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## Flora of inland Atlantic riparian forests in southwestern Brazil

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**Abstract:** The flora of the Atlantic Rainforest of Mato Grosso do Sul, southwestern Brazil, has not been inventoried in spite of being the westernmost inland region of this domain. We present an inventory of the riparian flora of inland Atlantic Forest in Mato Grosso do Sul. We describe the species distribution along three habitats with contrasting flood conditions: non-flooded, seasonally flooded, and swampy forests. The inventory consisted of sampling every reproductive individual, during 12 months on 1.12 ha of plots inside a 24 ha study area. We recorded 1967 individuals of 253 species and 72 families. The most representative families in number of species were Asteraceae (27), Fabaceae (19), Myrtaceae (17), Cyperaceae (12), Rubiaceae, Solanaceae and Orchidaceae (10 each). The most abundant reproductive species were *Guarea macrophylla* (169 individuals), *Miconia chamissois* (85) and *Conyza bonariensis* (80). Eleven species of six families were recorded for the first time in Mato Grosso do Sul, two of them endemic to the Atlantic Forest – *Passiflora jilekii* and *Capanema micromera*. We found 119 species exclusively in non-flooded habitat, 19 in seasonally flooded habitat, and 31 in swampy forest. *Guarea macrophylla* was the most frequent species in swampy forest, and *Gochnatia polymorpha* in non-flooded. The riparian forest flora at the study site resembles the Atlantic Forest and includes wide distribution riparian species; the variation of flood conditions among habitats favors its richness. Our records add new occurrences for Mato Grosso do Sul and new distribution ranges for some plant species, what arises concern upon the local biodiversity conservation.

**Keywords:** flood gradient, plant distribution, plant richness, riparian forest, semideciduous forest.

FAXINA, C., FISCHER, E., POTT, A. **Flora de florestas ripárias da Mata Atlântica de interior no sudoeste do Brasil**. Biota Neotropica. 15(3): 1–12. <http://dx.doi.org/10.1590/1676-06032015008313>

**Resumo:** Vegetação ripária de Floresta Atlântica de interior no sudoeste do Brasil. A flora da Mata Atlântica de Mato Grosso do Sul, sudoeste do Brasil, tem sido muito pouco estudada, embora represente a porção mais oeste e continental deste domínio. Descrevemos aqui a flora de matas ciliares na região de Mata Atlântica de Mato Grosso do Sul, e a distribuição das espécies em três habitats classificados segundo a ocorrência de inundação como: floresta não inundável, floresta sazonalmente inundável, e floresta inundada. O inventário consistiu de um ano de amostragens mensais de todos os indivíduos reprodutivos em 1,12 ha de parcelas em 24 ha. Encontramos 1967 indivíduos de 253 espécies e 72 famílias. As famílias mais representativas foram Asteraceae (27), Fabaceae (19), Myrtaceae (17), Cyperaceae (12), Rubiaceae, Solanaceae e Orchidaceae (10 espécies cada). As espécies reprodutivas mais abundantes foram *Guarea macrophylla* (169), *Miconia chamissois* (85) e *Conyza bonariensis* (80). Onze espécies de seis famílias foram registradas pela primeira vez em Mato Grosso do Sul, duas delas endêmicas da Mata Atlântica – *Passiflora jilekii* e *Capanema micromera*. Encontramos 119 espécies apenas na floresta não inundável, 19 na floresta sazonalmente inundável, e 31 na floresta inundada. *Guarea macrophylla* foi a espécie mais comum na floresta inundada e *Gochnatia polymorpha*, na floresta não inundável. A flora das matas ciliares estudadas assemelha-se à da Mata Atlântica e apresenta espécies ripárias de ampla distribuição; a variação do regime de inundação entre os habitats favorece sua riqueza. Nossos registros adicionam novas ocorrências para Mato Grosso do Sul e novos limites de distribuição para algumas espécies, fatos que trazem preocupação quanto à conservação da biodiversidade local.

**Palavras-chave:** distribuição de plantas, gradiente de inundação, floresta ripária, floresta semidecídua, riqueza de espécies.

## Introduction

Floristic inventories are important to know plant species distribution and diversity, and to subsidize conservation initiatives. The southeastern Mato Grosso do Sul's territory has been considered part of the Atlantic Forest domain, indeed its westernmost inland limit (Rizzini 1979). However, this region is widely uncovered regarding plant surveys. Most inventory efforts in the state of Mato Grosso do Sul have focused on the Pantanal and its surrounding Cerrado floras (Pott & Pott 1994, 2000; 2003, Salis et al. 2004, Pott et al. 2006, Lehn et al. 2008, Damasceno-Junior et al. 2009, Noguchi et al. 2009). Additional plant surveys are available for the northeastern and south-western Cerrado regions of the state (Pott et al. 2006, Arruda & Daniel 2007, Baptista-Maria et al. 2009). This situation occurs, in part, because the Atlantic Forest domain in Mato Grosso do Sul was largely modified for agriculture, and the remaining natural vegetation became limited to riparian forests.

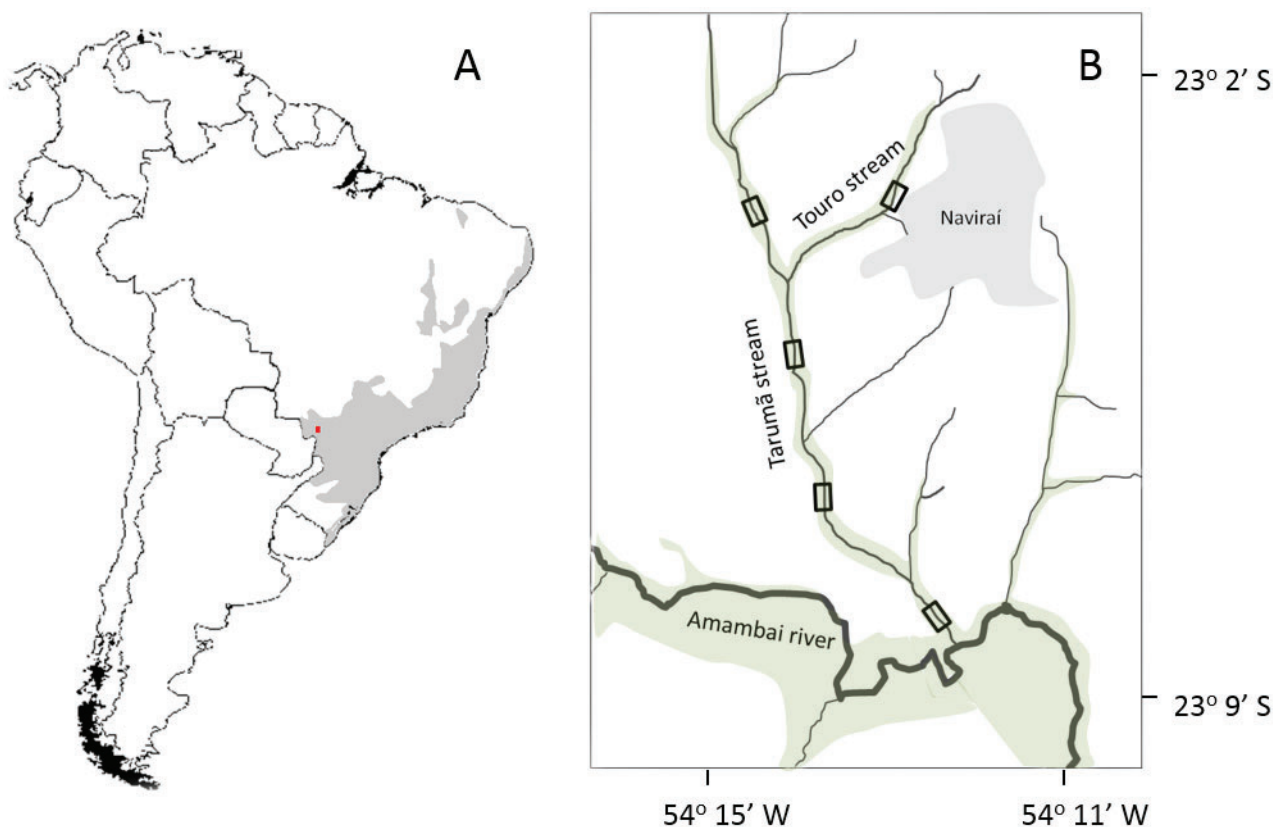
Riparian forests are highly diverse, often presenting low similarity of flora even between adjacent portions (Rodrigues & Nave 2004). Variation of flood conditions is largely associated with heterogeneity in floristic composition and life forms along riparian forests (Fischer & Araujo 1995, Rodrigues & Shepherd 2004). The importance of abiotic and biotic pressures appears to vary along the gradient of flooding. Increased flood depth and duration can select plant taxa whose traits allow escaping from waterlogging, whereas competitive ability is expected to

determine plant occurrences in non-flooded forest patches (Fischer & Santos 2001, Rodrigues & Shepherd 2004). Here, we describe the flora of riparian forests along Touro and Tarumã streams in the Mato Grosso do Sul's Atlantic Forest domain, and address species distribution among three contiguous habitats with contrasting flood conditions.

## Methods

### Study site

The study was carried out in five plots within 24 ha of the Touro and Tarumã riparian vegetation in the Paraná river basin, municipality of Naviraí, Mato Grosso do Sul (Figure 1). The climate is seasonal characterized by rainy summers and dry winters (Cfa of Köppen); mean annual temperature varies from 12 to 28 °C and mean annual rainfall is 1600 mm (IBGE 1984). The region belongs to the Caiuá geological formation, from upper Cretaceous, with 360 m average altitude and fertile soils, mainly Red Latosol and small patches of Red Spodosol (IBGE 1984), and hydromorphic soils on floodable or swampy areas. The study site is located in the western portion of the major continental phytogeographic domain of Atlantic Rainforest (Ab'Saber 2000). Remaining vegetation comprises mainly alluvial or submontane semideciduous forests (Veloso et al. 1991). Hereafter we refer to the study alluvial semideciduous forests simply as 'riparian forests'.



**Figure 1.** (A) Atlantic Forest domain (gray) and the study site (red dot). (B) Location of plant surveys (rectangles) in the Touro and Tarumã riparian forests (greenish); gray indicates the urban area of Naviraí, and white does pastures and cultivated areas.

**Figura 1.** (A) Domínio da Mata Atlântica (cinza) e local de estudo (ponto vermelho). (B) Localização das amostragens de plantas (retângulos) nas florestas ripárias (esverdeado) do Touro e Tarumã; cinza indica a área urbana de Naviraí, e branco indica pastagens e áreas cultivadas.

## Data collection and analysis

From July 2009 to June 2010 we monthly surveyed all reproductive plant individuals in six meters wide plots perpendicular to the streams, to include the flood gradient from the river margin to the higher ground of the riparian forest. Plots were placed at least 30 m apart, and their lengths varied from 40 to 180 m according to the riparian forest width at each stretch. The total sampled area was 1.12 ha. To control previously sampled individuals, we marked them with numbered aluminum tags. Samples included all angiosperms of different habits (Guedes-Bruni et al. 2002): ground herbs (without woody stems above ground), shrubs (multiple woody stems), climbers (woody or non-woody with climbing structures), trees (one woody stem; palms included), epiphytes, and parasites. For some species of shrubs and herbs in tussocks or multi-stemmed clumps, each bunch was counted as one individual. We also recorded monthly the flood condition (flooded or not flooded) where individuals, or their hosts if epiphyte or parasite, were rooted. After one year of records of flood conditions we assumed three habitat categories: (1) soil not flooded (non-flooded habitat, hereafter), (2) soil flooded during the rainy season (seasonally flooded habitat), and (3) soil persistently flooded (swampy habitat). We then determined limits of habitats within the plots and estimated the area covered by them with help of field GPS readings checked on Google Earth images, where we measured distances between zones. The altimetric difference between the lowest and the upper sampled areas was ca 43 m. Based on the surveyed area for each habitat (non-flooded = 0.64 ha, seasonally flooded = 0.22 ha, and swampy = 0.26 ha) we calculated density of reproductive individuals per species ( $N \cdot ha^{-1}$ ) per habitat. We then used values of density per habitat as a proxy for number of individuals after controlling for equal size of areas (1 ha) among habitats. Considering the total of individuals estimated for one hectare of each habitat, we calculated the proportion (%) of individuals per habitat for each species separately. Finally we entered the values of proportion of individuals in a species x habitat matrix to ordinate plant species in relation to habitats, in the R program (R Development Core Team 2010); epiphytes and species with less than 10 individuals were not included. Number of surveyed species relative to sample size was evaluated through rarefaction curves; in the Past program (Hammer et al. 2001). Identifications were based on comparisons with herbarium materials, and help of literature and specialists. Taxonomy follows the Angiosperm Phylogeny Group (APG III 2009). Voucher material was included in the Herbarium CGMS, Universidade Federal de Mato Grosso do Sul. Finally, we obtained from literature and herbarium sites ([www.tropicos.org](http://www.tropicos.org); [www.floradobrasil.jbrj.gov.br](http://www.floradobrasil.jbrj.gov.br)) the occurrences of species throughout the phytogeographical domains. Each species was assigned to a domain when its previous known occurrence was restricted, or assigned as “wide distribution” when its occurrence included more domains, considered as Amazonia, Atlantic Forest, Caatinga, Cerrado, Chaco, Pampas or Pantanal. Species that are not South American natives were assigned as exotic.

## Results

### Surveyed flora and new occurrences in Mato Grosso do Sul

We recorded 1967 reproductive individuals of 253 species, 193 genera and 72 families (Table 1). The eight richest families

included 46% of all surveyed species – Asteraceae (27 species), Fabaceae (19), Myrtaceae (17), Cyperaceae (12), Malvaceae, Orchidaceae, Rubiaceae and Solanaceae (10). Thirty-three families presented two to nine species, and the remaining families presented a single one. The most abundant reproductive species were *Guarea macrophylla* (Meliaceae; 169 individuals), *Miconia chamissois* (Melastomataceae; 85), *Conyza bonariensis* (Asteraceae; 80), *Ocotea lancifolia* (Lauraceae; 65) and *Cecropia pachystachya* (Urticaceae; 57). Eleven species were recorded for the first time in Mato Grosso do Sul – *Campylocentrum grisebachii*, *Capanemia micromera*, *Cohniella jonesiana*, *Microlaelia hunii*, *Rodriguezia decora*, *Sauroglossum nitidum* (all Orchidaceae), *Passiflora jilekii* (Passifloraceae), *Persea wilddenovii* (Lauraceae), *Merremia macrocalyx* (Convolvulaceae), *Qualea cordata* (Vochysiaceae), and the saprophyte *Apteris aphylla* (Burmanniaceae). We additionally recorded the parasite *Phoradendron piperoides* (Viscaceae) and four invader species – *Leucaena leucocephala* (Fabaceae), *Tecoma stans* (Bignoniaceae), *Cordia myxa* (Cordiaceae), and *Hedygium coronarium* (Zingiberaceae). Most species were herbs (99; 39%) or trees (72; 28%). Climbers and shrubs included 39 (15%) and 33 (13%) species, respectively, and epiphytes, nine species (4%).

### Species distribution among habitats

Floras of swampy and seasonally flooded forests showed less species and so tended to be fully surveyed, but flora of non-flooded forest was richer and less completely surveyed despite its larger area sampled (Figure 2). In general, most species (169 out of 253) were sampled only in one habitat, mainly in non-flooded (119) than in swampy (31) or seasonally flooded (19) (Table 1). On the other hand, considering only those species with 10 or more individuals recorded ( $n = 49$  species), 63% were found in the three habitats, 20% in two habitats, 13% exclusively in non-flooded, 4% in swampy, and none was found solely in seasonally flooded habitat. In overall, densities of the most abundant herbs and shrubs species in swampy and seasonally flooded habitats were one order of magnitude above non-flooded habitat. Among tree species, densities in swampy were one order of magnitude above the other habitats.

Among herbaceous plants, *Conyza bonariensis* ( $62.5 N \cdot ha^{-1}$ ), *Geophila repens* (57.8) and *Triumfetta bartramia* (45.3) were the species with highest densities in non-flooded habitats; *G. repens*, *Elephantopus mollis* (32.8) and *Rhynchospora marisculus* (23.4) occurred in this habitat only (Table 1). The commonest species in swampy habitat were *Coccocypselum lanceolatum* (153.9) and *Calyptracarya glomerulata* (119.2), whereas *Conyza bonariensis* (182.6) and *Canna indica* (160.0) were the most common in seasonally flooded habitat. Among shrubs, highest densities in non-flooded habitat were found for *Piper aduncum* (32.8), *Psychotria carthagenensis* (31.3) and *Ludwigia sericea* (23.4), and in swampy for *Miconia chamissois* (28.8), *M. theizans* (13.9) and *Gaylussacia brasiliensis* (61.5) (Table 1). Density of *Piper aduncum* (122.7) was one order of magnitude higher than the subsequent most abundant species in seasonally flooded habitat, *M. chamissois* (45.5), *Lantana camara* (31.8) and *Ludwigia sericea* (22.7). The commonest tree species in non-flooded habitat were *Gochnatia polymorpha* (34.4), *Allophylus edulis* (31.25) and *Helietta apiculata* (28.1); *G. polymorpha* and *H. apiculata* were exclusively found in this habitat (Table 1). *Guarea macrophylla* (557.7), *Ocotea lancifolia* (188.5) and *Styrax*

**Table 1.** Families, species, habits (TRE = trees; SHR = shrubs; EPI = epiphytes; HER = herbs; CLI = climbers; PAR = parasites), number of individuals (n), and density (N.ha<sup>-1</sup>) in three soil moisture types (NF = non flooded; SF = seasonally flooded; SW = swampy) in the riparian forests along Touro and Tarumã streams, Paraná river basin, Mato Grosso do Sul. Collection number: CF = Claudenice Faxina; Phytogeography: AF = Atlantic Forest, CE = Cerrado, CH = Chaco, WD = wide distribution, EX = exotic.

**Tabela 1.** Famílias, espécies, hábitos (TRE = árvores; SHR = arbustos; EPI = epífitas; HER = herbáceas; CLI = climbers; PAR = parasita), número de indivíduos (n) e densidade (N.ha<sup>-1</sup>) em três tipos umidade de solo (NF = não inundado; SF = sazonalmente inundado; SW = permanentemente inundado) ao longo da floresta ripária dos córregos Touro e Tarumã, bacia do rio Paraná, Mato Grosso do Sul. Número de coleta: CF = Claudenice Faxina; Fitogeografia: AF = Mata Atlântica, CE = Cerrado, CH = Chaco, WD = ampla distribuição, EX = exótica.

Family	Species	Habit	n	NF	SF	SW	Phyto-geography	Collection number
Acanthaceae	<i>Hygrophila costata</i> Nees	HER	1	1.6			WD	
	<i>Ruellia</i> cf. <i>brevifolia</i> (Pohl) C. Ezcurra	SHR	1	1.6			WD	CF 075
Alismataceae	<i>Echinodorus longipetalus</i> Micheli	HER	4			15.4	WD	CF 229
	<i>Sagittaria rhombifolia</i> Cham.	HER	1			3.9	WD	
Anacardiaceae	<i>Schinus terebenthifolia</i> Raddi	TRE	3	4.7			WD	CF 042
	<i>Tapirira guianensis</i> Aubl.	TRE	32	7.8	36.4	73.8	WD	
Apocynaceae	<i>Condylocarpon isthmicum</i> (Vell.) A. DC.	CLI	7	3.2	4.6	15.4	AF	CF 238
	<i>Mesechites</i> sp.	CLI	1	1.6			WD	CF 217
	<i>Tabernaemontana catharinensis</i> A. DC.	SHR	1	1.6			AF	
Aquifoliaceae	<i>Ilex brasiliensis</i> Loes.	TRE	13	1.6	9.1	38.5	AF	CF 228
	<i>Ilex affinis</i> Gardner	TRE	2			7.7	WD	CF 174
Araliaceae	<i>Hydrocotyle leucocephala</i> Cham. & Schltdl.	HER	9	1.6	4.6	27.9	WD	
	<i>Hydrocotyle verticillata</i> Thunb.	HER	1		4.6		WD	
Arecaceae	<i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart.	TRE	5	7.8			WD	
	<i>Geonoma brevispatha</i> Barb. Rodr.	TRE	12			46.2	AF	CF 011
	<i>Syagrus romanzoffiana</i> (Cham.) Glassman	TRE	14	9.4	18.2	15.4	AF	
Aristolochiaceae	<i>Aristolochia triangularis</i> Cham.	CLI	3	4.7			AF	CF 081
Asteraceae	<i>Achyrocline satureioides</i> (Lam.) DC.	HER	5	7.8			WD	
	<i>Aspilia latissima</i> Malme	HER	2	1.6	3.9		WD	
	<i>Baccharis</i> sp.	HER	1	1.6				CF 302
	<i>Barrosoa candolleana</i> (Hook. & Arn.) R. M. King & H. Rob.	HER	1			3.9	WD	CF 274
	<i>Conyza bonariensis</i> (L.) Cronquist	HER	80	62.5	182.6		WD	CF 262
	<i>Chromolaena odorata</i> (L.) R. M. King & H. Rob.	HER	11	9.4	18.2	3.9	WD	CF 063
	<i>Eclipta prostrata</i> (L.) L.	HER	2			7.7	WD	CF 337
	<i>Elephantopus mollis</i> Kunth	HER	21	32.8			WD	CF 125
	<i>Elephantopus palustris</i> Gardner	HER	2	1.6	3.9		WD	CF 112
	<i>Emilia fosbergii</i> Nicolson	HER	2	3.1			WD	CF 141
	<i>Erechtites hieracifolius</i> (L.) Raf. ex DC.	HER	2		10.0		WD	CF 183
	<i>Gnaphalium pensylvanicum</i> Willd.	HER	1		4.6		WD	CF 143
	<i>Gochnatia polymorpha</i> (Less.) Cabrera	SHR	22	34.4			WD	CF 044
	<i>Gymnocoronis spilanthoides</i> (D. Don ex Hook. & Arn.) DC.	HER	1			3.9	WD	CF 118
	<i>Mikania cordifolia</i> (L. f.) Willd.	CLI	2	1.6	4.6		WD	CF 041
	<i>Mikania micrantha</i> Kunth	CLI	6	9.4			WD	CF 335
	<i>Porophyllum ruderale</i> (Jacq.) Cass.	HER	3	4.7			WD	CF 209
	<i>Sonchus oleraceus</i> L.	HER	2	3.1			EX	CF 128
	<i>Trichogonia crenulata</i> (Gardner) D. J. N. Hind	SHR	2			7.7	WD	CF 108
	<i>Trixis antimenorrhoea</i> (Schrank) Kuntze	CLI	3	4.7			WD	CF 155
	<i>Vernonanthura cuneifolia</i> (Gardner) H. Rob.	HER	6				WD	CF 139
	<i>Vernonia</i> cf. <i>grandiflora</i> Less.	HER	2	3.1			WD	CF 297
	<i>Vernonia remotiflora</i> Rich.	HER	4	4.7	4.6		WD	CF 207
	<i>Vernonia</i> sp.1	HER	1	1.6				CF 345
	<i>Vernonia</i> sp.2	SHR	5	6.3	4.6			CF 065
	Indet. 1	HER	1	1.6				CF 263
	Indet. 2	SHR	1	1.6				CF 338
Begoniaceae	<i>Begonia cucullata</i> Willd.	HER	22	1.6	18.2	65.4	WD	CF 216

Continued on next page



Table 1. Continued.

Family	Species	Habit	n	NF	SF	SW	Phyto- geography	Collection number
Bignoniaceae	<i>Anemopaegma chamberlaynii</i> (Sims) Bureau & K. Schum.	CLI	1	1.6			WD	CF 184
	<i>Fridericia florida</i> (DC.) L.G. Lohmann	CLI	3	4.7			WD	CF 085
	<i>Fridericia</i> sp.	CLI	1	1.6				CF 145
	<i>Pyrostegia venusta</i> (Ker Gawl.) Miers	CLI	2		9.1		AF	CF 043
	<i>Tecoma stans</i> (L.) Juss. ex Kunth	SHR	3	4.7			EX	CF 181
Bromeliaceae	<i>Aechmea bromeliifolia</i> (Rudge) Baker	EPI	2	1.6		3.9	WD	
	<i>Bromelia balansae</i> Mez	HER	7	4.7	13.6	3.9	WD	
Burmaniaceae	<i>Apteria aphylla</i> (Nutt.) Barnhart ex Small	HER	4			15.4	WD	CF 199
Boraginaceae	<i>Cordia myxa</i> L.	TRE	2	1.6	4.6		EX	CF 233
	<i>Cordia polycephala</i> (Lam.) I. M. Johnst.	SHR	5	3.1	9.1	3.9	WD	CF 248
Cactaceae	<i>Epiphyllum phyllanthus</i> (L.) Haw.	EPI	1	1.6			WD	
Campanulaceae	<i>Pratia</i> cf. <i>hederacea</i> (Cham.) G. Don	HER	2				WD	
Cannaceae	<i>Canna indica</i> L.	HER	37	1.6	160.0	3.9	WD	CF 048
Cannabaceae	<i>Trema micrantha</i> (L.) Blume	TRE	3	4.7			WD	CF 130
Cardiopteridaceae	<i>Citronella gongonha</i> (Mart.) R. A. Howard	TRE	5	1.6		15.4	WD	CF 023
Commelinaceae	<i>Commelina erecta</i> L.	HER	2		10.0		WD	CF 121
	<i>Floscopa glabrata</i> (Kunth) Hassk.	HER	2	1.6	4.6		WD	CF 313
Convolvulaceae	<i>Ipomoea</i> sp.	CLI	1	1.6				CF 298
	<i>Jacquemontia</i> sp.	CLI	1	1.6				CF 187
	<i>Merremia macrocalyx</i> (Ruiz & Pav.) O'Donell	CLI	1	1.6			WD	CF 336
Costaceae	<i>Costus arabicus</i> L.	HER	11		45.5	3.8	WD	
Cucurbitaceae	<i>Melothria</i> cf. <i>pendula</i> L.	CLI	1	1.6			WD	CF 235
Cyperaceae	<i>Calyptrocarya glomerulata</i> (Brongn.) Urb.	HER	37	3.1	18.2	119.2	WD	CF 324
	<i>Cyperus haspan</i> L.	HER	20		10.0	69.2	WD	CF 311
	<i>Cyperus luzulae</i> (L.) Rottb. ex Retz.	HER	9		27.3	11.5	WD	CF 260
	<i>Cyperus odoratus</i> L.	HER	5			19.2	WD	CF 256
	<i>Diplacrum longifolium</i> (Griseb.) C. B. Clarke	HER	6		10.0	15.4	WD	CF 325
	<i>Fimbristylis complanata</i> (Retz.) Link	HER	3		13.6		WD	CF 258
	<i>Fuirena umbellata</i> Rottb.	HER	4		13.6	3.8	WD	CF 294
	<i>Pycneus lanceolatus</i> (Poir.) C. B. Clarke	HER	8	3.1	10.0	15.4	WD	CF 242
	<i>Rhynchospora corymbosa</i> (L.) Britton	HER	8	1.6	13.6	15.4	WD	CF 210
	<i>Rhynchospora marisculus</i> Nees	HER	15	23.4			WD	CF 244
	<i>Scleria</i> cf. <i>bancana</i> Miq.	HER	21	7.8	22.7	42.4	WD	CF 124
	<i>Scleria melaleuca</i> Rchb.	HER	26	3.1	18.2	76.9	WD	
Dioscoreaceae	<i>Dioscorea altissima</i> Lam.	CLI	4	6.3			WD	CF 347
	<i>Dioscorea</i> cf. <i>trifida</i> L. f.	CLI	1		4.6		WD	CF 291
	<i>Dioscorea</i> sp.1	CLI	5	1.6		15.4		CF 096
	<i>Dioscorea</i> sp.2	CLI	4	1.6		11.5		CF 259
Ebenaceae	<i>Diospyros inconstans</i> Jacq.	TRE	1	1.6			WD	CF 059
Ericaceae	<i>Gaylussacia brasiliensis</i> (Spreng.) Meisn.	SHR	16			61.5	WD	CF 107
Eriocaulaceae	<i>Syngonanthus caulescens</i> (Poir.) Ruhland	HER	4		4.6	11.5	WD	CF 243
Euphorbiaceae	<i>Acalypha</i> sp.	HER	1			3.9		
	<i>Croton lobatus</i> L.	HER	1	1.6			WD	CF 226
	<i>Croton urucurana</i> Baill.	TRE	6	9.4			WD	CF 060
	<i>Euphorbia heterophylla</i> L.	HER	1	1.6			WD	CF 142
	<i>Ricinus communis</i> L.	TRE	5	7.8			EX	
	<i>Sapium haematospermum</i> Müll. Arg.	TRE	8	4.7	18.2	3.9	WD	CF 208
	<i>Sebastiania brasiliensis</i> Spreng.	TRE	18	18.8	18.2	7.7	WD	CF 055
	<i>Tragia</i> sp.	CLI	1	1.6				CF 158
Fabaceae	<i>Canavalia mattogrossensis</i> (Barb. Rodr.) Malme	CLI	3	4.7			WD	CF 319
	<i>Centrosema sagittatum</i> (Humb. & Bonpl. ex Willd.) Brandegee	CLI	2	3.1			WD	CF 320
	<i>Chamaecrista nictitans</i> (L.) Moench	HER	1	1.6			WD	CF 343
	<i>Copaifera langsdorffii</i> Desf.	TRE	2	3.1			WD	CF 193
	<i>Crotalaria pallida</i> Aiton	HER	5	7.8			WD	CF 342

Continued on next page

Table 1. Continued.

Family	Species	Habit	n	NF	SF	SW	Phyto- geography	Collection number
Gentianaceae	<i>Desmodium cajanifolium</i> (Kunth) DC.	HER	1		4.6		WD	
	<i>Desmodium incanum</i> DC.	HER	3	4.7			WD	CF 299
	<i>Galactia striata</i> (Jacq.) Urb.	HER	1	1.6			WD	CF 300
	<i>Inga vera</i> Willd.	TRE	1	1.6			WD	CF 266
	<i>Leucaena leucocephala</i> (Lam.) de Wit	TRE	1	1.6			EX	CF 071
	<i>Macroptilium lathyroides</i> (L.) Urb.	HER	1			3.9	WD	CF 326
	<i>Mimosa debilis</i> Humb. & Bonpl. ex Willd.	HER	1	1.6			WD	CF 270
	<i>Parapiptadenia rigida</i> (Benth.) Brenan	TRE	2	3.1			AF	
	<i>Rhynchosia edulis</i> Griseb.	CLI	1	1.6			WD	CF 153
	<i>Rhynchosia melanocarpa</i> Grear	CLI	1			3.9	WD	CF 283
	<i>Senegalia riparia</i> (Kunth) Britton & Rose ex Britton & Killip	TRE	3	4.7			WD	
	<i>Senna pendula</i> (Humb. & Bonpl. ex Willd.) H.S. Irwin & Barneby	SHR	1		4.6		WD	CF 070
	<i>Sesbania virgata</i> (Cav.) Pers.	TRE	1	1.6			WD	CF 052
	<i>Vigna caracalla</i> (L.) Verdc.	CLI	1	1.6			WD	CF 305
	<i>Irlbachia alata</i> (Aubl.) Maas	HER	7		22.7	7.7	WD	CF 284
	<i>Aegiphila sellowiana</i> Cham.	TRE	3	4.7			AF	CF 271
	<i>Hyptis althaeifolia</i> Pohl ex Benth.	HER	1	1.6			WD	CF 331
	<i>Peltodon tomentosus</i> Pohl	HER	2	3.1			WD	CF 064
	<i>Vitex montevidensis</i> Cham.	TRE	1		4.6		AF	
Lauraceae	<i>Endlicheria paniculata</i> (Spreng.) J. F. Macbr.	TRE	23	28.1	13.6	7.7	WD	CF 078
	<i>Nectandra megapotamica</i> (Spreng.) Mez	TRE	3	4.7			AF	
	<i>Nectandra warmingii</i> Meisn.	TRE	2	3.1			CE	CF 148
	<i>Ocotea lancifolia</i> (Schott) Mez	TRE	65	9.4	45.5	188.5	AF	CF 340
	<i>Ocotea minarum</i> (Nees & C. Mart.) Mez	TRE	2	3.1			WD	
Lentibulariaceae	<i>Persea willdenovii</i> Kosterm.	TRE	2			7.7	AF	CF 349
	<i>Utricularia gibba</i> L.	HER	2			7.7	WD	
Lythraceae	<i>Cuphea</i> cf. <i>sessiliflora</i> A. St.-Hil.	HER	1	1.6			WD	CF 332
	<i>Cuphea melvilla</i> Lindl.	HER	1			3.9	WD	CF 329
	<i>Cuphea retrorsicapilla</i> Koehne	HER	1	1.6			WD	
Malpighiaceae	<i>Heimia myrtifolia</i> Cham. & Schltdl.	HER	1	1.6			AF	CF 330
	<i>Banisteriopsis pubipetala</i> (A. Juss.) Cuatrec.	CLI	1			3.9	WD	CF 190
	<i>Heteropterys</i> sp.	CLI	1			3.9		CF 293
	<i>Janusia guaranitica</i> (A. St.-Hil.) A. Juss.	CLI	1	1.6			WD	CF 247
Malvaceae	<i>Ayenia tomentosa</i> L.	HER	1	1.6			CH	CF 166
	<i>Luehea candicans</i> Mart.	TRE	8	10.9	4.6		WD	CF 038
	<i>Luehea divaricata</i> Mart.	TRE	13	9.4	31.8		AF	CF 047
	<i>Sida cordifolia</i> L.	SHR	1		4.6		WD	CF 264
	<i>Sida linifolia</i> Cav.	HER	1		4.6		WD	CF 309
	<i>Sidastrum paniculatum</i> (L.) Fryxell	HER	1				WD	CF 287
	<i>Triumfetta bartramia</i> L.	HER	35	45.3	27.3		EX	CF 068
	<i>Urena lobata</i> L.	SHR	1	1.6			EX	CF 103
	<i>Wissadula subpeltata</i> (Kuntze) R. E. Fr.	SHR	1	1.6			WD	CF 312
	<i>Calathea grandiflora</i> K. Schum.	HER	2	3.1			WD	CF 215
Marantaceae	<i>Maranta divaricata</i> Roscoe	HER	7	10.9			WD	CF 211
	<i>Mayaca sellowiana</i> Kunth	HER	2			7.7	WD	CF 280
Mayacaceae	<i>Clidemia</i> cf. <i>urceolata</i> DC.	HER	12	1.6	27.3	19.2	WD	CF 101
	<i>Clidemia hirta</i> (L.) D. Don	HER	1		4.6		WD	CF 140
Melastomataceae	<i>Clidemia</i> sp.	HER	1	1.6				CF 225
	<i>Miconia chamissois</i> Naudin	SHR	85	3.1	45.5	280.8	WD	CF 098
	<i>Miconia theizans</i> (Bonpl.) Cogn.	SHR	32	3.1	13.6	103.8	WD	CF 087
	<i>Rhynchanthera verbenoides</i> Cham.	HER	1				WD	CF 246
	<i>Rhynchanthera</i> sp.	HER	7		22.7	7.7		CF 286
	<i>Guarea macrophylla</i> Vahl	TRE	169	14.6	68.2	557.7	WD	CF 012
	<i>Trichilia elegans</i> A. Juss.	TRE	10	15.6			WD	CF 076
Meliaceae								

Continued on next page

Table 1. Continued.

Family	Species	Habit	n	NF	SF	SW	Phyto- geography	Collection number
Moraceae	<i>Trichilia pallida</i> Sw.	TRE	1	1.6			WD	CF 310
	<i>Ficus</i> cf. <i>luschnathiana</i> (Miq.) Miq.	TRE	1	1.6			AF	
	<i>Ficus</i> sp.	TRE	1			3.9		
Myrsinaceae	<i>Rapanea gardneriana</i> (A. DC.) Mez	TRE	30	6.3	27.3	76.9	WD	CF 092
Myrtaceae	<i>Calyptranthes clusiifolia</i> (Miq.) O. Berg	SHR	1		4.6		CE	
	<i>Calyptranthes lucida</i> Mart. ex DC.	SHR	16	4.7		50.0	WD	CF 332
	<i>Calyptranthes concinna</i> DC.	SHR					WD	CF 322
	<i>Calyptranthes</i> sp.	SHR	8	1.6		26.9		CF 288
	<i>Campomanesia guazumifolia</i> (Cambess.) O. Berg	TRE	1	1.6			AF	CF 191
	<i>Eugenia hiemalis</i> Cambess.	TRE	1	1.6			AF	CF 150
	<i>Eugenia involucrata</i> DC.	TRE	1	1.6			WD	CF 200
	<i>Eugenia pyriformis</i> Cambess.	TRE	1	1.6			WD	CF 220
	<i>Eugenia speciosa</i> Cambess.	TRE	1	1.6			WD	CF 205
	<i>Eugenia</i> sp.1	TRE	1		4.6			
	<i>Eugenia</i> sp.2	TRE	1	1.6				
	<i>Eugenia</i> sp.3	TRE	1	1.6				
	<i>Myrcia guianensis</i> (Aubl.) DC.	TRE	4	6.3			WD	CF 231
	<i>Myrcia splendens</i> (Sw.) DC.	TRE	3	4.7			WD	CF 224
	<i>Myrcia</i> sp.	TRE						CF 255
	<i>Psidium guajava</i> L.	TRE	2	3.1			EX	CF 180
	Indet	TRE	1	1.6				CF 202
Nyctaginaceae	cf. <i>Guapira</i>	TRE	1	1.6				CF 176
Ochnaceae	<i>Ouratea</i> cf. <i>cuspidata</i> Tiegh.	TRE	2	3.1			AF	CF 253
	<i>Sauvagesia racemosa</i> A. St.-Hil.	HER	1	1.6			WD	CF 106
Onagraceae	<i>Ludwigia decurrens</i> Walter	HER	2	3.1			WD	CF 268
	<i>Ludwigia sericea</i> (Cambess.) H. Hara	SHR	21	23.4	22.7	3.9	WD	CF 093
	<i>Ludwigia tomentosa</i> (Cambess.) H. Hara	SHR	12	1.6	18.2	26.9	WD	CF 030
Orchidaceae	<i>Campylocentrum aromaticum</i> Barb. Rodr.	EPI	1			3.9	AF, CE	
	<i>Campylocentrum grisebachii</i> Cogn.	EPI	1			3.9	WD	CF 123
	<i>Capanemia micromera</i> Barb. Rodr.	EPI	1			3.9	AF	
	<i>Catasetum</i> sp.	EPI	1	1.6				
	<i>Cochniella jonesiana</i> (Rchb. F). Christenson	EPI	1			3.9	WD	
	<i>Habenaria</i> sp.	HER	1			3.9		CF 353
	<i>Microlaelia lundii</i> (Rchb. f.) Chiron & V. P. Castro	EPI	10			38.5	AF, CE	CF 021
	<i>Oeceoclades maculata</i> (Lindl.) Lindl.	HER	14	17.2	4.6	7.7	WD	CF 051
	<i>Rodriguezia decora</i> (Lem.) Rchb. f.	EPI	5			19.2	AF, CE	CF 113
	<i>Sauroglossum nitidum</i> (Vell.) Schltr.	HER	1			3.9	WD	
Oxalidaceae	<i>Oxalis corymbosa</i> DC.	HER	1	1.6			EX	
	<i>Oxalis latifolia</i> Kunth	HER	1	1.6			EX	CF 056
Passifloraceae	<i>Passiflora alata</i> Curtis	CLI	6	6.3		7.7	WD	CF 074
	<i>Passiflora jilekii</i> Wawra	CLI	1	1.6			AF	CF 201
	<i>Passiflora misera</i> Kunth	CLI	1	1.6			WD	CF 251
	<i>Passiflora speciosa</i> Gardner	CLI	1	1.6			AF	CF 133
Piperaceae	<i>Piper aduncum</i> L.	TRE	52	32.8	122.7	15.4	WD	CF 029
	<i>Piper amalago</i> L.	TRE	3	3.1		3.9	WD	CF 273
	<i>Piper arboreum</i> Aubl.	TRE	2	3.1			WD	CF 058
	<i>Piper umbellatum</i> L.	SHR	8	4.7	4.6	15.4	WD	CF 122
Poaceae	<i>Merostachys</i> sp.	SHR	1	1.6			AF	CF 111
	<i>Oplismenus hirtellus</i> (L.) P. Beauv.	HER	4	3.1		7.7	AF, CE	
	<i>Panicum cyanescens</i> Nees ex Trin.	HER	1			3.9	WD	CF 290
	<i>Panicum</i> sp.	HER	3	4.7				CF 245
	<i>Pharus lappulaceus</i> Aubl.	HER	14	18.8		7.7	AF	CF 135
	<i>Setaria parviflora</i> (Poir.) Kerguélen	HER	1	7.8			WD	CF 272

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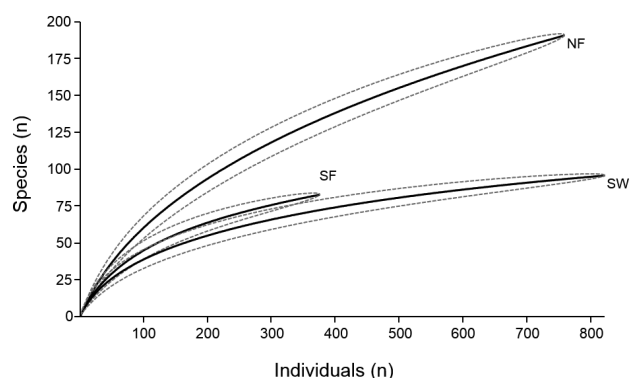
Table 1. Continued.

Family	Species	Habit	n	NF	SF	SW	Phyto- geography	Collection number
Rhamnaceae	<i>Gouania mollis</i> Reissek	CLI	8	9.4	4.6	3.9	WD	CF 045
Rosaceae	<i>Prunus myrtifolia</i> (L.) Urb.	TRE	17	4.7	9.1	46.2	WD	CF 306
Rubiaceae	<i>Chomelia obtusa</i> Cham. & Schltldl.	TRE	8	12.5			WD	CF 304
	<i>Coccocypselum lanceolatum</i> (Ruiz & Pav.) Pers.	HER	45	7.8		153.9	WD	CF 083
	<i>Emmeorhiza umbellata</i> (Spreng.) K. Schum.	HER	1	1.6			WD	CF 115
	<i>Geophila repens</i> (L.) I. M. Johnst.	HER	37	57.8			WD	CF 062
	<i>Manettia cordifolia</i> Mart.	CLI	1	1.6			WD	CF 315
	<i>Palicourea marcgravii</i> A. St.-Hil.	SHR	17	10.9	13.6	26.9	AF	CF 218
	<i>Psychotria carthagenensis</i> Jacq.	SHR	31	31.3		42.4	AF	CF 234
	<i>Psychotria racemosa</i> Rich.	SHR	18	3.1	9.1	53.9	WD	CF 079
	<i>Randia nitida</i> (Kunth) DC.	TRE	1	1.6			WD	CF 237
	Indet.	TRE	18	25.0	9.1			CF 253
Rutaceae	<i>Esenbeckia febrifuga</i> (A. St.-Hil.) A. Juss. ex Mart.	TRE	7	10.9			AF, CE	CF 061
	<i>Helietta apiculata</i> Benth.	TRE	18	28.1			AF, CE	CF 213
	<i>Zanthoxylum rhoifolium</i> Lam.	TRE	1	1.6			WD	CF 223
Salicaceae	<i>Casearia decandra</i> Jacq.	TRE	1	1.6			WD	CF 221
Santalaceae	<i>Phoradendron piperoides</i> (Kunth) Trel.	PAR	1			3.9	WD	CF 230
Sapindaceae	<i>Allophylus edulis</i> (A. St.-Hil., Cambess. & A. Juss.) Radlk.	TRE	22	31.3	9.1		WD	CF 165
	<i>Cupania vernalis</i> Cambess.	TRE	6	9.4			AF, CE	CF 160
	<i>Matayba elaeagnoides</i> Radlk.	TRE	9	14.6			AF, CE	CF 194
	<i>Paullinia pinnata</i> L.	CLI	2	1.6		3.9	WD	CF 069
	<i>Serjania caracasana</i> (Jacq.) Willd.	CLI	4	1.6		11.5	WD	CF 131
	<i>Urvillea ulmacea</i> Kunth	CLI	1	1.6			WD	CF 163
Sapotaceae	<i>Chrysophyllum marginatum</i> (Hook. & Arn.) Radlk.	TRE	18	21.9	4.6	11.5	AF, CE	CF 100
Smilacaceae	<i>Smilax campestris</i> Griseb.	CLI	16	6.3	45.5	7.7	WD	CF 084
	<i>Smilax fluminensis</i> Steud.	CLI	25	21.9	31.8	15.4	WD	CF 035
Solanaceae	<i>Capsicum baccatum</i> L.	HER	1		4.6		WD	CF 269
	<i>Capsicum chinense</i> Jacq.	HER	1	1.6			EX	
	<i>Cestrum axillare</i> Vell.	SHR	9	12.5	4.6		WD	CF 135
	<i>Cestrum mariquitense</i> Kunth	TRE	1	1.6			WD	
	<i>Cestrum schlechtendalii</i> G. Don	SHR	1	1.6			WD	
	<i>Cestrum strigilatum</i> Ruiz & Pav.	SHR	5	3.1	13.6		WD	CF 120
	<i>Physalis angulata</i> L.	HER	1		4.6		WD	CF 189
	<i>Solanum americanum</i> Mill.	HER	3	4.7			WD	CF 053
	<i>Solanum mauritianum</i> Scop.	TRE	3	4.7			AF	CF 040
	<i>Solanum paniculatum</i> L.	SHR	1	1.6			WD	CF 227
Styracaceae	<i>Styrax pohlii</i> A. DC.	TRE	47	3.1	36.4	142.4	WD	CF 239
Theophrastaceae	<i>Clavija nutans</i> (Vell.) B. Stahl	SHR	7		4.6	23.8	AF, CE	CF 162
Thymelaeaceae	<i>Daphnopsis racemosa</i> Griseb.	SHR	3	4.7			AF	CF 161
Urticaceae	<i>Cecropia pachystachya</i> Trécul	TRE	57	15.6	95.5	100.0	WD	
	<i>Boehmeria</i> sp.	HER	1		4.6			CF 265
Verbenaceae	<i>Lantana camara</i> L.	SHR	10	1.6	31.8	7.7	WD	CF 046
Violaceae	<i>Hybanthus communis</i> (A. St.-Hil.) Taub.	HER	1	1.6			WD	
Vitaceae	<i>Cissus</i> sp.	CLI	1	1.6				CF 333
Vochysiaceae	<i>Qualea cordata</i> (Mart.) Spreng.	TRE	1		4.6		AF, CE	
Xyridaceae	<i>Xyris laxifolia</i> Mart.	HER	15		22.7	38.5	WD	
Zingiberaceae	<i>Hedychium coronarium</i> J. König	HER	1	1.6			EX	

*pohlii* (142.4) presented the highest densities among trees in swampy, and *Cecropia pachystachya* (95.5) and *Guarea macrophylla* (68.2) in seasonally flooded habitat.

Density of epiphytes was very low, but they tended to occur in swampy rather than in the other habitats. Six orchid species

(*Campylocentrum aromaticum*, *C. grisebachii*, *Capanemia micromera*, *Microlaelia lundii*, *Cohniella jonesiana* and *Rodriguezia decora*) included 19 individuals exclusively in swampy, and one orchid species (*Catasetum* sp.) presented one individual in non-flooded habitat (Table 1). The bromeliad



**Figure 2.** Rarefaction curves for cumulative species according to number of reproductive individuals sampled in non-flooded (NF), seasonally flooded (SF) and swampy (SW) habitats in the riparian forests of Touro and Tarumã streams, southwestern Brazil. Dotted lines show 95% Confidence Intervals.

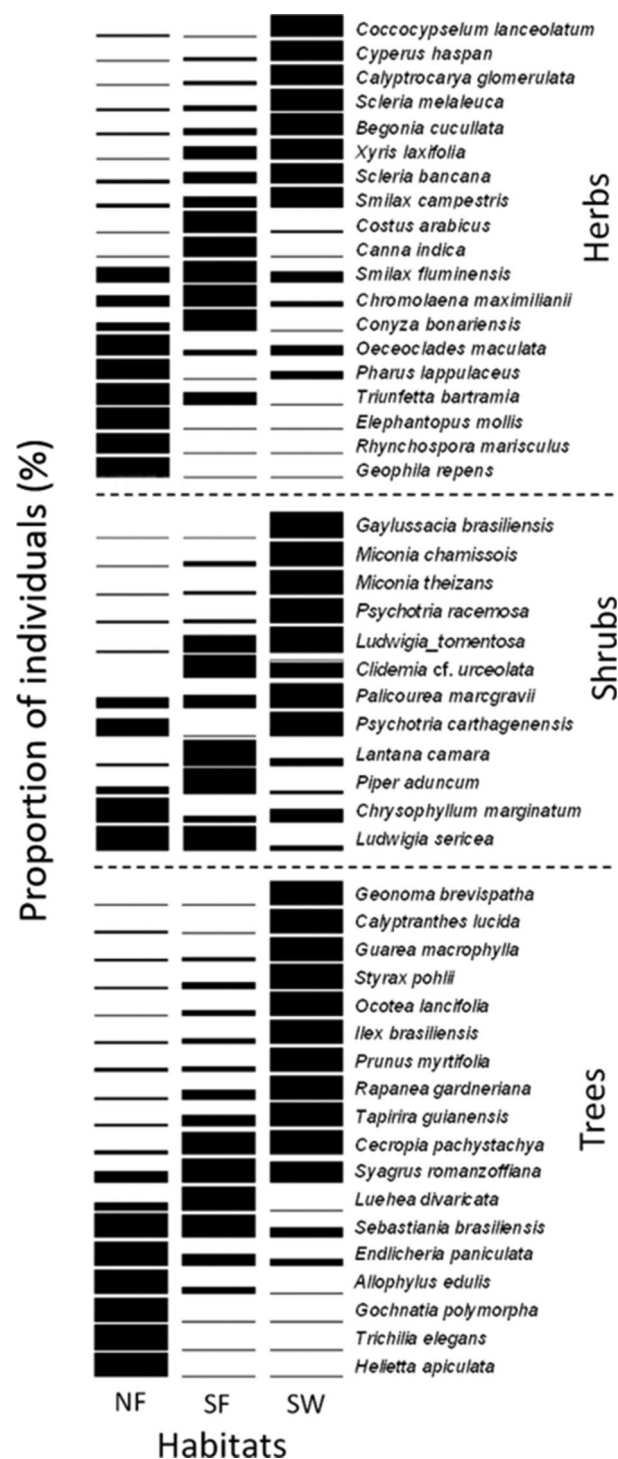
**Figura 2.** Curvas de rarefação de espécies com base na quantidade de indivíduos reprodutivos amostrados em habitat não inundável (NF), sazonalmente inundável (SF) e permanentemente inundado (SW) nas florestas ripárias dos rios Touro e Tarumã, sudoeste do Brasil. Linhas pontilhadas mostram Intervalos de Confiança de 95%

*Aechmea bromeliifolia* showed one individual in swampy and another in non-flooded habitat, where also one individual of the epiphytic cactus *Epiphyllum phyllanthus* occurred.

Based on proportional distribution of species with sample size  $\geq 10$  individuals, most of them presented higher abundance in swampy (25) than in seasonally (10) or non-flooded habitats (14). This pattern was also consistent within habits – herbs, shrubs or trees (Figure 3). The most frequent species in swampy were *Coccocypselum lanceolatum*, *Cyperus haspan*, *Calyptrocarya glomerulata*, *Scleria melaleuca*, *Begonia cucullata*, *Xyris laxifolia*, *Scleria bancana*, *Smilax campestris* (herbs), *Gaylussacia brasiliensis*, *Miconia chamissois*, *M. theizans*, *Psychotria racemosa*, *Ludwigia tomentosa* (shrubs), *Geonoma brevispatha*, *Calypttranthes lucida*, *Guarea macrophylla*, *Styrax pohlii*, *Ocotea lancifolia*, *Ilex brasiliensis*, *Prunus myrtifolia*, *Rapanea gardneriana*, *Tapirira guianensis*, *Cecropia pachystachya* (trees). On the other hand, in non-flooded habitat were *Geophila repens*, *Rhynchospora marisculus*, *Elephantopus mollis*, *Triumfetta bartramia*, *Pharus lappulaceus*, *Oeceoclades maculata* (herbs), *Ludwigia sericea*, *Chrysophyllum marginatum* (shrubs), *Helietta apiculata*, *Trichilia elegans*, *Gochnatia polymorpha*, *Allophylus edulis*, *Endlicheria paniculata*, and *Sebastiania brasiliensis* (trees). Common species in seasonally flooded habitat were *Costus arabicus*, *Canna indica*, *Smilax fluminensis*, *Chromolaena maximilianii*, *Conyza bonariensis* (herbs), *Piper aduncum*, *Lantana camara*, *Clidemia cf. urceolata* (shrubs), *Luehea divaricata* and *Syagrus romanzoffiana* (trees). The pioneer tree *Cecropia pachystachya* was equally abundant in swampy and seasonally flooded habitats (Figure 3).

## Discussion

The flora we inventoried seems to be markedly similar to other Atlantic Forest floras elsewhere, as all recorded species indeed occur throughout this domain (sensu Ab'Saber 2000), including two regarded as endemic, *Capanemia micromera* (Orchidaceae) and *Passiflora jilekii* (Passifloraceae) (Cervi 1997, Stehmann et al. 2009, Buzatto & Machado 2011). The richest families in our study site (Asteraceae, Fabaceae, Myrtaceae, Cyperaceae, Malvaceae,



**Figure 3.** Commonest herbaceous, shrub and tree species ( $\geq 10$  individuals) ordinated according to non-flooded (NF), seasonally flooded (SF) and swampy (SW) habitats along Touro and Tarumã riparian forests, Mato Grosso do Sul. Black bars indicate the proportion (%) of reproductive individuals per habitat for each species, estimated for areas of equal sizes among habitats.

**Figura 3.** Espécies herbáceas, arbustivas e arbóreas mais comuns ( $> 10$  indivíduos) ordenadas conforme os tipos de habitats, não inundável (NF), sazonalmente inundável (SF) e permanentemente inundado (SW), ao longo da floresta ripária do Touro e Tarumã, Mato Grosso do Sul. Barras pretas indicam a proporção (%) de indivíduos reprodutivos por habitat para cada espécie, estimada para áreas de tamanhos iguais entre os habitats.

Orchidaceae, Rubiaceae and Solanaceae) also show high number of species in other Atlantic Forest sites (Romagnolo & Souza 2000, Rodrigues & Nave 2004, Stehmann et al. 2009). Furthermore, the local high representativeness of Orchidaceae and low richness of some families, such as Moraceae, differ from the expected for riparian forests in the state's Cerrado domain (Pott et al. 2006, Lehn et al. 2008, Baptista-Maria et al. 2009). Therefore, flora of Touro and Tarumã riparian forests add support to sustain the southeastern Mato Grosso do Sul as an inland region of the Atlantic Forest domain, as formerly suggested by Rizzini (1979).

We found several species that have not been reported in the Mato Grosso do Sul regions of Cerrado or Pantanal, which reinforces the influence of the Atlantic Forest domain on our study site. The orchid *Campylocentrum grisebachii* is known to occur in the Atlantic Forest and Amazon, and our record increases its known distribution (Johnson 2001, Barros et al. 2010) towards the center of South America. In addition, the distribution of *Capanemia micromera* is known along Atlantic Forest in Brazil, and in Paraguay, Uruguay and Argentina (Johnson 2001, Barros et al. 2010, Buzatto & Singer 2010, Buzatto et al. 2011), thus our record enlarges its distribution to 290 km northward and 150 km eastward. Our record of *Microlaelia hundii* (Orchidaceae), distributed in the Atlantic Forest and Cerrado domains (Barros et al. 2010), increases the species' distribution to 290 km north, 650 km south (Dubs 1998), and 300 km westward (Barros et al. 2010). Other orchid species recorded here for the first time in Mato Grosso do Sul have been found 100 and 300 km apart, respectively *Rodriguezia decora* in Atlantic Forest and Cerrado (Johnson 2001, Souza et al. 2009, Barros et al. 2010) and *Sauroglossum nitidum* in Atlantic Forest, Cerrado and Caatinga (Barros et al. 2010). The occurrence of *Passiflora jilekii* in the Touro and Tarumã riparian forests increases its distribution 1100 km westward (Forzza et al. 2010, Cervi et al. 2010). For *Persea willdenovii* (Lauraceae), our record is 600 km northwestern from its previous known distribution (Quinet et al. 2010, Forzza et al. 2010). Additional species recorded for the first time in Mato Grosso do Sul – *Merremia macrocalyx* (Convolvulaceae), *Apteria aphylla* (Burmanniaceae) and *Qualea cordata* (Vochysiaceae) – might be expected since they are widely distributed throughout different domains (Dubs 1998, Bianchini & Ferreira 2010, Forzza et al. 2010, França 2010, Maas & Maas 2010). *Ilex brasiliensis* (Aquifoliaceae), *Gaylussacia brasiliensis* (Ericaceae), *Daphnopsis racemosa* (Thymelaeaceae), *Condylorcarpon isthmicum* (Apocynaceae) and *Citronella gongonha* (Cardiopteridaceae) were previously recorded in mid-east regions of Cerrado in Mato Grosso do Sul only (Pott et al. 2006).

In general, the studied flora is highly composed of herbs and contains few tree species, compared to other riparian forests in the Atlantic Forest domain or even elsewhere in Brazil (Oliveira-Filho & Ratter 1995, Metzger et al. 1997, Oliveira-Filho & Fontes 2000, Felfili et al. 2001, Souza et al. 2009). The extension of wetter soils – swampy and seasonally flooded – could partially explain such differences, as they are highly occupied by herbs at the study site. Tree richness is otherwise expected to be favored in non-flooded habitats, where we recorded several species with low abundances. On the other hand, the most abundant species within any habit are the flood-tolerant ones, which occur in the habitats with reduced number of species. This pattern agrees with the expectation that non-flooded sites allow occurrence of most plant species, whose abundances are mainly regulated by interspecific competition, whereas environmental filter determines plant

species under flood conditions (Ivanauskas et al. 1997, Fischer & Santos 2001, Marques et al. 2003, Lobo & Joly 2004).

Richness of epiphytes in Touro and Tarumã forests is lower than that in other Atlantic Forest regions with less seasonality and higher annual rainfall than in our study site (1600 mm), as indeed expected since humidity has been regarded as a main factor affecting epiphytic growth (Fischer & Araujo 1995, Rogalski & Zanin 2003, Bataghin et al. 2012; Forzza et al. 2014). Likewise, epiphytes were richer and more abundant in swampy than in non-flooded habitat at the study site probably due to higher humidity in the former. However, additional factors are likely contributing to low richness of epiphytes at the study site, since other Atlantic Forest sites with similar annual rainfall can present remarkably more epiphytic species (Forzza et al. 2014). The narrow forest remnants along Touro and Tarumã streams are enclosed in pasture and cultivated landscapes, thus different sources of disturbance can contribute to the low richness of epiphytes at the study site (Wolf 1994, Pinto et al. 1995, Barthlot et al. 2001, Rogalski & Zanin 2003).

Overall, flora of Touro and Tarumã riparian forests contains several components expected for the Atlantic Forest, although it predominantly included species widespread in different domains. The local flood gradient may favor plant richness. A certain level of disturbance is indeed apparent at the study site due to the relatively high abundance of herbs, the lack of epiphytes in some suitable sites, the conspicuous presence of weedy pioneers, and the occurrence of exotic invaders. The new occurrences for Mato Grosso do Sul and the new limits of distribution for plant species surveyed here highlight the importance of conservation of the remaining forests in the westernmost Atlantic Forest.

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