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Comparison Between Canopy Trees and Arboreal Lower Strata of Urban Semideciduous Seasonal Forest in Araguari - MG

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ABSTRACT

The present study intended to determine the phytosociological characteristics of the tree elements on the lower strata and the canopy of a semideciduous seasonal forest. The trees (≥ 15 cm circumference at breast height) were sampled in 40 plots of 10m x 20m. The individuals in the lower strata (≥ 1m up to 15 cm of circumference in the base of the stem) were sampled in plots of 10m x 10m. Licania apetala *and* Micrandra elata *obtained the first and second places in the two strata. Among the species with the highest value of importance on the canopy,* Alchornea glandulosa, Pimenta pseudocaryophyllus, Copaifera langsdorffii, Heisteria ovata *and* Didymopanax morototoni *presented a ratio of less than one individual in the lower strata when compared to the canopy. However, there was a high floristic similarity between the lower strata and the canopy.*

Key words: Semideciduous forest, lower strata, canopy

INTRODUCTION

The semideciduous seasonal forest has been more widely altered in all its occurrence area that comprehended part of Minas Gerais, Goiás, Mato Grosso do Sul and Bahia. In the remaining fragments, few present representative areas are preserved (Durigan et al., 2000). The use of these vegetation spots as public forests minimizes the action of factors such as fires, selective extraction and cattle invasion (Cielo Filho and Santin, 2002). According to Santin (1999), those areas are small and very isolated, due to the urbanization of their neighbourhood, as is the case of the forest in Araguari-MG. Several phytosociological studies on those forests were carried out in the States of São Paulo (Grombone et al., 1990; Bernacci and Leitão Filho, 1996; Dislich et al., 2001), and Minas Gerais (Araújo and Haridasan, 1997; Werneck et al., 2000a), with samples of individuals with a circumference at breast height (CBH) > 10 cm. Surveys have been carried out using different methodologies, with a criterion of inclusion based on the height and on the circumference of the individual's stem (Felfili, 1997a; Durigan et al., 2000; Salimon and Negrelle, 2001). Felfili (1997a), in Distrito Federal, and Durigan et al. (2000) in the State of São Paulo, sampled all the individuals in a forest community. Salimon and Negrelle (2001) in Santa Catarina, used as inclusion criterion individuals with at least

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one meter of height. Those studies, with wider samplings of the plant community allowed the classification of the same individuals in different strata (Durigan et al., 2000). However, in these surveys no standardized methodology was used, thus hindering the comparison of the results.

Researches in different strata of the forests can be useful for instantaneous responses about the diversity of species (Felfili, 1997a), and may also provide data for management plans and conservation of the forests. (Schlittler et al., 1995; Durigan et al., 2000; Barreira et al., 2002). Thus, the aim of this work was to compare the phytosociological structure of the canopy trees and lower strata (arboreal) in a semideciduous seasonal forest located in the urban area of the municipality of Araguari in the State of Minas Gerais, Brazil.

MATERIAL AND METHODS

Study area - The study was carried out at John Kennedy Forest (48º 11' W and 18º 38' S), an urban semideciduous seasonal forest in the city of Araguari, Minas Gerais, Brazil. The area of 11.2ha of the forest was largely composed of a semideciduous seasonal forest (73.21% of its total area), with arboreal individuals up to 25m of height. The remaining of the area comprised trails, coops of plants and a small park for kids. Yet, some gaps were found in the forest, as a result of standing dead trees or tree falls (Araújo et al., 1997). According to Köppen's classification, the climate in the municipal district of Araguari is Cwa, with a relatively dry season in the winter and rains in the summer. The annual average temperature is 22ºC, and annual rainfall of 1500mm (Rosa, 1992). The soil under the forest of Araguari was classified as an Acric Dark Red Latosol, with a franc-clayish texture. Due to the low availability of K, Ca and Mg, and to the high levels of exchangeable Al, the soil presented a high-acidity (Araújo et al., 1997).

Sampling the Vegetation - The height was the criterion to differentiate the canopy species from those of the lower strata. In order to sample the canopy tree species, 40 plots of 10m x 20m systematically located in the forest (0.8 ha) were used. In each plot, all trees with a circumference of at least 15cm at breast height (1.30m) were sampled. For the lower strata sub-plots of 10m x 10m, within the 10m x 20m plots were used. In those sub-plots, all individuals with at least one meter height and up to 15cm circumference on the base of the stem were sampled. With the objective of determining which individuals would be included in the research, a 2-m bamboo stick was used to measure their height. The identification of the species was made *in loco*. Unknown species were collected for subsequent identification and deposited in the Herbarium Uberlandense (HUFU-Federal University of Uberlândia). Identification was done by comparison with herbarium sheets and, specialists were also consulted. The classification system followed Cronquist (1988), except for Leguminosae which included Caesalpiniaceae, Fabaceae and Mimosaceae.

Data analysis - The phytosociological parameters (absolute and relative density, dominance, frequency, Shannon diversity index (H'), and importance value index (IVI)) were obtained using the PREPARE and PARAMS applications of the FITOPAC I program (Sherpherd, 1995). The Sørensen index (Mueller-Dombois and Ellemberg, 1974) was used to calculate floristic similarity between the canopy trees and the arboreal lower strata. In order to establish the ratio between the two strata, the number of individuals in the arboreal lower strata sampled in a 0.4ha area was divided by the individual of the same species at the canopy (0.8ha). For the comparison, the number of individuals of lower strata was projected for same area surveyed for canopy species.

RESULTS

In the phytosociological survey of the two arboreal strata, (lower and canopy), 4,396 individuals, distributed in 110 species, belonging to 46 families were sampled. In the lower strata, in 0.4ha, 3,218 individuals, belonging to 94 species, distributed in 43 families were sampled. In the canopy, 1,178 individuals, belonging to 90 species and 41 families were found in an area of 0.8ha (Table 1). The Shannon diversity index (H') was 3.3 nats/individual for the lower strata and 3.7 for the canopy, and the equability of Pielou (J') was 0.7 and 0.8, respectively. The floristic similarity (Sørensen index) between the canopy and the lower strata was 78.26%. Leguminosae, Rubiaceae and Myrtaceae were the families with a largest number of species in both the lower strata and the canopy, with 33 and 32% of the species total, respectively (Fig. 1). On the other hand, 24

families in the lower strata and 25 in the canopy had only one species (Table 1).

The 19 most important species of the canopy and lower strata had 67.4 and 69.9%, respectively of the total IVI. Among them, *Licania apetala* and *Micrandra elata* were ranked first and second in both strata. Among the 19 species with the highest IVI in the canopy, 13 had larger number of individuals in the lower strata. When compared with the canopy, *Licania apetala* (7.03), *Micrandra elata* (9.63), *Inga vera* (9.33), *Aspidosperma discolor* (9.80), *Inga laurina* (11.60), *Apuleia leiocarpa* (12.63), and *Micropholis venulosa* (16.83) showed a proportion over seven times the number of individuals in the lower strata; and *Astronium nelson-rosae* (5.63) and *Qualea jundiahy* (5.64) had about five times more individuals in the lower strata. Among the species of high importance value in the canopy, *Alchornea glandulosa* (0.22), *Pimenta pseudocaryophyllus* (0.42), *Copaifera langsdorffii* (0.48), *Heisteria ovata* (0.48) and *Didymopanax morototoni* (0.95) had less individuals in the lower strata (Table 1).

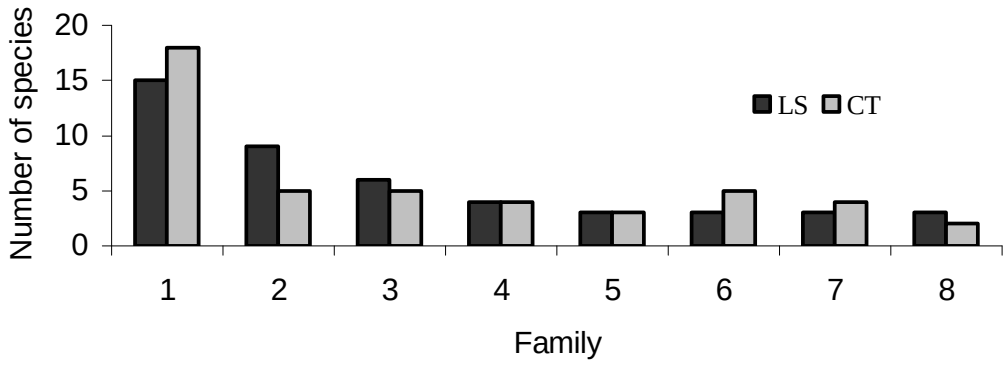

Figure 1 - Families with the largest numbers of species in the canopy trees (CT), and lower strata (LS), sampled in the semideciduous forest, Araguari, MG. 1 - Leguminosae, 2 - Myrtaceae, 3 - Rubiaceae, 4 - Euphorbiaeae, 5 - Chrysobalanaceae, 6 - Annonaceae, 7 - Lauraceae, 8 - Bignoniaceae.

Besides those species of a higher importance value index, a proportion of more than 13 times was registered in the lower strata than in the canopy in *Myrcia rostrata* (13.33), *Protium heptaphyllum* (18.46), *Casearia grandiflora* (22.67), *Siphoneugenia densiflora* (37.2), *Ocotea corymbosa* (47.33) and *Myrciaria* sp. (122.0) (Table 1). The lower strata and canopy presented 20 and 17 exclusive species respectively (Table 1).

Table 1 - Species of the arboreal lower strata and canopy trees, ranked according to the IVI of the canopy trees, in the phytosociological sampling of the semideciduous forest, Araguari, Minas Gerais. N = number of individuals sampled; CT = Canopy trees, LS = Lower strata; IVI = importance value index; P = proportion of individuals in the lower strata in relation to canopy. * Number of individuals projected for the same area surveyed for canopy species.

Family	Species	N		IVI		P
		CT	LS*	CT	LS	
Chrysobalacaceae	*Licania apetala* (E. Mey.) Fritsch	172	1210	34.07	36.74	7.03
Euphorbiaceae	*Micrandra elata* (Didr.) Müll. Arg.	97	934	27.97	31.63	9.63
Leguminosae	*Copaifera langsdorffii* Desf.	25	12	18.03	0.81	0.48
Euphorbiaceae	*Alchornea glandulosa* Poepp. & Endl.	73	16	12.12	1.42	0.22
Monimiaceae	*Siparuna guianensis* Aubl.	61	82	9.87	4.62	1.34

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Cont. Table 1

Araliaceae	*Didymopanax morototoni* (Aubl.) Decne. & Planch.	42	40	9.67	3.95	0.95
Annonaceae	*Duguetia lanceolata* A. St.-Hil.	49	128	9.32	8.18	2.61
Anacardiaceae	*Astronium nelson-rosae* Santin	32	180	8.75	7.95	5.63
Vochysiaceae	*Qualea jundiahy* Warm.	33	186	8.64	9.42	5.64
Leguminosae	*Inga laurina* (Sw.) Willd.	10	116	7.33	5.15	11.60
Rubiaceae	*Amaioua intermedia* Mart.	43	92	7.16	6.57	2.14
Sapotaceae	*Micropholis venulosa* (Mart & Eichler) Pierre	24	404	6.46	16.10	16.83
Celastraceae	*Maytenus* sp.	25	30	6.04	1.60	1.20
Leguminosae	*Inga vera* ssp. *affinis* (D.C.) T.D. Penn	27	252	5.41	10.45	9.33
Leguminosae	*Apuleia leiocarpa* (Vogel) J.F. Macbr.	16	202	5.35	8.51	12.63
Apocynaceae	*Aspidosperma discolor* A. DC.	20	196	5.17	9.11	9.80
Olacaceae	*Heisteria ovata* Benth.	21	10	5.16	0.69	0.48
Hippocrateaceae	*Cheiloclinium cognatum* (Miers) A.C. Sm.	24	76	5.12	4.77	3.17
Myrtaceae	*Pimenta pseudocaryophyllus* (Gomes) Landrum	24	10	5.04	0.41	0.42
Leguminosae	*Hymenaea courbaril* L.	9	36	4.31	2.88	4.00
Rubiaceae	*Ixora warmingii* Müll. Arg.	15	68	3.93	3.83	4.53
Anacardiaceae	*Tapirira peckoltiana* Engl.	6	10	3.90	0.74	1.67
Meliaceae	*Cabralea cangerana* Saldanha	22	12	3.85	1.16	0.55
Annonaceae	*Annona cacans* Warm.	6	-	3.71	-	0.00
Myristicaceae	*Virola sebifera* Aubl.	9	42	3.51	2.47	4.67
Burseraceae	*Protium heptaphyllum* (Aubl.) Marchand	13	240	3.47	9.71	18.46
Chrysobalacaceae	*Hirtella glandulosa* Spreng.	9	58	3.36	3.43	6.44
Rutaceae	*Zanthoxylum rhoifolium* Lam.	11	14	3.18	0.93	1.27
Rubiaceae	*Faramea cyanea* Müll. Arg.	15	114	3.06	5.77	7.60
Lauraceae	*Ocotea spixiana* (Nees) Mez	4	46	2.80	2.89	11.50
Melastomataceae	*Miconia* sp.	12	-	2.67	-	0.00
Combretaceae	*Terminalia brasiliensis* (Cambess. ex A. St.-Hil.) Eichler	7	4	2.52	0.33	0.57
Vochysiaceae	*Callisthene major* Mart.	3	4	2.44	0.35	1.33
Bignoniaceae	*Jacaranda macrantha* Cham.	10	18	2.44	1.62	1.80
Asteraceae	*Piptocarpha macropoda* (DC.) Baker	11	20	2.42	1.10	1.82
Chrysobalacaceae	*Hirtella gracilipes* (Hook. F.) Prance	7	22	2.41	1.42	22.00
Bombacaceae	*Chorisia speciosa* A. St.-Hil.	3	4	2.40	0.43	1.33
Boraginaceae	*Cordia sellowiana* Cham.	9	16	2.01	1.32	1.78
Myrtaceae	*Myrcia rostrata* DC.	9	120	2.00	6.83	13.33
Euphorbiaceae	*Maprounea guianensis* Aubl.	9	10	1.84	0.86	1.11
Flacourtiaceae	*Casearia grandiflora* Cambess.	9	204	1.83	8.96	22.67
Rubiaceae	*Alibertia sessilis* (Vell.) K. Schum.	8	84	1.75	5.44	10.50
Lacistemataceae	*Lacistema aggregatum* (P.J. Bergius) Rusby	8	48	1.74	3.48	6.00
Melastomataceae	*Miconia sellowiana* Naudin	6	-	1.69	-	0.00
Piperaceae	*Piper arboreum* Aubl.	11	-	1.66	-	0.00
Verbanaceae	*Vitex polygama* Cham.	3	18	1.64	1.00	6.00
Leguminosae	*Albizia polycephala* (Benth.) Killip ex	3	6	1.52	0.40	2.00
Myrtaceae	*Siphoneugenia densiflora* O. Berg.	5	186	1.43	9.01	37.20
Meliaceae	*Trichilia pallida* Sw.	7	48	1.42	2.83	6.86
Styracaceae	*Styrax acuminatus* Pohl	7	22	1.32	1.57	3.14
Myrtaceae	*Eugenia florida* DC.	5	22	1.29	1.65	4.40
Elaeocarpaceae	*Sloanea monospema* Vell.	4	14	1.23	1.35	3.50
Leguminosae	*Platypodium elegans* Vogel	5	14	1.15	1.00	2.80
Sapotaceae	*Pouteria torta* (Mart.) Radlk	4	4	1.13	0.31	1.00
Leguminosae	*Machaerium* sp.	4	2	1.06	0.21	0.50

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Moraceae	*Sorocea bonplandii* (Baiil.) W.C. Burger. Lanj. & Wess. Boer	6	42	1.04	2.23	7.00
Moraceae	*Ficus enormis* (Mart. Ex Miq.) Mart.	3	2	0.95	0.16	0.67
Opiliaceae	*Agonandra brasiliensis* Miers ex Benth. & Hook. F.	2	4	0.91	0.22	2.00
Leguminosae	*Swartzia apetala* Raddi	4	34	0.87	2.01	8.50
Bignoniaceae	*Tabebuia serratifolia* (Vahl) G. Nicholson	3	46	0.87	3.52	15.33
Leguminosae	*Senna macranthera* (DC. ex Collad.) H.S. Irwin & Barneby	6	8	0.76	0.62	1.33
Leguminosae	*Cassia ferruginea* (Schrader) Schrader ex DC.	2	2	0.75	0.17	1.00
Annonaceae	*Xylopia sericea* A. St.-Hil.	4	22	0.74	1.54	5.50
Lauraceae	*Ocotea corymbosa* (Meisn.) Mez	3	142	0.71	6.84	47.33
Clusiaceae	*Rheedia gardneriana* Planch. & Triana	3	28	0.71	2.26	9.33
Annonaceae	*Cardiopetalum calophyllum* Schltdl.	3	22	0.69	1.24	7.33
Apocynaceae	*Aspidosperma cylindrocarpon* Müll.	1	5	0.64	0.77	5.00
Flacourtiaceae	*Casearia gossypiosperma* Briq.	3	-	0.62	-	0.00
Lauraceae	*Cryptocarya aschersoniana* Mez	2	14	0.60	1.03	7.00
Nyctaginaceae	*Guapira cacerensis* (Hoehne) Lund	2	20	0.58	1.18	10.00
Lauraceae	*Ocotea* sp.	1	-	0.56	-	0.00
Leguminosae	*Machaerium villosum* Vogel	1	10	0.52	0.59	10.00
Leguminosae	*Swartzia myrtifolia* Sm.	2	-	0.52	-	0.00
Flacourtiaceae	*Casearia sylvestris* Sw.	2	16	0.52	1.00	8.00
Leguminosae	*Sweetia fruticosa* Spreng.	1	-	0.50	-	0.00
Moraceae	*Maclura tinctoria* (L.) D. Don ex Steud.	1	-	0.49	-	0.00
Melastomataceae	*Mouriri apiranga* Spruce ex Triana	1	-	0.45	-	0.00
Myrtaceae	*Myrciaria* sp.	1	122	0.45	7.91	122.0
Annonaceae	*Annona* sp.	2	-	0.42	-	0.00
Proteaceae	*Roupala brasiliensis* Klotzsch	1	16	0.38	0.91	16.00
Leguminosae	*Ormosia arborea* (Vell.) Harms	2	-	0.37	-	0.00
Lecythidaceae	*Cariniana estrellensis* (Raddi) Kuntze	2	14	0.35	0.99	7.00
Sapindaceae	*Matayba guianensis* Aubl.	1	6	0.34	0.53	6.00
Euphorbiaceae	*Pera glabrata* (Schott) Poepp. ex Baill.	1	-	0.32	-	0.00
Tiliaceae	*Luehea grandiflora* Mart.	1	-	0.28	-	0.00
Leguminosae	*Machaerium* sp. 1	1	-	0.27	-	0.00
Leguminosae	*Machaerium nyctitans* (Vell.) Benth.	1	2	0.27	0.27	2.00
Myrsinaceae	*Rapanea lancifolia* (Mart.) Mez	1	2	0.26	0.18	2.00
Leguminosae	*Bauhinia ungulata* L.	1	-	0.26	-	0.00
Rubiaceae	*Psychotria* sp.	1	-	0.26	-	0.00
Sapindaceae	*Cupania vernalis* Cambess.	-	32	-	1.61	32.00
Polygalaceae	*Bredemeyera floribunda* Willd.	-	24	-	1.21	24.00
Rubiaceae	*Alibertia concolor* (Cham.) K. Schum.	-	16	-	1.11	16.00
Leguminosae	*Machaerium aculeatum* Raddi	-	8	-	0.74	8.00
Bombacaceae	*Eriotheca candolleana* (K. Schum.) A. Robyns	-	4	-	0.51	4.00
Rutaceae	*Metrodorea pubescens* A. St.- Hil. & Tul.	-	4	-	0.50	4.00
Myrtaceae	*Gomidesia lindeliana* O. Berg.	-	4	-	0.47	4.00
Myrtaceae	*Myrcia coriacea* (Vahl.) DC.	-	4	-	0.41	4.00
Rubiaceae	*Rudgea viburnoides* (Cham.) Benth.	-	4	-	0.39	4.00
Myrtaceae	*Myrcia tomentosa* (Aubl.) DC.	-	4	-	0.34	4.00
Ulmaceae	*Celtis iguanaea* (Jacq.) Sarg.	-	4	-	0.27	4.00
Nyctaginaceae	*Guapira* sp.	-	2	-	0.26	2.00
Verbenaceae	*Aegiphila sellowiana* Cham.	-	4	-	0.24	4.00
Rhamnaceae	*Colubrina* sp.	-	4	-	0.23	4.00
Leguminosae	*Sclerolobium paniculatum* Vogel	-	4	-	0.23	4.00

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Cecropiaceae	*Cecropia pachystachya* Trécul	-	2	-	0.20	2.00
Euphorbiaceae	*Margaritaria nobilis* L. f.	-	2	-	0.18	2.00
Bignoniaceae	*Tabebuia* sp.	-	2	-	0.17	2.00
Symplocaceae	*Symplocos* sp.	-	2	-	0.17	2.00
Myrtaceae	*Calyptranthes lucida* DC.	-	2	-	0.15	2.00

DISCUSSION

The forest of Araguari is an urban residual forest, administered by the municipality since 1988 (Araújo et al., 1997). In spite of the disturbance report (construction of paved trails, introduction of exotic species, isolation effect, among others), the forest presents physionomic and floristic aspects similar to other forest formations in the Triângulo Mineiro region. The height of the canopy trees, the complexity of the arboreal strata, and the richness of woody species determined herein are among the values found by Araújo and Haridasan (1997), Moreno and Schiavini (2001) in similar plant communities close to the area. There was a high floristic similarity between the lower strata and the canopy, showing that the trees in the forest were in their majority, regenerating in the area, and that the floristic composition of the community was not likely to undergo serious changes, except for those species with a small number of individuals in the lower strata, and those which, presented also a small population size in the canopy.

The Shannon diversity index for species of the lower strata and canopy were among the values (3.04 to 4.34) found in other surveys both for canopy (Araújo and Haridassan, 1997; Pinto and Oliveira-Filho, 1999; Dislich et al., 2001) and (1.75 to 2.01) with lower strata (Durigan et al., 2000; Salimon and Negrelle, 2001). The maximum diversity was found when all species were equally abundant (Magurran, 1988); in John Kennedy Forest there was a great predominance of some species, thus reducing the local diversity index.

Regarding the three families with the largest number of species found in the forest of Araguari, the Leguminosae presented the highest richness in Tropical forests. This could be a consequence of nitrogen transfer and retention, an important mechanism for the development and establishment of plants in this family (Faria et al., 1984). Myrtaceae and Rubiaceae occur with many species in the understorey (Durigan et al., 2000) and the canopy (Bernacci and Leitão Filho, 1996; Araújo and Haridasan, 1997), in semideciduous forests. The number of individuals found in the phytosociological general sampling in the forest of Araguari was larger than in other studies developed in the region of Triângulo Mineiro. This was explained by the sampling of individuals $\geq$ 1 meter of height, which determined the occurrence of a great number of young plants in the lower strata. This fact had already been observed by Felfili (1997a) in gallery forests, and Durigan et al. (2000) in semideciduous forests, with similar sampling criteria. Another fact observed was the occurrence of few species with numerous individuals. Most of the species had few individuals, a characteristic considered common in seasonal forests (Martins, 1991; Pagano et al., 1987).

The results showed that among the species with a higher importance value index in both strata, *Licania apetala* and *Micrandra elata* had the highest number of individuals. These species characterized the forest of Araguari, occupying the canopy with trees of dense crown, up to 25 m high. The occurrence of one or few species highly dominant in isolated forest fragments had already been observed by Leigh et al. (1993) and Araújo et al. (1997). In addition to the two mentioned species, *Astronium nelson-rosae*, *Qualea jundiahy*, *Inga laurina*, *Micropholis venulosa*, *Inga vera* ssp. *affinis*, *Apuleia leiocarpa* and *Aspidosperma discolor* had more individuals in the lower strata, and the proportion between this strata and the canopy was over five times. *A. nelson-rosae*, *I. vera* and *I. laurina* appear in phytosociological surveys of semideciduous forests, but commonly with a low number of individuals (Bernacci and Leitão Filho, 1996; Rodrigues et al., 1989; Lopes et al., 2002). *Q. jundiahy*, belonging to aluminum-accumulating Vochysiaceae (Haridasan and Araújo, 1988), occured with 14 and 32 individuals/ha in the canopy of semideciduous forests on aluminum-rich soils in the region of Triângulo Mineiro (Araújo and Haridasan, 1997; Araújo et al., 1997). *M. venulosa* was sampled with less than ten individuals in the arboreal strata of a gallery forest in DF (Felfili, 1994), and in a

semideciduous forest in the south of Minas Gerais (Pinto and Oliveira-Filho, 1999). *A. leiocarpa* and *A. discolor* presented large populations on the canopy of forests in Distrito Federal (Felfili, 1997a), and in the region of Triângulo Mineiro (Araújo et al., 1997). According to Mantovani (2001), the occupation history, the natural dynamics and man's action processes could explain those variations. Considering the isolation of the fragment and the degree of human activity in the study area, those species seemed to be good competitors in the current stage of the forest.

Some of the most important species of the canopy, *Copaifera langsdorffii*, *Didymopanax morototoni*, *Alchornea glandulosa*, *Heisteria ovata* and *Pimenta pseudocaryophyllus* had a smaller number of individuals in the lower strata than in the canopy. *Copaifera langsdorffii* is a species with high dominance, but with few individuals in semideciuous forests in the region of Triângulo Mineiro (Araújo and Haridasan, 1997; Araújo et al., 1997), and in gallery forests in DF (Felfili, 1994). Felfili (1997b) suggests that many species of canopy do not follow the pattern of the "reverse-J", i.e., they do not present a high density of young individuals. This fact suggests low regeneration in recent years. *Didymopanax morototoni* and *Alchornea glandulosa* occur with many individuals in gaps in the forest of Araguari (Araújo et al., 1997), and present characteristics of pioneer species. *Heisteria ovata* presented also a few adult individuals in other forests in the South of Minas Gerais (Pinto and Oliveira-Filho, 1999; Lopes et al., 2002). *Pimenta pseudocaryophyllus* was mentioned as rare species by Werneck et al. (2000b) in deciduous forests in Minas Gerais. The number of plant species individuals can vary locally in response to the fragmentation and human activity (Whitmore, 1997). The opening of gaps (Laurence, 1997), absence of pollination, and seed dispersal (Viana et al., 1997), and the introduction of exotic species (Laurence, 1997), may be causing factors of the low recruitment for many species.

However, *Protium heptaphyllum*, *Myrcia rostrata*, *Casearia grandiflora*, *Siphoneugenia densiflora*, *Ocotea corymbosa* and *Myrciaria* sp. with a small importance value index and with few individuals in the canopy had more than 120 individuals in the lower strata. *Protium heptaphyllum*, which, according to Pinto and Oliveira-Filho (1999) was an initial secondary species, typical of humid environments in the area of Triângulo Mineiro, inhabited preferably gallery forests (Cardoso and Schiavini, 2002). Its presence in the forest of Araguari was likely to indicate possible changes in the humidity of the soil of the area. *Myrcia rostrata* and *Casearia grandiflora*, both pioneer species (Gandolfi et al., 1995) presented many individuals in areas of cerradão border (Cardoso and Schiavini, 2002) and semideciduous forests (Araújo and Haridasan, 1997) in Uberlândia, MG. *Siphoneugenia densiflora*, an canopy species with characteristics of secondary initial (tolerant to shade) (Tabarelli and Mantovani, 1997) was found with a low importance in a riparian forest in Itutinga (Van Den Berg and Oliveira-Filho, 2000). *Ocotea corymbosa*, species of canopy, a secondary initial (Gandolfi et al., 1995) was mentioned with a single individual in studies developed in São Paulo (Pagano et al., 1987; Rodrigues et al., 1989). Species with different life habits like the ones above mentioned seemed to be exploring, with many individuals in the lower strata, the several niches (gaps, borders of forest, areas covered with lianas, dense canopy) in the forest of Araguari. In the future, their representation in the canopy would depend on the forest dynamics and human activities occurring in the area.

Twenty species were exclusive of the lower strata, and 17 of the canopy. In their majority, these cited species previously do not exceed six individuals and they are, therefore, relatively rare. The changes in the structure of forest communities are caused by those rare species (Crow, 1980; Nascimento et al., 1999). Nascimento et al. (1999) mentioned that species with low population size and widely scattered in fragments could be more subject to local extinction. According to Cielo Filho and Santin (2002), species with few individuals, obligatory cross fertilization and without vectors for pollination and/or seed dispersal were likely to become extinct more easily. According to Turner et al. (1996), the extinction was due to the individuals death combined with the absence of recruitment. These species with few individuals were the most vulnerable to the fragmentation factors and human activities in the urban forest of Araguari, and required a close follow up of their responses to such processes.

Further studies and continuous observation would be necessary on both the structure and composition of the tree species so that the impacts of possible changes or damages to the forest, due to tourist

visitation, as well as fragmentation effects could be effectively reduced.

RESUMO

O presente estudo pretendeu determinar as características fitossociológicas do estrato arbóreo superior e inferior, de uma floresta estacional semidecidual, visando à comparação entre estes estratos. As espécies do estrato superior ($\geq$ 15 cm circunferência à altura do peito) foram amostradas em 40 parcelas de 10m x 20m. As do estrato inferior ($\geq$ 1m até 15 cm de circunferência na base do caule) em parcelas de 10m x 10m. *Licania apetala* e *Micrandra elata* obtiveram o primeiro e segundo lugares nos dois estratos. Entre as espécies de maior valor de importância do estrato superior *Alchornea glandulosa*, *Pimenta pseudocaryophyllus*, *Copaifera langsdorffii*, *Heisteria ovata* e *Didymopanax morototoni*, tiveram uma razão menor do que 1 indivíduo no estrato inferior em relação ao superior. Entretanto, houve uma alta similaridade florística entre o estrato inferior e o superior.

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