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Original Paper

Flora of Rio de Janeiro: *Protium* Burm. f. (Burseraceae)

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Abstract

The current study aims to contribute to the knowledge the genus *Protium* occurring in the state of Rio de Janeiro. Collections deposited in national herbaria were examined and field collections were carried out, in addition to research in specialized literature and consultations in online international herbaria. Seven species were cataloged for the state of Rio de Janeiro. Descriptions, illustrations, comments, as well as information on phenology, ecology, conservation, and distribution maps for all species are presented.

Key words: Atlantic Forest, *Protium,* Rio de Janeiro, taxonomy.

Resumo

O presente estudo tem como objetivo contribuir com o conhecimento das espécies do gênero *Protium* ocorrentes no estado do Rio de Janeiro. Foram examinadas coleções depositadas em herbários nacionais e realizadas coletas em campo, além de pesquisas em literaturas especializadas e consultas em exemplares online de herbários internacionais. Foram registradas sete espécies para o estado do Rio de Janeiro. São apresentados descrições, ilustrações, comentários, além de informações sobre fenologia, ecologia, conservação e mapas de distribuição das espécies.

Palavras-chave: Mata Atlântica, *Protium*, Rio de Janeiro, taxonomia.

Introduction

Protium Burm. f. is the largest genus of Burseraceae, with approximately 175 species distributed in the Neotropical region (Daly *et al.* 2012), Burseraceae consists of about 750 species and 19 genera, with Pantropical distribution (Marques *et al.* 2010). In Brazil, the family is represented by 7 genera and 104 species (BFG 2015, 2022).

In Brazil, *Protium* is represented by 84 species, 18 of which are endemic (Flora e Funga do Brasil 2023), it exhibits a distinct distribution, concentrated in the Northern region, specifically in the Amazon biome, with the Atlantic Forest as one of the secondary areas of diversity. This fact may partly explain the low number of studies on its richness in the latter biome (Fine *et al*. 2014; Daly 2018), which currently includes 14 species (Flora e Funga do Brasil 2023). The Atlantic Forest is considered one of the global biodiversity *hotspots* (Laurance 2009; Zachos & Habel 2011), it is home to 20,000 plant species that occur in remnants of native forest and non-forest ecosystems, with high rates of endemism (Mittermeier *et al*. 2011).

Protium species are popularly known as "breu or almecegueira" and represent the most abundant genus of the Burseraceae family (Siani *et al*. 2004), with approximately 70% of the species of the family present in Brazilian territory (Siqueira 1991; Daly *et al.* 2011). Morphologically, *Protium* species possess imparipinnate compound leaves, aromatic resin with a transparent or milky color. The flowers are actinomorphic, clustered in paniculate inflorescences. The fruits are drupe type of different shapes (Daly *et al.* 2011; Santamaría-Aguilar & Lagomarsino 2017). *Protium* species are rich in exudates and oleoresins, whose volatile substances are used in the manufacture of perfumes, production of incense and tea (Siani *et al.* 2004).

Protium has a confusing taxonomic history, characterized by many synonyms and application of unclear taxonomic features. Its recognition in the field becomes challenging, due to the tiny flowers,

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making it difficult to recognize their species in the field. Therefore, the vegetative characters have been deemed more relevantly at the time of collection. (Fernandez & Scudeller 2011). Nine sections have been recognized under the generic level (Daly & Fine 2018).

To gather data on the diversity of *Protium* for the Atlantic Forest in the state of Rio de Janeiro, a taxonomic treatment was carried out where detailed descriptions, taxonomic comments, information on phenology, ecology, conservation, distribution maps and illustrations were developed for all species.

Material and Methods

This study was based on fieldwork and analysis of material from the following herbaria: R, RB, RBR, RFA, FCAB, HUENF, HB and HRJ, NY, P, COL, P, K, F, BM, B. Information on the "*obra pincipes*" and type collections were accessed through the platforms IPNI (<https://www.ipni.org/>) and Tropicos (<https://www.tropicos.org/home>).

Field expeditions were carried out between 2021 and 2022 in the state of Rio de Janeiro, based on the information available in the databases and online herbaria CRIA (<http://www.splink.org.br>), GIBIF (<https://www.gbif.org/>) and REFLORA (<http://reflora.jbrj.gov.br>). All vouchers were incorporated into the RB herbarium. For species identification, the samples were compared to protologues and specialized literature (Daly 1987, 1989, 1992, 1998, 2011, 2020; Daly & Fine 2018).

Stearn (2004) and Ellis *et al* (2009) terminology was used to describe the leaves, nervation, petioles, branches, and other descriptive concepts. Flower morphology was based on Daly *et al*. (2011, 2022). For analysis of the reproductive structures, in the absence of fresh material, herborized flowers were rehydrated with water and analyzed using a Digital Microscopic Camera Leica DMC4500. The distribution maps were elaborated using QGIS Desktop version 2.16.3 (<http://qgis.osgeo.org>).

Results and Discussion

In the state of Rio de Janeiro there are seven species of *Protium* distributed in three sections: *Protium* sect. *Icica* (Aubl.) Swart: *P. brasiliense* (Spreng.), *P. glaziovii* Swart, *P. heptaphyllum* (Aubl.) March, *P. icicariba* (DC.) Marchand and *P. widgrenii* Engl. *Protium* sect. *Icicopsis* (Engl.) Swart: *P. warmingianum* Marchand and *Protium* sect. *Tetragastris* (Gaertn.) Daly & P. Fine.*: P. breviacuminatum* (Swart) Byng & Christenh.

Taxonomic treatment

Protium Burm. f., fl. Indicates: 88. 1768.

Trees or shrubs, heliophytic to semi-sciophyte, white or orange aromatic resin; branches usually with lenticels. Leaves compound, alternate, imparipennate, petiolate; opposite leaflets, usually with entire margin; pulvinus in the petioles. Inflorescence axillar, rarely terminal; peduncle usually very short. Flowers 4–5-merous, pedicellate or rarely sessile; bracts small, triangular; sepals fused, triangular; petals free, membranous to fleshy; diplostemonous stamens arranged at the base of the disc, subulate filaments, anthers normally dorsifixed. Intrastaminal disc 8–10-lobed, usually annular, thick; gynoecium 4–5-carpellar, 4–5-locular, glabrous or pilose, ovary superior, style 1 or absent, stigma 4–5-lobed, usually persistent in the fruit. Fruit dehiscent nuculan, globose to ovoid or ellipsoid, often oblique, fleshy epicarp, mesocarp forming a pulpy white pseudo-aryl; pyrenes 4–5; seed membranous or leathery.

1. *Protium brasiliense* (Spreng.) Engl. *Fl. bras*. (Martius) 12(2): 268. 1874. Fig. 1-2a

Shrub or trees, 2–13 m tall, smooth and aromatic bark. Branches 2–3.5 mm in diameter, slender to stout, rounded, glabrous. Leaves 6.5–15 cm long, 1–2 pairs of leaflets. Petiole 5–9.5 cm long, semi-rounded. Petiole 1–3cm long, semi-rounded, with conspicuous pulvinule. Leaflets 3–13 × 1.2–4.5 cm, leathery, discolored, adaxial surface dark green and abaxial surface lighter, oblong to elliptical, apex acuminate to obtuse, acumen up to 1 cm in length, cuneiform base, slightly asymmetrical, margin entire, usually curved downwards. Secondary venation festooned brochidodromous, 8 pairs of veins per side, primary vein impressed on the adaxial surface and slightly prominent on the abaxial surface. Inflorescence rachis 1.5–2 mm long; bracts 0.5 mm long; triangular. Staminate flowers 2.5–3.5 (3.6–5) mm long, yellowish green, 4–5 merous; corolla dialipetalous, cupuliform; petals 2–2.9 (1–1.3) mm long, oblong-ovate, apex acute, trichomes spaced on the abaxial face and glabrous on the adaxial face; calyx gamosepalous, cupuliform, sepals 0.4–1.2 mm long, trichomes spaced on the abaxial face and glabrous on the adaxial face. Pedicel 2.1–3.1 mm long, rounded. Pistilode 0.4–0.6 mm long, glabrous, 4–5 carpels; vestigial ovary 0.2–0.4 mm long, globose, glabrous, two vestigial ovules per locule, subsessile stigma measuring 0.1–0.2 mm wide, 4–5 lobes. Androecium 1–1.5 mm long; 8 to

10 stamens, based under disc, higher than pistilode; anther 0.5–0.8 mm long, oblong, two thecas; fillets 0.9–1 mm long, embedded in the base. Pistillate flowers 2–2.9 mm long, 4–5 merous; corolla dialipetalous, cupuliform; petals 1.7–2.2 (0.8–1) mm long, oblong-ovate, apex acute, trichomes scattered on the abaxial face and glabrous on the adaxial face; calyx gamosepalous, cupuliform, sepals 0.5–1 mm long, trichomes arranged on the abaxial face and glabrous on the adaxial face.

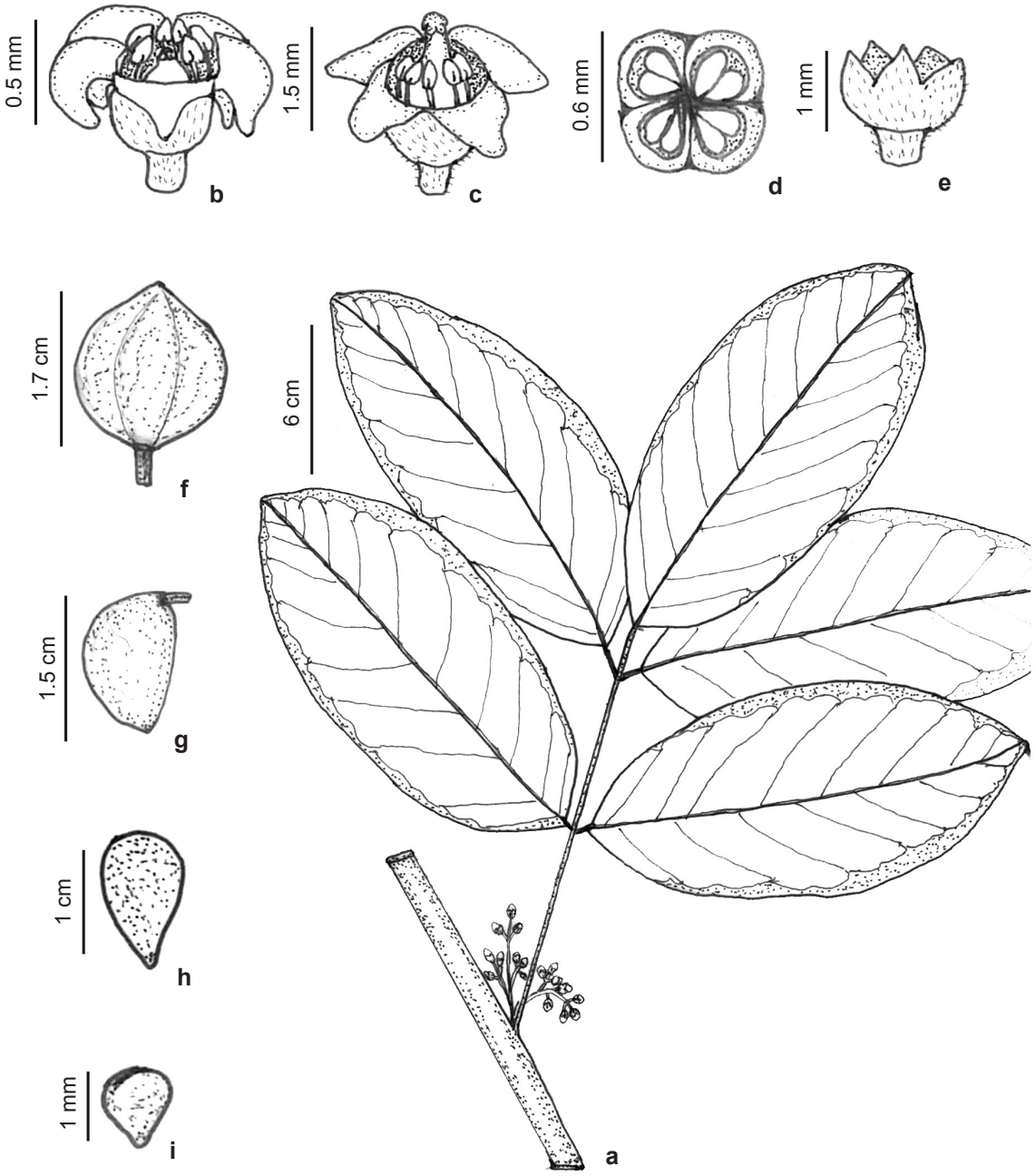

Figure 1 – *Protium brasiliense* – a. habit; b. staminate flower with four stamens removed, showing the vestigial pistilode; c. pistillate flower without three staminodes; d. cross-section of the ovary, showing four carpels; e. calyx with pedicel of the staminate flower with the presence of trichome in its external extension; f. fruit in frontal view; g. fruit in lateral view; h. pyrene in frontal view; i. seed in frontal view (a-d. *S de VA Pessoa et al.* 751 (RB76244), *D. Araújo et al.* 7549); e-g. *JG Kuhlmann* (RB 148692); h-i. *G. S Guimarães* 64) Line drawings by Débora Cássia).

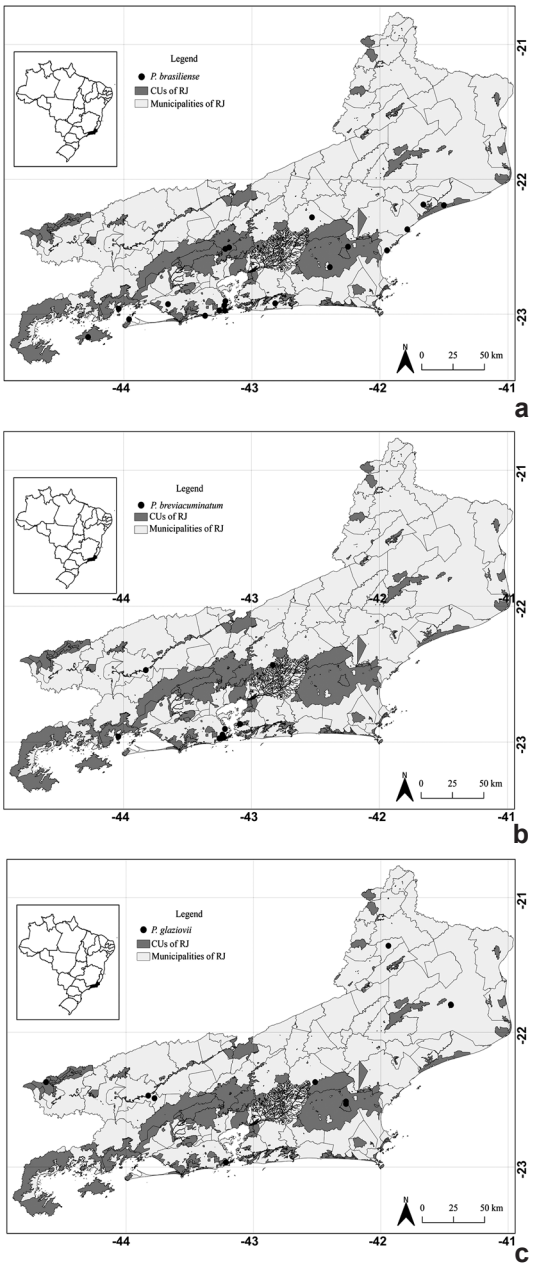

Figure 2 – Distribution maps of the species in the state of Rio de Janeiro – a. *Protium brasiliense*; b. *P. breviacuminatum*; c. *P. glaziovii*.

Pedicel, 0.8–1.3 mm long, rounded. Pistil 1.2–1.5 mm long, glabrous, base embedded and surrounded by glabrous nectariferous disc 0.3 mm long; ovary 0.4–0.6 mm long, globoso-conical, 4–5 carpels, two ovules per locules, style 0.1–0.2 mm; stigma 0.1–0.2 mm wide, 4–5 lobes. Androecium 0.6–0.9 mm long; 8 to 10 staminodes, based below the disc, arranged around the gynoecium, below the level of the stigma; anthers 0.3–0.4 mm long, dorsifix, oblong; fillets 0.7–0.8 mm long. Fruit 1–1.6 × 0.8–1.5 cm long, oblique-ovoid, 2–4 locules; exocarp green when immature and vinaceous when mature and thin and woody endocarp covered by mesocarp of fleshy appearance; 1–4 pyrene per fruit. Seed 0.8–0.9 × 0.7–1 mm long, white.

Selected material: Angra dos Reis, Ilha Grande, Reserva Biológica Estadual da Praia do Sul, 30.XI.1992, fl., *D. Araújo 9683* (NY). Cabo Frio, Conglomerado, 10.IX.2013, fr., *H.F. Uller 431 & G. Terra* (RB). Carapebus, Parque Nacional da Restinga de Jurutiba, 10.X.2004, fl., *B.C. Kurtz, 341 & J. Caruso* (RB). Casimiro de Abreu, Fazenda Carioca, remanescente da torre, 14.XII.2006, fl., *S. de V.A. Pessoa et al. 1176* (RB).Macaé, Fazenda Jurubatiba, 17.IX.1986, fl., *D. Araújo et al. 7549* (RB). Maricá, APA-área de Proteção de Maricá, 1.III.1987, fl., *A. Souza et al. 1591* (R). Mangaratiba, Ilha de Marambaia, Praia Grande, 19.XI.1987, fr., *E.M. Occhionii et al. 565* (R). Niterói, Restinga secundária, 6.IX.1978, fl., *G. Martinelli 4904* (RB). Nova Friburgo, Macé de Cima, Fazenda Ouro Verde, 5.II.1994, fr., *C.M. Vieira 534 & I.C. Gurken* (HB). Petrópolis, estrada para cachambi, 29.X.1875, *A. Glaziou* (P). Rio das Ostras, Reserva Biológica União, 22.X.1997, fr., *P.P. Oliveira 707 C* (NY). Rio de Janeiro, Restinga da Tijuca, *O. Machado* (RB76243); Pedra de Guaratiba, Área de Proteção Ambiental das Brisas, 25.XI.2021, fr., *G.S. Guimarães 64* (RB). Silva Jardim, REBIO Poço das Antas, Mata do rio Pau Preto, borda da mata, 19.X.1994, fl. & fr., *S de V.A. Pessoa et al. 751* (RB); Fazenda Santo Antônio do Maratuá, 15.IV.2008, *S. de V.A. Pessoa 1220* (NY).

Popularly known as *amescla*, *breu* and *almíscar*.

Flowering from August to October, and fruiting from December to February.

The species is found in the Dense Ombrophylous Forest/ Upper Montana Forest/ Seasonal Semideciduous Forest/ Riparian Forest. (Barbosa *et al.* 2017). It occurs in the restinga vegetation, periodically flooded. It can be found in sandy soils. It is endemic to Brazilian territory, being spread in the Cerrado and Atlantic Forest domains. It is distributed in the Northeast (BA), Midwest (DF, GO, MT) and Southeast (ES, MG, RJ, SP) states (REFLORA 2022). *Protium brasiliense* is among species that can be used for ecological restoration (Barbosa *et al.* 2017). It has colorless resin with a strong smell of turpentine.

Protium brasiliense can be differentiated from other fluminensis species by the short petioles. Species population found in the sandbanks tend to have a smaller number of leaflets compared to populations of similar species, *P. icicariba* and *P. heptaphyllum* that occur in the same habitat.

It is listed as Endangered – EN category of the IUCN Red List of Threatened Species (Fraga *et al.* 2019).

The oil-resin extracted from the trunk can be used in the treatment of gangrenous ulcers (Reitz 1950).

2. Protium breviacuminatum (Swart) Byng and Christenh. Global Fl. 4: 134. 2018. Fig. 2b; 3

Shrub or tree 5–18 m tall, rough, aromatic bark, loose in irregular patches. Branches 3–3.3 mm in diameter, thin, rounded, puberules rarely present. Leaves 16–23 cm long; 2–3 pairs of leaflets; Petioles 5.5–17 cm long, semi-rounded. Petiole 0.6–1 cm long, semi-rounded, without pulvinule. Leaflets 8–18 × 2.5–4 cm, cartaceous-coriaceous, concolor, elliptical-oblong, apex rounded to acuminate, rarely obtuse, acumen up to 1 cm in length, cuneiform base, entire margin. Secondary nerves festooned-brochidodromous, 9–11 pairs of veins per side, prominent abaxial and adaxial face, presents a protrusion on the primary and secondary vein on the abaxial face and on the primary vein on the adaxial face. Inflorescence rachis 1–2 cm long; bracts 0.7 mm long, oblong to triangular. Staminate flower 2.6–3.1 mm long, light green, 4–5 merous, cupuliform dialipetal corolla; petals 1.9–2.5 mm long, ovate to triangular, apex acute-rounded, glabrous on the adaxial side and with trichomes on the abaxial side, gamosepal cupuliform calyx, sepals 0.81–1 mm long, trichomes spaced on the abaxial face and glabrous on the adaxial face. Pedicel 1.2–2.2 mm long, rounded. Pistilode 0.9–1.2 mm long, glabrous, surrounded by glabrous nectariferous disk, 4–5 carpels, vestigial ovary 0.3–0.6 mm long, conical, without ovules when cut. Androecium 2.1–2.6 mm long; 8–10 stamens, base under disc, higher than pistilode; anther 1.5–2 mm long, oblong, two thecas; fillets 0.5–0.6 mm long, embedded in its extension. Pistillate flowers 1.5–2.6 mm long, 4 merous; corolla cupuliform dialipetal; petals 0.8–2 mm long, oval to triangular, apex acute, trichomes along the entire length of the abaxial face and glabrous on the adaxial face; calyx cupuliform gamosepalous; sepals 0.6–0.9 mm long, trichomes on the abaxial side and glabrous on the adaxial side. Pedicel 1.2–1.5 mm long, rounded. Pistil 1.5–2 mm long, glabrous, above height of stamens, base embedded and surrounded by the glabrous nectariferous disc of 0.5 mm in length; ovary 0.3–0.4 mm long; globose, 4 carpels, two ovules per locules, style 0.2–0.4 mm long; stigma 0.1–0.3 mm wide, 4 lobes. Androecium 0.4–0.7 mm long; 8 staminodes, base below disc, arranged around gynoecium, below level of stigma; anther 0.3–0.5 mm long, basifix, oblong; fillets 0.1–0.2 mm long, short and inset at the base. Fruit 1.5–2.2 × 1.4–3 cm long, globose, 1–4 locules, exocarp green when immature and pink to red when mature and endocarp covered by mesocarp that is white, sweet; 1–4 pyrene per fruit. Seed 0.8–1× 0.7–1.2 mm long, white.

Selected material: Angra dos Reis, Saco de Piraquara de Fora, Remanescente de Mata Atlântica, 9.IX.1999, *A. Oliveira et al.* (RB402674). Guapimirim, Estação Ecológica Estadual de Paraíso, 27.III.1992, *S.V.A. Pessoa et al.* (RB325993). Rio de Janeiro, Parque Nacional da Tijuca, 5.XII.1932, fl., *J.G. Kuhlmann* (RB62351); Jardim Botânico do Rio de Janeiro, Horto Florestal, 18.I.1985, fr., *D.C. Daly & J. Gomes & M. Vodicka-Asbury* (RB230737); mata do Horto Florestal, 17.XII.1928, fr., *G.M. Barino* (RB159); Horto Florestal, 18.I.1985, fl., *D.C. Daly et al. 407* (NY); 26.IX.1928, fl. & fr., *G.M. Barino* (RB62353); 18.I.1985, fl. & fr., *D.C. Daly et al.* (RB230738); trilha da Caixa D'agua, 23.III.2004, *W.R. Matos 192* (FCAB); trilha da Caixa D'agua, 23.III.2004, *W.R. Matos 173* (FCAB); Mata da Vista Chinesa, 13.X.1935, fl. & fr., *D. Constantino* (RB21035); Mata do Rumo, 12.XII.1971, fr., *D. Sucre 8093* (RB); trilha que chega a Vista Chinesa, 20.I.2022, fr., *D.C. Silva 5* (RB).

Popularly known as *pinhão do mato*.

Flowering from October to January and fruiting from December to January.

Protium breviacuminatum is an endemic species found in the state of Rio de Janeiro, municipalities of Angra dos Reis, Rio de Janeiro (areas of the Tijuca Forest) and in Petrópolis (Serra da Estrela). The degradation of the urbanized areas where the species occurs, puts it under threat (Do Couto Fernandes *et al.* 1999), mainly because of the edge effect caused by roads and paved trails due to the great tourist demand (Matos 2007; Soares 2008).

Protium breviacuminatum belongs to the section *Tetragastris*. It has basifixed anthers with short and wide filaments, a particular feature of this section. The androecium of the species, in comparison to the others found in the state of Rio de Janeiro, has ingrown and flattened anthers, slightly ingrown fillets and short in comparison to the anthers. It is also differentiated from the other species of *Protium* in the state by its bark, which is thick and fissured, comes off in large irregular plates, unlike the other six species that have a thin bark, with a fine and scaly texture.

It is listed as Endangered – EN category of the IUCN Red List of Threatened Species (Martinelli *et al.* 2018).

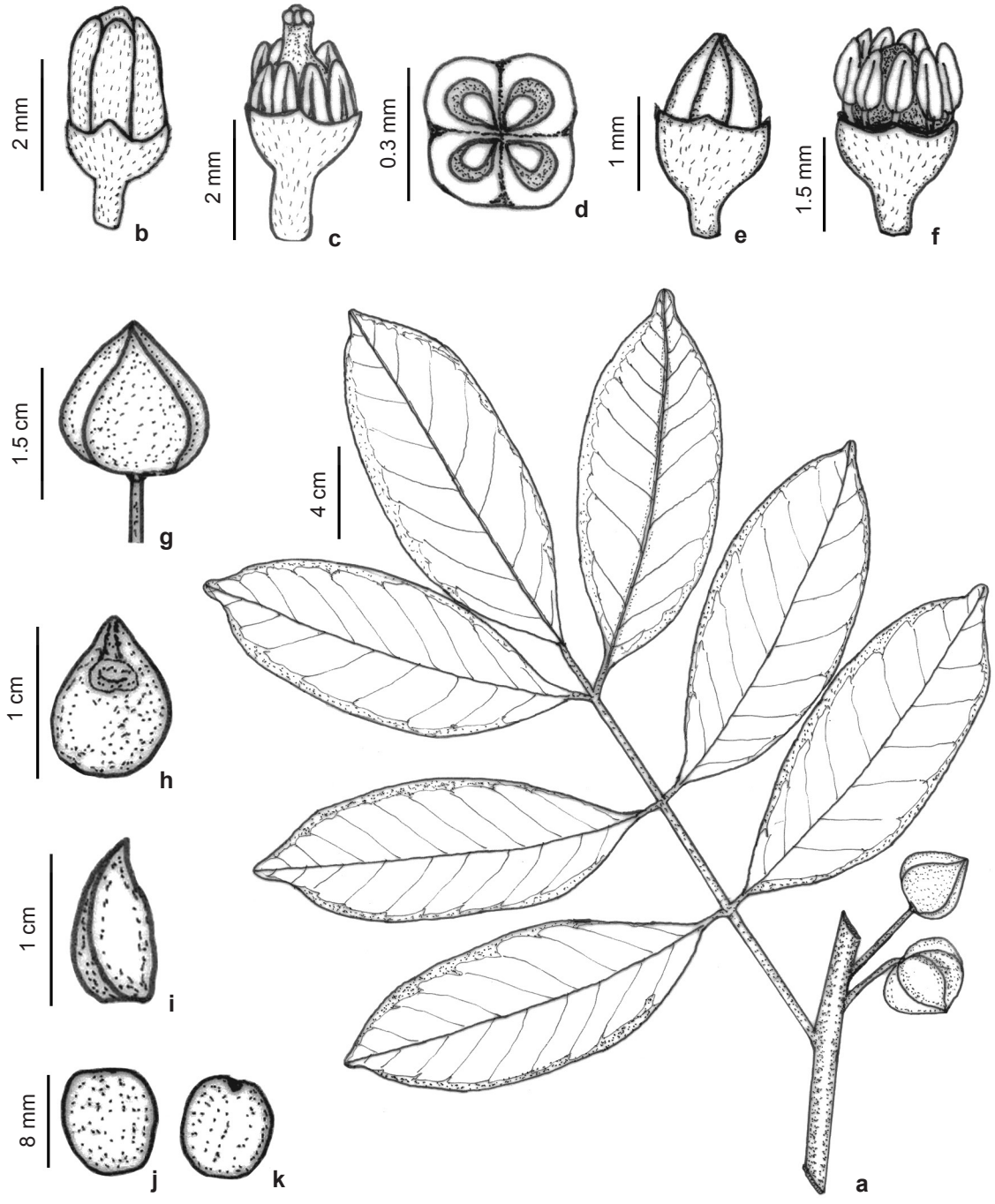

Figure 3 – *Protium breviacuminatum* – a. habit; b. closed pistillate flower with pedicel; c. pistillate flower with petals removed, showing the pistil and staminode; d. cross section of the ovary; e. staminate flower with petals and stamens removed, showing the pistilode; f. staminate flower with petals removed, showing the stamens and inconspicuous pistilode, below the height of the stamens; g. fruit in frontal view; h. pyrene in frontal view; i. pyrene in side view; j– k. seed in frontal and posterior view (a. *D.C Daly et al.* (RB 230738) ; b-d. *D Constantino* (RB21035) *D.C Daly et al.* (RB 230737), e-k. *J.G Kuhlmann* (RB62351), *D.C Daly et al.* (RB 230738). Line drawings by Débora Cássia).

3. Protium glaziovii Swart. Acta Bot. Neerl. 15: 51. 1966. Fig. 2c; 4

Trees 10–26 m tall, rough and aromatic bark. Branches 2.8–3.2 mm in diameter, stout and rounded. Leaves 15–20 cm long; 3–6 pairs of leaflets. Petiole 10–15 cm long, semi-rounded. Petiole 0.5–2 cm long, semi-rounded, with inconspicuous pulvinule. Leaflets, 7–15 × 2–3 cm, coriaceous, discolored, the adaxial face being bright green and light green on the abaxial face, elliptical-lanceolate, apex gradually acuminate, acumen up to 1 cm in length, cuneiform base; margin entire or serrated. Secondary venation festooned brochidodromous, 11 pairs of veins per side, prominent primary venation on the abaxial and adaxial surfaces of the leaf. Inflorescence rachis 4.5–6 cm long; bracts 0.2–0.3 mm long, triangular. Staminate flower 2.5–3 mm long, greenish-yellow, 4 merous; corolla cupuliform dialipetal; petals 2–2.9 long, oblong-triangular, apex acute, semi-glabrous on the adaxial face and glabrous on the abaxial face; calyx gamosepal cupuliform, sepals 0.6–1 mm long, semi glabrous on the adaxial face and glabrous on the abaxial face. Pedicel 1.1–1.2 mm long, rounded. Pistillode 0.8–1 mm long, pilose, with trichomes concentrated at the base, surrounded by glabrous nectariferous disk, vestigial ovary 0.3–0.5 mm long, globose-conical, trichomes spaced around, 4 carpels, two vestigial ovules per locule, style 0.5 mm long; stigma measuring 0.4–0.6 mm long, 4 lobes. Androecium 1.4–1.9 mm; 8 stamens, base coming out from under disc, higher than pistilode; anther 0.6–0.9 mm long, oblong, two thecas; fillets 0.8–1 mm long. Pistillate flower 2.1–3.3 mm long, 4 merous, rarely 5; corolla cupuliform dialipetal; petals 2.1–3.3 mm long, oblong triangular, apex acute, trichomes spaced on the abaxial side and glabrous on the adaxial side; gamosepal cupuliform calyx; sepals 0.2–0.7 mm long, scattered trichomes on the abaxial face and glabrous on the adaxial face. Pedicel 1–2 mm long; rounded. Pistil 1.4–1.8 mm long, pilose, with trichomes arranged at its base, surrounded by a glabrous annular nectariferous disc 0.5mm in length; ovary 0.7–1.5 mm long, globose-conical, trichomes spaced around 4–5 carpels, two ovules per locule, style 0.4–0.8 mm; stigma 0.1–0.3 mm wide, 4–5 lobes. Androecium 0.8–1.2 mm long; 8–10 staminodes, base below disc, arranged around gynoecium, below level of stigma; anther 0.6–0.8 mm long, dorsifix, oblong; fillets up to 1 mm long. Fruit 2–3 × 1–2 cm long, ovoid - globose, 2 – 3 locules, exocarp green when immature and red when mature, endocarp covered by white mesocarp, 1–3 pyrene per fruit. Seed 1–1.5 × 0.8–1 mm long, black.

Selected material: Barra do Piraí, Fazenda Ponte Alta, 3.VIII.2011, *V. Maioli 1086* (HRJ). Campos dos Goytacazes, Maciço do Itaoca, 24.4.2013*, T.P. Souza 508* & *C.T. Heme* (HUENF). Itatiaia, Parque Nacional do Itatiaia, 20.I.2022, fr., *D.C. Silva 2* (RB). Miguel Perreira, G. Portella, Monte Sinai, fl., *G.M. Nunes 199* (NY). Nova Friburgo, Reserva Ecológica Municipal de Macaé de Cima, Sitio Fazenda Velha, 25.VII.1990, *T. Fontoura et al*. (RB290783). Resende, Parque Nacional do Itatiaia, perto do Abrigo 4, 22.X.1977, *M.C. Vianna et al. 1217* (COL). São José do Ubá, Sitio Camacho, 11. X.2008, *M.T. Nascimento et al. 2892* (HUENF). Silva Jardim, Reserva Biológica de Poço das Antas, Trilha Portuense, 2.II.2000, fr., *C. Luchiari et al*. 807 (RB); 19.VII.1994, *M.L. Vilela et al.* (RB353677); Trilha do Pau-Preto, próximo ao Rio Preto, 29.X.1997, fl, *J.M.A. Braga et al*. 4401 (RB).

Popularly known as *amescla-chumbinho*.

Flowering from October to December, and fruiting from January to April.

The species is endemic to Brazil, with distribution in the Atlantic Forest (ES, PR, MG, RJ), in dense Ombrophylous Forest with fragmented habitat (Moraes *et al*. 2020). *P. glaziovii* has lost habitat due to deforestation caused by anthropic growth, mining and increased agricultural and livestock expansion, leading to a decrease in its diversity within the Atlantic Forest (Ribeiro *et al*. 2009).

Among the species of *Protium* present in the state of Rio de Janeiro, it is the only species that presents variation in the margin of the leaflet, from entire to serrated margin. This is the first record of a specimen with serrated margin. The ovary has trichomes but less quantity when compared to *P. warmingianum* and *P. widgrenii*.

According to Moraes *et al.* (2020) *P. glaziovii* is in the Endangered – EN category of the IUCN Red List of Threatened Species.

4. *Protium heptaphyllum* (Aubl) Marchand. Vidensk. Meddel. Naturist. Foren. Kjøbenhavn (1873) 55. Fig. 5-6a

Tree or shrub 2–20 m tall; smooth and aromatic bark. Branches 3–4 mm in diameter, slender, rounded, glabrous. Leaves 10–25 cm long, 3–4 pairs of leaflets. Petiole 7–12 cm long, semi-rounded, inlaid base. Petiole 2.5–6 mm long, semi-rounded, with conspicuous pulvinule. Leaflets 5–15 × 3.5–7 cm long, coriaceous to subcoriaceous, discolored, oblong-lanceolate to oblong-elliptical, apex abruptly acuminate,

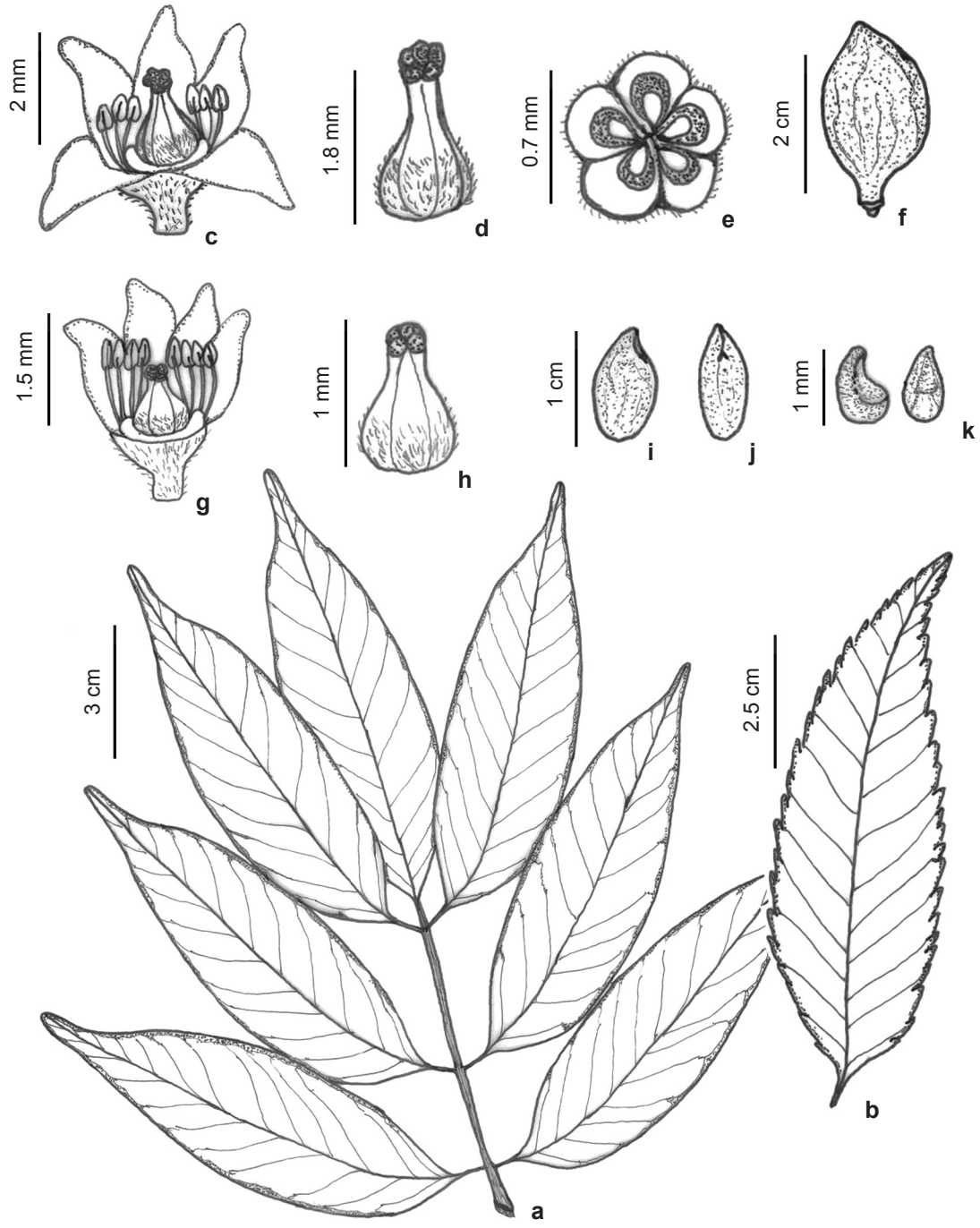

Figure 4 – *Protium glaziovii* – a. habit with entire margin leaflets; b. leaflet variation with serrated margin; c. open pistillate flower with petals, pedicel, and four staminodes removed; d. pistil of the pistillate flower with trichome at the base; e. cross-section of the ovary showing the number of carpels and trichomes around it; f. fruit in frontal view; g. open staminate flower; h. pistillode with trichomes at the base; i-j. pyrene in lateral and frontal views; k. seed inside and front view (a-b. *T.B Flores 897* & *G.S Siqueira*; c-d. *T.B Flores 897* & *G Siqueira*; e. *J.G Jardim 2780*; f. *M.V Stefano et al. 252*; g-k. *D.C Silva 2*) Line drawings by Débora Cassia).

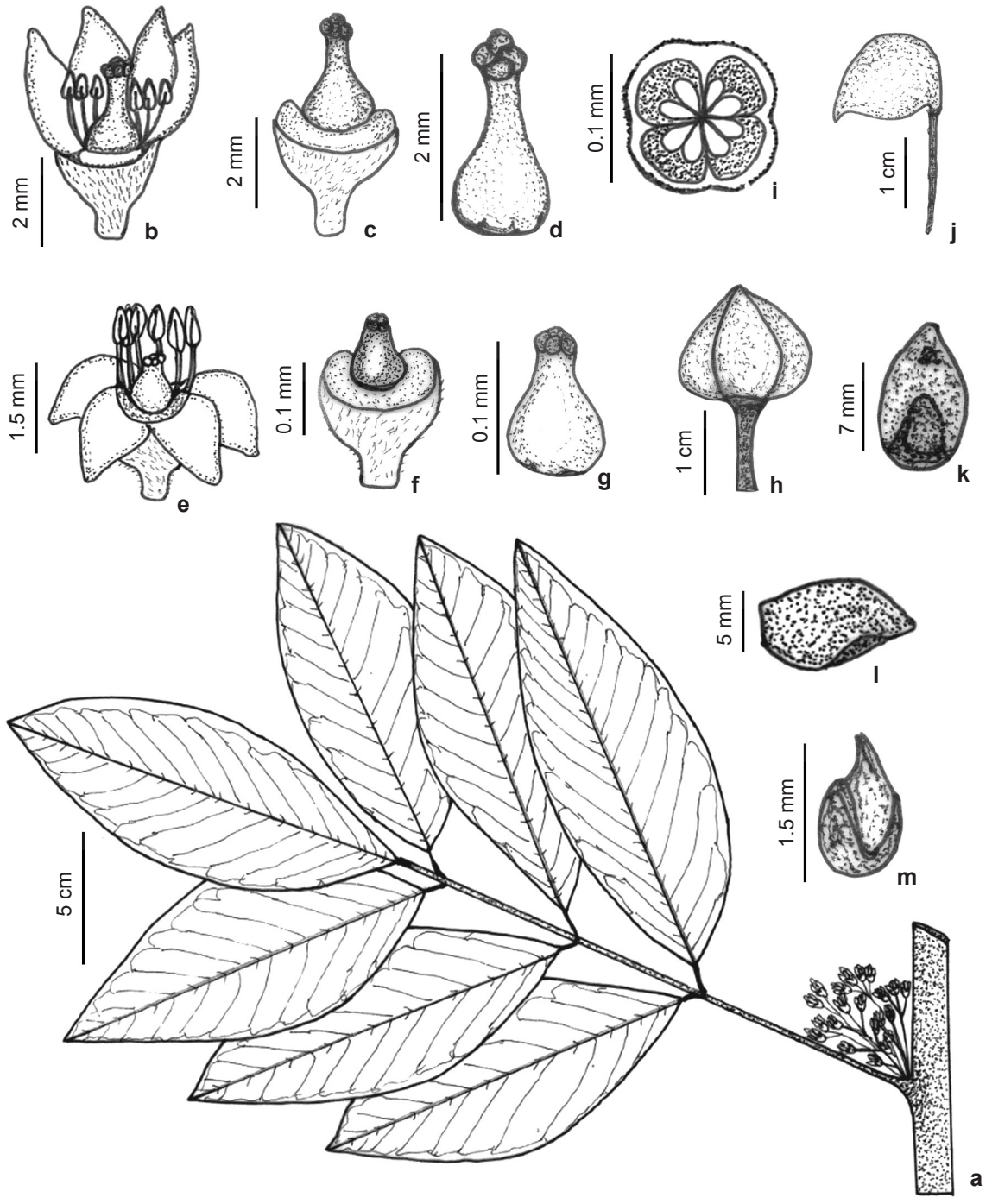

Figure 5 – *Protium heptaphyllum* – a. habit; b. pistillate flower with petals separated and two staminodes removed, showing the floral cluster, with the stigma of the pistil above the height of the staminodes; c. pistillate flower with calyx, corolla and staminodes removed, showing the gynoecium and nectariferous disk; d. pistil with a fillet crowned by a 4-lobed stigma; e. cross-section of the ovary; f. staminate flower with petals lowered and two stamens removed, showing the floral arrangement, with stamens above the height of the pistilodium; g. staminate flower with calyx, corolla and staminodes removed, showing the reduced pistilode and the nectariferous disk; h. pistilode topped by a short stipe crowned by a 4-lobed stigma; i. fruit in frontal view with long pedicel; j. fruit in lateral view with elongated pedicel; k. pyrenium in lateral view; l. seed in frontal view; m. seed in lateral view. (a. *L.M Nascimento et al. 12*; b-e. *L.M Nascimento et al. 11*; f-h. *J.R Mattos et al. 525*; i-m. *L.M Nascimento et al. 14*) Line drawings by Débora Cássia.

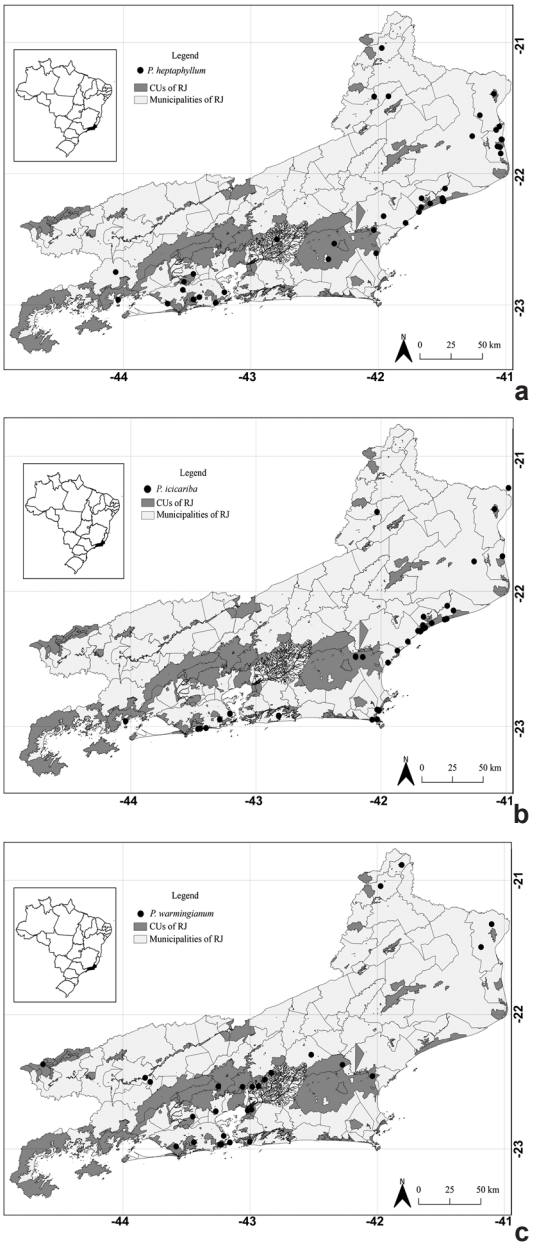

Figure 6 – Distribution maps of the species in the state of Rio de Janeiro – a. *Protium heptaphyllum*; b. *P. icicariba*; c. *P. warmingianum*.

acumen up to 1 cm in length, asymmetric obliquecuneiform base, entire margin. Secondary veins eucamptodromous 10–13 pairs of veins per side, prominent primary vein on abaxial and adaxial surface and prominent secondary vein on abaxial surface. Inflorescence rachis 1 – 2 cm long, bracts 0.25 mm long, triangular. Staminate flowers 2–2.9 mm long, light green, 4 merous; cupuliform dialipetal corolla; petals 1.4–2.8 mm long, oblong, apex acute, subglaba abaxial face, margin covered by trichome and glabrous adaxial face; calyx gamosepal cupuliform; sepals 0.3–0.9 mm long, subglabrous on the abaxial face and glabrous on the adaxial face. Pedicel 1.5–1.8 mm long, rounded. Pistilode 1.2–1.5mm long, glabrous, base embedded and surrounded by the glabrous nectariferous disc; 4 carpels, vestigial ovary 0.3–0.6 mm long, globose, glabrous, two vestigial ovules per locule, style 1.5–1.8 mm long; stigma 0.1–0.2 mm wide, 4 lobes. Androecium 1.2–1.8 mm long; 8 stamens, taller than pistilode, with base under disc; anther 0.3–0.8 mm long, oblong-lanceolate, two thecas; fillets 0.3 – 0.9 mm long. Pistillate flowers 2.6–3.1 mm long, bright green, 4 merous, rarely 5; corolla cupuliform dialipetalous; petals 1.3–2.5 mm long; oblong acute, apex acute, subglabrous abaxial face with widely spaced trichomes and papillose margin, glabrous adaxial face; calyx gamosepal cupuliform; sepals 0.5–1 mm long, trichomes on the outside and glabrous on the inside. Pedicel 0.4–0.9 mm long, rounded. Pistil glabrous, 2–2.7 mm long, base surrounded and embedded in the middle of the glabrous nectariferous disc, 0.2 mm high; ovary 0.5–0.8 mm, globose, 4 carpels, two ovules per locule, style up to 1 mm in length; stigma 0.1–0.2 mm wide, 4 lobes. Androecium 1.5–1.75 in length; 8 staminodes, base below the disc, arranged around the gynoecium, below the level of the stigma; anthers 0.5–0.7 mm long, oblong-lanceolate; fillets 0.9–1 mm long. Fruit, 1.5–2 × 1–2 cm of length, oblique-ovoid to globose, 1–3 locules, exocarp green when immature and red when ripe, slender, and woody endocarp covered by white fleshy mesocarp, 1–3 pyrene. Seed 1–1.2 × 0.6–0.8 mm long, black, white.

Selected material: Cabo Frio, 28.IX.2003, fr., *D. Fernandes et al. 953* (RB). Campos dos Goytacazes, Mata do Bom Jesus, 17.XII.2001 (HUENF8874). Carapebus, Restinga Carapebus, 1.IX.1997, fl., *L.F. Branquinho* (RB427218). Itatiaia, 13.IX.1963, fl, *Sócrates 120* (RB). Macaé, Parque Nacional da Restinga de Jurubatiba, 6.VI.2013, *L.M. Nascimento et al.* 5 (RB). Magé, 6.XI.1984, *G. Martinelli et al. 10169* (RB). Mangaratiba, Ilha da Marambaia, Praia da Armação, 2.IV.1999, fl., *L.F.T. Menezes 520* (RBR). Nova Iguaçu, 15.XI.1994, fr., *S.J. Silva Neto 477* (RB). Rio Claro, Fazenda São José, mata perto do curral da fazenda São José, 18.XII.2021, fr., *D.C. Silva 01* (RB). São José de Ubá, Fazenda Prosperidade, 1.XI.2007, *M.I. Dan et al. 748* (HUENF).

Popularly known as *almecega*, *almecegueira*, lemon gum and white pitch.

Flowering from August to September and fruiting from October to January.

In Brazil, the species has a wide distribution, being found in the following regions: North (AC, AM, AP, PA, RO, RR, TO), Northeast (AL, BA, CE, MA, PE, RN, SE), Midwest (DF, GO, MS, MG) and Southeast (ES, MG, RJ, SP), distributed by phytogeographic domains: Amazon, Caatinga, Cerrado and Atlantic Forest (REFLORA 2022). Species of the plant can be used for plant restoration in degraded areas, mainly in riparian forests of rivers and streams (Lima 2012; Lorenzi 1992). According to the Flora do Brasil red book, the species is included in the list of non-threatened species that are useful for conservation and research. (Martinelli & Moraes 2013).

The morphology of the flower may differ depending on the area the populations were found, and may have reddish pentamerous flowers in other states, such as the one observed in Minas Gerais state. The species *P. heptaphyllum* is classified under the Sect. Icica, where the species are distinguished by having a pulvinulus.

It is listed as Least Concern – LC category of the IUCN (Sun & Canteiro 2021).

The bark of the plants has healing and anti-inflammatory properties, being used in the treatment of some diseases such as ulcers, bronchitis, and whooping cough (Lima 2012; Lorenzi & Matos 2002).

5. Protium icicariba (DC) Marchand. Adansonia 8: 52. 1867. Fig. 6b; 7

Tree to shrub, 3–10 m tall, slightly exfoliating, aromatic peel. Branches 4–5 mm in diameter, stout, rounded. Leaves 15–21 cm long, 1–2 pairs of leaflets, sometimes having only one pair of leaflets. Petiole 5–11 cm long, rounded. Petiole 1–2 cm long, semi-rounded, with conspicuous pulvinule. Leaflets 5–12 × 3–5 cm, coriaceous to subcoriaceous, discolored, elliptical-obovate to oblong, apex acuminate, acumen up to 1 cm in length; cuneiform base, entire margin. Secondary vein camptodromous, 11 pairs of veins per side, primary and secondary vein grooved and prominent on both sides. Inflorescence rachis 2–4 cm long; bracts 0.6 mm long, oval-triangular. Staminate flowers light green, 1.8–2.6 mm long, 5 merous; corolla cupuliform dialipetalous; petals 1.0–2.5 mm long, triangular, apex acute, glabrous on the adaxial face and with trichomes on the abaxial face and margin; calyx gamosepal cupuliform; sepals 0.6 – 0.8 mm long, glabrous on the adaxial side and with trichome on the abaxial side. Pedicel 0.7–1.5 mm long, rounded. Pistilode 0.5–0.7 mm long, glabrous, vestigial ovary 0.2–0.3 mm long, globose-ovoid, glabrous, 5 carpels, vestigial ovary 0.2–0.3 mm long, globose-ovoid, glabrous, two vestigial ovules per locule, style 1.4–1.6mm, stigma measuring 0.1–0.2 mm wide, 5 lobes. Androecium 1.1–1.7 mm long; 10 stamens, base coming out from under the disk, above height of the pistilode; anther 0.6–0.7 mm long, oblong-lanceolate, dorsifixed, two thecas; fillets 0.5–1.0 mm long. Pistillate flowers 2–2.8 mm long, 5 merous; corolla cupuliform dialipetalous; petals 1.3–2 mm long, triangular, apex acute, trichomes on abaxial face and margin, glabrous on adaxial face; calyx gamosepal cupuliform; sepals 0.5–0.7 mm long, glabrous adaxial face and abaxial face with trichomes. Pedicel 0.5–1.3 mm long, rounded. Pistil 0.9–1.3mm long, glabrous, base surrounded by a glabrous nectariferous disc 0.2 mm high; ovary 0.3–0.74 mm long, globose, 5 carpels, two ovules per locule, style 0.6–0.9 mm long; stigma 0.2–0.3 mm wide, 5 lobes. Androecium 0.5–0.7 mm long; 10 staminodes, base below the disc, arranged around the gynoecium, below the level of the stigma; anthers 0.2–0.3 mm long, dorsifix, oblong-lanceolate; fillet 0.3–0.6 mm long. Fruit 1–1.3 × 0.7–1 cm long, obliquo-ellipsoid, 1–3 locules, exocarp green when immature and red when mature and thin endocarp covered by mesocarp with a fleshy and white appearance. Seeds 2.5–3 × 2–4 mm long, black.

Selected material: Cabo Frio, Restinga de Cabo Frio, 8.X.1968, fl., *D. Sucre 3838* (RB).Campos dos Goytacazes, Mata do Mergulhão, 26.4.1996, *M.T. Nascimento et al. 126* (HUENF). Carapebus, Restinga de Carapebus, side of the road to Praia Carapebus, 14.XII.1995, fr. and fl., *MG Santos et al. 674* (RB). Rio de Janeiro, Parque Natural Municipal Marapendi, 20.IX.2020, *A.L.S. Oliveira et al.* 22 (RB); Restinga de Grumari, 1.XII.1974, fl., *P. Occhionii 6566* (RFA). Macaé, Restinga de Macaé, 11. I.1985, fr., *A.H. Gentry et al. 49413* (NY). Magé, 20.IX.1975, fl., *P. Occhionii 7739* (RFA). Mangaratiba, Restinga da Marambaia, caminho da Praia do Sino, near CADIM, 6.XI.2004, fr., *D.C. Carvalho 7* (RBR). Marica, Praia de Itaipuaçu, 11.IV.1986, fr., *D.S.D. de Araújo 7369* (NY). São João da Barra, Reserva Particular do Patrimônio Natural Fazenda Caruara, Restinga de iquipari, 29.XI.2007, *M.M.A.C. Fraga 84* (HUENF).

Popularly known as *almécega* or *almesca*.

Flowering between September and November and fruiting from December to February.

It is endemic to Brazil, distributed in the Northeast (BA) and Southeast (ES, RJ) regions, within the Atlantic Forest phytogeographic domain

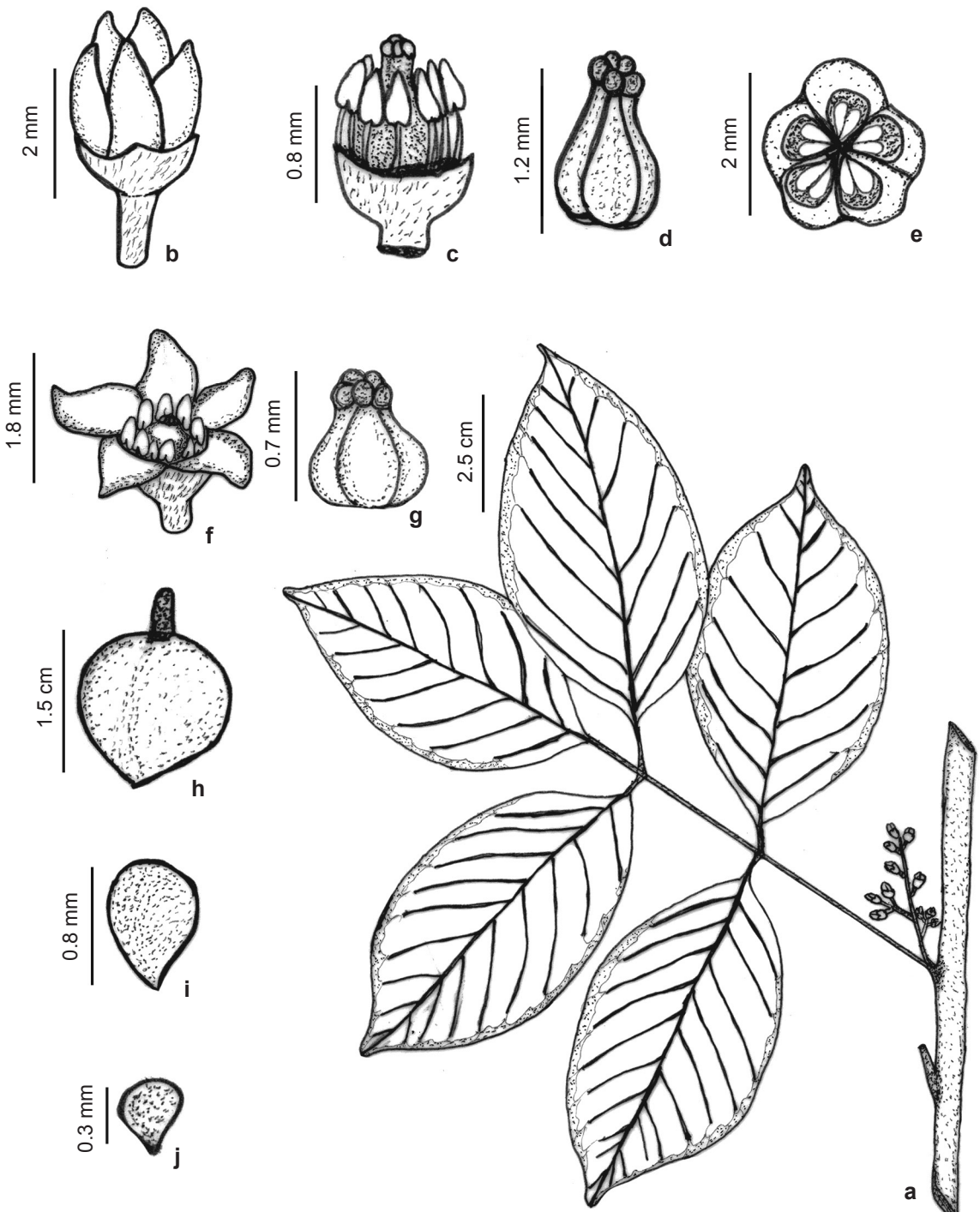

Figure 7 – *Protium icicariba*– a. habit; b. closed pistillate flower; c. pistillate flower with calyx, corolla and three staminodes removed, showing the internal floral composition, with stigma above the height of the staminodes; d. pistil with a fillet crowned by a stigma with five lobes; e. cross section of the ovary; f. staminate flower with lowered petals showing stamens above the height of the pistilode; g. pistillode reduced with short filament and stigma with 5 lobes; h. fruit in frontal view with short pedicel; i. pyrene in frontal view; j. seed in frontal view (a. *J.P Fontelha et al. 227*; b-e. *J.P Fontelha et al. 227*; f-g. *L.M Nascimento et al. 10*; h-l. *M.C.F dos Santos* (RB533356. Line drawings by Débora Cássia).

(REFLORA 2022). *Protium icicariba* has been pointed as a potential species to be used in the recovery of restinga forest areas degraded by anthropization (Zamith & Scarano 2004). The species inhabit places that suffer a great anthropic influence.

Among the species of *Protium* present in the state of Rio de Janeiro, it can be distinguished by being the only one that presents monopyrene, and its leaflets have a striking elliptical-obovate shape, not seen in other species.

It is listed as Endangered – EN in the national list of the Ministry of the Environment (MMA) and Instituto de Pesquisas Jardim Botânico do Rio de Janeiro (JBRJ).

Its oil-resin is used in the treatment of gangrenous ulcers (Reitz 1950).

6. *Protium warmingianum* Marchand. Vidensk. Meddel. Naturist. Foren. Kjøbenhavn. 1873. 55. Fig. 6c; 8

Tree 8–22 m tall, smooth and aromatic bark. Branches 7.5 mm in diameter, robust, rounded, glabrous. Leaves 28–34 (42–60) cm long, 4–7 (9–15) pairs of leaflets. Petioles 9–25 cm long, semi-rounded. Petiole 2–4 cm long, semi-rounded, with conspicuous pulvinule. Leaflets 10–27.5 × 4–9 cm, coriaceous to subcoriaceous, discolored, being dark green on the adaxial side and light green on the abaxial side, lanceolate-oblong to oblong-elliptical, apex acuminate, with well-marked tapering, acumen 0.6–1.3 cm long; wedge-shaped to slightly rounded base, entire margin. Secondary vein brochidodromous, 12–18 pairs of veins per side, primary and secondary vein well marked, forming a relief on the abaxial surface. Inflorescence rachis 2.5–9 (10–12) cm long, bracts 0.5–0.7 mm long, acute-triangular. Staminate flowers 2.8–3.6 mm long, greenish-yellow sessile, 5 merous; corolla dialipetalous cupuliform; petals 2.5–3.4 mm long, oblong to lanceolate–triangular, apex acute, subglabrous on the adaxial face and glabrous on the abaxial face, margin pilose; calyx gamosepal cupuliform; sepals 0.5–0.6 mm long, subglabrous on the adaxial side with trichomes scattered along its length, glabrous on the abaxial side. Pistilode 0.4–0.6 mm long, densely covered by trichomes, without the presence of ovules. Androecium 0.8–1.5 mm long; 10 stamens of alternating heights with base under disc, above pistilode, 5 smaller stamens 0.7–0.9 mm, 5 larger stamens 1.2–1.5 mm; anthers elliptical-oblong, dorsifixed, two thecae; fillets with inset dilated base. Pistillate flowers sessile 1.5–2.9 mm long, 5 merous; corolla cupuliform dialipetal; petals 1.1–2.4 mm, oblong to lanceolate-triangular, apex acute, subglabrous on abaxial face, glabrous on adaxial face, margin pilose; calyx gamosepal cupuliform; sepals 0.4–0.6 mm high, triangular, subglabrous on the abaxial face with trichomes scattered throughout, glabrous on the adaxial face. Pistil 1.5–2 mm long, glabrous, base surrounded by nectariferous disc 0.2 mm high; ovary 0.5–0.7 mm, ovoid-conical, densely pubescent, 5–6 carpels, two ovules per locule, style 0.5 mm, stigma 0.3–0.4 mm wide, 5–6 lobes. Androecium 1–1.3 mm, 10 staminodes, base below the disc, arranged around the gynoecium, below the level of the stigma; anthers 0.3–0.5 mm, dorsifix, elliptical-oblong; fillets 0.3–0.8 mm long. Fruit 1.5–2.5 × 1.5–3 cm long; globose-ovoid, 2–5 locules, exocarp green when immature and reddish when ripe, thin endocarp covered by white to sulferine mesocarp in ripe fruit. Seeds 1–1.2 × 0.5–0.9 mm long, black.

Selected material: Barra do Pirai, Fazenda Ponte Alta, 2.V.2011, *V. Maioli 1084* (HRJ). Caxias, Reserva da Petrobras, 30.XI.2000, fr., *S.J.S. Neto et al. 1422* (RB). Guapimirim, Estação Ecológica Estadual de Paraíso, 29.VIII.1991, fl, *A.F. Vaz et al*. (RB 296819). Magé, Santo Aleixo, close to the Reserva Particular do Patrimônio Natural El Nagual, 29.VI.2010, fr., *E.A. Ribeiro 230* (RB). Niterói, Parque Estadual da Serra da Tiririca, Morro do Telégrafo, Cumeira trail, 8.III.2006, *A.A.M. de. Barros 3102 & N. Coqueiro (RB)*; Nova Iguaçu, 13.VIII.1994, *H.C. Rodrigues* (RBR 26059). Paraty, Apacaruçu, Laranjeiras road to Praia do Sono, 9.VIII.1994, fr., *C. Duarte et al.* 82 (RB). Rio das Ostras, Reserva Biológica da União, 8.III.2006, fl, *J. Pires et al. 19* (RB). Rio de Janeiro, Camorim, Maciço da Pedra Branca, 10.VII.2009, *J.M.C. Freire et al. 420* (FCAB). São Francisco do Itabapoana, Fazenda Imburi, 15.IX.2008, *K.M.P. Archanjo 1107* & *M.T. Nascimento* (HUENF).

Popularly known as Eleni, amescla branca.

Flowering from September to November and fruiting from October to January.

The species is present in Dense Ombrophylous Forest and Semideciduous Seasonal Forest. Endemic to Brazil, distributed in the Northeast (AL, BH, SE) and Southeast (ES, MG, RJ) regions, within the Cerrado and Atlantic Forest domains (REFLORA 2022). *Protium warmingianum* is consider a late secondary species, with specimens characterized by developing in shaded understory (Paula *et al.* 2004).

The species is distinguished by having inflorescences of diclinous, monoecious flowers. It is the only one that presents sessile flowers. The

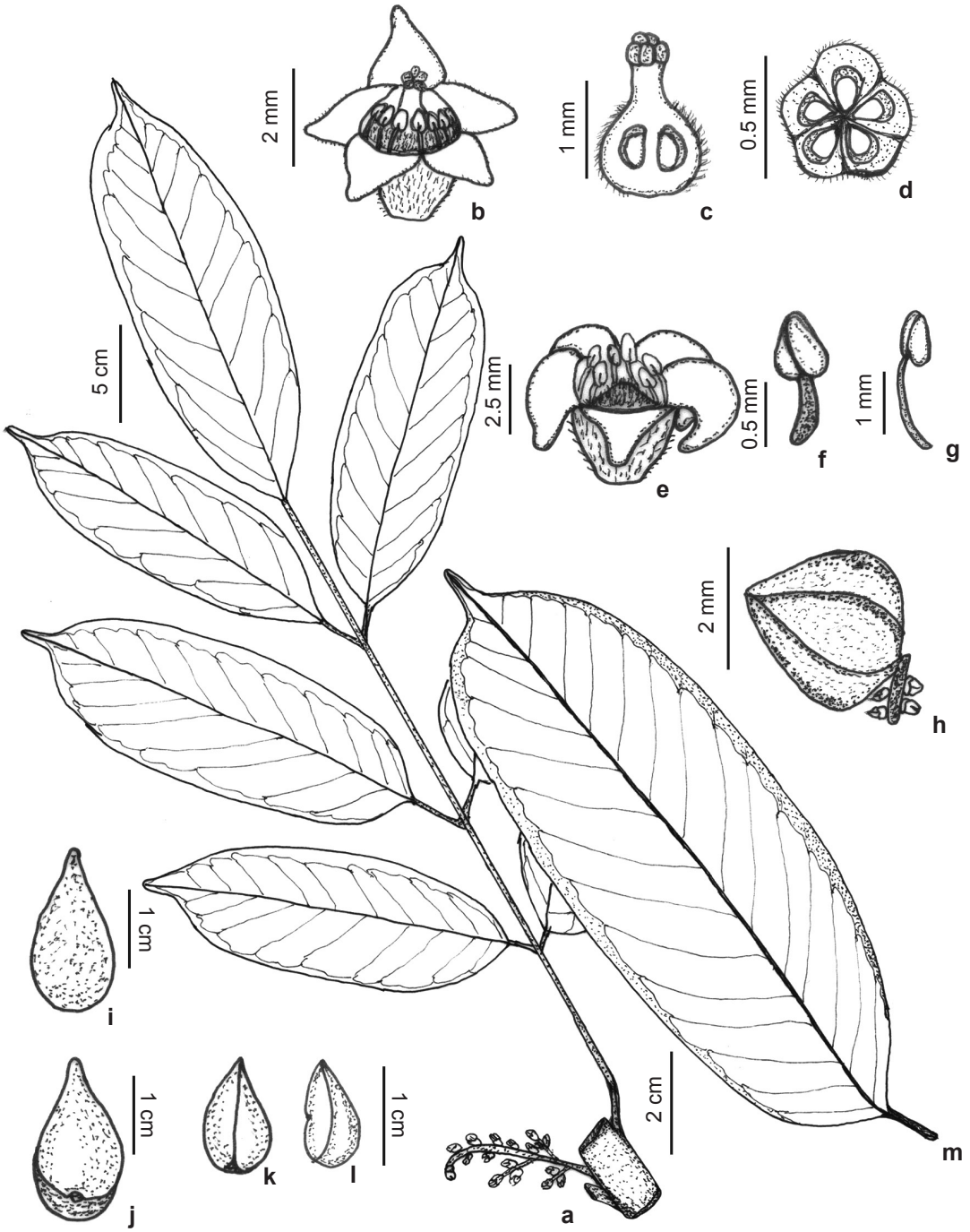

Figure 8 – *Protium warmingianum*– a. habit; b. sessile pistillate flower with lowered petals showing the staminodes below the height of the stigma; c. pistil with ovary surrounded completely by trichomes, with a fillet crowned by a stigma with five lobes; d. cross section of the ovary; e. staminate flower with lowered petals and with four stamens removed, showing an inconspicuous pistillode completely covered by trichomes and stamens above the height of the pistilode; f. variation of shorter stamens present in the staminate flower; g. larger stamen variation found in the staminate flower; h. large sessile fruit in lateral view, with detail of inflorescence branch with undeveloped flowers; i–j. Smaller sessile fruit in frontal and posterior views; k–l. pyrene in front and side views; m. upper portion of the leaflet. (a. *J. Pires et al. 19*; b-d. *A.F. Vaz et al.* (RB296819); e-g. *L.C. Giorgdano et al. 977*; h-l. *R. Guedes et al. 2236*; m. *A.F. Vaz et al.* (RB296819). Line drawings by Débora Cássia).

vestigial ovary in the staminate flowers is densely covered by trichomes as well as in the pistillate flowers, with a glabrous style and stigma. The species is also distinguished by the size of its leaf in relation to other species in the state, which can reach up to one meter in length and leaflets up to 30 cm in length.

7. *Protium widgrenii* Engl. *Fl. bras*. (Martius) 12(2): 272 (1874). Figs. 9-10

Tree 8–28 m tall, smooth, slightly fissured, aromatic bark. Branches 2–3.5 mm in diameter, slender, rounded. Leaves 8–20 cm long, 3–9 pairs of leaflets. Petiole 8–12 cm long, rounded, inlaid base. Petiole 1–3 cm long, semi-rounded, with inconspicuous pulvinule. Leaflets 6–13 × 2.5–4 cm, coriaceous to subcoriaceous, rarely discolored, with both sides clear dark green, mostly lanceolate, rarely elliptical-lanceolate, narrow ends, apex acuminate, acumen 0.5–1 cm, cuneiform, and acute base, entire margin; Secondary nerves brochidodromous, 11–14 pairs of veins per side, primary veins well marked on abaxial surface and rarely on adaxial surface. Inflorescence rachis 7–12 cm long; bracts up to 0.5 mm in length, acute-triangular. Staminate flowers greenish to yellow, 3.0–3.5 mm long; 4–5 merous; corolla cupuliform dialipetalous; petals 1.5–3.3 mm long, oblong-ovate, apex acute, trichomes scattered on abaxial face, hairy margin, adaxial face glabrous; calyx gamosepal cupuliform; sepals 0.5–1 mm, trichomes on abaxial face, glabrous on adaxial face. Pedicel 0.7–1.5 mm long, rounded. Pistillode 0.4–0.8 mm long, pilose, with trichomes concentrated at the base, surrounded by glabrous nectariferous disc, vestigial ovary 0.3–0.6 mm long, globose-ovoid, covered with trichomes, 4–5 carpels, two vestigial ovules per locule; stigma subsessile, glabrous, with 4–5 lobes. Androecium 1–1.5 mm long; 8–10 stamens, base coming out from under the disk, with the height of the pistillode standing out; anthers 0.3–0.7 mm long, oblong-elliptical, dorsifixed, two-thecas; fillets 0.6–1 mm long. Pistillate flower 3.0–3.2 mm long, light green, 4–5 merous, rarely 6 merous; corolla cupuliform dialipetalous; petals 1.5–3.0 mm long, oblong-ovate, apex acute, trichomes scattered on the abaxial side, with pilose margin, glabrous on the adaxial side; calyx gamosepal cupuliform; sepals 0.6–1 mm long, trichomes scattered on abaxial face, margin pilose, glabrous on adaxial face. Pedicel 0.6–3 mm long, rounded. Pistil pilose, with trichomes concentrated at the base, 1.5–1.9 mm long; base embedded in glabrous nectariferous disc 0.3–0.5 mm high; ovary 0.6–0.8 mm long, globose-ovoid, trichomes spaced around, 5 carpels, two ovules per locule, subsessile stigma of 4–5 lobes. Androecium 1–1.4 mm long; 8–10 staminodes, base below disc, arranged around gynoecium, below level of stigma; anthers 0.6–0.8 mm long, dorsifix, oblong-elliptical; fillets 0.4–0.8 mm long. Fruit 1–2 × 1–2.5 cm long, globose–ovoid, 3–5 lobes, exocarp green when immature and reddish to vinaceous when ripe, thick and fleshy white mesocarp, thin endocarp, 1–5 pyrene. Seed 0.5–1 × 0.3–0.8 mm long, ovoid, white.

Selected material: Angra dos Reis, Ilha Grande, Dois Rios, Mata do Pesqueiro in Cavalinho, 5. IV.2009, *V. Maioli et al. 1236* (HRJ). Barra do Piraí, Ponte Alta Farm, 3.VIII. 2011, *V. Maioli 1085* (HRJ). Campos dos Goytacazes. Mata do Mergulhão, 27.III.1996, *MT Nascimento 64* (HUENF). Itatiaia, Parque Nacional do Itatiaia. Mirante do último adeus, 20.I.2022, fr., *DC Silva 4* (RB). Magé, Paraiso, area of the Centro de Primatologia do RJ, 18.X.1984, fl., *HC de Lima et al. 2269* (RB). Nova Iguaçu, REBIO Tinguá, Boa Esperança, road to the dam, Mata do Sopé da encosta, 16.XI.2001, *H.C. de Lima et al. 5954* (RB). Rezende, Parque Nacional de Itatiaia, bank of the Campo Belo River, near lot 17, 17.X.1977, fr., *VF Ferreira et al. 121* (RB). Rio de Janeiro, Parque Estadual da Pedra Branca, Morro da Mesa, 8.III.2005, *A. Solórzano et al. 75* (RB); Vista Chinesa, 25.X.1940, *E. Pereira 73* (HB). São Joao da Barra, Reserva Particular do Patrimônio Natural Fazenda Caruara, 17.IX.2013, *AA Nascimento et al.* (HUENF 9360).

Popularly known as *almecega*, *almecegueira*, *elemi*, *breu branco*.

Flowering from June to October and fruiting from October to February.

It occurs in Dense Ombrophylous Forest/ Seasonal Semideciduous Forest (Lima & Pirani 2005). Endemic to Brazil, distributed in the Northeast (BH) and Southeast (ES, MG, RJ, SP) regions, within the Atlantic Forest biome (REFLORA 2022). *Protium widgrenii* is a species considered hygrophilous, characterized by being a plant adapted to regions with high humidity, such as riparian forests (Lorenzi 1992; São Paulo 2001).

It can be distinguished from the narrow and lanceolate leaflets, with a striking dark green color, rarely discolored. The pistil of both type of flowers present trichomes, but in smaller quantities when compared to the species *P. warmingianum*.

It is listed as Least Concern – LC category according to León *et al.* (2020).

Protium widgrenii has medicinal purposes linked to its analgesic and healing action (Seiffert 2003).

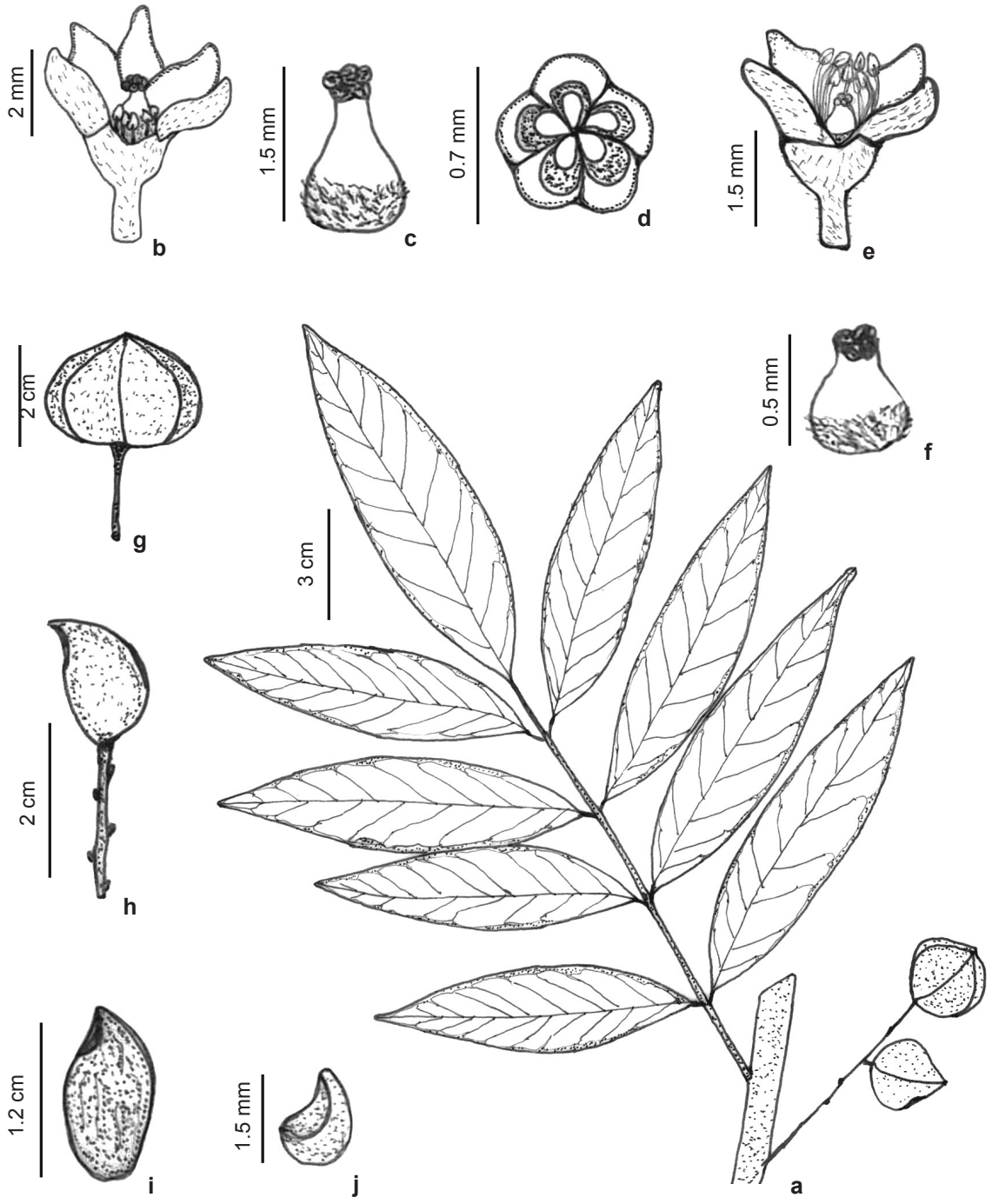

Figure 9 – *Protium widgrenii* – a. habit; b. open pistillate flower with pedicel and five stamens removed; c. pistil of the pistillate flower with trichomes at the base; d. cross section of the ovary; e. open staminate flower with pedicel; f. pistillode of the staminate flower with trichomes at the base; g. fruit in frontal view; h. fruit in lateral view; i. pyrene in side view; j. seed in lateral view (a. *D.C. Silva 4*; b-c. *J.G. Kuhlmann et al* (RB4598); d-e. *J. Pires et al.* (RB496060); f-j. *D.C. Silva 3*). Line drawings by Débora Cássia).

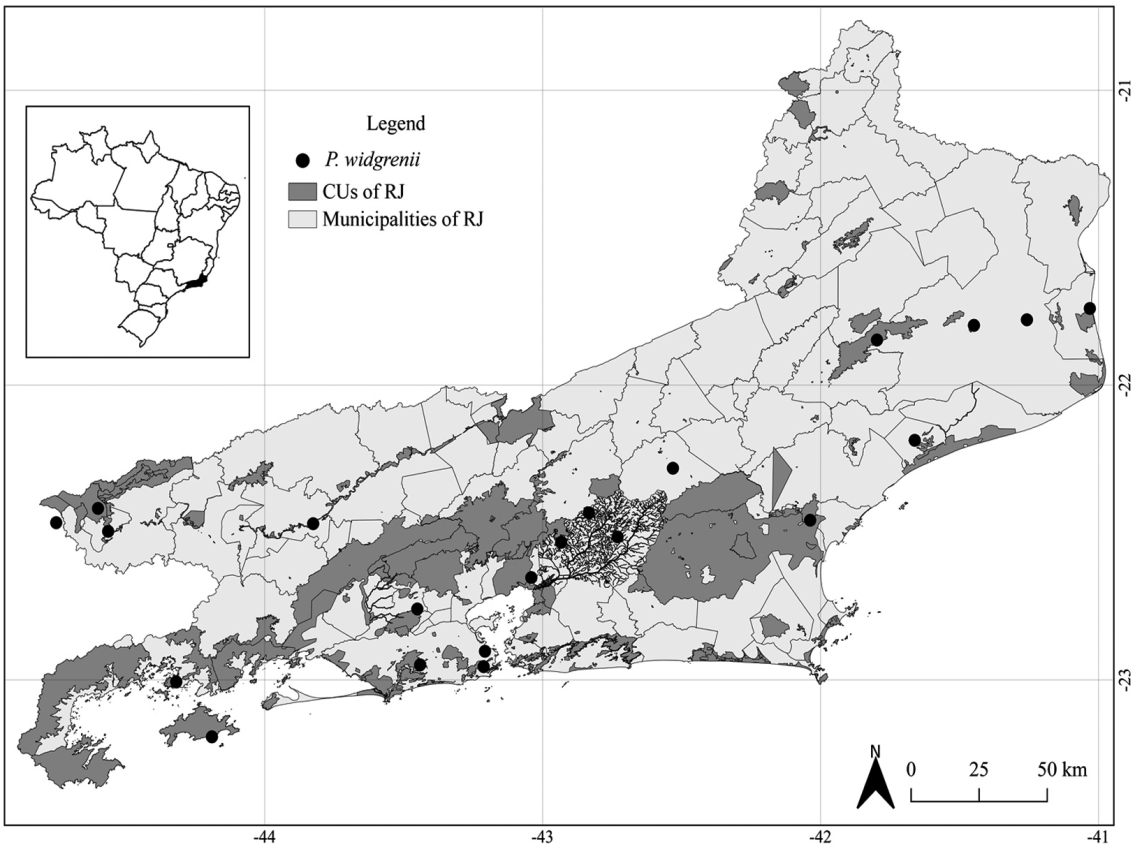

Figure 10 – Distribution map of the species *P. widgrenii* in the state of Rio de Janeiro.

Key to the species of *Protium* of the state of Rio de Janeiro

1. Trees or shrubs, 1–2 pairs of leaflets, 8 pairs of veins, common species in restingas .... *Protium brasiliense*

1’ Trees or shrubs, 1–9 pairs of leaflets, 9–18 pairs of veins, occurs in restingas, Dense Ombrophylous Forest, tableland forest 2

2. Leaflets 10–27.5 × 4–9 cm, 12–18 pairs of vein segments, sessile flowers, densely pilose gynoecium ..... *Protium warmingianum*

2’ Leaflets 5–18 × 1.2–7 cm, 8–14 pairs of vein segments, pedicellate flowers, glabrous or pilose gynoecium 3

3. Number of pairs of leaflets 3–9, leaflets mostly lanceolate ..... *Protium widgrenii*

3’ Number of leaflet pairs 1–6, leaflets elliptic-obovate to oblong, oblong to elliptical, elliptical-oblong, elliptical-lanceolate, oblong-lanceolate, without leaflets mostly lanceolate 4

4. Trees up to 26 m, margin of leaflets entire or serrated, inflorescence 4.5–6 cm long, gynoecium pilose ..... *Protium glaziovii*

4’ Trees or shrubs up to 20 m, margin of leaflets entire, inflorescence length 1–4 cm to 7–12 cm long, gynoecium glabrous 5

5. Leaflets with apex rounded to rounded acuminate and in rare cases obtuse, tubular corolla, basifix anther ..... *Protium breviacuminatum*

5’ Leaflets with apex acuminate, corolla cupuliform, anther dorsifixed 6

6. Tree or shrub up to 20 m, number of leaflet pairs 3-4, base of leaflet wedge-shaped to oblique ..... *Protium heptaphyllum*

6’ Tree or shrub up to 10 m, 1–2 pairs of leaflets, wedge-shaped base .... *Protium icicariba*

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Data availability statement

In accordance with Open Science communication practices, the authors inform that all data are available within the manuscript.

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