Floristic analysis and dispersal syndromes of woody species of the Serra de Maracaju, Mato Grosso do Sul, Brazil

Ramos, WM.[a] *and Sartori, ALB.*[b]*

[a]Programa de Pós-graduação em Biologia Vegetal, Universidade Federal de Mato Grosso do Sul – UFMS, Campo Grande, MS, Brazil
[b]Laboratório de Botânica, Centro de Ciências Biológicas e da Saúde, Universidade Federal de Mato Grosso do Sul – UFMS, CEP 79070-900, Campo Grande, MS, Brazil
*e-mail: albsartori@gmail.com

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(With 3 figures)

Abstract

This paper presents a floristic survey of the wood component of *cerrado s.s.* (eastern face) and gallery forest (western face) areas carried out in the southern part of the Serra de Maracaju. The dispersal syndromes and floristic relations of this portion of the Serra were compared to those of other formations from different regions of Brazil. Between October 2007 and September 2008, monthly collections identified 144 species. As for dispersal syndromes, zoochory prevails, followed by autochory and anemochory. The gallery forest is a heterogeneous formation that shelters floristic elements shared with the Atlantic rain forest, the Amazonian forest, semi-deciduous seasonal forests and dry forests of the Pantanal. Low similarity between the two areas analyzed makes this region unique and suggests that the Serra de Maracaju is greatly influenced by the semi-deciduous seasonal forests of the southeastern region.

Keywords: cerrado, floristic survey, gallery forest, floristic similarity.

Análise florística e síndromes de dispersão de espécies lenhosas da Serra de Maracaju, Mato Grosso do Sul, Brasil

Resumo

Ao sul da Serra de Maracaju, foi efetuada a florística do componente lenhoso de áreas de cerrado *s.s.* (Face Leste) e Mata de Galeria (Face Oeste), com investigações das síndromes de dispersão e das relações florísticas desta porção da Serra com outras formações em diferentes regiões do Brasil. Os dados obtidos resultaram em 144 espécies, em coletas mensais, no período de outubro de 2007 a setembro de 2008. Para as síndromes de dispersão, verificou-se predominância da zoocoria, seguida por autocoria e anemocoria. A Mata de Galeria da Serra de Maracaju é uma formação heterogênea, que detém elementos florísticos compartilhados com a Floresta Pluvial Atlântica, a Floresta Amazônica, a Floresta Estacional Semidecidual e as Florestas Secas do Pantanal. A baixa similaridade entre as áreas analisadas confere um caráter único à região e sugere que a Serra de Maracaju recebe maior influência das Florestas Estacionais Semideciduais da Região Sudeste.

Palavras-chave: cerrado, levantamento florístico, mata de galeria, similaridade florística.

1. Introduction

Characterized as savanna-like vegetation, *Cerrado*, which covers 22% of the Brazilian territory (Ratter and Dargie, 1992), prevails on the Central Plateau and is the second largest plant formation (Rodrigues, 2005).

The floristic unit of cerrado seems to be especially determined by the woody flora, which is more homogeneous than the herbaceous one along the physiognomic gradient (Batalha et al., 2001), and its flora is considered the richest among the world savannas, with high levels of endemism (Ribeiro and Walter, 1998). The Cerrado is influenced by adjacent biomes with which it shares certain species (Ribeiro and Walter, 1998; Oliveira Filho and Ratter, 1995). Since it occupies a region bordered by the Chaco, the caatinga and the Amazonian and Atlantic forests, it serves as a corridor connecting them (Oliveira Filho and Ratter, 1995).

The flora of the state of Mato Grosso do Sul is considered a vegetational mosaic because of the influences of the Amazonian forest to the North, of the Atlantic forest to the East, of the Chaco to the West, of the seasonal forests of the river Paraná basin to the South and of the Central Plateau *Cerrado* in its center. *Cerrado* constitutes about 65% (Costa et al., 2003) of the natural formations of this state. It is represented by several of its different phytophysiognomies found in plains and on hill tops.

High mountain environments are little explored scientifically. In addition, high rates of deforestation contribute to the loss of valuable information on both their flora and their ecological and biogeographical aspects. Furthermore, between the hills are valleys and rock outcrops with different phytophysiognomies and more fertile soils, which possibly contribute to increasing species diversity (van den Berg and Oliveira-Filho, 2000).

Gallery forests occupy only 5% of the area covered with Cerrado (Silva Júnior, 2004). Yet, they present high species diversity, are fairly heterogeneous in terms of sheltering many elements common to the Atlantic rain forest and the Amazonian forest (Oliveira Filho and Ratter, 1995). Due to their connection to other grassland and savanna formations typical of Central Brazil (Ribeiro and Walter, 1998), gallery forests can act as corridors between forest fragments and help maintain the genetic flow.

Seed dispersal represents an important phase of the plant reproductive cycle. It is also critical to regenerate the natural populations and communities (Janzen, 1970). Dispersal mechanisms are essential to the natural distribution of species and to the movements and exchanges of genetic material within and without populations. In tropical forests, zoochory (Howe and Smallwood, 1982) prevails over abiotic syndromes while in less humid habitats, anemochory predominates (Vieira et al., 2002).

The aim of this study is to observe the dispersal syndrome of two areas, one of cerrado s.s. and one of gallery forests, and to explore the possible floristic relations in the southern part of the Serra de Maracaju. To do so, we sought to answer the following questions: 1) Which syndrome prevails in each area? 2) What are the floristic relations between the Serra de Maracaju and other Brazilian plant formations?

2. Material and Methods

The study area (Figure 1) is located in the southern part of the Serra de Maracaju, state of Mato Grosso do

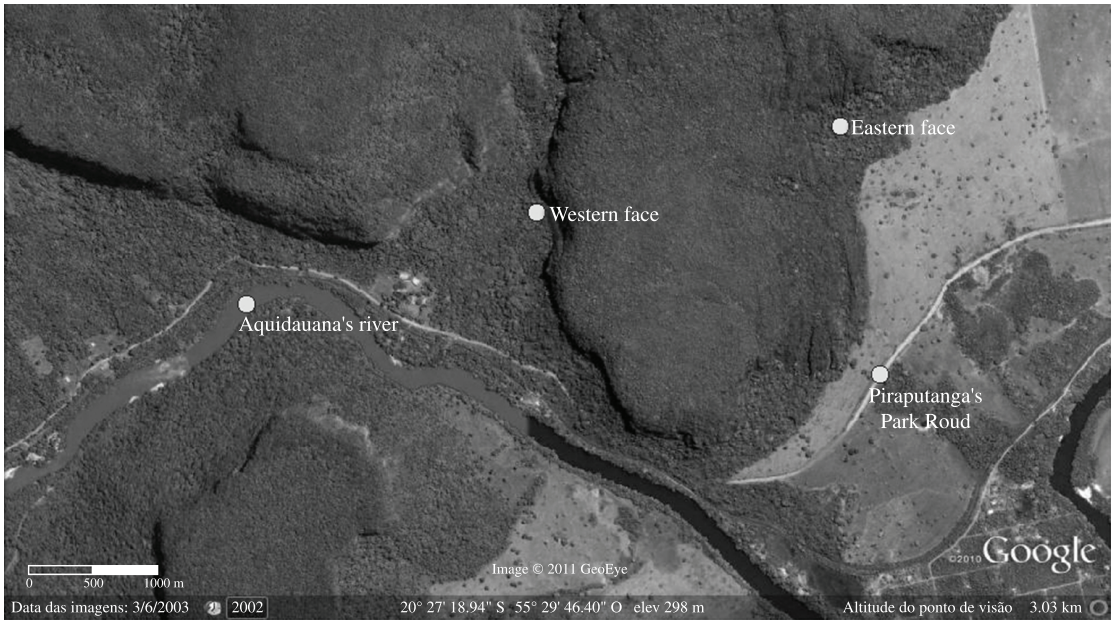

Figure 1. The area where the study was carried out is highlighted, showing the eastern and western faces of the southern part of the Serra de Maracaju, Aquidauana, state of Mato Grosso do Sul.

Sul, Brazil, where it separates the Central Plateau from the Pantanal plain (Brasil, 1997). It is covered with *cerrado sensu stricto* on its eastern face (20° 27' 17" S and 55° 29' 24" W) and with gallery forest on its western face (20° 26' 88" S and 55° 29' 77" W).

The study area comprises low to medium (between 2 and 15 m high) trees. The gallery forest shelters 3-30 meter high trees and it is characterized by high moisture and rich herbaceous vegetation, essentially cryptogams and epiphytes. It also presents an area with closed vegetation difficult to access, with rock outcrops and stone walls. A narrow (approximately 2.0 m wide) creek runs through the whole valley bottom before it flows into the Aquidauana River.

According to Ribeiro and Walter (1998), the concept of *cerrado* adopted here includes such physiognomies as forest formations (riparian forests, gallery forests, dry forests and *cerradão*), savannas (*cerrado sensu stricto*, *parque de cerrado*, palm groves and *veredas* (wet savannas) and grasslands (*campos sujos* – open shrubby savannas), *campos rupestres* (rocky grasslands) and *campos limpos* (open grasslands).

Fertile angiosperm individuals of trees, shrubs and palms tree were collected monthly along trails, between October 2007 and September 2008, in a total area sampled of 10 ha. We classified the species in families, according to APG III (2009), and growth habit, with reference to Whittaker (1975). Collected samples were deposited at the herbarium CGMS of the Federal University of Mato Grosso do Sul, at Campo Grande. Diaspore analysis was based on the materials collected in the field and the classification of dispersal syndromes is according to van der Pijl (1982).

The floristic similarity between the studied gallery forest and 16 other surveys carried out in different regions (Table 1) was assessed using the Sørensen similarity index (Müller-Dombois and Ellenberg, 1974). Similarity relations were generated by the Unweighted Pair-Group Method using Arithmetic Averages (UPGMA) method with the software PAST (Hammer et al., 2001). The results were converted into a dendrogram (Sneath and Sokal, 1973).

3. Results

Floristic composition – 144 species distributed into 104 genera and 45 families (Table 2) were found. Among them were 53 trees and 45 shrubs in the gallery forest and 66 trees and 43 shrubs species in the *cerrado s.s*.

Among the 98 species found in the gallery forest, 34 are not shared with the area of *cerrado s.s*. The most representative families are Fabaceae (15), Rubiaceae (6), Piperaceae (6), Malvaceae (5), Euphorbiaceae (4) and Salicaceae (4) to which 41% of the total of species belongs. The most representative genera were *Piper*, *Casearia*, *Trichilia*, *Miconia* and *Bauhinia*.

Forty-eight of the 109 species (Table 2) collected in the *cerrado s.s.* are exclusive to it, while the others also grow in the area of gallery forest. Fifty-four percent of the total species belong to the following families: Fabaceae (24), Malvaceae (9), Bignoniaceae (6), Euphorbiaceae (5), Annonaceae (5), Malphighiaceae (5) and Melastomataceae (5). The most representative genera were *Miconia*, *Casearia*, *Piper*, *Luehea*, *Bauhinia*, *Tabebuia* and *Annona*.

Dispersal syndromes – Among the species sampled, zoochory (57.3%) prevails, followed by the autochory (22%) and anemochory (20.7%) in both habits. Some species were found to have more than one dispersal syndrome.

Among the 53 tree species collected in the gallery forest, 57.6% are zoochoric, 20.3% autochoric and 22.1% anemochoric. As for the 45 bush species, zoochory (64.5%) and autochory (25%) present similar values, while anemochory shows much lower values (10.5%) (Figure 2).

Table 1. Studies used to compare floristic similarity, authors, phytophysiognomy and place where they were performed.

Code	References	Phytophysiognomies	Site
A	Studied area	gallery forest	MS
B	Saporetti Junior et al. (2003)	cerrado *s.s.*	MG
C	Felfili et al. (2002)	cerrado *s.s.*	MT
D	Marimon Junior and Haridasan (2005)	cerradão	MT
E	Costa and Araujo (2001)	cerradão	MG
F	Guarino and Walter (2005)	gallery forest	DF
G	Silva Júnior (2004)	gallery forest	DF
H	Teixeira and Rodrigues (2006)	gallery forest	SP
I	Dietzsch et al. (2006)	gallery forest	DF
J	Oliveira and Felfili (2005)	gallery forest	DF
K	Lugnani et al. (2007)	gallery forest	MS
L	Kinoshita et al. (2006)	semi-deciduous seasonal forest	SP
M	Rondon Neto et al. (2000)	semi-deciduous seasonal forest	MG
N	Arruda (2007)	semi-deciduous seasonal forest	MS
O	Paiva et al. (2007)	semi-deciduous seasonal forest	MG
P	Yamamoto et al. (2005)	semi-deciduous seasonal forest	SP
Q	Takahashi and Fina (2004)	semi-deciduous seasonal forest	MS

Table 2. Relations of the families and species found in the southern part of the Serra de Maracaju, Aquidauana, state of Mato Grosso do Sul, Brazil. Area of occurrence (C = *Cerrado*; MG = Gallery Forest), habit (Av = tree; Ab = shrub) and dispersal syndromes (Zo = zoochoric; Au = autochoric; Na = anemochoric).

Family/species	Area of occurrence	Habit	Dispersal Syndromes	Collector number
ANACARDIACEAE				
Myracroduon urundeuva Allemão	C + MG	Av	An	W 181
ANNONACEAE				
Annona coriacea Mart.	C	Av	Zo	W 272
Annona crassiflora Mart.	C	Ab	Zo	W 276
Annona dioica St. Hil.	C	Ab	Zo	F 473
Duguetia furfuracea (A. St.-Hil.) Benth.	C	Ab	Zo	F 303
Unonopsis lindmanii Fries.	MG	Av	Zo	A 386
Xylopia aromatica (Lam.) Mart.	C + MG	Av	Zo/Au	W 206
ARACEAE				
Philodendron sp.	MG	Ab	Zo	W 021
ARALIACEAE				
Dendropanax cuneatus (Dc.) Dene & Planch	C + MG	Ab	Zo	A 450
ARECACEAE				
Acrocomia aculeata (N. J. Jacquin) *Loddiges*	C + MG	Av	Zo	W 791
Attalea sp.	C + MG	Av	Zo	W 602
ASTERACEAE				
Vernonia cf. *condensata* Baker	C + MG	Ab	An	W 177
BEGONIACEAE				
Begonia lindmanii Brade	MG	Ab	Au	A 381
BIGNONIACEAE				
Arrabidea caudigera (s. Moore) A. H. Gentry	C + MG	Ab	An	W 263
Cuspidaria sp.	C	Ab	An	F 462
Handroanthus impetiginosus (Mart. Ex DC) Mattos	C	Av	An	E 416
Tabebuia aurea (Silva Manso) Benth. & Hook. f. ex S. Moore	C	Av	An	W 464
Tabebuia rosealba (Rid.) Sandw.	C	Av	An	W 204
Tabebuia sp.	C	Av	An	A 375
BORAGINACEAE				
Cordia polycephala (Lam.) I. M. Jonhst.	MG	Ab	Zo	W 242
Cordia trichotoma (Vell.) Arrabida ex Steudel.	C	Av	Zo	W 411
CANNABACEAE				
Celtis pubescens (H. B. K.) Spreng.	C + MG	Ab	Zo	W 267
Trema micrantha (L.) Engler	C + MG	Av	Zo	W 231
CARYOCARACEAE				
Caryocar brasiliense A.St.-Hil.	C	Av	Zo	W 277
CELASTRACEAE				
Maytenus ilicifolia Mart. ex. Reiss.	C	Ab	Zo	W 253
Salacia elliptica (Mart.) Peyer.	MG	Av	Zo	W 162
CHRYSOBALANACEAE				
Hirtella glandulosa Spreng.	C	Av	Zo	W 259
Hirtella gracilipes (Hook. F.) Prance.	C	Av	Zo	W 240

Table 2. Continued...

Family/species	Area of occurrence	Habit	Dispersal Syndromes	Collector number
COMBRETACEAE				
Buchenavia tomentosa Eichler	C + MG	Av	An	W 351
Combretum laxum Jacq.	C + MG	Av	Zo	W 252
Combretum leprosum Mart.	C + MG	Ab	An	W 128
Terminalia argentea Mart.	C	Av	An	W 364
DILENIACEAE				
Curatella americana L	C	Av	Zo	W 463
Doliocarpus dentatus (Aubl.) Standl.	C + MG	Ab	Au	W 439
EBENACEAE				
Diospyros hispida D.C.	C + MG	Av	Zo	W 345
Diospyros obovata Jacq.	MG	Av	Zo	W 373
ELAEOCARPACEAE				
Sloanea guianensis (Aubl.) Benth.	MG	Av	Zo	W 156
EUPHORBIACEAE				
Acalypha communis M. Arg	MG	Ab	Au	W 236
Croton macrobothrys Baill.	C + MG	Av	Au	W 476
Croton urucurana Baill.	C + MG	Av	Au	W 421
Jatropha elliptica (Pohl) Bail.	C	Ab	Zo	W 330
Sapium haematospermum Kunt.	C	Av	Zo	W 185
Sebastiana brasiliensis Spreg	C + MG	Ab	Zo/Au	W 492
FABACEAE				
Acacia polyphylla D.C.	C + MG	Av	An/Au	W 293
Anadenanthera colubrina var. cebil (Vell.) Brenan	C + MG	Av	An/Au	W 404
Anadenanthera peregrina var. *falcata* Speg.	C + MG	Av	An/Au	W 356
Andira fraxinifolia Benth.	MG	Ab	Zo	W 340
Bauhinia cheilantha (Bong.) Steud.	C + MG	Ab	Au	W 310
Bauhinia longifolia (Bong.) Steud.	C + MG	Av	Au	W 320
Bauhinia mollis (Bong.) D. Dietr	C	Ab	Au	W 400
Bauhinia ungulata L.	C + MG	Ab	Au	W 365
Copaifera martii Hagne	C	Ab	Zo/Au	W 494
Cratylia sp.	C + MG	Ab	Au	W 353
Dimorphandra molis Benth.	C	Av	Zo/Au	W 239
Dipteryx alata Vog.	C	Av	Au/Zo	W 380
Hymenaea courbaril L. var. *stilbocarpa*	C	Av	Zo/Au	W 244
Indigofera suffruticosa Mill.	C	Ab	Au	W 176
Inga vera Willd subsp. a*ffinis* (D.C.) I.D. Penn.	C	Av	Zo	W 188
Lonchocarpus cf. muelbergianus	MG	Ab	Au	W 496
Machaerium acutifolium Vog.	C	Av	An	W 318
Machaerium amplum Benth.	C + MG	Av	An	W 438
Machaerium hirtum (Vell.) Stellfeld	C	Av	An	W 378
Mimosa polycarpa Kunth	C + MG	Ab	Au	W 338
Myrocarpus venezuelensis Rudd	MG	Av	An	W 489
Peltogyne confertiflora (Mart. Ex Hayne) Benth.	C	Av	An	W 455
Peltophorum dubium (Spreng.) Taub.	C + MG	Av	Zo	W 257
Platypodium elegans Vogel	C + MG	Av	An	W 312
Pterocarpus sp.	MG	Av	An	W 493

Table 2. Continued...

Family/species	Area of occurrence	Habit	Dispersal Syndromes	Collector number
FABACEAE				
Senna occidentalis (L.) Link.	C	Av	Zo/Au	W 315
Senna velutina (Vog.) Irwin & Barneby	C	Av	Zo/Au	W 369
ICACINACEAE				
Emmotum nitens (Benth.) Miers	C + MG	Ab	Zo	W 465
LAURACEAE				
Ocotea diospyrifolia (Meisn.) Mez	C + MG	Av	Zo	W 265
Ocotea velloziana (Meissn.) Mez	C + MG	Av	Zo	W 424
LOGANIACEAE				
Strychnos pseudoquina A.St.-Hil.	MG	Ab	Zo	W 487
MALPIGHIACEAE				
Bunchosia paraguariensis Nield	C + MG	Av	Zo	W 311
Byrsonima crassifolia (L.) Kunth.	C + MG	Ab	Zo	W 271
Heteropterys sp.	C	Ab	An	W 466
Mascagania pubiflora (Adr. Juss) Griseb.	C	Ab	An	W 268
Peixotoa cordistipula A. Juss.	C	Ab	An	W 334
MALVACEAE				
Apeiba tiborbou Aubl.	C + MG	Av	Au	W 309
Guazuma ulmifolia Lam.	C + MG	Av	Zo/Au	W 151
Helicteres lhotzkyana chum.	C	Ab	Au	W 298
Luehea cf. *candicans* Mart.	C	Ab	An/Au	W 189
Luehea grandiflora Mart. & Zucc.	C + MG	Ab	An/Au	W 238
Luehea paniculata Mart.	C + MG	Ab	An/Au	W 250
Pseudobombax tomentosum (Mart. & Zucc.) Robyns	C + MG	Av	An/Au	W 377
Sterculia apetala (Jacq.) Karst.	C	Av	Zo/Au	W 295
Sterculia striata A. St.-Hil. & Naudin	C	Av	Zo/Au	W 488
MARCGRAVIACEAE				
Norantea guianensis Aubl.	C	Ab	Zo	W 376
MELASTOMATACEAE				
Miconia albicans (Sw.) Triana	C + MG	Ab	Zo	W 486
Miconia burchellii Triana	C + MG	Ab	Zo	W 394
Miconia cf. *cavescens* DC.	C	Ab	Zo	W 422
Miconia fallax DC.	C + MG	Ab	Zo	W 457
Mouriri guianensis Aubl.	C	Ab	Zo	W 406
MELIACEAE				
Cedrella fissilis Vell.	C + MG	Av	An	W 230
Guarea guidonea (L.) Slaumer	C + MG	Av	Zo	W 154
Guarea Khunthiana A. Juss.	MG	Av	Zo	W 218
Trichilia elegans A. Juss	MG	Ab	Zo	W 472
Trichilia hirta L.	MG	Ab	Zo	W 159
Trichilia pallida Sw.	MG	Ab	Zo	W 200
MENISPERMACEAE				
Abuta grandifolia (Mart.) Sandwith	C + MG	Av	Zo	W 354
MORACEAE				
Brosimum gaudichaudii Trec.	C + MG	Av	Zo	W 444
Ficus sp.	MG	Ab	Zo	W 256

Table 2. Continued...

Family/species	Area of occurrence	Habit	Dispersal Syndromes	Collector number
MORACEAE				
Ficus sp2.	MG	Av	Zo	W 447
Sorocea sprucei (Baill.) J.F. Macbr.	C + MG	Ab	Zo	W 173
MYRTACEAE				
Eugenia francavilleana O.Berg	C + MG	Ab	Zo	W 149
Eugenia sp.	C	Av	Zo	W 497
Myrcia laruotteana Cambess.	MG	Ab	Zo	W 484
Myrciaria floribunda (*H.West ex Willd.*) *O.Berg*	C + MG	Ab	Zo	W 501
NYCTAGINACEAE				
Guapira areolata (Heimerl) Lundell.	MG	Av	Zo	W 451
Neea hermaphrodita S. Moore	C + MG	Av	Zo	W 233
OCHNACEAE				
Ouratea castanaefolia Engl.	C + MG	Av	Zo	W 180
OPILIACEAE				
Agonandra brasiliensis Miers	C	Av	Zo	W 209
PIPERACEAE				
Piper aduncum L.	C + MG	Ab	Zo	W 495
Piper angustifolium R et. P.	MG	Ab	Zo	W 158
Piper arboreum Aubl.	C + MG	Av	Zo	W 485
Piper cf. glabratum	MG	Ab	Zo	W 499
Piper gaudichaudianum Kunt.	MG	Ab	Zo	W 286
Piper tuberculatum Jacq.	C + MG	Ab	Zo	W 216
POLYGONACEAE				
Coccoloba mollis Casar.	C + MG	Av	Zo	W 183
RHAMNACEAE				
Rhamnidium elaocarpum Reiss.	C + MG	Av	Zo	W 196
RUBIACEAE				
Alibertia edulis (Rich.) A. Rich. ex DC.	C + MG	Av	Zo	W 604
Calycophylum multiflorum Griseb.	MG	Ab	Au	W 227
Genipa americana L.	C	Av	Zo	W 192
Palicourea marcgravii A. St.- Hil.	MG	Ab	Zo	W 235
Pogonopus tubulosus (A. Rich) K. Schum	MG	Av	Zo	W 385
Psychotria carthagenensis Jacq.	C + MG	Ab	Zo	W 219
Psychotria cf. *deinocalix* Sandwith	MG	Ab	Zo	W 186
RUTACEAE				
Esenbeckia grandiflora Mart.	MG	Av	Au	W 226
SALICACEAE				
Casearia decandra Jacq.	C + MG	Av	Zo	W 435
Casearia gossypiosperma Briq.	C + MG	Ab	Zo	W 477
Casearia rupestris Eichler.	C + MG	Av	Zo	W 223
Casearia sylvestris SW.	C + MG	Ab	Zo	W 178
SAPINDACEAE				
Matayba guianensis Aubl.	C + MG	Av	Zo	W 193
SAPOTACEAE				
Chrysophyllum marginatum (Hook. & Arn.) Radlk.	MG	Av	Zo	W 390

Table 2. Continued...

Family/species	Area of occurrence	Habit	Dispersal Syndromes	Collector number
SOLANACEAE				
Cestrum strigillatum Reiz et. Pav	MG	Ab	Zo	W 448
URTICACEAE				
Cecropia pachistachya Trec.	MG	Av	Zo	W 191
VERBENACEAE				
Aegiphila candelabrum Briq. ex Chodat & Hassl.	MG	Av	Zo	W 478
Aloysia virgata (Ruiz & Pav.) Juss.	MG	Av	An	W 479
Vitex cymosa Bert.	C + MG	Av	Zo	W 187
VOCHYSIACEAE				
Callisthene fasciculata Mart.	C + MG	Av	An/Au	W 481
Qualea grandiflora Mart.	C	Av	An	W 301
Qualea multiflora Mart.	C	Av	An	W 269

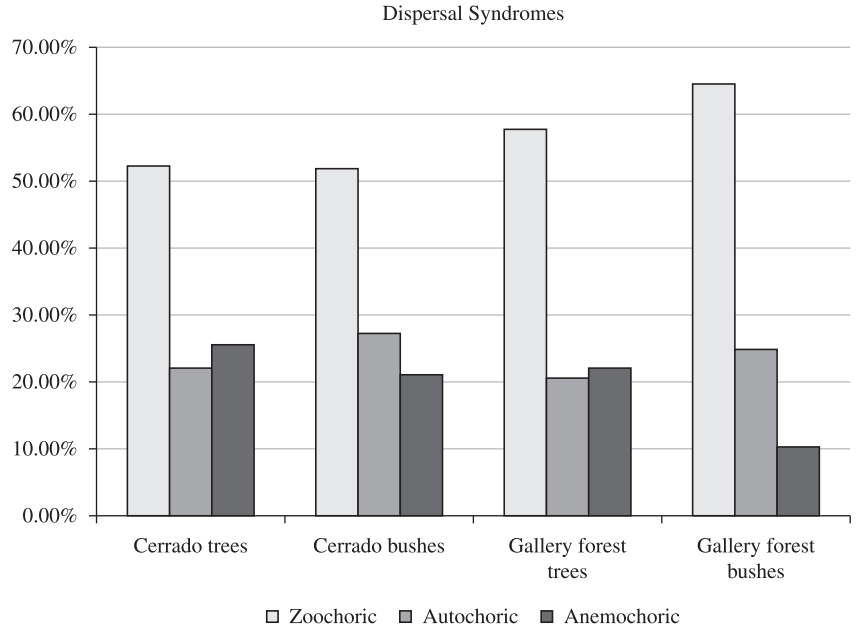

Figure 2. Distribution of the dispersal syndrome related to habits in both the gallery forest and the *cerrado* of the southern part of the Serra de Maracaju, Aquidauana, state of Mato Grosso do Sul Brazil.

In the *cerrado s.s.*, out of the 66 tree species, 52.4% are zoochoric, 22%, autochoric and 25.6% anemochoric. The values for the 43 bush species do not differ much: zoochory (52%), autochory (27%) and anemochory (21%) (Figure 2).

Floristic comparison – The floristic list of the gallery forest studied here and that of 16 surveys of different remnants were fed into a presence/absence matrix, totaling 780 binomials. The floristic relations of the gallery forest in the southern part of the Serra de Maracaju to these other remnants were converted into a dendrogram that reveals two main groups (Figure 3). The first one comprised remnants of gallery forests and semi-deciduous seasonal forests in Mato Grosso do Sul, Minas Gerais, São Paulo and Distrito Federal, which showed low similarity (S = 0,15) among themselves and with all the other forests studied. The second one was constituted by remnants of gallery forest, semi-deciduous seasonal forest, *cerrado s.s.* and *cerradão* in the Distrito Federal, São Paulo, Minas Gerais and Mato Grosso. All the cerrado remnants were grouped and the highest similarity values were recorded for those of Minas Gerais (S = 0,48). Two gallery forests of the Distrito Federal presented the second highest similarity value (S = 0,40). There was also a grouping between

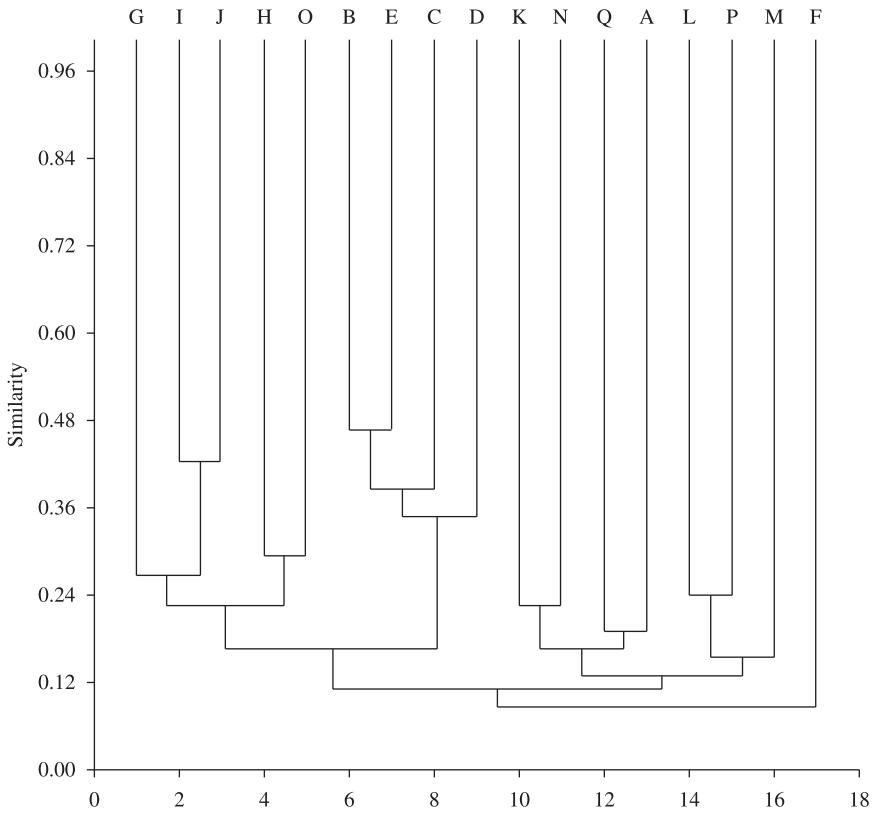

Figure 3. Dendrogram for group analysis obtained from the Sørensen index and group mean (UPGMA), applied to the tree-bush species sampled in 16 surveys in different regions of the country. Legend: **A =** studied area; Areas of *cerrado* **B =** Saporetti Junior et al. (2003) (Minas Gerais) and **C =** Felfili et al. (2002) (Mato Grosso); Cerradão **D =** Marimon Junior and Haridasan (2005) (Mato Grosso) and **E =** Costa and Araujo (2001) (Minas Gerais); Gallery Forests **F =** Guarino and Walter (2005) (Distrito Federal), **G =** Silva Junior (2004) (Distrito Federal), **H =** Teixeira and Rodrigues (2006) (São Paulo), **I =** Dietzsch et al. (2006) (Distrito Federal), **J =** Oliveira and Felfili (2005) (Distrito Federal) and **K =** Lugnani et al. (2007) (Mato Grosso do Sul); Semi-Deciduous Seasonal Forest **L =** Kinoshita et al. (2006) (São Paulo), **M =** Rondon Neto et al. (2000) (Minas Gerais), **N =** Arruda (2007) (MS), **O =** Paiva et al. (2007) (Minas Gerais), **P =** Yamamoto et al. (2005) (São Paulo) and **Q =** Takahashi and Fina (2004) (MS).

remnants of gallery forest and semi-deciduous seasonal forests of the southeastern region, but it showed lower similarity values (S = 0,30).

4. Discussion

Floristic composition – The species richness found in the present study (144 species) is similar to that by Mendonça et al. (1998) who surveyed woody species of Cerrado. Among the species common to the gallery forest of Central Brazil are *Xylopia aromatica*, *Unonopsis lindmanii*, *Diospyros hispida*, *Emmotum nitens* of which the two latter only occur in that region (Oliveira Filho and Ratter, 1995). Thirty-four species of this gallery forest (western face) were not found in the area of cerrado s.s. (eastern face), but have already been reported in different Brazilian plant formations: *Sloanea guianensis*, *Myrciaria floribunda*, *Salacia elliptica*, *Andira fraxinifolia* were mentioned in areas of Atlantic rain forest (Guilherme et al., 2004; Durigan et al., 2008); *Diospyros obovata*, *Trichillia elegans*, *Esenbeckia grandiflora*, *Chrysophyllum marginatum*, *Aloysia virgata* were registered in areas of semi-deciduous seasonal forests (Jurinitz and Jarenkow, 2003); *Abuta grandifolia*, *Mouriri guianensis* were considered as Amazonian elements that can be found in gallery forests (Prance and Schaller, 1982); *Calycophylum multiflorum* was cited in dry forests in the Pantanal (Prance and Schaller, 1982). Thus, elements of the gallery forest can be common to the Atlantic rain forest, the Amazonian forest (Oliveira Filho and Ratter, 1995), semi-deciduous seasonal forests (van den Berg and Oliveira-Filho, 2000) and dry forests in the Pantanal (Prance and Schaller, 1982)**.** The occurrence of the above mentioned species suggests that the gallery forest of the Serra de Maracaju shelters floristic elements from different plant formations. In addition to these floristic elements exclusive to the western face, 64 species are shared with the adjacent *cerrado* (eastern face).

The area of *cerrado s.s.* (eastern face) shares species not only with the western face, but also with the vegetation

along the Aquidauana River, which explains the high number of species sampled (109). A significant number of woody species were also reported in other Brazilian regions with areas of *cerrado s.s.* (Ratter et al., 1997). In *cerrado s.s.*, the occurrence of given species as *Annona crassiflora*, *Caryocar brasiliensis*, *Curatella americana*, *Dimorphandra mollis*, *Machaerium acutifolium*, *Qualea grandiflora*, *Qualea multiflora and Tabebuia aurea* helps characterize this plant formation. According to Ribeiro and Walter (1998), the above mentioned species are considered as typical of *cerrado s.s.*.

Dispersal syndromes – Zoochory prevails in the woody components, which was expected since the characteristic species of all the forest layers yield zoochoric fruits (Mikich and Silva, 2001). According to Howe and Smallwood (1982), in tropical forests, between 50% and 90% of the trees and bush produce zoochoric fruits, confirming the importance of biotic agents in the genetic flow of forest habitats. The anemochoric and autochoric syndromes did not differ in percentage (in both areas) which must be a local pattern, because this region is surrounded by hills under the influence of waterways and strong winds, which favor abiotic syndromes. The results obtained for autochory differ from those found by Vieira et al. (2002), who suggested that this strategy is rarely found in *cerrado s.s.*. Autochory is a dispersal mechanism related only to mother plants involving the release of ripe seeds. Thus, autochoric species probably depends on a secondary seed-disperser, since many have no efficient dispersal mechanisms (van der Pijl, 1982). Some species were classified as both autochoric and zoochoric based on the initial dehiscence of their fruits that later exhibited some seed ornamentation, as arils, observed in *Copaifera martii*, which suggests that a secondary agent participates in its dispersal. Since they have mucilaginous or fleshy arils, *Guazuma ulmifolia* and *Guarea Guidonia* are probably dispersed by birds, as mentioned by Howe and Smallwood (1982).

Floristic comparison – the low similarity rates reported for the gallery forest (western face) of the Serra de Maracaju reveal a heterogeneous area, forming groupings close to those of semi-deciduous seasonal forests and gallery forest in Mato Grosso do Sul. Based on the analysis of different tree phytophysiognomies found in Central Brazil, Felfili et al. (2002) asserted that gallery forests are the richest, and the most diverse and heterogeneous ones. They present the lowest similarity rates between themselves. Therefore, even physically closest gallery forests can present floristic compositions that differ from one to the other (Silva Júnior, 2004), indicating a vegetation mosaic (Sampaio et al., 2000). Floristic similarity analysis showed that the gallery forest studied here is more similar to the semi-deciduous seasonal forests of southeastern Brazil. This aspect is corroborated by Oliveira Filho and Ratter (1995) and van den Berg and Oliveira Filho (2000), who found strong floristic relations between the gallery forest of the central part of the Central-Western Region and the semi-deciduous seasonal forests of the Paraná River basin.

The grouping formed by the set of remnants of gallery forest, *cerrado* and *cerradão* possibly shares a species with a distribution pattern concentrated in the central region of Brazil, as suggested by Oliveira Filho and Ratter (1995). Interspersed in this grouping was a subgroup formed by gallery forests (São Paulo) and semi-deciduous seasonal forests (Minas Gerais) probably gathered because they share species whose distribution extends from southeastern Brazil to the Central Plateau.

5. Conclusions

The woody component in the southern part of the Serra de Maracaju is very dependent on the fauna for their dispersion in the gallery forest and *cerrado s.s.*, which shows the need of conserving these communities to ensure the action of dispersers since many avoid clean areas because of the high risk of predation. The abiotic syndromes make up an important percentage and have a fundamental role in the Serra de Maracaju formed by a set of steep hills which act as physical barriers and require agents like wind, water and action of gravity so that winged fruits or no winged can be dispersed.

The low similarity among the areas analyzed gives a unique floristic characteristic to this region. This was shown to be the case with gallery forests, in other places, which were characterized as very heterogeneous forests in floristic terms, but with low similarity when compared to other areas. The similarity between the areas analyzed suggests that the Serra de Maracaju is greatly influenced by the semi-deciduous seasonal forests of the southeastern region.

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