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Original Papers

Taxonomic synopsis of Sapindaceae in the Upper Paraná Atlantic Forest

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Abstract

Sapindaceae is one of the richest families in the Atlantic Forest and an important component of tropical and subtropical forests, with an ecological role in environmental dynamics both in the structure and in the canopy of tree and climbing species. This work aims to contribute to the floristic knowledge of Sapindaceae in the Iguaçu National Park (Brazil) and the Iguazú National Park (Argentina). Were found 24 native species in both areas, of which three are cosmopolitan, 19 neotropical and two endemics of Brazil; whereas regarding the habit, 18 are climbing species and six are arboreal. In the protected areas, 20 species are found in the Iguaçu National Park and 19 species in the Iguazú National Park, with some differences in the species composition. All 24 species were found in Seasonal Semidecidual Forest and only five species were also found in Mixed Ombrophilous Forest. The most diverse genera were *Serjania* with eight species, and *Allophylus*, *Cardiospermum* and *Urvillea* with three species each. *Serjania hatschbachii* is recorded for the first time for the western region of Paraná. A key for the identification of the species, diagnosis, scientific illustrations and/or photographs, geographic distribution, habitat, phenology, common names and observations are presented.
Key words: flora, Iguaçu National Park, Iguazú National Park, Sapindaceae, Semideciduous Seasonal Forest.

Resumen

Sapindaceae es una de las familias más ricas del Bosque Atlántico y un componente importante de los bosques tropicales y subtropicales, con un papel ecológico en la dinámica ambiental tanto en la estructura como en el dosel de las especies arbóreas y trepadoras. Este trabajo tiene como objetivo contribuir al conocimiento florístico de Sapindaceae en el Parque Nacional do Iguaçu (Brasil) y en el Parque Nacional de Iguazú (Argentina). Se encontraron 24 especies nativas en total en ambas áreas, de las cuales tres son cosmopolitas, 19 neotropicales y dos endémicas de Brasil; mientras que, en relación al hábito, 18 son especies trepadoras y seis son arbóreas. En las áreas protegidas, se encontraron 20 especies en el Parque Nacional do Iguaçu y 19 especies en el Parque Nacional Iguazú, con algunas diferencias en la composición de especies. Todas las 24 especies se encontraron en el Bosque Estacional Semidecidual y sólo cinco de ellas también se localizaron en el Bosque Umbrófilo Mixto. Los géneros más diversos fueron *Serjania* con ocho especies, y *Allophylus*, *Cardiospermum* y *Urvillea* con tres especies cada uno. *Serjania hatschbachii* es una nueva cita para el oeste de Paraná. Se presentan una clave de identificación de las especies, diagnosis, ilustraciones científicas y/o fotografías, distribución geográfica, hábitat, fenología, nombres comunes y observaciones.
Palabras clave: flora, Parque Nacional do Iguaçu, Parque Nacional Iguazú, Bosque Estacional Semideciduo, Sapindaceae.

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Introduction

Sapindaceae is one of the most diverse families of the order Sapindales (Gadek *et al.* 1996), with 144 genera and 1,900 species (Buerki *et al.* 2021). For a long time, several authors treated Sapindaceae *sensu stricto* according to morphological and biogeographical features (Buerki *et al.* 2010). However, recent molecular analyses have broadened the limits of Sapindaceae *sensu lato* to include Aceraceae, Hippocastanaceae, and Xanthocerataceae with some chemical synapomorphies such as cyclopropane amino acids, thus redefining the phylogenetic relations of the group (Harrington *et al.* 2005; Judd *et al.* 2009; Buerki *et al.* 2010; APG IV 2016). The morphology of Sapindaceae comprises different habits, *e.g.*, trees, shrubs, hemicryptophytes, herbs and climbers, and is one of the families that contribute most to the lianas of the Neotropics (Ferrucci 1998; Simpson 2006; Stevens 2021). Most Sapindaceae have alternate and compound leaves, cymose inflorescences, flowers with an imbricate prefloration, petals hairy, unguiculate, and usually with glandular tricomes, also exhibiting an adaxial petaloid appendage; an extrastaminal nectariferous disc; berries, capsules or schizocarps fruits, and seeds with or without aril (Ferrucci 1998; Acevedo-Rodríguez *et al.* 2011). The family is predominantly distributed in the tropics and subtropics, with few genera occurring in temperate regions, being present in various environments and vegetation types (Sommer & Ferrucci 2009; Acevedo-Rodríguez *et al.* 2011).

Its applications range from flavoring the traditional beverage "tereré" with crushed leaves of vacum or cocú, *Allophylus edulis* (A.St.-Hil. *et al.*) Hieron. *ex* Niederl., to stimulant drinks with high caffeine contents like guarana, an amazonian species *Paullinia cupana* Kunth, that is one of the most consumed drinks in Brazil (Ferrucci 1998; Simpson 2006; Stevens 2021). This family also has significant economic potential as an important source of tropical and subtropical fruits for the fauna and humans (Simpson 2006; Stevens 2021). Another potential is in the pharmaceutical industry due to the saponins present in the fruits of various species, *e.g.*, the wingleaf soapberry *Sapindus saponaria* L., the genus of which gives name to the family (Simpson 2006; Judd *et al.* 2009; Souza & Lorenzi 2019).

Sapindaceae is an important woody component of Neotropical forests and is among the most species-rich families in the Atlantic Forest (Gentry 1995; Morellato & Leitão Filho 1996; Ríos 2010). The trees and vines of the Sapindaceae play a crucial role in environmental dynamics as a source of resources, in the same structure, and in the canopy connection (Morellato & Leitão Filho 1996). The Atlantic Forest is one of the world's biodiversity hotspots (Mittermeier *et al.* 2011), consisting of a complex of almost-continuous ecosystems that differs from other tropical forests by having a set of geographical (latitudinal, longitudinal, and altitude amplitude) and climatic variables that make it unique (Stehmann *et al.* 2009). According to Flora do Brasil 2020 (continuously updated), there are 23 genera, 203 species, one subspecies and 4 varieties of Sapindaceae in the Atlantic Forest. The southwest portion constitutes the Upper Paraná Atlantic Forest ecoregion (UPAF), mainly distributed over the second and third plateaus of the state of Paraná until the western slope of the Serra do Mar mountains in Brazil, east of Paraguay and northwest of Argentina (Di Bitetti *et al.* 2003). Only 5% of its original cover remains due to the advance of the agricultural-livestock frontier, with very different conservation states and degrees of fragmentation in these countries due to historical, productive and demographic particularities (Di Bitetti *et al.* 2003; Giraudo *et al.* 2005). This ecoregion contains the Iguaçu National Park (ParNa Iguaçu) and the Iguazú National Park (ParNa Iguazú), located in Brazil and Argentina, respectively, and which, despite their fragmentation are the largest entirely protected remnants of the Atlantic Forest. In the phytosociological studies conducted in both protected areas, Souza *et al.* (2019) identified five tree species of Sapindaceae for the ParNa Iguaçu, whereas Srur *et al.* (2009) identified five tree species and nine climbing species for ParNa Iguazú. Due to its richness of species, diversity of habits, presence in all strata of the canopy, and various ethnobotanical uses in the local daily life, Sapindaceae constitutes one of the most important families in the Upper Paraná Atlantic Forest, justifying the importance of studies in the largest protected area.

Materials and Methods

Study area

This study was conducted at the Iguaçu National Park (ParNa Iguaçu) in Brazil and at the Iguazú National Park (ParNa Iguazú) in Argentina, both located in the Upper Paraná Atlantic Forest ecoregion. The local climate is classified as mesothermal, humid and subtropical, with an annual rainfall of 1,500–2,000 mm, with no defined dry season, and little chance of frost (Srur *et al.* 2009; Alvares *et al.* 2013; Souza *et al.* 2017, 2019). The Semideciduous Seasonal Forest (SSF) mostly occupies ParNa Iguaçu (Cabrera 1971; Di Bitetti *et al.* 2003; Giraudo *et al.* 2005; Srur *et al.* 2009; Zanotti *et al.* 2020), and the south and center of ParNa Iguaçu. The seasonal climate determines a state of physiological rest (drought due to the cold of winter), which causes the fall of 20–50% of the semi-deciduous foliage of trees. Further to the north of the ParNa Iguaçu are the Araucaria moist forests or Mixed Ombrophilous Forest (MOF) (15%), areas with high temperatures and rainfall rates (IBGE 2012; Souza *et al.* 2017).

The ParNa Iguaçu is located in 14 municipalities, the main of which are Céu Azul, Matelândia, São Miguel do Iguaçu, Serranópolis do Iguaçu and Foz do Iguaçu, in the state of Paraná, Brazil, encompassing 185,262.5 hectares from 25º05' to 25º41'S and 53º40'to 54º38'W (Souza *et al.* 2017, 2019). This area is located over the Third Paraná Plateau, in Oxisols, and at elevations ranging from 750 m in the north to 100 m in the south, limited by the Iguaçú river basin (Souza *et al.* 2017, 2019).

The ParNa Iguazú comprises the National Iguazú Reserve and the Iguazú National Park, occupying a surface of 67,000 hectares from 25º58'S to 54º13'W located in the Iguazú Department, Misiones Province, Argentina (Tressens *et al.* 1994; Srur *et al.* 2009). The soils are deep Ultisols with high concentrations of iron, aluminum and silicon (Srur *et al.* 2009). The plateau-like relief consists of gentle undulations, with an elevation ranging from 125 m to the north over the west limit at the beginning of the Lower Iguazú River to 380 m to the southeast of the Yacuí creek (Srur *et al.* 2009).

For the survey of both protected areas, the locations were divided into five large areas (Fig. 1): ParNa Iguaçu, with four areas comprised of Céu Azul to the north, Capanema to the south, Foz do Iguaçu to the west, and the ParNa Iguazú with an area to the southwest. Area 1 of Céu Azul comprised the following trails: Fazenda Rio Butu, Nascentes do Jumelo, Araucárias, Cachoeira Rio Azul, Manoel Gomes, and Jacutinga (Fig. 1, trails A-F). Area 2 consisted of the Matelândia/Serranópolis trail. Area 3 of Capanema contained the following trails: Banks of the Iguaçu River on the Brazilian side, Cachoeira Rio Silva-Jardim, and Ilha do Sol (Fig. 1, trails H-J). Area 4 of Foz do Iguaçu contained the following trails: Poço Preto, Represa São João, Antiga Usina, Escola Parque, Macuco Safari, Bananeiras, Cataratas, and Hidrante (Fig. 1, trails K-R). Finally, area 5 of Puerto Iguazú contained the following trails: along the Ruta Nacional 12 and the Ruta Provincial 101, way to the Hidrómetro, Camping Ñandú, Garganta del Diablo, Sendero Inferior, Sendero Macuco, Sendero Superior, Sendero Verde (Fig. 1).

Data collection and identification

The floristic survey was performed according to the Walking Method (Filgueiras *et al.* 1994), with monthly collections from March 2019 to March 2020 and isolated collections from November 2020 to September 2021. The specimens were gathered at the ParNa Iguaçu and incorporated in EVB herbarium (acronyms following Thiers, continuously updated). In turn, the specimens gathered at the ParNa Iguazú, were processed at the Center of Subtropical Ecological Research (CIES), and incorporated in CTES and SI. The material was photographed with a Sony DSC hx400v camera, and prepared according to the technique described by Gadelha-Neto *et al.* (2013).

The specimens from the herbaria CTES, EVB, MBM, UNOP and UPCB were personally analyzed. The virtual specimens of Jabot (2021), JSTOR (2021), ReFlora (2021) and SpeciesLink (2021) were also consulted, along with the database *Documenta Florae Australis* (Flora Argentina 2020), which includes an updated checklist of the vascular flora of Argentina and the Southern Cone. The confirmed species were also revised using the virtual platforms of the following herbaria: BAA, BAB, FURB, HCF, HRCB, HUEFS, HUEM, HUESJ, HUFU, ICN, LIL, MO, NY, RB, SI, SP, SPSF, U, UEC, UFMT and US.

Species identification was performed using specialized literature, *e.g.*, dissertations,

taxonomic reviews, identification keys, floras and checklist (Radlkofer 1890, 1892–1900, 1931–1934; Barkley 1957; Leenhouts 1967; Ferrucci 1991, 1998, 2004, 2020, 2021; Ferrucci & Somner 2008; Somner & Ferrucci 2009; Acevedo-Rodríguez 1993; Acevedo-Rodríguez *et al.* 2011; Ferrucci & Urdampilleta 2011; Coulleri & Ferrucci 2012; Coelho 2014; Coulleri 2014; Ferrucci *et al.* 2014; Rosado & Souza 2022; Rosado *et al.* 2014; Coelho *et al.* 2017; Ferrucci & Coulleri 2022). The phenology of each species was referred to the specimens of the study area and includes supplemental data available in the bibliography of the region. The conservation status of each species was verified using the CNCFlora (2021) and IUCN (2021) databases. The scientific names and information about authors were checked in the nomenclatural database The International Plant Names Index (IPNI). The terminology used agreed with Lindley (1951), Font Quer for general terms (1953), Hickey (1973) for morphology, Stearn (1992) for Latin terms, Solís & Ferrucci (2006) for domatia and Ellis *et al.* (2009) for leaf architecture.

Regarding vernacular names, in the tri-border region, they are used interchangeably, *e.g.* in ParNa Iguazú the names are utilized in Spanish, Guaraní, and Portuguese.

Results

A total of 24 species distributed into nine genera were found in both parks (Tab. 1), the most representative of which is *Serjania*, with eight species, and *Allophylus*, *Cardiospermum* and *Urvillea*, with three species each. Regarding to the growth habit, six are tree species of different canopy strata and the rest of the 18 species are climbers, including both lianas and vines.

Sapindaceae Jussieu (1789: 246) como "Sapindi", nom. cons.

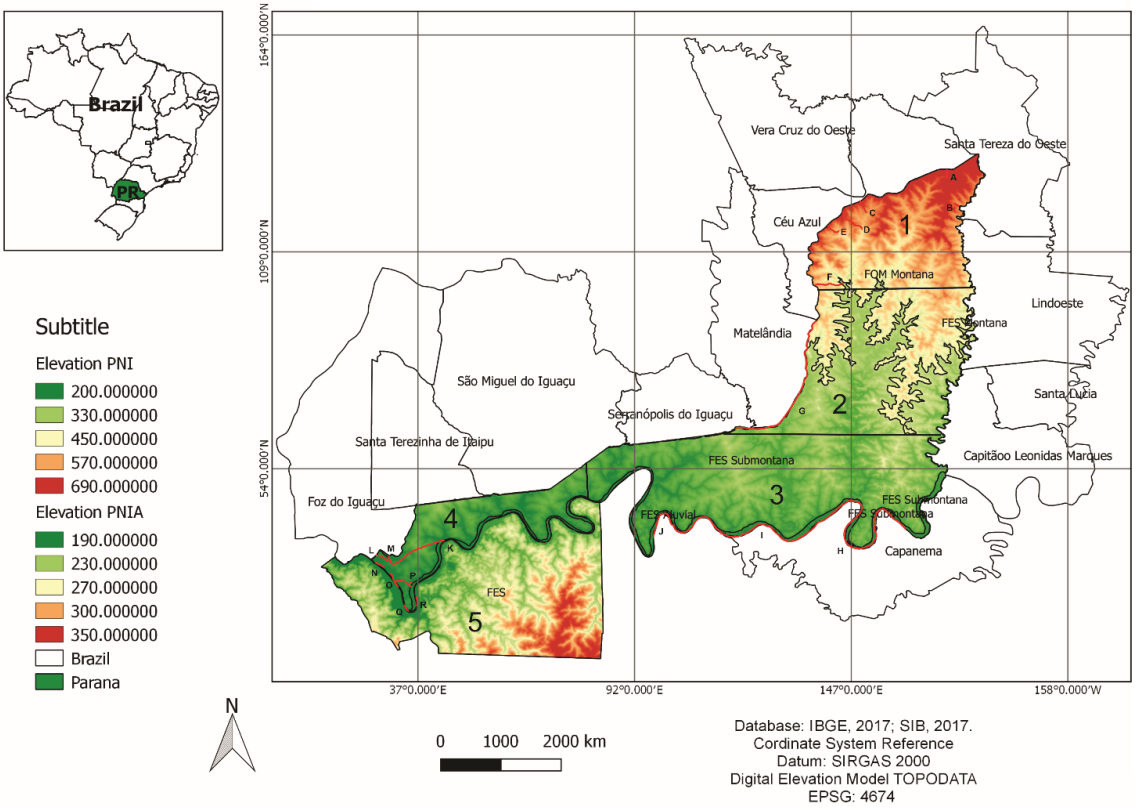

Figure 1 – ParNa Iguaçu and ParNa Iguazú areas: Area 1 = Céu Azul, trails A-F; Area 2 = Matelândia / Serranópolis, trail G; Area 3 = Capanema, trails H-J; Area 4 = Foz do Iguaçu, trails K-R; Area 5 = ParNa Iguazú (Modified from Hammes *et al.* 2021).

Table 1 – List of Sapindaceae species in ParNa Iguaçu & ParNa Iguazú with status (endemic, neotropical, cosmopolitan), vegetation type (SSF = Seasonal Forest Semideciduous; MOF = Ombrophilous Mixed Montane Forest) by area, dispersal syndrome (anemochoric and zoochoric) and conservation status according to UICN and CNC (CR = critically endangered; LC = little concern; NE = not evaluated).

Especies	Status	ParNa Iguaçu				ParNa Iguazú	Dispersal syndrome	UICN	CNC
		1	2	3	4	5			
Allophylus edulis (A.St.-Hil. A. Juss. & Cambess.) Hieron. *ex* Niederl.	Neotropical	-	-	SSF	SSF	SSF	Zoochoric	LC	NE
Allophylus guaraniticus (A.St.-Hil.) Radlk.	Neotropical	MOF	SSF	-	SSF	SSF	Zoochoric	NE	NE
Allophylus petiolulatus Radlk.	Neotropical	MOF	-	-	-	-	Zoochoric	NE	NE
Cardiospermum corindum L.	Cosmopolitan	-	-	-	-	SSF	Anemochoric, autochoric	NE	LC
Cardiospermum grandiflorum Sw.	Cosmopolitan	MOF	SSF	-	-	SSF	Anemochoric, autochoric	NE	NE
Cardiospermum halicacabum L. var. *microcarpum* (Kunth) Blume	Cosmopolitan	MOF	-	-	-	-	Anemochoric, autochoric	LC	NE
Cupania vernalis Cambess.	Neotropical	MOF	-	-	SSF	SSF	Zoochoric	LC	NE
Diatenopteryx sorbifolia Radlk.	Neotropical	-	-	-	SSF	SSF	Anemochoric	NE	NE
Matayba elaeagnoides Radlk.	Neotropical	-	SSF	SSF	SSF	SSF	Zoochoric	NE	NE
Paullinia elegans Cambess.	Neotropical	MOF	SSF	SSF	SSF	SSF	Zoochoric	NE	NE
Paullinia meliifolia Juss.	Neotropical	MOF	-	-	SSF	SSF	Zoochoric	NE	NE
Serjania altissima (Poepp.) Radlk.	Neotropical	-	-	-	-	SSF	Anemochoric	NE	NE
Serjania caracasana (Jacq.) Willd.	Neotropical	MOF	-	-	-	-	Anemochoric	NE	NE
Serjania fuscifolia Radlk.	Neotropical	MOF	-	-	SSF	SSF	Anemochoric	NE	NE
Serjania glabrata Kunth	Neotropical	-	-	-	SSF	SSF	Anemochoric	NE	NE
Serjania hatschbachii Ferrucci	Endemic of Brazil	-	-	-	SSF	-	Anemochoric	NE	CR
Serjania laurotteana Cambess.	Neotropical	MOF	-	-	SSF	SSF	Anemochroric	NE	NE
Serjania meridionalis Cambess.	Neotropical	-	SSF	SSF	SSF	SSF	Anemochoric	NE	NE
Serjania multiflora Cambess.	Endemic of Brazil	-	-	-	SSF	-	Anemochoric	NE	NE
Thinouia mucronata Radlk.	Neotropical	-	SSF	-	SSF	SSF	Anemochoric	NE	NE
Thinouia ventricosa Radlk.	Neotropical	-	-	-	-	SSF	Anemochoric	NE	NE
Urvillea laevis Radlk.	Neotropical	MOF	-	-	-	SSF	Anemochoric, autochoric	NE	NE
Urvillea ulmacea Kunth	Neotropical	-	-	-	SSF	SSF	Anemochoric, autochoric	NE	NE
Urvillea uniloba Radlk.	Neotropical	-	-	-	-	SSF	Anemochoric, autochoric	NE	NE
Total				**20**		**19**			

Key to the species of Sapindaceae in the Upper Paraná Atlantic Forest

1. Trees; without stipules and tendrils 2
1'. Climbers; with stipules and tendrils 7
2. Leaves 3-foliolate; fleshy fruits 3
2'. Leaves with more than 4 leaflets; dry fruits 5
3. Terminal leaflet longer than 12.3 cm, petiolule up to 2 cm long ..... 3. *Allophylus petiolulatus*
3'. Terminal leaflet smaller than 12 cm, petiolule smaller than 0.5 cm 4
4. Flowering branches grey-brown, smooth, with linear lenticels; terminal leaflet narrow-elliptic to ovate-lanceolate; leaflets dentate-serrate from the base to the apex; calyx glabrous ..... 1. *Allophylus edulis*
4'. Flowering branches reddish-brown, scaly, non-lenticellate; terminal leaflet ovate or obovate-rhomboidal, leaflets dentate-serrate in the apical half or sub-entire; calyx hispidulous ..... 2. *Allophylus guaraniticus*
5. Leaflets entire; calyx gamosepalous with early opening; fruits apiculate; aril pinkish-white ..... 9. *Matayba elaeagnoides*
5'. Leaflets dentate-serrate; calyx dialysepalous with normal opening; fruit non-apiculate; aril if present never pinkish-white 6
6. Leaflets with a pubescent hypophyll, domatia pilose and/or pocket-shaped; flowers actinomorphic, petals with a bipartite basal appendage; capsules loculicidal; seeds with an orange fleshy aril ..... 7. *Cupania vernalis*
6'. Leaflets with a glabrous hypophyll, domatia absent; flower zygomorphic, petals with an entire basal appendage; schizocarps with two-samaroid mericarps; seeds without aril ..... 8. *Diatenopteryx sorbifolia*
7. Capsules septifragal, central seminiferous portion, seeds with a sarcotesta or aril 8
7'. Schizocarps with 3 samaroid mericarps, seminiferous portion basal or apical; seed without sarcotesta or aril 15
8. Pericarp sub-fleshy, seeds with a fleshy sarcotesta 9
8'. Pericarp papyraceous or membranaceous, seeds with a dry aril 10
9. Stem with supernumerary cambia, angular; stipules scarious, subulate, symmetrical; leaves with 5 leaflets; petiole and rachis apterous; thyrses axillary longer than the leaves; capsules apterous ..... 10. *Paullinia elegans*
9'. Stem with a single cambium, cylindrical; stipules foliaceous, cuneiform, asymmetrical; leaves with 7–9 leaflets; rachis alate or marginate; thyrses axillary shorter than the leaves; capsules 3-alate ..... 11. *Paullinia meliifolia*
10. Leaves 3-foliolate; capsules with 3 evident wings 11
10'. Leaves biternate; capsules apterous or with 3 narrow wings 13
11. Stipules longer than 3 mm, deciduous; anthers without an apical expansion of the connective; capsules 1-seeded, with locules laterally compressed; seeds trigonous ..... 22. *Urvillea laevis*
11'. Stipules shorter than 3 mm, persistent; anthers with an apical expansion of the connective; capsules 3-seeded, with inflate locules; seeds ellipsoid 12

12. Leaflets pubescent, lateral leaflets dentate-serrate, with more than 14 teeth, non-lobulate, with 1–2 incisions that do not exceed one-third of leaf blade, apex acute or obtuse; thyrses spiciform ..... 23. *Urvillea ulmacea*

12'. Leaflets glabrous, lateral leaflets incised-serrate, with less than 10 teeth, laterally 1-lobed, with an incision that exceed one-third of leaf blade, apex long attenuate or acuminate; thyrses racemiform .... 24. *Urvillea uniloba*

13. Flowers longer than 6 mm, with 2 corniculiform nectariferous lobes; seeds with an aril of triangular outline..... 5. *Cardiospermum grandiflorum*

13'. Flowers shorter than 5.5 mm, with 4 short nectariferous lobes; seeds with an aril of non-triangular outline..... 14

14. Terminal leaflets with conspicuous, marginate petiolules, up to 18 mm long, shorter in the others; capsules broad-obovate, apiculate or emarginate apex, yellowish-greenish with dark brown venation, purplish when immature; seeds with an emarginate aril ..... 4. *Cardiospermum corindum*

14'. Terminal leaflets with petiolules apterous, less than 12 mm long; capsules turbinate-trigonous, with subtruncate apex, reddish-brown; seeds with a cordate aril..... 6. *Cardiospermum halicacabum* var. *microcarpum*

15. Leaves 3-foliolate; thyrses umbelliform; flowers actinomorphic, calyx with early opening, nectariferous disc annular; seminiferous portion in the proximal part of the mericarp, wings vertical upward 16

15'. Leaves biternate; thyrses racemiform; flowers zygomorphic, calyx with a normal aperture, 4 nectariferous lobes; seminiferous portion in the distal part of the mericarp, wings vertical downward..... 17

16. Leaflets discolored, base decurrent, terminal leaflet ovate-rhomboid; mericarps up to 3.9 cm long, with a conspicuous constriction over the seminiferous portion ..... 20. *Thinouia mucronata*

16'. Leaflets concolorous, base acute, obtuse, or truncate; terminal leaflet ovate-oblong; mericarps longer than 4 cm, with an inconspicuous constriction over the seminiferous portion ..... 21. *Thinouia ventricosa*

17. Stem simple (a single vascular cylinder)..... 18

17'. Stem compound (with a central and several peripheral vascular cylinders) ... 19

18. Stem 5–6 ribbed; simple, glandular and setose trichomes in three layers; without domatia in the hypophyll; petaloid appendage with an emarginate crest on the posterior petals; mericarp sub-rectangular with a flattened seminiferous portion and with an inconspicuous venation ..... 12. *Serjania altissima*

18'. Stem 8–10 ribbed; glabrescent or puberulous with simple trichomes in a single layer; domatia pilose in the hypophyll; petaloid appendage with a bicorniculiform crest on the posterior petals; mericarp ovate-cordate with an inflated seed portion and with a conspicuous venation ..... 18. *Serjania meridionalis*

19. Stem with 8–10 peripheral vascular cylinders..... 20

19'. Stem with 1–8 peripheral vascular cylinders..... 21

20. Stem with peripheral cylinders of equal size as the central one; hypophyll with pilose domatia; cincinni pedunculate ..... 14. *Serjania fuscifolia*

20'. Stem with peripheral cylinders smaller than the central one; hypophyll without domatia; cincinni subsessile ..... 19. *Serjania multiflora*

21. Leaflets ovate-lanceolate; mericarp with a flattened seminiferous portion.....22
21'. Leaflets non-ovate-lanceolate; mericarp with an inflated seminiferous portion.....23
22. Stem with vascular cylinders arranged irregularly, when young, with a dense indumentum of short and curved hairs; stipules oblong, deciduous leaving a semi-lunate scar; squizocarp ovate..... .....17. *Serjania laruotteana*
22'. Stem with vascular cylinders arranged regularly, sparsely setulose and often with prickles; stipules triangular, persistent; squizocarp obovate.....16. *Serjania hatschbachii*
23. Stem with 3–5 peripheral vascular cylinders disposed in a triangular way around the central; terminal leaflet obovate- or ovate-rhomboidal; seminiferous portion of mericarps with conspicuous venation and without a dorsal crest.....15. *Serjania glabrata*
23'. Stem with 3–7(–8) peripheral vascular cylinders surrounding the central one; terminal leaflet ovate or oblong; seminiferous portion of mericarps smooth, venation inconspicuous and with narrow dorsal crest.....13. *Serjania caracasana*

1. ***Allophylus edulis*** (A.St.-Hil. *et al.*) Hieron. *ex* Niederl., Bol. Mens. Mus. Prod. Argent. 3, no. 29: 180 (1890). Figs. 2a-g; 3a-d

Trees up to 15 m high, bark scaly, reddish-brown; flowering branches grey-brown, smooth, with linear lenticels; leaves 3-foliolate, leaflets 15–105 × 9–37 mm, dentate-serrate from the base to the apex, glabrous, domatia pilose in the hypophyll, lateral leaflets symmetric to slightly asymmetrical, petiolulates, terminal leaflet narrow-elliptic to ovate-lanceolate, petiolule 0.05–0.5 cm long; thyrses simple, axillary; flowers 4-merous, zygomorphic, whitish; calyx glabrous; petaloid appendage bifid to bipartite; nectariferous disc annular, yellow-orange; schizocarps with 1–3 drupaceous cocci, bright red, glabrous.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Anfiteatro, 1.XI.2020, fr., *A.M. Panizza 243* (CTES, SI). BRAZIL. PARANÁ: Capanema, ParNa Iguaçu, Rio Floriano, 30.XI.1966, fr., *J.C. Lindeman & J.H. de Haas 3521* (RB). Foz do Iguaçu, ParNa Iguaçu, trilha do Poço Preto, 11.XI.2010, fr., *L.G. Temponi et al. 887* (UNOP).

Widely distributed across South America from Guyana, southern Bolivia, Brazil, Paraguay, Uruguay, to central Argentina, showing a wide but irregular distribution (Reitz 1980; Ferrucci 1998; Somner & Ferrucci 2009). Grows in the forest, coastal mountains and sandy ravines, sometimes ruderal (Ferrucci 1991; Coelho 2014). Species sciophyte and selective hygrophyte, in humid soils as well as rocky soils of more open forests, also in clearings and riparian forests (Reitz 1980). Found in three of the five areas here evaluated, including an old specimen in the intangible region of ParNa Iguaçu. Flowering in July and August and fruiting in October and November in both parks.

The vernacular names for this species are "chal-chal"; "cocú"; "coloradillo"; "conhú"; "grão-de-galo"; "picazú-rembiú" (wild pigeon food); "pau-pombo"; "três-folhas-do-mato"; "vacum"; "yoyra-hove-y" (Ferrucci 1998; Guarim Neto *et al.* 2000; Coelho 2014).

2. ***Allophylus guaraniticus*** (A. St.-Hil.) Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 20: 312 (1890). Figs. 2h-k; 3e-h

Trees up to 5(–6) m high; flowering branches reddish-brown, scaly, non-lenticellate; leaves 3-foliolate, leaflets 15–90 × 10–29 mm, dentate-serrate in the apical half or sub-entire, pubescent, domatia pilose in the hypophyll, lateral leaflets (sub) sessile and asymmetrical, terminal leaflet ovate or obovate-rhomboidal, petiolule 0.2–0.5 cm long; thyrses simple, axillary, flowers 4-merous, zygomorphic, whitish; calyx hispidulous; petaloid appendage 2 inflexed, tongue-shaped; 4 nectariferous lobes; schizocarps with 1–3 drupaceous cocci, orange to bright red, puberulous.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, cruce con Ruta 12, 5.II.2020, fl., *A.M. Panizza 172* (CTES, SI). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, cachoeira do Rio Azul, 19.II.2020, fl., *A.M. Panizza et al. 195* (EVB). Foz do Iguaçu, trilha Poço Preto, 18.V.2019, fr., *A.M. Panizza et al. 106, 111* (EVB). Matelândia, ParNa Iguaçu, entrada de Matelândia a Serranópolis do Iguaçu, 21.II.2020, fl., *A.M. Panizza et al. 221* (EVB).

Southern Brazil, western Paraguay, Uruguay, northeastern Argentina, with an irregular and discontinuous distribution (Reitz 1980; Ferrucci 1998; Coelho 2014). In secondary forests, flooded areas, forest edges, riparian forest, areas affected by pasture and clearings with *Araucaria* (Coelho 2014). Species sciophyte and selective hygrophyte,

very common in MOF forests, in little-moved and humid soils (Reitz 1980). Found in four of the five areas evaluated in this study. Flowering in February–April and fruiting in February–August in both parks, coinciding with Ferrucci (1991), even though the fruit-setting period can last a little longer. However, according to Reitz (1980) and Coelho (2014), both periods can last longer.

Allophylus guaraniticus is recognized by the petaloid appendage 2 inflexed, tongue-shaped, 4 nectariferous lobes, and blooming in March, whereas *A. edulis* shows a petaloid appendage bifid to bipartite, nectariferous disc annular, and blooming from August to September.

The vernacular names for this species are "chal-chal"; "cocurá"; "guamerim"; "koku'i" (cocú

Figure 2 – a-g. *Allophylus edulis* – a. bark; b. branch with leaves; c. detail of pilose domatia in hypophyll; d. flowering branch; e. staminate flower; f. staminate flower, devoid of petals, showing the nectariferous disc; g. branches with mature fruits. h-k. *Allophylus guaraniticus* – h. branch with leaves; i. detail of epyphyll and hypophyll of the leaves and inmature fruit; j. detail of pilose domatia in hypophyll; k. mature fruits. (Photos: a-k. A.M. Panizza).

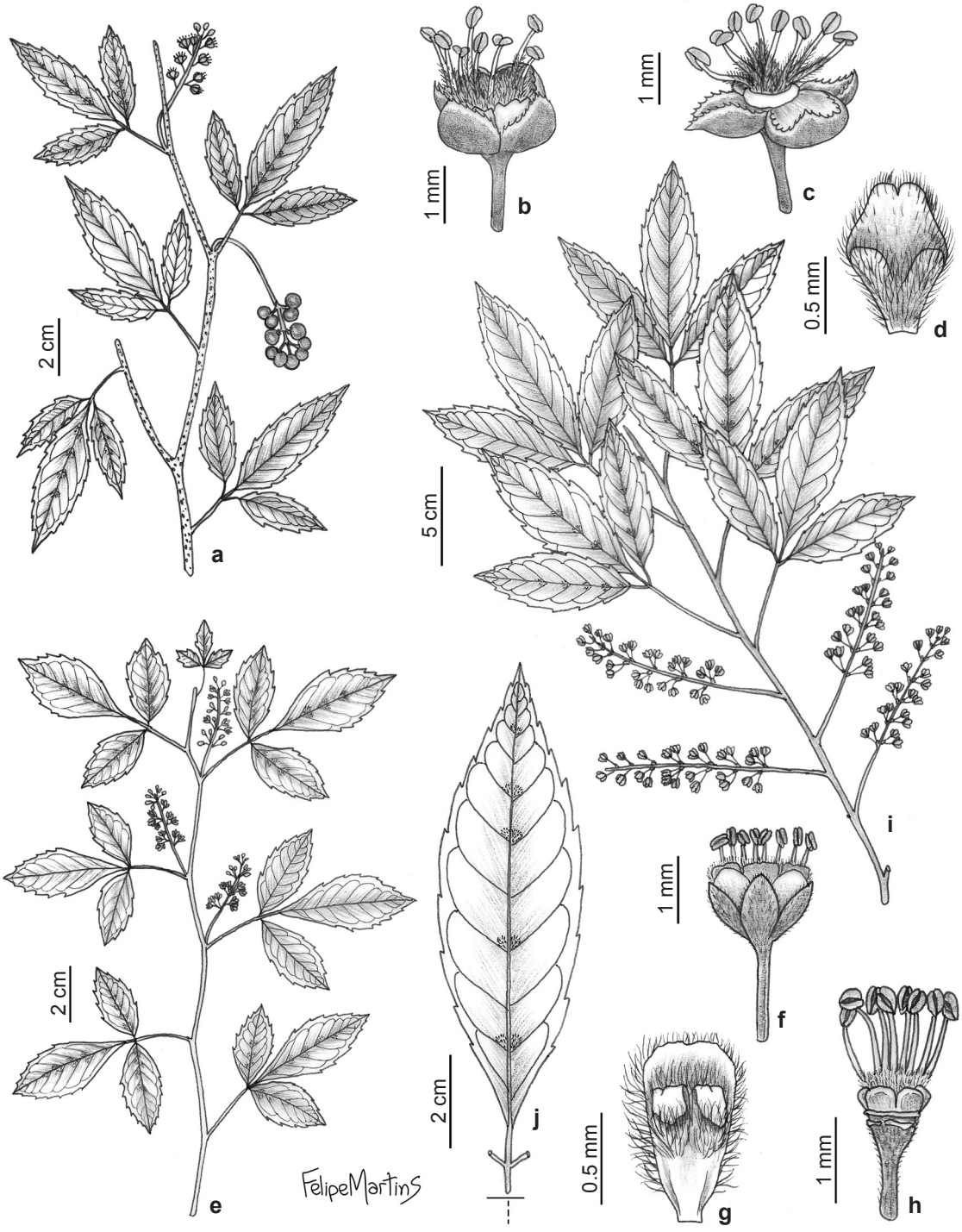

Figure 3 – a-d. *Allophylus edulis* – a. branches with inflorescence and fruits; b. staminate flower; c. staminate flower, devoid of petals, showing the nectariferous disc; d. petal with basal appendage. e-h. *Allophylus guaraniticus* – e. flowering branch; f. staminate flower; g. petal with basal appendage; h. staminate flower, devoid of sepals and petals, showing the 4 nectariferous lobes. i-j. *Allophylus petiolulatus* – i. flowering branch; j. detail of the petiolule of the terminal leaflet and pilose domatia in the hypophyll. (a-d. *Panizza 243*; e-h. *Panizza 195*; i-j. *Temponi 595*).

small); "tapité"; "vacum-mirim"; "uacoi-mini" (Reitz 1980; Ferrucci 1991, 1998; Coelho 2014).

3. *Allophylus petiolulatus* Radlk., Abh. Königl. Ges. Wiss. Göttingen 16: 181 (1886). Fig. 3i-j

Trees up to 10 m high, flowering branches greyish to greyish-brown, lenticels yellowish, punctiform or linear; leaves 3-foliolate, leaflets 67–165 × 22 – 55 mm, subentire or dentate-serrate the apical half, glabrous, domatia pilose in the hypophyll or absent, terminal leaflet elliptic-lanceolate, petiolule 2–2.8 cm long; thyrses simple, axillary or terminal, sometimes branched at the base; flowers 4-merous, zygomorphic, white; calyx glabrous or puberulous; petaloid appendage 2 inflexed, tongue-shaped; 4 nectariferous lobes; schizocarps with 1–2 drupaceous cocci, red, puberulous.

Specimens examined: Céu Azul, ParNa Iguaçu, trilha Jacutinga, 10.X.2009, fl., *L.G. Temponi et al. 595* (MBM, UNOP).

It is distributed in Bolivia and Brazil, and was recorded for clearings, inside and forest edges, and riparian forests (Coelho 2014; Ferrucci *et al.* 2014). Species sciophyte and selective hygrophyte, more frequent to the north of Santa Catarina, becoming rare to the south (Reitz 1980). Present in a single area. Flowering in October; according to Coelho (2014), the species blooms from January to August, November and December, and bears fruit from February to April and from June to December.

This species differs from *A. edulis* by the petaloid appendage 2 inflexed, tongue-shaped and 4 nectariferous lobes.

The vernacular names for this species are "baga-de-morcego"; "fruta-de-paraó"; "fruta-de-pombo"; "guairana"; "três-folhas-do-mato"; "timbó-mirim"; "trevo-da-serra"; "vacum" (Coelho 2014).

4. *Cardiospermum corindum* L., Sp. Pl., ed. 2. 1: 526 (1762). Fig. 4a

Semi-woody climbers, stems herbaceous when young, 5–6 ribbed, later woody and cylindrical, glabrescent or puberulous, cross section a single vascular cylinder; stipules triangular-subulate, persistent; leaves biternate, leaflets ovate or narrow-ovate, pinnatifid to pinnatisect, glabrous to puberulous, dentate-serrate, terminal leaflets with conspicuous, marginate petiolutes, up to 18 mm long, shorter in the others; thyrses axillary, a single whorl of 3–4 cincinni, pedicels 3.5–5.5 mm long; flowers 4-merous, zygomorphic, white; 4 short nectariferous lobes; capsules septifragal, broad-obovate, membranaceous, narrowly winged, apiculate or emarginate apex, yellowish-greenish with dark brown venation, purplish when immature; seeds subspherical, bony integument, dark brown; aril emarginate, dry.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, cruce ingreso a Cataratas, 21.II.1996, fl., *J. Herrera & K. Schiaffino 149* (CTES).

Cardiospermum corindum has a cosmopolitan distribution, in the Americas from the south of the United States to central Argentina, growing in different environments (Ferrucci 1998; Ferrucci & Urdampilleta 2011; Coulleri & Ferrucci 2012; Coulleri *et al.* 2020). Found in a single area to the south of the five areas evaluated in this study. Flowering in February–September. However, according to Ferrucci (1998), the species blooms and bears fruits during all the year.

5. *Cardiospermum grandiflorum* Sw., Prodr. 64. (1788). Fig. 4b

Semi-woody climbers, stems when young herbaceus, 5–6 ribbed, obtusely angled, deeply furrowed, sometimes fistulous, later cylindrical, pubescent, cross section a single vascular cylinder; stipules triangular, persistent; leaves biternate, leaflets ovate, pinnatifid to pinnatisect, densely pubescent, dentate-serrate; thyrses racemiform, axillary, cincinni separated by conspicuous internode, pedicels 6–6.5 mm long; flowers 4-merous, zygomorphic, white, 2 corniculiform nectariferous lobes; capsules septifragal, apterous, ellipsoid or ovoid, papyraceous, yellowish-brown; seeds subspherical, bony, bluish-black; aril of triangular outline.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, límite sur del parque, Aº sin nombre, 5.X.1949, *Perrone* (BA 54462). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, trilha Jacutinga, 6.IX.2011, fr., *L. Boff et al. 2* (UNOP). ParNa Iguaçu, Matelândia, ParNa Iguaçu, trilha do Benjamim, 26.V.1949, fl., *A.P. Duarte & E. Pereira 1908* (RB, CTES); estrada de chão Céu Azul-Serranópolis do Iguaçu, 21.VIII.2015, fl. and fr., *M.G. Caxambu et al. 6810* (HCF, UEC).

This species has a cosmopolitan distribution, native to the Americas but introduced in the Old World (Africa, Australia, Asia); in the Americas extends from southern Mexico to central Argentina. Common in the secondary vegetation such as clearings and roadsides and

in riparian forests and forest edges, rare inside primary forests (Reitz 1980; Ferrucci 1998; Sommer & Ferrucci 2009; Coulleri & Ferrucci 2012; Coulleri *et al.* 2020). Species sciophyte and selective hygrophyte, infrequent; with a wide but discontinuous distribution (Reitz 1980). Located in three of the five areas evaluated in this study. Flowering in May–August and fruiting in July–August, simultaneously coinciding according to Reitz (1980).

The vernacular names for this species are "balãozinho"; "chumbinho"; "cipó-timbó-miúdo"; "ensacadinha"; "erva-de-vaqueiro"; "kamambu guasu" (guasu = large); "ysypo kamambu" (kama = breast, and mbu = tip or nipple) (Reitz 1980; Ferrucci 1991).

Figure 4 – a. *Cardiospermum corindum* – herbarium specimen. b. *Cardiospermum grandiflorum* – herbarium specimen. c. *Cardiospermum halicacabum* var. *microcarpum* – herbarium specimen. (a. *Herrera & Schiaffino 149*; b. *Boff et al. 2*; c. *Caxambu et al. 7244*).

6. *Cardiospermum halicacabum* L. var. ***microcarpum*** (Kunth) Blume, Rumphia 3: 185 (1849). Fig. 4c

Annual vines 1–2 m high; stems herbaceous, 5–6 ribbed, cylindrical, woody at the base, puberulous to pubescent, sometimes reddish, cross section a single vascular cylinder; stipules triangular-subulate, persistent; leaves biternate, leaflets ovate or oblong, pinnatipartite, pinnatisect, or entire terminal leaflet, glabrous to puberulous, incised-dentate, petiolules apterous or less than 12 mm long; flowers 4-merous, zygomorphic, white, 2–3 mm long; 4 short nectariferous lobes; capsules septifragal, turbinate-trigonous, with 3 narrow wings, membranaceous, subtruncate, reddish-brown; seeds spherical, integument bony, bluish-black; aril cordate, dry.

Specimens examined: Céu Azul, ParNa Iguaçu, Cercanias da BR-277, 12.II.2016, fl., *M.G. Caxambu et al. 7244* (HCF).

Additional specimen examined: BRAZIL. PARANÁ: Foz do Iguaçu, rod. BR-277, km 2, 11.V.1979, fr, *E. Buttura 51* (EVB).

This variety has a cosmopolitan distribution, in the Americas is found from the south of the United States to central Chile and Argentina; in forest edges, fields, riparian forest and marshes, in addition to secondary vegetation areas such as clearings, anthropic environments, and crop invaders; frequent in sandy soils (Reitz 1980; Ferrucci 1998; Sommer & Ferrucci 2009; Coulleri & Ferrucci 2012; Coulleri *et al.* 2020). Species sciophyte and selective hygrophyte, very rare; with a wide but discontinuous distribution (Reitz 1980). Found in a single area to the north of the five areas evaluated in this study. Flowering in February, although Ferrucci (1998) stated that the species blooms in December–April and bears fruits from December to May (September).

The vernacular names for this species are "amor en bolsa"; "balãozinho"; "batuquinha"; "coração-da-índia"; "globitos"; "kamuvu" (inflated breast); "michi ra'yi" (cat testicle); "poapyi'a" (poapy = wrist, a = fruit or seed, used in bracelets); "qof lei" (Reitz 1980; Ferrucci 1991).

7. *Cupania vernalis* Cambess., Fl. Bras. Merid. (quarto ed.) 1(10): 387 (1828). Fig. 5a-i

Trees up to 25 m high, bark subtly fissured, grayish-brown, with a yellow-ochraceous indumentum in younger branches, terminal branches ridged, ochraceous-yellow to reddish-brown; leaves paripinnate with 8–12 leaflets sub-opposite to alternate, dentate-serrate, domatia pilose and/or pocket-shaped in the pubescent hypophyll, petiole canaliculate, rachis bicanaliculate; flowers actinomorphic, pentamerous, white; calyx dialysepalous; petaloid appendage bipartite; annular nectariferous disc, 5-lobate, gold-yellow; capsules loculicidal, turbinate-obovate, coriaceous, warty, reddish brown to dark brown; bright black seeds; aril fleshy, orange.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Pto. Canoas, 31.III.1995, fl., *R.O. Vanni et al. 3358* (CTES). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, trilha Educação Ambiental, 26.VI.2016, fl., *L.H.S.M. Conceição et al. 111* (UNOP). Foz do Iguaçu, ParNa Iguaçu, entrada principal via ponte Rio São João, 27.V.2017, fl., *L.C.P. Lima et al. 944* (EVB).

This species occurs in southern Bolivia, eastern Paraguay, southern Brazil, northern Argentina and Uruguay, growing inside primary forests and in various stages of secondary forests, forest edges, riparian forests, cerrado, and clearings (Reitz 1980; Ferrucci 1998; Sommer & Ferrucci 2009). Preferably heliophyte to mesophyte (light), selective hygrophyte or mesophyte (soil), including rocky soils, frequent (Reitz 1980). Found in three of the five areas evaluated in this study. Flowering in March–June and fruiting in October; according to Reitz (1980), the blooming and fruit setting periods last longer in southern Brazil.

The vernacular names for this species are "aguay colorado"; "arco-de-peneira"; "camboatá colorado" (hard-leaf weed); "camboatá-de-folha-grande"; "cragoatã"; "guarantã"; "rabo-de-bugio"; "ramo colorado"; "yaguá-ratay-pyta" (red dog blight); "ybirá-corpus" (Ferrucci 1991, 1998, 2004; Guarim Neto *et al.* 2000; Sommer & Ferrucci 2009).

8. *Diatenopteryx sorbifolia* Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 285 (1878). Fig. 6a-g

Trees up to 30 m high, trunk fluted, bark scaly, irregular, brown; leaves imparipinnate or paripinnate with 8–12 opposite, sub-opposite, or alternate leaflets, basal leaflets smaller than the apical ones, dentate-serrate, pubescent only in the midrib of the glabrous hypophyll, petiole and rachis canaliculate; flowers zygomorphic, 4–5-merous, white; calyx dialysepalous; petaloid appendage entire; nectariferous disc unilateral; schizocarps with two-samaroid mericarps.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Camping Ñandú hacia el Hidrómetro, 20.XI.2020, fr., *A.M. Panizza & P. Poszkus 258* (CTES, SI). BRAZIL. PARANÁ: Foz

do Iguaçu, ParNa Iguaçu, trilha da represa São João, 12.X.2009, fl. and fr., *Temponi et al. 700* (UNOP).

It is distributed in southern Bolivia, eastern Paraguay, southern Brazil, and northern Argentina, in tall and riparian forests (Ferrucci 1991; Sommer & Ferrucci 2009). Heliophyte and selective hygrophyte, frequent, abundant but irregular in some zones, pioneer species with a more intense aggressive character, going into *Araucari*a forests (Reitz 1980). Found in two of the five areas

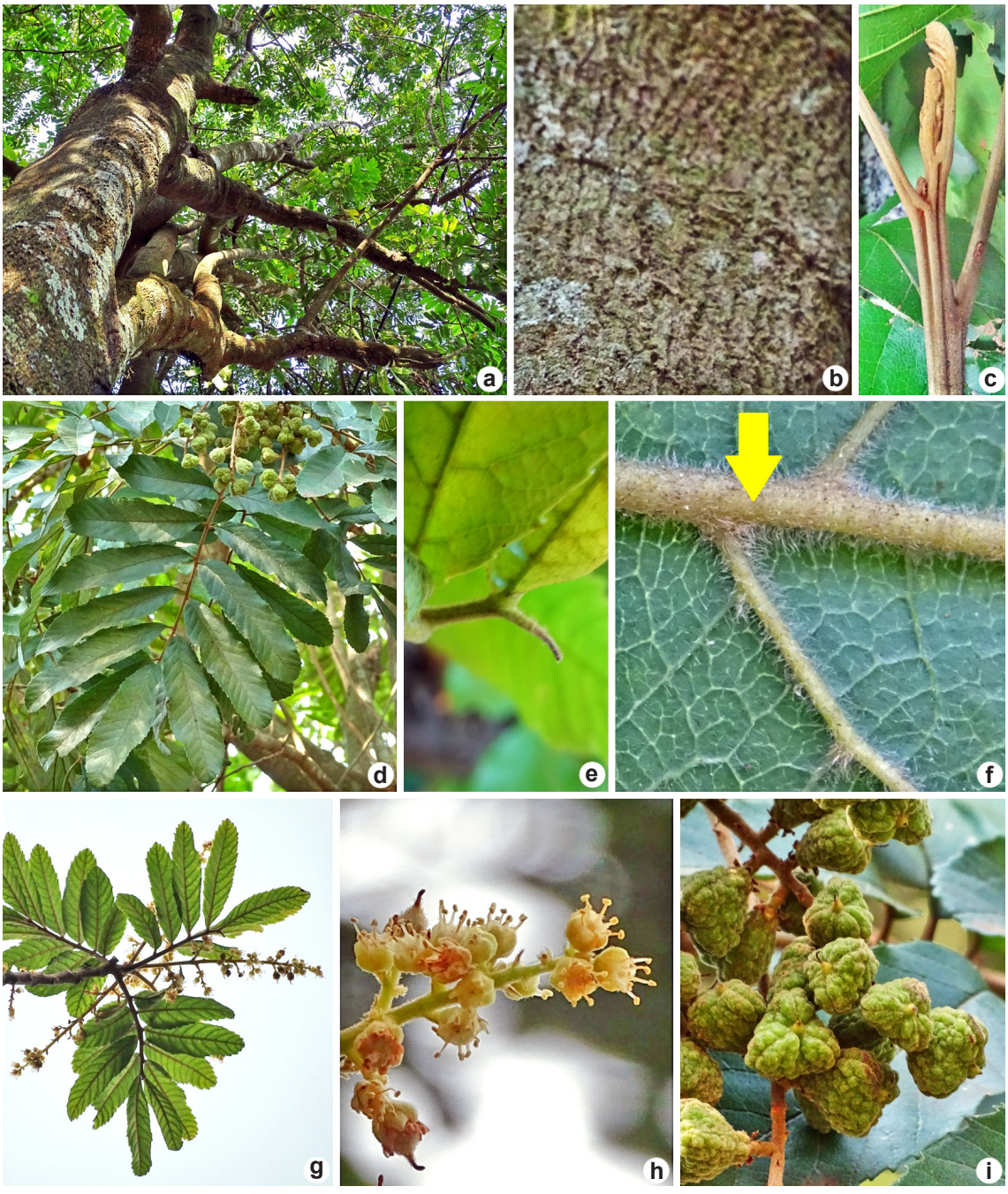

Figure 5 – a-i. *Cupania vernalis* – a. habit; b. bark; c. terminal branch ridged; d. leaf; e. apical vestigial leaflet; f. detail of pilose domatia in hypophyll; g. flowering branch; h. detail of inflorescense; i. inmature fruits. (Photos: a-e. A.M. Panizza).

evaluated in this study. Flowering in September and October and fruiting in October–December.

9. *Matayba elaeagnoides* Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 9: 635 (1879). Fig. 7a-h

Trees up to 25 m high, bark fissured, greyish; leaves paripinnate with 6–12 leaflets alternate to sub-opposite, entire, glabrous, prominent veins in the epiphyll, domatia urceolate in the hypophyll, rachis bicanaliculate; flowers actinomorphic, 5-merous, white; calyx 5-lobate, with early opening; capsules loculicidal, turbinate-obovoid, coriaceous, pinkish-green to pinkish, stipitate, apiculate; seeds dark brown; aril pinkish-white.
Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Anfiteatro, 1.XI.2020, fr., *A.M. Panizza 242* (CTES, SI). BRAZIL.

Figure 6 – a-g. *Diatenopteryx sorbifolia* – a. habit; b. trunk; c. bark; d. leaves; e. detail of the inflorescence; f. fruiting branch; g. fruits. (Photos: a-g. A.M. Panizza).

PARANÁ: Capanema, ParNa Iguaçu, bank of Rio Iguaçu, near ferry in road to Capanema, 8.XII.1966, fr., *J.C. Lindeman & J.H.de Haas 3501* (RB). Matelândia, ParNa Iguaçu, entrada de Matelândia a Serranópolis do Iguaçu, 21.II.2020, fr., *A.M. Panizza et al. 215* (EVB). Foz do Iguaçu, ParNa Iguaçu, próx. à antiga Fazenda Salinet, 11.X.2010, estéril, *A.P. Cardozo et al. 23* (UNOP). Santa Tereza do Oeste, ParNa Iguaçu, Limite Leste PN Iguaçu, APP Rio Gonçalves Dias, 9.IX.2015, fl., *A.R. Escher et al. 52* (UNOP).

It occurs in the Central-West, Southeast, and Southern regions of Brazil, eastern Paraguay, Uruguay, and northern Argentina; present in the cerrado and in riparian forests (Sommer & Ferrucci 2009; Coelho *et al.* 2017). Species mesophyte and selective, with an irregular and discontinuous

Figure 7 – a-h. *Matayba elaeagnoides* – a. habit; b. bark; c. apical vestigial leaflet; d. detail of urceolate domatia in hypophyll; e. flowering branch; f. detail of the inflorescence; g. fruiting branch; h. mature fruits with arilated seeds. (Photos: a-h. A.M. Panizza).

distribution, very frequent in MOF with humid and compact soils (Reitz 1980). Present in the five areas here evaluated. Flowering in September–November and, fruiting in October–December and in February.

The vernacular names for this species are "camboatá blanco"; "cragoatam-branco"; "mbata-yva" (magician's blight); "miguel-pintado"; "papagaeiro"; "pau-de-espeto"; "peito-de-pombo" (Ferrucci 1991, 1998; Guarim Neto *et al.* 2000; Sommer & Ferrucci 2009).

10. *Paullinia elegans* Cambess., Fl. Bras. Merid. (quarto ed.) 1(10): 370 (1828). Fig. 8a-g

Lianas, stems angular, 5–6 ribbed, with a central vascular cylinder and 3(–4–5) peripheral smaller ones; stipules scarious, subulate, symmetrical; leaves imparipinnate, 5-foliolate (basal leaves 3-foliolate), glabrous, domatia pilose in the hypophyll, petiole and rachis apterous; thyrses racemiform, axillary, longer than the leaves; flowers zygomorphic, white; capsules septifragal, apterous, apiculate, smooth, red, sub-fleshy; seeds 1–3, black with a white, fleshy sarcotesta.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Sendero Superior, 5.II.2020, fr., *A.M. Panizza 160* (CTES, SI). BRAZIL. PARANÁ: Capanema, ParNa Iguaçu, Rio Iguacú, 3.IV.2019, fr., *C.R. Rauber et al. 368* (UNOP). Céu Azul, ParNa Iguaçu, Rio Floriano, 19.III.2004, fl., *O.S. Ribas et al. 6098* (CTES, MBM). Foz do Iguaçu, ParNa Iguaçu, trilha Poço Preto, 8.XII.2016, fl., *L.C.P. Lima et al. 834* (CTES, EVB). Serranópolis do Iguaçu, ParNa Iguaçu, Rio Iguaçu, 29.X.2015, fl., *M.G. Caxambu et al. 7067* (HCF, UEC).

This species is widely distributed. It occurs in Colombia, Bolivia, Brazil, Paraguay, Uruguay, and northeastern Argentina (Sommer & Ferrucci 2009). Species possibly heliophyte or of diffuse light and selective hygrophyte, infrequent, in riparian forests, forest edges, clearings, and secondary vegetation areas, also occurring inside primary forests as a sciophyte, preferring sandy or clayey soils (Reitz 1980; Ferrucci 1991). Found in the five areas evaluated in this study. Flowering in October–July and fruiting in February–August.

The vernacular names for this species are "caí-escalera-rá" (monkey ladder); "cipó-timbó"; "îsîpó hú"; "isipó-morotí" (white liana); "ojo de muñeca"; "olho-de-cabra"; "olho-de-yacú"; "ysypo paje" (liana magic) (Ferrucci 1998; Guarim Neto *et al.* 2000; Sommer & Ferrucci 2009).

11. *Paullinia meliifolia* Juss., Ann. Mus. Natl. Hist. Nat. 4: 347 (1804). Fig. 8h-l

Lianas, stems cylindrical, 5(–6) ribbed, with a single vascular cylinder; stipules foliaceous, cuneiform, asymmetrical; leaves imparipinnate, 3–4 pinnate, 7–9-foliolate, a basal pair of leaflets with 3(–5) pinnules, glabrous, domatia pilose (rarely pocket-shaped) in the hypophyll, rachis alate or marginate; thyrses racemiform, axillary, shorter than the leaves; flowers zygomorphic, white; capsules septifragal, 3-alate, apiculate, smooth, sub-fleshy; seeds 1, black with a white, fleshy sarcotesta.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, cruce con Ruta 101, 21.III.2017, fr., *M.S. Ferrucci et al. 3483* (CTES). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, trilha Jacutinga, 6.IX.2011, fl., *L. Boff et al. 6* (UNOP). Foz do Iguaçu, ParNa Iguaçu, Sendero Macuco, 18.VI.2019, fr., *A.M. Panizza et al. 101* (EVB).

It occurs in Brazil, eastern Paraguay, and northeastern Argentina, mainly in dense primary forests, in clearings and forest edges; preferably sciophyte and selective hygrophyte (Reitz 1980; Ferrucci 1998). Found in three of the five areas here evaluated. Flowering in May and in August–November, fruiting almost all year round, from October to July, although with not records from April to May.

The vernacular names for this species are "cipó-timbó"; "cipó-timboeira"; "timbó-peba"; "timbó-de-folha-grande"; "timbó-vermelho"; "tingui"; "ysypo piriri" (striated liana) (Reitz 1980; Ferrucci 1991; Sommer & Ferrucci 2009).

12. *Serjania altissima* (Poepp.) Radlk., Consp. Sect. Sp. Serjan. 5 (1874). Fig. 9a-g

Lianas, glutinous, indument of three trichome types: simple, whitish, glandular, brown-ferruginous and setose; stems 5–6 ribbed, reddish-brown, cross section with a single vascular cylinder; stipules subulate, persistent; leave biternate, leaflets oblong or elliptical, the terminal one obovate or ovate, dentate-serrate or subentire, discolored, epiphyll puberulous to pubescent, hypophyll pubescent; thyrses racemiform; flowers zygomorphic, white; petaloid appendage with an emarginate crest on the posterior petals; 4 nectariferous lobes, unilateral; schizocarps with 3 samaroid mericarps, wings vertical downward; mericarps sub-rectangular, chartaceous, pubescent, seminiferous portion flattened, venation inconspicuous, with setose hairs and a dorsal crest.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Sendero Superior, 5.II.2020, fl. and fr., *A.M. Panizza 168* (CTES, SI).

This species is found in eastern Paraguay, Brazil, and northeastern Argentina, where it only reaches the ParNa Iguazú, being present in the marginal forest of the Iguazú River; grows in forest edges, hillsides, between rocks, and closed fields (Ferrucci 1991; Sommer & Ferrucci 2009; Ferrucci & Coulleri 2022). Found in a single area to the south of the five evaluated in this study. Flowering in December–March and in August, fruiting in February–July.

The vernacular names for this species are "timbó-branco"; "ysypo takuãi" (takuãi = enis, virile member) (Ferrucci 1991; Guarim Neto *et al.* 2000).

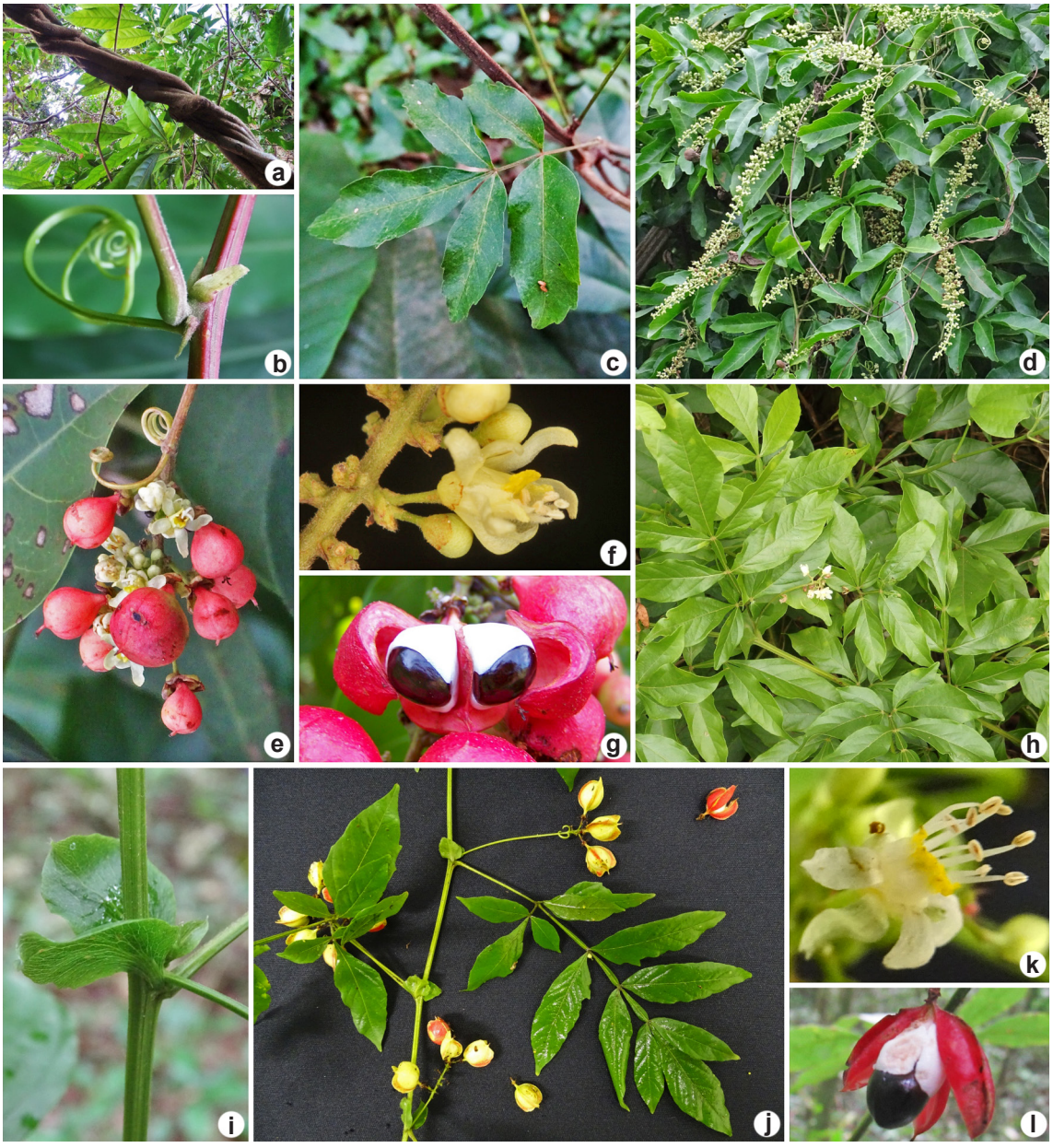

Figure 8 – a-g. *Paullinia elegans* – a. stem; b. stipules and tendrils; c. leaf; d. flowering branches; e. flowers buds, open flowers, inmature and mature fruits; f. staminate flower; g. mature fruit with arilated seeds. h-l. *Paullinia meliifolia* – h. flowering branch; i. stipules; j. fruiting branch; k. staminate flower; l. mature fruit with arilate seed. (Photos: a-d, h-i. A.M. Panizza; f. C.A. Zanotti; g. F. Gatti).

13. *Serjania caracasana* (Jacq.) Willd., Sp. Pl. 2(1): 465 (1799). Fig. 10a-b

Lianas, stems subcylindrical, glabrous, cross section with 1 central vascular cylinder and 3–7(–8) smaller peripheral ones; stipules triangular, short, persistent; leaves biternate or 5-foliolate, rarely 3-foliolate, lateral leaflets oblong or ovate, sometimes smaller than the terminal one, terminal leaflet ovate or oblong, dentate-serrate, glabrous, pilose domatia in the hypophyll; thyrses racemiform; flowers zygomorphic, white, 4 nectariferous lobes, unilateral; schizocarps with 3 samaroid mericarps, wings vertical downward; mericarps ovate-cordate, chartaceous, glabrous, seminiferous portion inflated, dark brown, smooth, venation inconspicuous and with narrow dorsal crest.

Figure 9 – a-g. *Serjania altissima* – a. habit; b. detail of stem; c. leaf; d. detail of epiphyll and hypophyll of leaflets; e. detail of the tendrils at the base of the rachis of the inflorescence; f. flowering branch with some immature fruits; g. staminate flower. (Photos: a-g. A.M. Panizza).

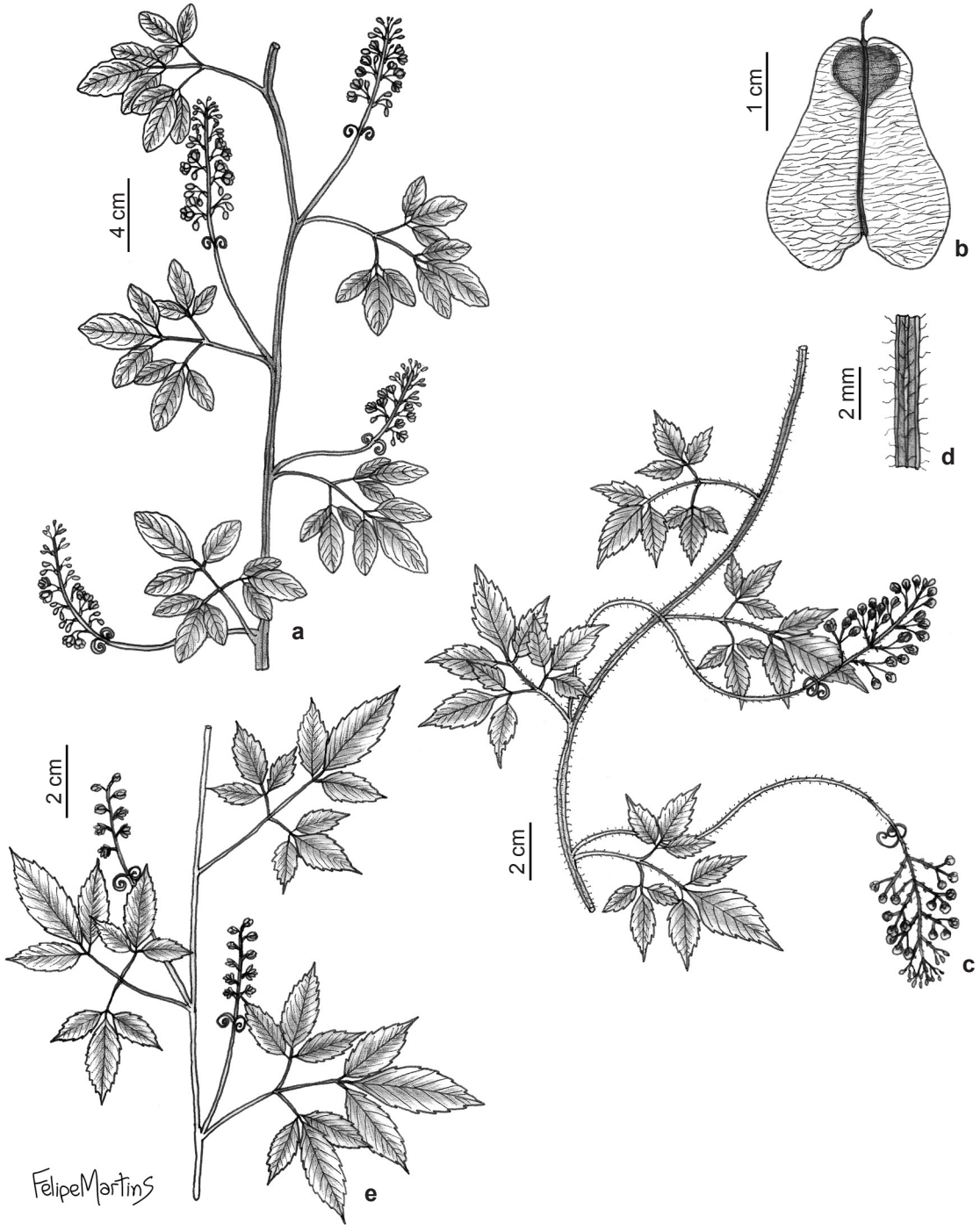

Figure 10 – a-b. *Serjania caracasana* – a. flowering branch; b. detail of the fruit. c-d. *Serjania hatschbachii* – c. flowering branch; d. detail of stem. e. *Serjania multiflora* – flowering branch. (a. *Caxambu et al. 6589*; b. *Buttura 137*; c-d. *Caxambu et al. 7055*; e. *Galeão 89*).

Specimen examined: Céu Azul, ParNa Iguaçu, cercanias da BR-277, 19.VI.2015, fl., *M.G. Caxambu et al. 6589* (EVB, HCF, UEC).

This species is widely distributed throughout the Neotropical region, it extends from Mexico to northern Argentina and grows in forest edges, wooded hillsides, xerophytic open forests, and riparian forests, especially on the banks of the Paraná River (Ferrucci 1991, 1998; Sommer & Ferrucci 2009). Present in a single area of the five here evaluated. Only one record of flowering in June, coinciding with Ferrucci (1998), who stated that the species blooms from June to October (December), and fruiting in October–December.

According to Ferrucci (1991), there are pubescent specimens in xerophytic environments and glabrous specimens widely distributed in moister environments, as is the case of the specimens gathered in the study area.

The vernacular names for this species are "cipó-leiteiro"; "isipó-y"; "isipó de agua"; "karakara sã" (karakara = bird of prey, and sã = rope); "tingui-da-mata" (Ferrucci 1991, 1998; Guarim Neto *et al*. 2000; Sommer & Ferrucci 2009).

14. ***Serjania fuscifolia*** Radlk., Consp. Sect. Sp. Serjan. 10 (1874). Fig. 11a-h

Lianas, with a dense indument, whitish to ferruginous, stems cylindrical, 8–10-ribbed, cross section with 8–10 peripheral cylinders of equal size as the central one; stipules triangular, persistent; leaves biternate, leaflets ovate or elliptical, the terminal one ovate-rhomboid, dentate-serrate, pubescent, discolored with a ferruginous pubescence in the hypophyll, pilose domatia in the hypophyll; thyrses racemiform with cincinni pedunculate; flowers zygomorphic, white; 4 nectariferous lobes, unilateral; schizocarps with 3 samaroid mericarps, wings vertical downward; mericarps ovate-cordate, chartaceous, pubescent, seminiferous portion inflated.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Ruta 101, Ao. Sto. Domingo, 22.VI.1995, fl., *J. Herrera 55* (CTES). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, borda do parque, 26.VI.2019, fl. and fr., *L.H.S.M. Conceição et al. 112* (UNOP). Foz do Iguaçu,. ParNa Iguaçu, 1.VII.2017, fl., *L.C.P. Lima et al. 963* (CTES, EVB).

This species occurs in Brazil, Paraguay, and northeastern Argentina, present in forest edges and frequent in degraded forests (Ferrucci 1998; Sommer & Ferrucci 2009). Found in three of the five areas evaluated in this study. Flowering in May–July, coincides with Ferrucci (1998) and fruiting in June–August.

The vernacular names for this species are "cipó-timbó"; "pira jukaha" (pira = fish, and jukaha = that kills) (Ferrucci 1991; Sommer & Ferrucci 2009).

15. ***Serjania glabrata*** Kunth, Nov. Gen. Sp. (quarto ed.) 5: 110 (1821). Fig. 12a-g

Lianas, stems trigonous, glabrous to puberulous, 8-ribbed, cross section with 1 central vascular cylinder and 3–5 peripheral ones, if more than 3, they are arranged in pairs; stipules triangular, short, persistent; leaves biternate, terminal leaflet obovate- or ovate-rhomboidal, lateral leaflets ovate to elliptical, dentate-serrate, glabrous, pilose domatia in the hypophyll; thyrses racemiform; flowers zygomorphic, white; 4 nectariferous lobes, unilateral; schizocarps with 3 samaroid mericarps, wings vertical downward; mericarps ovate-cordate, chartaceous, glabrous, seminiferous portion inflated, dark brown, venation conspicuous, warty, with a constriction below the locule, wings lighter in color.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, camino a Garganta del Diablo, 19.III.2017, fl., *M.S. Ferrucci et al. 3386* (CTES). BRAZIL. PARANÁ: Foz do Iguaçu, ParNa Iguaçu, sobre ciclovía, 13.VII.2019, fr., *A.M. Panizza et al. 116* (EVB).

It occurs in Ecuador, Peru, Bolivia, Brazil, Paraguay, and Argentina, with a wide but discontinuous distribution, lives preferably in secondary vegetation areas such as clearings, forest edges, and anthropized environments, very rare in primary forests; heliophyte and selective hygrophyte to mesophyte (Reitz 1980; Ferrucci 1998; Sommer & Ferrucci 2009). Found in two of the five areas evaluated in this study. Flowering in February–March and fruiting in February, April, July, and August.

Similar to *Serjania meridionalis* due to the ribbed stem and glabrous leaves, but different by its compound stem and warty seminiferous portion with a conspicuous venation.

The vernacular name for this species is "ysypo timbo perõ" (ysypo = liana, timbo = beard, and perõ = peeled) (Ferrucci 1991).

16. ***Serjania hatschbachii*** Ferrucci, Bonplandia 5(26): 243 (1983). Fig. 10c-d

Semi-woody climbers, stems 6-ribbed, setose, sometimes with short spiny projections, cross section with a larger central vascular cylinderand (4–)6 smaller peripheral ones; stipules triangular,

persistent; leaves biternate, leaflets ovate-lanceolate, dentate-serrate, glabrous; thyrses racemiform; flowers zygomorphic, white; 4 nectariferous lobes, unilateral; schizocarps obovate with 3 samaroid mericarps, wings vertical downward; mericarps glabrous, chartaceous, seminiferous portion flattened, with a dorsal crest.

Specimens examined: Serranópolis do Iguaçu, ParNa Iguaçu, Rio Iguaçu, 29.X.2015, fl., *M.G. Caxambu et al. 7055* (EVB, HCF, HUEM).

This species is endemic to southeastern Brazil, restricted to the state of Paraná and its limit with São Paulo (Acevedo-Rodríguez 1993). Found in a single area of the five evaluated in this study and is a new record for western Paraná. A single blooming sample during October in the ParNa Iguaçu;

Figure 11 – a-h. *Serjania fuscifolia* – a. habit; b. woody stem; c. stem with stipule; d. leaf; e. detail of hypophyll of the terminal leaflet; f. flowering branches; g. detail of the inflorescence; h. infructescences with inmature fruits. (Photos: a-h. A.M. Panizza).

flowers and fruits in January and April according to Acevedo-Rodríguez (1993).

The specimen examined was previously identified as *S. communis,* but this species differs by having a compound stem with a central cylinder and three equidistant, smaller peripheral cylinders, and with a lax, pendulate thyrse.

17. *Serjania laruotteana* Cambess., Fl. Bras. Merid. (quarto ed.) 1(10): 368 (1828). Fig. 13a-g

Lianas; with milky white exudate, indumentum of short and curved hairs; stem pubescent when young, later glabrous, upper branches trigonous, with 8 puberulous ribs, and lower branches cylindrical, with 8 inconspicuous,

Figure 12 – a-g. *Serjania glabrata* – a. habit; b. woody stem; c. portion of stem showing closed leaf tendrils; d. leaf; e. detail of the terminal leaflet; f. detail of the inflorescence with staminate flowers; g. detail of infructescence with mature fruits. (Photos: a-g. A.M. Panizza).

pubescent ribs, cross section with 1 central vascular cylinderand 4–7(–8) smaller peripheral ones of irregular sizes, later in mature stems the peripheral vascular cylinders surround the central one; stipules oblong, deciduous leaving a semi-lunate scar; leaves biternate, leaflets ovate-lanceolate, dentate-serrate, glabrous, pilose domatia in the hypophyll; thyrses sub-racemiform, with pink axes; flowers zygomorphic, white; 4 nectariferous lobes, unilateral; squizocarps ovate with 3 samaroid mericarps, wings vertical downward; mericarps subcordate, chartaceous, glabrous, unripe green to reddish, seminiferous portion flattened, with a conspicuous constriction under the locule.

Figure 13 – a-g. *Serjania laureotteana* – a. habit; b. woody stem; c. lower branch with crescentic scar; d. detail of the leaf blade; e. detail of pilose domatia in hypophyll; f. detail of the inflorescence with staminate flowers and inmature fruits; g. detail of infructescence with inmature fruits. (Photos: a-g. A.M. Panizza).

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, camino a Garganta del Diablo, 11.VI.2021, fr., *A.M. Panizza 277* (CTES, SI). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, trilha Barro Preto, 27.VI.2007, fl., *E. Barbosa et al. 2198* (CTES, MBM). Foz do Iguaçu, ParNa Iguaçu, trilha São João, 1.VII.2017, fr., *L.C.P. Lima et al. 971* (CTES, EVB).
Additional specimen examined: BRAZIL. PARANÁ: Matelândia, Matelândia, orla da mata pluvial, 18.VI.1967, fr., *G. Hatschbach & J.H. Haas 16573* (MBM, MO, NY, US).

This species can be found in eastern Brazil, eastern Paraguay, and northeastern Argentina; common and with a wide distribution (Reitz 1980; Acevedo-Rodríguez 1993; Ferrucci 1998). Heliophyte to sciophyte and selective hygrophyte, very frequent in open and disturbed places such as clearings and forest edges as well as riparian forests, inside dense and shady forests of both SSF and the pine forests of MOF (Reitz 1980; Acevedo-Rodríguez 1993; Ferrucci 1998). Found in three (and close to a fourth) of the five areas evaluated in this study. Flowering in June and fruiting in June–August, whereas Ferrucci (1998) stated that the species blooms in May, bears fruits in September and October.

The vernacular names for this species are "cipó-timbó-açu"; "cipó-uva"; "enredadera aleta"; "erva-timbó"; "timbó-grande" (Reitz 1980; Ferrucci 1998; Sommer & Ferrucci 2009).

18. *Serjania meridionalis* Cambess., Fl. Bras. Merid. (quarto ed.) 1(10): 366, pl. 76 (1828). Fig. 14a-j

Lianas with milky white exudate, glabrescent or puberulous; stem 8–10 ribbed, cross section with a single vascular cylinder; stipules triangular, short, persistent; leaves biternate, leaflets ovate or elliptical, dentate-serrate, glabrous, pilose domatia in the hypophyll; thyrses racemiform; flowers zygomorphic, white; petaloid appendage with a bicorniculiform crest on the posterior petals; 4 nectariferous lobes, unilateral; schizocarps with 3 samaroid mericarps, wings vertical downward; mericarps ovate-cordate, chartaceous, glabrous, seminiferous portion inflated, venation conspicuous.
Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Ruta 101, Arroyo Ñandú, 20.III.2017, fr., *M.S. Ferrucci et al. 3413* (CTES). BRAZIL. PARANÁ: Capanema, ParNa Iguaçu, Rio Iguaçu, 3.IV.2019, fl., *C.R. Rauber et al. 391* (UNOP). Foz do Iguaçu, ParNa Iguaçu, estrada principal, 18.III.2017, fl. and fr., *L.C.P. Lima et al. 912* (CTES, EVB). Matelândia, ParNa Iguaçu, entrada de Matelândia a Serranópolis do Iguaçu, 21.II.2020, fl., *A.M. Panizza et al. 218* (EVB).

It can be found in Bolivia, Brazil, eastern Paraguay, Uruguay, and central Argentina until Buenos Aires and the Martín García Island, marking the southernmost limit of the genus; with a wide but discontinuous distribution (Reitz 1980; Ferrucci 1998; Sommer & Ferrucci 2009). Heliophyte and selective hydrophyte, infrequent, preferably in secondary vegetation areas such as clearings and edges of the forest, also in riparian forests, very rare in primary forests (Reitz 1980; Ferrucci 1998). Found in four of the five areas evaluated in this study. Flowering in December–April and fruiting in March–April, some specimens were gathered with fruits in July and August.

In a vegetative state, it can be confused with *S. laurotteana*, although the latter has a compound stem and blooms during the winter, whereas *S. meridionalis* has a simple stem and blooms during the summer.

The vernacular names for this species are "cipó-timbó"; "cipó-uva" (Reitz 1980; Ferrucci 2004).

19. *Serjania multiflora* Cambess., Fl. Bras. Merid. (quarto ed.) 1(10): 365 (1828). Fig. 10e

Lianas, stems cylindrical, 8–10 ribbed, glabrous, cross section with 8–10 peripheral cylinders smaller than the central one; stipules subulate, persistent; leaves biternate, leaflets ovate to elliptical, dentate-serrate in the apical half, glabrous; thyrses spiciform, with cincinni subsessile; flowers zygomorphic, white-yellowish; 4 nectariferous lobes, unilateral; schizocarps with 3 samaroid mericarps, wings vertical downward; mericarps ovate-cordate, chartaceous, puberulous or ferruginous-pubescent, seminiferous portion inflated, sometimes with a dorsal crest.
Specimens examined: Foz do Iguaçu, ParNa Iguaçu, 21.IV.1949, fl., *J. Galeão 89* (RB).

It is endemic to Brazil, with a wide distribution, although rare in SSF and MOF; species preferably sciophyte and selective hygrophyte, especially inside primary forests but also in clearings, forest edges, and riparian forests (Reitz 1980; Sommer & Ferrucci 2009). Found in a single area of the five evaluated in this study. A single specimen with flowers in April; according to Sommer & Ferrucci (2009), the species blooms in April–September and fruiting in July and August.

The vernacular names for this species are "cipó-timbó"; "timbó" (Sommer & Ferrucci 2009).

20. *Thinouia mucronata* Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 282 (1878). Fig. 15a-f

Lianas, stems glabrous or puberulous, cross section of branches up to 7 cm diameter with a single vascular cylinder, older stems with neoformed vascular cylinders; leaves 3-foliolate, leaflets ovate, terminal leaflet ovate-rhomboid, lateral leaflets asymmetrical, subentire, base

Figure 14 – a-j. *Serjania meridionalis* – a. habit; b. woody stem; c. cross section of stem with white exudate; d. stipules; e. leaf; f. flowering branch; g. detail of the cincinni of pistilate flowers with petaloid appendage; h. detail of the pistillate flower with petaloid appendage; i. infructescence with inmature fruits; j. detail of the mature fruits. (Photos: a-g, i-j. A.M. Panizza; h. C.A. Zanotti).

decurrent, discolored, with inconspicuous venation, (sub)sessile, domatia pilose and/or pocket-shaped in the hypophyll; thyrses umbelliform; flower actinomorphic, 5-merous, white; calyx with early opening; nectariferous disc annular; schizocarps with 3 samaroid mericarps, wings vertical upward; mericarps 3.5–3.9 cm long, obcordiform, chartaceous, dark brown, seminiferous portion inflated, with a conspicuous constriction.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Secc. Yacuy, 1.IV.2021, fr., *A.M. Panizza 269* (CTES, SI). BRAZIL. PARANÁ: Foz do Iguaçu, ParNa Iguaçu, trilha próxima ao centro de visitacao, 13.II.2017, fr., *L.C.P. Lima et al.*

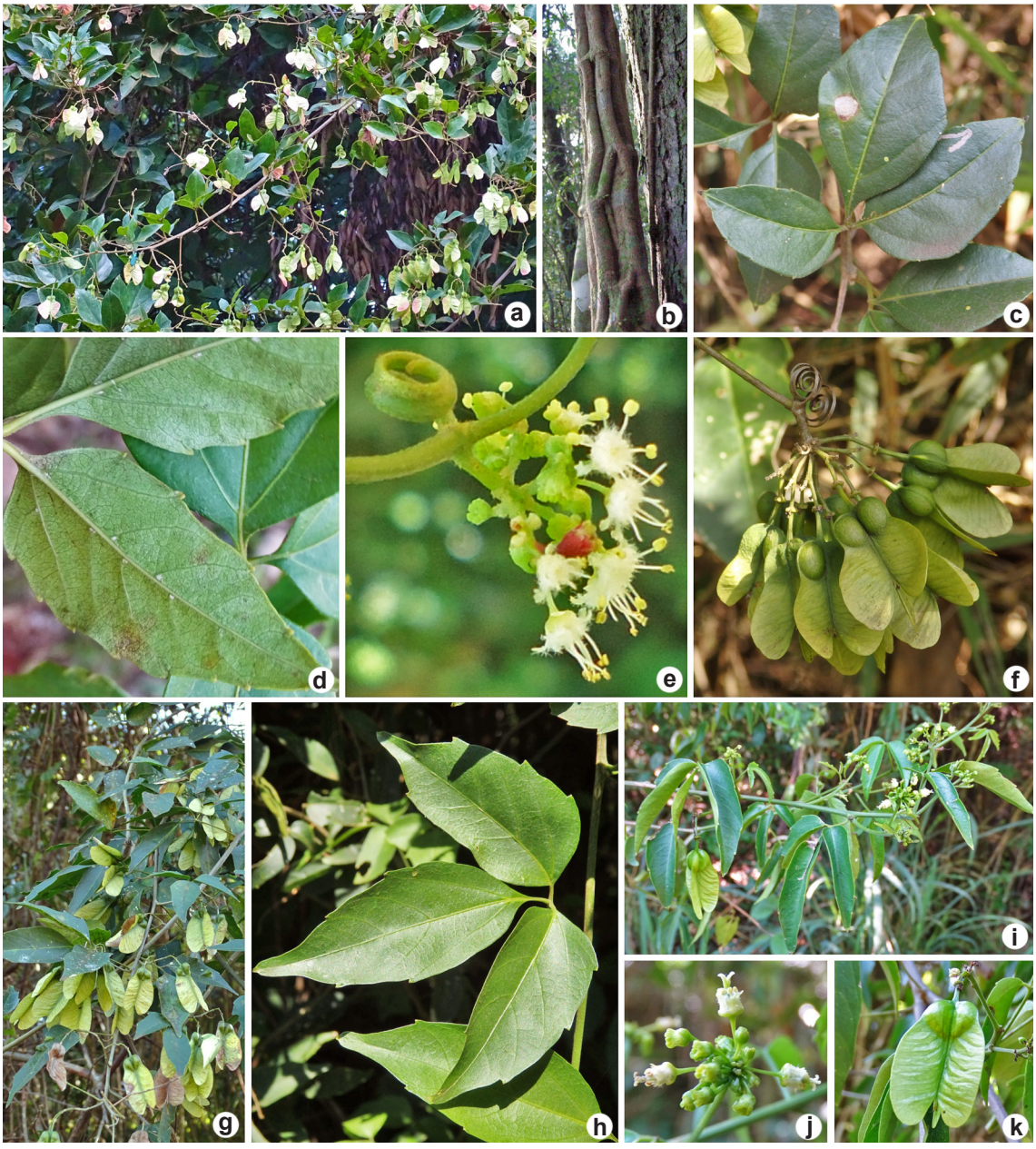

Figure 15 – a-f. *Thinouia mucronata* – a. habit; b. woody stem; c. leaf; d. detail of discolor hypophyll of the leaflets with pilose domatia; e. detail of inflorescence with staminate flowers; f. infrutescence with inmature fruits. g-k. *Thinouia ventricosa* – g. habit; h. leaf; i. terminal branch with inflorescences and inmature fruit; j. detail of the inflorescence with pistillate flowers; k. detail of the inmature fruit. (Photos: a-k. A.M. Panizza).

878 (CTES, EVB). Matelândia, ParNa Iguaçu, entrada de Matelândia a Serranópolis do Iguaçu, 21.II.2020, fr., *A.M. Panizza et al. 209* (EVB).

This species can be found in southern Bolivia, eastern Paraguay, Brazil, and northern Argentina, growing inside and in the edges of forests as well as in degraded areas (Ferrucci 1998). Found in three of the five areas evaluated in this study. Flowering in February and fruiting in February–July.

The vernacular names for this species are "ychypo chimbo" (chi = white, and mbo = that bursts or emerges, names of several plants used as piscicides possibly about the foam produced by their use) (Keller 2008).

21. *Thinouia ventricosa* Radlk., Atti Congr. Int. Bot. Firenze 61 (1876). Fig. 15g-k

Lianas, stems in terminal branches terete or with 5 inconspicuous ribs, cross section of branches up to 7 cm diameter with a single vascular cylinder; leaves 3-foliolate, leaflets ovate-narrow, terminal leaflet ovate-oblong, lateral leaflets asymmetrical, dentate-serrate, base acute, obtuse, or truncate, concolorous, with conspicuous veins, domatia pilose or pocket-shaped in the hypophyll; thyrses umbelliform; flowers actinomorphic, 5-merous, white; calyx with early opening; nectariferous disc annular; schizocarps with 3 samaroid mericarps, wings vertical upward; mericarps 4–4.7 cm long, obcordiform, chartaceous, dark brown, seminiferous portion inflated, with an inconspicuous constriction.
Specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, camino Hidrómetro a Garganta del Diablo, 20.XI.2020, fl. and fr., *A.M. Panizza & P. Poszkus 250* (CTES, SI).

It occurs in Brazil and northeastern Argentina, occupying forest edges (Ferrucci 1998; Sommer & Ferrucci 2009). Found in a single area to the south of the five evaluated in this study. Only one specimen was gathered with flowers and a single apical fruit in November. The blooming period is normally in January, and fruiting in July–August.

The vernacular names for this species are "cipó"; "cipó-timbó" (liana bearded) (Sommer & Ferrucci 2009).

22. *Urvillea laevis* Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 264 (1878). Fig. 16a-f

Lianas, stems 3-furrowed, when young puberulous, later glabrous, lenticels warty; cross section with a single vascular cylinder, branch not floriferous ca. 7 mm diam, with cambium radially divided into 6 parts; stipules subulate, 3–4.5 mm long, deciduous; leaves 3-foliolate, leaflets ovate or ovate-narrow, crenate-dentate, glabrous, discolored, apex acute or obtuse, brown laticifers, domatia pilose and/or pocket-shaped in the hypophyll; thyrses spiciform; flowers 4-merous, zygomorphic, white; capsules septifragal, with locules laterally compressed, with 3 evident wings, oblong or obovoid outline, papyraceous, intense pink when immature, later yellowish-brown; seed 1, trigonous, more or less isodiametric, brown; arilar macula whitish, dry.
Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Garganta del Diablo, 11.VI.2021, fr., *A.M. Panizza 278* (CTES, SI). BRAZIL. PARANÁ: Céu Azul, ParNa Iguaçu, ruta BR-277, Puesto de Peaje, 7.I.2020, fl., *A.M. Panizza & E. Hentz 157* (EVB).
Additional specimen examined: BRAZIL. PARANÁ: Foz do Iguaçu, Foz do Iguaçu, arredores, 23.V.1979, fr., *E. Buttura 63* (CTES, EVB).

It is distributed in Brazil, Bolivia, central-west region of eastern Paraguay, and northeastern Argentina, occupying riparian forests along the Iguazú River, in both dry and humid environments, Caatinga, and xerophytic forests, common in the secondary vegetation (Ferrucci 1998, 2020; Sommer & Ferrucci 2009). Found in two (and close to a third) of the five areas evaluated in this study. Flowering in January–March (May) and fruiting in May–August, coincides with the fruit setting period cited by Ferrucci (2020).

The vernacular names for this species are "cipó europa"; "lagartixa"; "mata-fome" (Ferrucci 2020).

23. *Urvillea ulmacea* Kunth, Nov. Gen. Sp. (quarto ed.) 5: 106-107, t. 440 (1821). Fig. 17a-e

Lianas, pubescent; young branches 5–6 ribbed; older ones deeply 3-lobate, cross section with a single vascular cylinder; stipules triangular or subulate, 1.25–2.9 mm long, persistent; leaves 3-foliolate, leaflets ovate, discolored, acute or obtuse, pubescent, with 15 to 52 teeth, lateral leaflets dentate-serrate, with more than 14 teeth, entire, with 1–2 incisions that do not exceed one-third of leaf blade, pilose domatia in the hypophyll; thyrses spiciform; flowers 4-merous, zygomorphic, white; anthers with an apical expansion of the connective; capsules septifragal, with inflate locules, with 3 evident wings, broad-elliptic or elliptic outline, pink when immature, later brownish-yellow or yellowish-paleaceous, papyraceous; seeds 3, ellipsoid, brown; aril whitish, cordiform, dry.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Ruta 101 y acceso a Cataratas, 14.VIII.1997, fr., *R.O. Vanni et al. 4002* (CTES). BRAZIL. PARANÁ: Foz do Iguaçu, ParNa Iguaçu, rodovia das Cataratas, 18.VIII.2018, fr., *C.R. Rauber et al. 148* (UNOP).

It is the most widely distributed species of the genus, from the south of the United States to northern Argentina; with great altitude variation and present in diverse environments, including the xerophytic forest, the caatinga, and forest edges (Ferrucci 2020). With a wide but restricted distribution, predominantly heliophyte, rarely sciophyte, infrequent, especially in secondary vegetation areas such as clearings, forest edges, and riparian forests, less frequent inside primary forests (Reitz 1980). Found in two of the five areas

Figure 16 – a-f. *Urvillea laevis* – a. habit; b. stem with stipule; c. leaves; d. flowering branch; e. detail of the inflorescence with staminate flowers; f. detail of infructescence with mature fruits. (Photos: a-f. A.M. Panizza).

evaluated in this study. Flowering in April–August and fruiting in the same period.

The vernacular names for this species are "balãocinho do matto"; "balãozinho"; "cipó-de-sabão"; "cipó-europa"; "cipó-timbó"; "cipó-tinguicururú"; "cipó de tres quintas"; "chumbinho"; "isipó tres"; "sipo tres" (Reitz 1980; Ferrucci 2020).

24. ***Urvillea uniloba*** Radlk., Sitzungsber. Math.-Phys. Cl. Königl. Bayer. Akad. Wiss. München 8: 264 (1878). Fig. 17f-j

Lianas, puberulous to glabrescent; young branches 5–6 ribbed, reddish-brown, lenticellate, cross section with a single vascular cylinder; stipules triangular, 1–2 mm long, persistent; leaves 3-foliolate, leaflets ovate-narrow, attenuate or acuminate, glabrous, lateral leaflets incised-serrate, with less than 10 teeth, laterally 1-lobed, with an incision that exceed one-third of leaf blade, terminal leaflet dentate-serrate to subentire, pilose domatia in the hypophyll; thyrses racemiform; flowers 4-merous, zygomorphic, white; anthers with an apical expansion of the connective; capsules septifragal, with inflate locules, with 3 evident wings, elliptic-suborbiculate, obovate-wide or elliptic outline, yellowish-brown, papyraceous; seeds 3, ellipsoid, brown; aril whitish, cordiform, dry.

Selected specimens examined: ARGENTINA. MISIONES: Iguazú, ParNa Iguazú, Garganta del Diablo, 11.VI.2021, fr., *A.M. Panizza 279* (CTES, SI).

It occurs in southern Brazil, eastern Paraguay, Uruguay, and northeastern Argentina; inside forests and in their edges, in secondary vegetation areas, especially clearings, and riparian forests (Reitz 1980; Ferrucci 2020). With a wide but discontinuous distribution, heliophyte to sciophyte and selective hygrophyte, infrequent (Reitz 1980). The ParNa Iguazú is the northernmost limit of the species since that was the only area where the species was found. Flowering and fruiting in March–May, and only fruiting in August; according to Ferrucci (2020), the species blooms and bears fruits from August to May.

The vernacular names for this species are "cipó"; "cipó-timbó", "timbó" (Reitz 1980; Ferrucci 1998).

Excluded species

Serjania hebecarpa Benth.

Cited for ParNa Iguazú by Srur *et al.* (2009) without herbarium specimen. No specimens were found in the study area or in herbarium specimens; however, there are specimens in nearby localities, which does not rule out that the species may be found later within the conservation areas.

Discussion

Of the 19 species found in the ParNa Iguazú, one is cosmopolitan, and the others are neotropicals. In contrast, in the ParNa Iguaçu were found two cosmopolitans and 20 neotropical species, of which two are endemic to Brazil (Tab. 1). With some differences in species composition between both conservation areas, is possible that more species will be found in the future. Twenty-four species were found in the SSF, and only five in the SSF and MOF, which will probably change when more material is gathered in difficult-to-access MOF and SSF areas, *e.g.*, areas 1 and 3, and the available herbarium material from these areas is revised.

With regard to the conservation status, only five species were categorized by UICN (global) or CNC Flora (Brazil), whereas 19 still need an evaluation. One new record was made for western Paraná in the ParNa Iguaçu, *S. hatschbachii*. Furthermore, this endemic species has been characterized as critically endangered by CNC Brazil, with a distribution restricted to the states of Paraná and São Paulo. Therefore, it is important to characterize the rest of the species to consider them in the management plants of both protected areas.

Ríos (2010) cited Sapindaceae as one of the predominant species in the seasonal forests of the Misiones Province. These species can be found in different environments, ranging from climbing species on forest edges to tree species in forest areas, integrating different canopy strata. Ríos (2010) and Souza *et al.* (2017) highlighted the role of *Cupania vernalis* as a predominant early secondary species, preferably in ombrophilous forest areas; however, in the present study, this species was found in both the SSF and MOF. Furthermore, the authors included *Allophylus edulis*, *Diatenopteryx sorbifolia* and *Matayba elaeagnoides* as species without preferences in the environments of the ParNa Iguaçu, agreeing with us. According to Ríos (2010), *Allophylus edulis* and *Matayba elaeagnoides* are the main early secondary species present in all regeneration stages in the MOF. Moreover, *Matayba elaeagnoides* is one of three species of the MOF that survives forest fires, dominates the canopy by suppressing pioneer species, and

is one of the most frequent regeneration species that decreases in absolute density throughout the successive stages. *Diatenopteryx sorbifolia* is one of the largest trees, predominating in the canopy, acting as a late secondary in the MOF (Ríos 2010), being a light-demanding climax species (Souza *et al*. 2019) and is one of the species with the highest importance value index in the typical submontane SSF in the edges of the ParNa Iguazú, where selective timber extraction

Figure 17 – a-e. *Urvillea ulmacea* – a. stem with stipule; b. detail of epiphyll and hypophyll of the leaves; c. part of inflorescence with staminate flowers; d. detail of staminate flower; e. terminal branch with flowers buds, staminate flowers and inmature fruits. f-j. *Urvillea uniloba* – f. leaf; g. detail of pilose domatia in hypophyll; h. inflorescence with staminate flowers; i. detail of staminate flower; j. detail of infructescence with inmature fruits. (Photos: a-j. A.M. Panizza).

occurred, as in most forests analyzed (Holz *et al.* 2009). Studies conducted in the SSF in southern Brazil, highlighted Sapindaceae as one of the most diverse families of climbers, reinforcing the need for more floristic studies on this family (Trochez *et al*. 2017; Rosado & Souza 2022). Coulleri & Ferrucci (2012) suggested that the expansion and reduction of dry seasonal forests in the Neotropical region could explain the current distribution patterns of *Cardiospermum* and *Urvillea*, with one of the richest subregions, Paranaense, regions, in which the study area is located, accumulating 35% of the species.

Most Sapindaceae have fragrant flowers pollinated by bees and dispersed by birds and coatis (Ferrucci 1998, 2004; Sommer & Ferrucci 2009). According to Rosado *et al.* (2014), the blooming and fruiting periods occur in May and September in Paraná state, in which there is a higher concentration of blooming species and with fruits from July to November; as a result, these events are more intense during the period of lower precipitation, representing an important food source for the fauna during a period of scarcity. In the present study, the family shows various species with flowers and/or fruit during all the year, including in the months with fewer resources, highlighting its importance in its ecologic relations with the fauna. This study uses phenology as a diagnostic character to differentiate some species. In terms of dispersal syndrome, most species are anemochoric, except for the fruit of *Allophylus* and the aril or sarcotesta of *Cupania vernalis*, *Matayba elaeagnoides* and *Paullinia*, both fleshy and attractive structures, which are zoochoric. Ríos (2010) mentioned the importance of the type of dispersal syndrome in only seven zoochoric species of remanent trees in the context of natural regeneration, *e.g.*, *Matayba elaeagnoides*, which is dispersed by birds and can originate in distant areas. Acevedo-Rodriguez *et al.* (2017) describe *Cardiospermum* and *Urvillea* as autochoric, a dispersal mechanism by gravity, that does not allow radiation into new habitats, resulting in low species diversity.

Regarding uses, from ornamentals for most species in general to timber, craftsmanship, and specific artistical purposes with the seeds, for example (Reitz 1980; Ferrucci 1991, 1998; Acevedo-Rodríguez 1993; Keller 2008; Somner & Ferrucci 2009; Guarim Neto *et al.* 2000). Other uses include foods, foraging, beekeeping, medicinal, aphrodisiac compounds, and special magical properties for some local cultures. *Allophylus* has wide use in the Triple Frontier region, including the leaves used in the *tereré* due to their refreshing effect, fruits used in beverages, and branches macerated as a digestive agent (Ferrucci 1991). Species of *Paullinia*, *Serjania*, and *Thinouia* have been reported to possess saponins in their fruits, with which a homemade soap is prepared, in addition to ichthyotoxic properties applied by local indigenous communities for fishing (Reitz 1980; Ferrucci 1991, 1998; Acevedo-Rodríguez 1993; Guarim Neto *et al.* 2000; Keller 2008). These multiple uses highlight the ethnoknowledge of the human populations throughout the world and evidence the transmission of this knowledge over generations (Guarim Neto *et al.* 2000). Based on the results of our study on the Sapindaceae of the Upper Paraná Atlantic Forest, it would be essential to carry out a study on the environmental or ethnobotanical perception of the visitors or locals of the vicinities of the Iguaçu National Park and/or the Iguazú National Park. Guarim Neto *et al.* (2000) mentioned the importance of recovering this knowledge in order to provide essential elements for the conservation of biodiversity by offering subsistence alternatives and maintaining cultural diversity.

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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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List of exsiccates

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