens and staminodes (only vestigial stamens in *L. lurida*); ovary 4(–5)-locular, with truncate apex, ovules many per locule, style well differentiated from the ovary. Pyxidia predominantly dehiscent, globose, subglobose or turbinate, lenticellate, supracalycine zone oblique (except in *L. lurida*), calyx not persistent; operculum usually with columella. Seeds with flat veins, aril present, fleshy, basal, well-developed or vestigial, cotyledons undifferentiated.

Lecythis comprises 28 species found predominantly in tropical forests from Nicaragua to Brazil; few species occur in savannas (Mori 1990a; Smith *et al*. 2016a). In Brazil, there are 22 species, of which 14 are endemic (BFG 2018). Four species occur in Espírito Santo (Fig. 2c,f-i; 6; 7h-l; 8i-l).

Key to the species of *Lecythis* in Espírito Santo

1. Phloem light red. Flowers subsessile, pedicels to 2 mm long; calyx lobes with longitudinally oriented mucilage ducts; petals pink with light yellow internal base; hood with anterior extension; style oblique, without stylar collar. Pyxidia secondarily indehiscent, subglobose, pericarp 3–5 mm thick. Seeds not sulcate, aril vestigial..... 4.2. *Lecythis lurida*

1’. Phloem colorless. Flowers pedicellate, pedicels > 2.5 mm long; calyx lobes without longitudinally oriented mucilage ducts; petals not pink or only with a pink apex and without a light yellow, internal base; hood flat; style erect, with stylar collar. Pyxidia dehiscent, turbinate or globose, pericarp ≥8 mm thick. Seeds sulcate, aril basal..... 2

2. New leaves pink to light reddish pink at flowering; margins crenulate, teeth conspicuous, forming deep lobes in the blade; only first venation order prominent on the adaxial surface. Pedicel 5–11 mm long, hypanthium and calyx lobes dark purple, calyx lobes not carenate, petals light purple or white. Pyxidia globose, infracalycine zone rounded, supracalycine zone not prominent ..... 4.4. *Lecythis pisonis*

2’. New leaves light green at flowering; margins serrulate or crenulate, teeth inconspicuous, not forming deep lobes in the blade; all venation orders prominent on the adaxial surface. Pedicel 2.5–4.5 mm long, hypanthium and calyx lobes light green, calyx lobes carenate, petals equal in color in all flowers. Pyxidia turbinate or broadly turbinate, infracalycine zone angular, supracalycine zone prominent 3

3. Petioles puberulous; leaf blade margins serrulate. Flowers 1.5–2 cm in diam., pedicel and hypanthium puberulous, petals white at the base and light purple or pink in the upper half. Pyxidia with flat infracalycine zone ..... 4.1. *Lecythis lanceolata*

3’. Petioles glabrous; leaf blade margins crenulate. Flowers 2.8–4 cm in diam., pedicel and hypanthium glabrous, petals white or cream. Pyxidia with slightly sulcate infracalycine zone..... ..... 4.3. *Lecythis marcgraaviana*

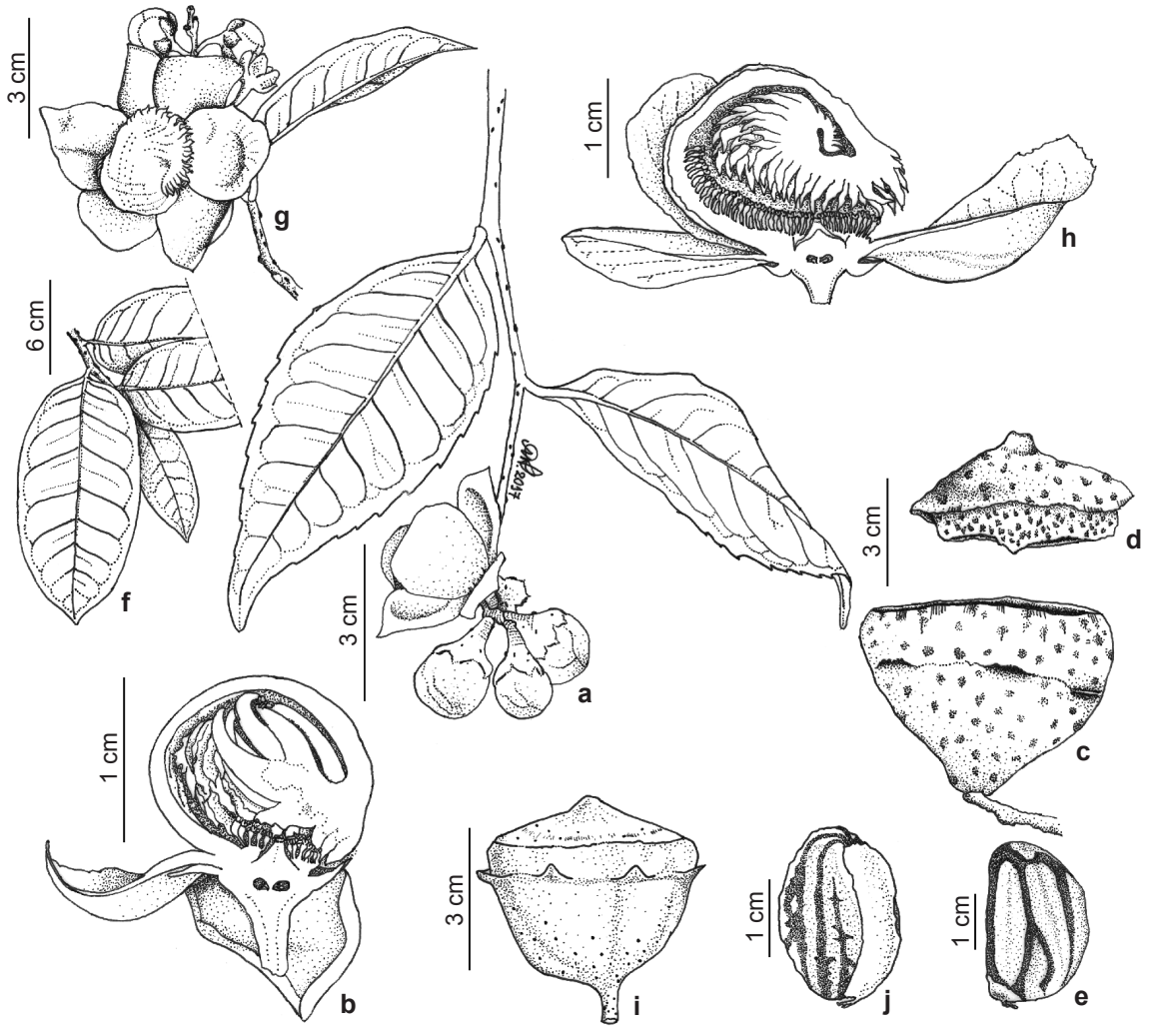

Figure 5 – a-e. *Eschweilera compressa* – a. stem with flower and buds; b. medial longitudinal section of a flower, note the androecial hood with single coil; c-d. pyxidium; e. seed with basal aril. f-j. *E. ovata* – f. leaves; g. stem with flower and buds; h. medial longitudinal section of a flower, note the androecial hood with double coil; i. pyxidium; j. seed with lateral aril. (a-b. *M. Ribeiro & F. Bravim 1159*; c-e. *G.S. Siqueira & Pretti 1048*; f. *M. Ribeiro 852*; g-h. *M. Ribeiro 981*; i-j. *M. Ribeiro 1095*).

4.1. *Lecythis lanceolata* Poiret, Encycl. Méth. 6(1): 27. 1804. Figs. 2c,f; 6a-b; 7i-j; 8j

Trees, to 33 m tall; inner bark with non-distinct phloem, colorless. Leaves: when immature with light green color at flowering; petioles 4–7(–9) × 1–1.5 mm, semi-cylindrical, puberulous; blades 4.8–7.5(–11.5) × 1.9–4.5 cm, elliptic, rarely oblong, coriaceous, puberulous or glabrate at leaf base, base obtuse, decurrent, margins serrulate, apex short- or long-acuminate; secondary veins in 11–15(–17) pairs, all venation orders prominent on the adaxial surface. Inflorescences in racemes, ramiflorous and axillary, subtended by leaves, puberulous; rachis 2.5–13 cm long, with 7–18 buds. Flowers 1.5–2 cm diam.; pedicel 2.5–4.5 mm long, puberulous; hypanthium puberulous, light green; calyx lobes 2–3.5 × 2–3 mm, ovate, carinate, without longitudinally oriented mucilage ducts, light green; petals 8–13 × 6–9 mm, obovate or elliptic, white at the base, light purple or pink in the upper half; hood flat, white, or white and yellow; stamens 80–95, the filaments 0.7–2.5 mm long, white, the anthers ca. 0.5 mm long, yellow; ovary 4(–5)-locular, ovules 5–18 per locule, style erect, with stylar collar. Pyxidia 7–14.5 × 7.7–16 cm, turbinate to broadly turbinate, brown; pericarp 8–20 mm, thick; infracalycine zone angular and flat, supracalycine zone prominent; operculum 4.5–6 × 7–10 cm, convex, columella quadrangular. Seeds 2.2–3.6 × 1.5–1.8 cm, 14–18 per fruit, sulcate, circular in cross section, brown; aril basal, white.
Selected specimens: Aracruz, Bairro Clemente, 11.XI.1993, fl., *R.N. Oliveira 653* (VIES). Conceição da Barra, Reserva Biológica de Córrego Grande, 23.VIII.2013, *M. Ribeiro et al. 905* (NY, RB). Linhares, Reserva Florestal de Linhares, 30.XII.1972, fl., *J. Spada 109* (CVRD, NY, RBR, RB). Pinheiros, Reserva Biológica de Córrego do Veado, 26.I.2011, fl., *M. Ribeiro et al. 431* (VIES). Santa Leopoldina, Rio da Prata, 20.XII.1987, fl., *V. Krause* (MBML 4388, RB 613328). São Mateus, Morada do Ribeirão, 10.I.2013, fl., *M. Ribeiro 851* (VIES). Sooretama, Reserva Biológica de Sooretama, 12.V.1985, mat. fr., *G. Martinelli et al. 10973* (CEPEC, MO, RB).

Lecythis lanceolata is characterized by the leaves with serrulate margins (also present in *L. lurida*, however in the latter the blades are generally larger and glabrous), small flowers 1.5–2 cm in diameter, puberulous pedicel and hypanthium, petals white at the base and light purple or pink in the upper half, and turbinate to broadly turbinate pyxidia (a character shared with *L. marcgraaviana*). It is morphologically similar to *L. marcgraaviana*. However, it is distinguished from the latter by the following: leaves with serrulate margins (*vs*. crenulate) and puberulous petiole (*vs*. glabrous); flowers 1.5–2 cm in diam. (*vs*. 2.8–4 cm diam.), pedicel and hypanthium puberulous (*vs*. glabrous), petals white at the base and light purple or pink on the upper half (*vs*. white); and pyxidia with flat infracalycine zone (*vs*. slightly sulcate). Among the *Lecythis* in Espírito Santo, in general *L. lanceolata* has bark with longer and proportionally wider fissures, the latter mainly in individuals found inside forests, and the smallest leaves and flowers. Young individuals generally have leaves that are longer than wide, with no decurrent base. Mori (1990a) cites flowers up to 4 cm in diameter for this species, but in specimens from Espírito Santo the flowers only reach 2 cm in diameter. It has been collected with flowers from November to February and with immature fruits in May. Individuals with all new leaves (newly flushed) in their crowns have been observed in January.

This species is restricted to Brazil and the Atlantic Forest (Mori 1990b; Smith *et al*. 2016a; BFG 2018). In Espírito Santo, it is found in hillside and *tabuleiro* forests (Ribeiro *et al*. 2014). It is known as *sapucaia-mirim* (*J. Spada 109*), *sapucaia* (*G. Martinelli et al. 10973*) or *sapucainha* (*V. Krause*, MBML 4388). Its wood is used to produce railroad ties and beams (*J. Spada 109*), and the species could be potentially used as an ornamental in squares and gardens.

4.2. *Lecythis lurida* (Miers) S.A. Mori, Brittonia 33(3): 362-363. 1981. Figs. 2g; 6c-d; 7h; 8i

Trees, to 33 m tall; inner bark with distinct phloem, light red. Leaves: when immature with light green or reddish-green color at flowering; petioles (6–)10–13 × 2–3 mm, canaliculate, glabrous; blades 9.8–18(–34.5) × 5–8.3(–13.5) cm, elliptic, oblong, chartaceous to coriaceous, glabrous, base obtuse, not decurrent, margins serrulate, infrequently entire, apex short-acuminate or obtuse; secondary veins in 14–20 pairs, only first venation order prominent on the adaxial surface. Inflorescences in racemes, terminal, glabrous; rachis 6–10 cm long, with 11–20 buds. Flowers 4–5 cm diam.; subssesile, pedicel to 2 mm long, glabrous; hypanthium glabrous, light green; calyx lobes 9–12 × 7–10 mm, ovate, carinate, with longitudinally oriented mucilage ducts, light green to pinkish green; petals 25–33 × 13–18 mm, oblong, ovate, pink with light yellow internal base, light purple or pink in the upper half; hood with anterior extension, yellow; stamens 110–115, the filaments 1.3–2 mm long, white, the anthers ca.

0.7 mm long, yellow; ovary 4(–5)-locular, ovules 7–13 per locule, style oblique, without stylar collar. Pyxidia secondarily indehiscent, 6.3–9 × 8–10.4 cm, subglobose, brown; pericarp 3–5 mm thick; infracalycine zone tapered, supracalycine zone not prominent; operculum indehiscent, 1.8 × 5.5–8.8 cm, slightly umbonate, without columella. Seeds 4–4.8 × 3.2–3.7 cm, 5–6 per fruit, not sulcate, circular in cross section, brown; aril vestigial.

Selected specimens: Água Doce do Norte, mata próxima ao morro da Torre, 25.III.2014, mat. fr., *B.S. Amorim et al. 1979* (UFP, VIES). Água Branca, Águas Claras, 22.XI.2007, fl., *V. Demuner 4606* (MBML). Aracruz, Reserva da Santur, 27.II.1992, fl., *R.N. Oliveira 164* (VIES). Cachoeiro de Itapemirim, Floresta Nacional de Pacotuba, 2.VII.2007, *L.N. Moreira 61* (VIES). Cariacica, Parque Municipal do Mochuara, 28.III.2003, mat. fr., *A.G. Christo 206* (RB). Colatina, São João Grande, 16.X.2008, mat. fr., *A.M. Assis & V. Pereira 1829* (MBML). Conceição da Barra, Reserva Biológica de Córrego Grande, 21.XII.2011, mat. fr., *M. Ribeiro & A.G. Oliveira 736* (VIES). Ecoporanga, estrada saindo de Ecoporanga, 25.XII.1991, fl., *V. Souza 269* (CVRD).

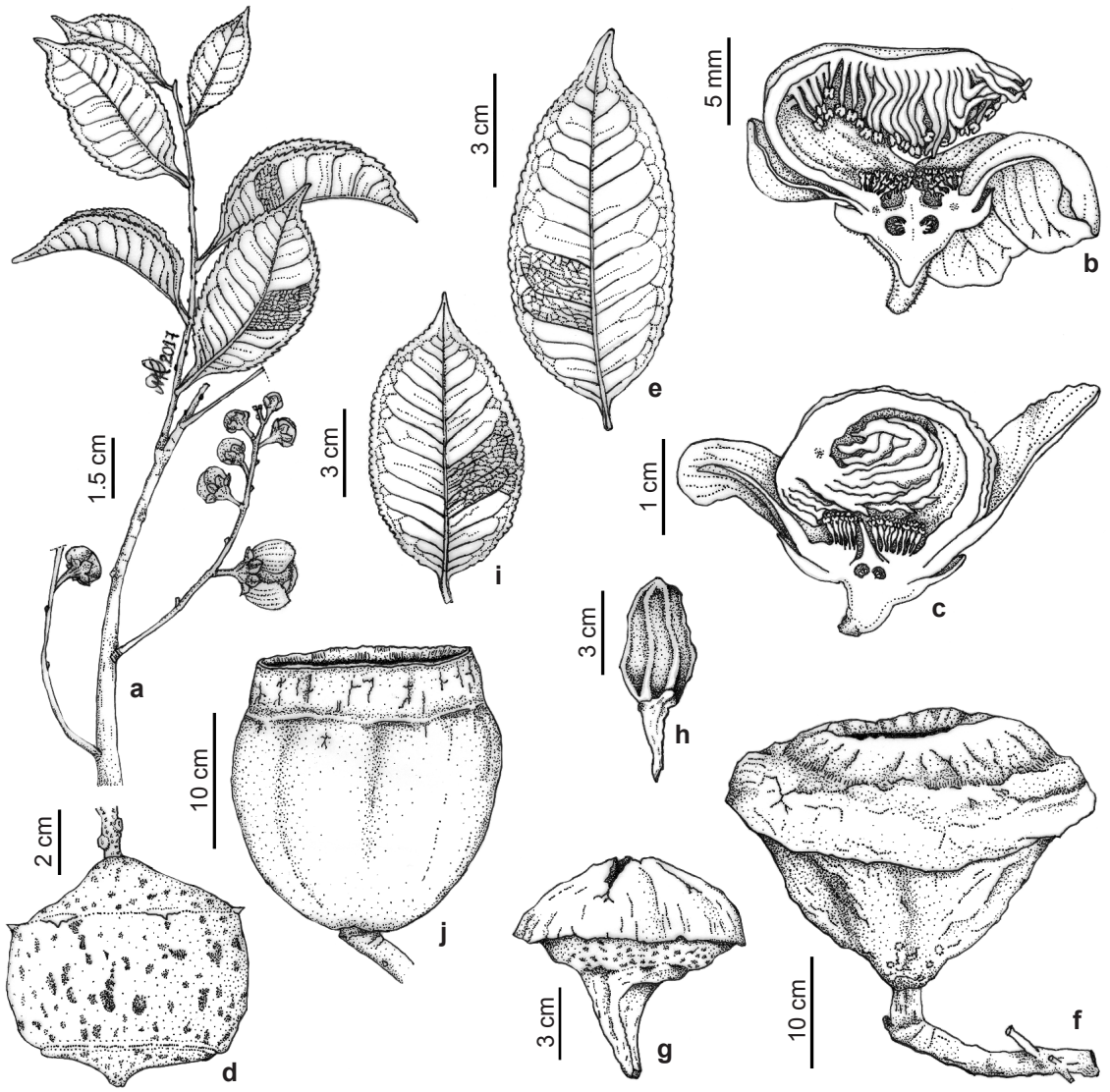

Figure 6 – a-b. *Lecythis lanceolata* – a. stem with flower and buds; b. medial longitudinal section of a flower, note the flat androecial hood. c-d. *L. lurida* – c. medial longitudinal section of a flower, note the androecial hood with anterior extension; d. pyxidium. e-h. *L. marcgraaviana* – e. leaf; f-g. pyxidium; h. seed with developed basal aril. i-j. *L. pisonis* – i. leaf; j. pyxidium. (f-h. *D.A. Folli 2360*; *M. Ribeiro*: a. *431*, b. *851*, c-d. *1137*, e. *1138*, i. *1036*, j. *917*).

Itaguaçu, Itaimbé, propriedade particular próx. a estrada, 18.IV.2014, pst. fr., *M. Ribeiro & N.P. Smith 1032* (RB). Itapemirim, Faz. Ouvidor, 15.III.2008, mat. fr., *A.M. Assis et al. 1471* (MBML). Linhares, ao lado da rodovia, 10.XI.2014, fl., *M. Ribeiro et al. 1137* (NY, RB). Nova Venécia, Córrego da Volta, 21.VIII.2013, mat. fr., *L. Marcarini* 110 (VIES). Pinheiros, 6.XI.1990, fl., *E.N. Moraes 54* (CVRD). São Domingos do Norte, I.1984, fl. and mat. fr., *G. Dalcolmo* (MBML 1232). Santa Leopoldina, Mangaraí, 21.VII.2005, *M.O.S. Crepaldi 16* (RB). Santa Teresa, São João de Petrópolis, 22.XII.2011, fl., *J. Gurtler et al. 32* (MBML). Sooretama, Reserva Biológica de Sooretama, 12.VII.1947, *A. Aguirre* (RB 60630). Vila Velha, Seringal, 5.IX.2013, pst. fr., *M. Ribeiro 856* (RB).

Lecythis lurida is distinguished by its bark with light red phloem, subsessile flowers, pedicels ≤ 2 mm long, pink petals with a light yellow, internal base, hood with an anterior extension, oblique style without a stylar collar, secondarily indehiscent, subglobose pyxidia with a thin pericarp (3–5 mm thick), and non-sulcate seeds with a vestigial aril. *L. lurida* has the largest leaves among the four species, usually with markedly serrate margins. When fresh, the mature leaves are slightly discolored and thick to the touch. Mori & Prance (1983) recorded flowers 3 cm in diameter and flowers with approximately 200 stamens, and Mori (1990a) observed flowers with 160 to 260 stamens. Fewer stamens were recorded in specimens from Espírito Santo (110–115). In the fruits of this species, despite the presence of a line of opercular dehiscence, the operculum does not separate from the capsule. Mori (1990a) observed that the mature fruit falls intact from the tree and its thin pericarp breaks from the fall, releasing the seeds, or the seeds germinate inside the fruit. It has been collected with flowers from November to March and with mature fruits from August to May.

This species is endemic to Brazil, with a disjunct distribution between Amazonia and the Atlantic Forest (Smith *et al*. 2016a; BFG 2018). In Espírito Santo, it is found in hillside and *tabuleiro* forests (Ribeiro *et al*. 2014). It is known as *inhaíba-vermelha* (*J. Spada 21*), *inhuiba-do-rego* and *inhaíba* (Mori 1990a,) and its wood is used in to produce railroad ties and fence posts (*J. Spada 21, 53*).

4.3. *Lecythis marcgraaviana* Miers, Trans. Linn. Soc. London 30(2): 210. 1874.

Figs. 2h; 6e-h; 7k; 8l

Trees, to 30 m tall; inner bark with non-distinct phloem, colorless. Leaves: when immature with light green color at flowering; petioles 5–12 × 1–3 mm, semi-cylindrical, glabrous; blades 8.5–13.5 × 4.5–5.5 cm, elliptic, rarely oblong, chartaceous to coriaceous, glabrous, base rounded or obtuse, narrowly decurrent, margins crenulate, teeth not forming deep lobes in the blade, apex long- or short-acuminate; secondary veins in 12–17 pairs, all venation orders prominent on the adaxial surface. Inflorescences in racemes, terminal, axillary, subtended by leaves, glabrous; rachis 7.8–15 cm long, with 10–23 buds. Flowers 2.8–4 cm diam.; pedicel 2.5–4 mm long, glabrous; hypanthium glabrous, light green; calyx lobes 3–5 × 4–4.5 mm, ovate, carinate, without longitudinally oriented mucilage ducts, light green; petals 14–27 × 10–20 mm, elliptic, oblong, white or cream; hood flat, white and yellow; stamens 200–230, the filaments 1–1.5 mm long, white, the anthers ca. 0.5 mm long, beige; ovary 4-locular, ovules 5–18 per locule, style erect, with stylar collar. Pyxidia 10.5–18 × 15.5–23 cm, turbinate to broadly turbinate, brown, lenticels forming depressions on exocarp; pericarp 15–33 mm thick; infracalycine zone angular and slightly sulcate, supracalycine zone prominent; operculum 5–8.5 × 9.3–10.5 cm, convex, columella quadrangular. Seeds 3–4.5 × 2–3.1 cm, ca. 17 per fruit, sulcate, circular in cross section, brown; aril basal, white.

Selected specimens: Aracruz, Coqueiral, 16.I.1992, fl., *R.N. Oliveira 70* (VIES). Conceição da Barra, Reserva Biológica Córrego Grande, 12.I.2014, fl., *M. Ribeiro et al. 973* (NY, RB). Linhares, Reserva Natural Vale, 31.I.2005, fl., *D.A. Folli 5026* (CVRD, NY).

Lecythis marcgraaviana is morphologically similar to *L. lanceolata* and *L. pisonis*. Compared to *L. pisonis*, it is distinguished by the crenulate margins teeth that do not form deep lobes in the blade (*vs*. crenulate with teeth that form deep and well-defined lobes in the blade), all venation orders prominent on the adaxial surface (*vs*. only the first venation order prominent on the adaxial surface), pedicel 2.5–4 mm long (*vs*. 5–11 mm long), flower with light green hypanthium and calyx lobes (*vs*. dark purple), calyx lobes carinate (*vs*. not carinate), and pyxidium turbinate to broadly turbinate (*vs*. globose). Due to the morphological similarities, incomplete collections and short descriptions on the labels (especially the color of floral parts) at the time, Mori (1990a) synonymized this taxon, along with others, under *L. pisonis*. The species has recently been reestablished and its morphology detailed by Smith *et al*. (2016b). It has been collected

with flowers in January and February and with immature and mature fruits in July. Individuals with all new leaves (newly flushed) in their crowns have been observed in January.

This species is endemic to the Atlantic Forest (Smith *et al*. 2016a). In Espírito Santo, it is restricted to *tabuleiro* forest; we did not record specimens from *restinga* forest, as reported by Smith *et al*. (2016b) for Paraíba. It is known as *sapucaiú* (*D.A. Folli 676*) or *sapucaia-mirim* (*J. Spada 39*) and its wood is used for fence posts and railroad ties (*J. Spada 39*).

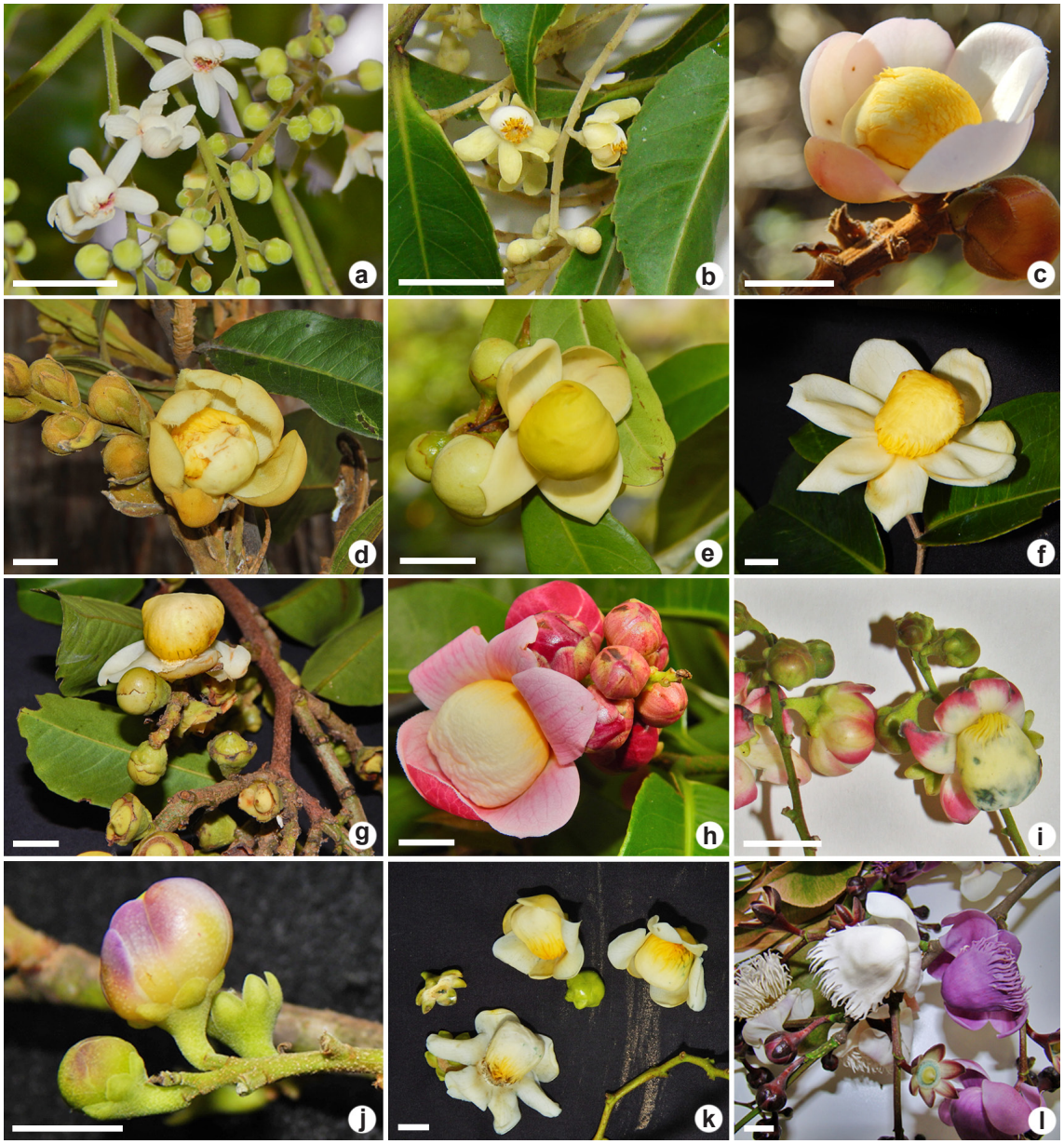

Figure 7 – a-l. Flowers of species of Lecythidaceae in Espírito Santo – a. *Cariniana estrellensis*; b. *C. legalis*; c. *Couratari asterophora*; d. *C. macrosperma*; e. *Eschweilera compressa*; f. *E. ovata*; g. *E. sphaerocarpa*; h. *Lecythis lurida*; i-j. *L lanceolata*; k. *L marcgraaviana*; l. *L pisonis*. (a. *M. Ribeiro 954*; b. *M. Ribeiro et al. 854*; c. *M. Ribeiro et al. 928*; d. *M. Ribeiro 1034*, e. *M. Ribeiro & F. Bravim 1159*; f. *M. Ribeiro 981*; g. *M. Ribeiro 1136*; h. *M. Ribeiro 1137*, i. *M. Ribeiro 951*; j. *M. Ribeiro 431*; k. *M. Ribeiro 973*; l. *M. Ribeiro 690*). Photos: a-l. M. Ribeiro.

4.4. *Lecythis pisonis* Cambessèdes in St. Hil., *Fl. bras.* Merid. 2: 377. 1829. Figs. 2i; 6i-j; 7l; 8k

Trees, to 33 m tall; inner bark with non-distinct phloem, colorless. Leaves: when immature with pink to light reddish pink color at flowering; petioles (3–)7–12 × 2–2.5 mm, canaliculate, glabrous; blades 8.7–10.8 × 3–5.3 cm, elliptic, chartaceous, base obtuse, narrowly decurrent, margins crenulate, teeth forming deep lobes in the blade, apex short- or long-acuminate; secondary veins in 10–17 pairs, only first venation order prominent on the adaxial surface. Inflorescences in racemes, terminal, axillary, glabrous; rachis 5–11.5 cm long, with 7–18 buds. Flowers 2.5–4.5 cm diam.; pedicel 5–11 mm long, glabrous; hypanthium glabrous, dark purple, calyx lobes 4–8 × 4–7 mm, ovate, not carinate, without longitudinally oriented mucilage ducts, dark purple; petals 15–22 × 11–14 mm, ovate to elliptic, light purple or white; hood flat, purple or white; stamens 118–200, the filaments 1–1.3 mm long, white, the anthers 0.5–0.7 mm long, cream; ovary 4-locular, ovules 6–21 per locule, style erect, with stylar collar. Pyxidia 13.5–21 × 12.5–16.5 cm, globose, light brown; pericarp 27–33 mm thick; infracalycine zone rounded, supracalycine zone not prominent; operculum 8.5–9 × 9.5–13 cm, convex, columella quadrangular. Seeds 4.6–5.3 × 2.5–3 cm, number per fruit not seen, sulcate, circular in cross section, dark brown; aril basal, white.

Selected specimens: Águia Branca, assentamento 16 de Abril, 15.III.2006, mat. fr., *V. Demuner 1924* (MBML). Aracruz, Coqueiral, 16.XII.1992, fl., *M.A. Pereira 39* (VIES). Baixo Guandu, afluente do Rio Doce, 18.IV.2019, *F.A. Paixão 30P72* (HDJF). Cachoeiro de Itapemirim, Flona de Pacotuba, 10.X.2011, fl., *H.M. Dias & A.E. Silva 569* (VIES). Colatina, VII.1918, *H.N. Whitford & F. Silveira 89* (F). Conceição da Barra, Reserva Biológica de Córrego Grande, 13.XI.2011, fl., *M. Ribeiro & J.S. Penha 690* (VIES, RB). Domingos Martins, Goiabeiras, 17.VIII.2013, fl. and mat. fr., *M. Ribeiro et al. 868* (RB). Linhares, Reserva Florestal Vale, 30.IX.1971, fl., *T.S. Santos 2009* (CVRD, NY). Pinheiros, Reserva Biológica de Córrego do Veado, 23.I.2011, pst. fr., *M. Ribeiro et al. 429* (RB). Rio Bananal, Alto Bananal, 6.XI.2007, fl., *V. Demuner 4464* (MBML). São Mateus, Jambeiro, 20.XI.2013, pst. fr., *M. Ribeiro & E.M. Rozário 937* (RB). Santa Leopoldina, Sumidoro, 10.IX.2009, fl., *A.M. Assis & F.M. Flores 2047* (MBML, RB). Santa Teresa, Vinte Cinco de Julho, 28.III.2000, fr., *V. Demuner 863* (MBML). Sooretama, Reserva Biológica de Sooretama, 26.VIII.2013, fl., *M. Ribeiro et al. 917* (RB). Viana, Jucuruaba, 4.IV.2014, pst. fr., *M. Ribeiro 994* (RB).

Lecythis pisonis can be recognized by the following: leaves pink to light reddish pink when flowering (*vs*. light green in *L. lanceolata* and *L. marcgraaviana*, or reddish green in *L. lurida*), margins crenulate with teeth forming deep and well-defined lobes in the blade, only the first order of venation prominent on the adaxial surface; flowers with pedicels 5–11 mm long, hypanthium and calyx lobes dark purple, petals light purple or white; and globose pyxidium. Mori (1990a) points out the great variation in the size and presentation of the more or less conspicuous calycine ring of the pixidia of this species, and also recorded 10–30 seeds per fruit. *L. pisonis* has the widest leaf in relation to its length compared to the other three species. In the flowering specimens observed, the branches usually had inflorescences with flowers with light purple petals and hoods (ca. 70%) compared to flowers with white petals and hoods (ca. 30%). It has been collected with flowers from August to November and with mature fruits from October to March. Individuals with all leaves newly flushed in their crowns were observed in October and November.

This species occurs in Brazil and Peru, with a disjunct distribution between Amazonia and the Atlantic Forest (Mori 1995; BFG 2018). In Espírito Santo, it is present in hillside and *tabuleiro* forests (Ribeiro *et al*. 2014). It is known as *sapucaia* (*V. Demuner 141*) or *sapucaia-vermelha* (*J. Spada 14*) and used as an ornamental in squares, gardens and on farms (Mori 1990a, personal observation M. Ribeiro). Its wood is used for railroad ties and fence posts (*J. Spada 14*); the seeds are edible and used in the preparation of *cocadinha* (a type of sweet) or consumed in natura (*M. Ribeiro et al. 868*).

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Figura 8 – a-l. Fruits of species of Lecythidaceae in Espírito Santo – a. *Cariniana estrellensis*; b. *C. ianeirensis*; c. *C. legalis*; d. *Couratari asterophora*; e. *C. macrosperma*; f. *Eschweilera compressa*; g. *E. ovata*; h. *E. sphaerocarpa*; i. *Lecythis lurida*; j. *L. lanceolata*; k. *L. pisonis*; l. *L. marcgraaviana.* (b-c, k. immature fruits; e-i, l. mature fruits; a, d, j. past fruits). Scale bars: a = 2 cm; b = 5 cm; c, e-i = 3 cm; d, j-l = 10 cm. (a. *M. Ribeiro 853*; b. *M. Ribeiro 1031*; c. *L.F.T. Menezes 1932*; d. photographic record; e. *M. Ribeiro 898*; f. *G. Siqueira 1048*; g. *M. Ribeiro 1095*; h. *D. Folli 6542*; i. *M. Ribeiro 1161*; j. *M. Ribeiro 431*; k. *M. Ribeiro 868*; l. *D. Folli 2360*). Photos: a-c, e, g-l. M. Ribeiro; d. L. Pimentel; f. G. Siqueira.

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