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Qualitative survey of the entomofauna in a semideciduous seasonal forest remnant

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Resumo

A Mata Atlântica apresenta apenas 8,5% em seus remanescentes florestais e no estado de São Paulo, uma das suas fitofisionomias, Floresta Estacional Semidecidual, tem sofrido desmatamento acelerado e contínuo, estando as poucas áreas ainda preservadas, em parques, reservas ou em propriedades particulares. Os insetos desenvolvem diversas funções ecológicas dentro desses sistemas e são considerados bons indicadores de impactos ambientais e importantes integrantes nos processos biológicos. O objetivo do presente estudo foi realizar um levantamento qualitativo preliminar da diversidade da entomofauna em um remanescente florestal, através do método por varredura e registro fotográfico, e analisar a correlação entre o número de espécimes registrados e algumas variáveis climatológicas. Foram registrados 213 indivíduos, distribuídos entre 14 ordens, 85 famílias e 191 gêneros. Coleóptera foi a ordem mais representada com 64 registros. As variáveis climatológicas temperatura máxima e mínima, pluviosidade e umidade relativa do ar não se mostraram influentes sobre a quantidade de organismos. A riqueza de espécies registrada neste estudo constitui um recurso natural imensurável, e, portanto, a preservação desta área se torna justificável, não apenas por estar contida em um Parque Estadual, mas também pelo seu patrimônio genético.

Palavras-chave: Mata atlântica, Insetos, Inventário.

Abstract

The Atlantic Forest has only 8.5% of its forest remnants and in the state of São Paulo, one of its phytophysiognomies, the Semideciduous Seasonal Forest, has registered accelerated and continuous deforestation, remaining for few areas still preserved, in parks, reserves or on private properties. Insects develop several ecological functions within these systems and are considered good indicators of environmental impacts and important members of biological processes. The objective of the present study was to carry out a preliminary qualitative survey of the diversity of entomofauna in a forest remnant, using the scanning method and photographic record, and to analyze the correlation between the number of specimens recorded and some climatological variables. A total of 213 individuals were registered, distributed among 14 orders and 85. Coleoptera was the most represented order with 64 records. Climatological variables, maximum and minimum temperature, rainfall and relative humidity did not influence the number of organisms. The species richness registered in this study constitutes an immeasurable natural

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resource, and, therefore, the preservation of this area becomes justifiable, not only because it is contained in a State Park, but also because of its genetic heritage.

Keywords: Atlantic Forest; Insects; Inventory.

Introduction

Even though it is one of the most diverse biomes in Brazil and of significant environmental importance, the Atlantic Forest only accounts for 8.5% of its forest remnants (FUNDAÇÃO SOS MATA ATLÂNTICA, 2014; LIRA et al., 2016) and remains incessantly altered by actions anthropic (DANTAS; ALMEIDA; SANTOS, 2017), mainly through the rapid course of urban expansion that promotes direct damage and a drastic decrease in biodiversity, leaving the biome in critical conditions (CYSNEIROS et al., 2016; TEIXEIRA et al., 2019).

Among the phytophysiognomies of the Atlantic Forest biome, the semideciduous seasonal forest stands out, characterized by diversified physiognomies (IVANAUSKAS; ASSIS, 2012) and by an intense leaf seasonality of the main tree constituents, as a result of the dry season and the decrease in temperature in the colder months (BARBOSA; THOMAS, 2002). However, in the state of São Paulo, this phytophysiognomy has suffered accelerated and continuous deforestation as a result of easy accessibility and real estate and agricultural constraints (KOTCHETKOFF-HENRIQUES; JOLY, 1994), with what remains of this phytophysiognomy still being preserved, in parks, reserves or on private properties distributed by the state (TABANEZ; VIANA; DIAS, 1997).

Although reduced and fragmented, the Atlantic Forest exhibits great biodiversity distributed among plant specimens, mammals, birds, reptiles, amphibians, fish and an infinity of invertebrates, including insects, with a significant portion composed of endemic species (CAMPANILI; SCHAFFER, 2010).

Insects are found in different ecosystems and contribute to various ecological functions such as seed dispersal, pollination, organic matter cycling, as vectors of diseases, being present in the food chain of several species (SEIBOLD et al., 2021) and also, some are pests in monocultures developed by the human species (SALIBA et al., 2021). The success of this group is demonstrated by the considerable number of specimens and by the adaptive radiation that can be attributed to several factors, mainly, by the evolution of flight, which conferred a distinct advantage over other terrestrial invertebrates, such as dispersion, escape from predators and access to food (RUPERT; FOX; BARNES, 2006; DEL-CLARO, 2012).

Inventories and monitoring of insect diversity and changes in its quantification are fundamental for understanding biodiversity in a given ecosystem (TRIPLERHORN; JOHNSON, 2011), since they support important information such as the biological cycle, peaks of occurrence, population density and integrity of environments (GARLET; COSTA; BOCARDIN, 2016), because these organisms are considered good indicators of environmental

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impacts, due to the great diversity of species and habitats, in addition to being important in the biological processes of natural systems (THOMANZINI; THOMANZINI, 2002).

In forest systems, insects are the most abundant organisms, and the number of species decreases with increasing anthropization of the environment (THOMANZINI; THOMANZINI, 2002), having, this fact, aroused the interest and the need to obtain information about the dynamics of these organisms, in order to obtain answers about the quality of the evaluated ecosystem (LOGAN, 2020).

Thus, the present study aimed to carry out a preliminary qualitative survey of the diversity of the entomofauna occurring in a fragment of seasonal semideciduous forest in Atlantic Forest biome.

Material and methods

Study area

This work was developed in the Águas da Prata State Park (21º54' to 21º55' S and 46º41' to 46º42' W), a small forest fragment with 48.4 hectares located at an altitude between 840 and 1060 meters, in the city of Águas da Prata, São Paulo (Figure 1). According to Migliorini Jr et al. (1983), the reserve has an altitude tropical climate with a cold and dry season (April to September - average annual temperature of 18 ºC and rainfall between 15 and 80 mm/month) and a hot and humid season (October to March - temperature annual average of 26 ºC and rainfall between 100 and 255 mm/month).

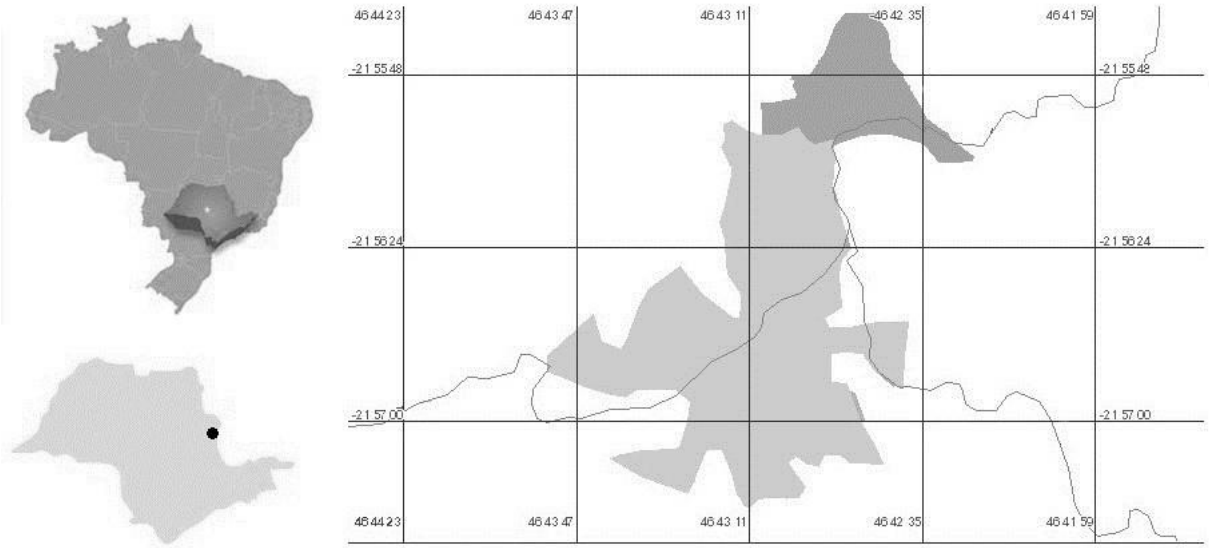

Figure 1. Location of the municipality of Águas da Prata in the state of São Paulo, Brazil (left side); Municipality of Águas da Prata - SP (right side). Urban area (■); State Reserve (■).

This fragment of Atlantic Forest is constituted by Semideciduous Seasonal Forest composed of representative species of dry and humid environments, with plant species little known, exhibiting herbaceous strata, low shrubs, lower trees and upper trees with well-closed

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vegetation zones with the presence of species parasites, epiphytes and woody plants (INSTITUTO FLORESTAL, 2011).

Qualitative survey of entomofauna and data analysis

For the qualitative survey and identification of the entomofauna present in the park, the scanning method and photographic records of all insects found in the area were established, except for insects of the same species already registered, since the objective was to identify as many organisms of different species as possible. The records were made on trails already existing at the local, in random daytime walks, once a month between January and December 2019. To make the photographic record of the archetypes found easier, some insects were collected with the help of an entomological net, in order to capture detailed morphological images, avoiding injuries in their handling. Specimens were identified to the taxonomic level of genus through consultation with specialists and specialized bibliographies.

To verify whether there are significant differences in the quantities of organisms identified between the evaluated months, an analysis of variance (ANOVA – one way) was performed and to verify if differences occur between the dry period and the rainy period, an analysis with 999 auto-resamplings (Bootstrap – hypothesis test t for two independent samples) was performed. These analyzes were performed using the statistical program BioEstat 5.0 and were considered significantly different when $p < 0.05$.

Species richness was estimated by summing the number of taxa and Shannon diversity (H'), uniformity (E) and Simpson dominance (D) for insect families were calculated using the statistical program PAST 3.20. These analyzes were also performed for the two periods (dry and rainy) separately and for the total recorded.

Results and discussion

The method of surveying the entomofauna by scanning and photographic recording is not as efficient, in relation to the number of insects to be registered, when compared to the different traps used to capture this group, since this method may not be effective for capturing small species. (CASARI; IDE, 2012). However, it proved to be quite satisfactory for a qualitative survey in a fragment of small proportions.

The collected data corroborate the perceptions of Brown Junior (1997) and Laurance et al. (2011), who reported that the size of a fragment may not be decisive in the composition of insect richness and abundance. According to the aforementioned authors, elements such as topography, climate, surrounding matrix, anthropogenic disturbances and edge effect, favor the increase of heterogeneity or connectivity between forests and usually manifest a strong and positive correlation with diversity and/or with the abundance of insects.

During the period sampled in the Águas da Prata State Park (SP), 213 specimens were recorded, distributed among 14 orders, 85 families and 193 genera identified and 5 unidentified genera (Figure 2). Coleoptera was the most represented order with 30.05% (n = 64) of the total specimens collected, followed by Lepidoptera (24.41%; n = 52) and Hemiptera (18.31%; n = 39). Isoptera, Phasmatodea and Thysanoptera were the least found, showing 0.47% of the total collected, with one individual each.

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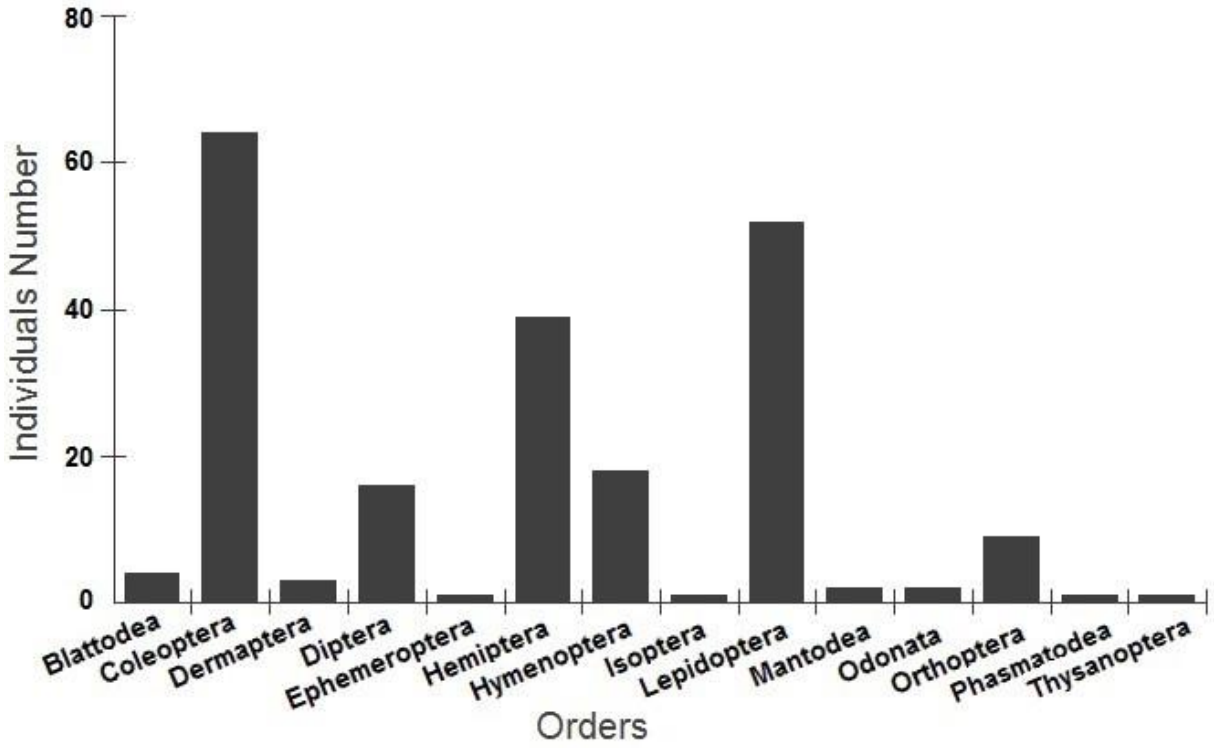

Figure 2. Number of specimens, distributed in order, of the entomofauna found in the Águas da Prata State Park.

Coleoptera is among the orders most found in surveys of entomofauna, and its occurrence is common in different environments (TRIPLERHORN; JOHNSON, 2011). Among arthropods, these are the most abundant organisms with about 360 thousand species described, performing different functions in forest ecosystems (SANTOS; TREVISAN; SOUZA, 2019; SILVA et al., 2020) and responding satisfactorily to disturbances in the environment (PENTEADO et al., 2011).

Alves et al. (2017) also found Coleoptera as the most abundant Order, with 25% of the total collected, in a remnant of Atlantic Forest in the state of Sergipe and Lopes, Da Silva and Antunes (2015), in a remnant of Semideciduous Seasonal Forest, found these organisms making up 25.19% of the entire sample, second only to Hymenoptera, in the state of Paraná. These latter authors also reported a low occurrence for the orders Dermaptera, Isoptera and Thysanoptera (n = 1), corroborating the present study in which these orders had three, one and one specimen identified, respectively.

Regarding the temporal distribution of insects, the Águas da Prata State Park presented the highest values for the months of April, October and December and the lowest records for the months of May and June (Table 1). Among the months sampled, there was no significant difference in relation to the number of insects (p = 0.9915), however, a statistical difference was proven between the dry and rainy periods (p = 0.0460). The indices analyzed showed that

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the diversity (H') of registered families was greater in the dry season, while dominance (D) and uniformity (E) were greater in the rainy season (Table 2).

The difference found between the dry and rainy periods was mainly due to the high presence of specimens of the orders Coleoptera, Hemiptera and Lepidoptera in the rainy season. The increase in the population of Hemiptera in the rainy season is probably associated with their reproductive habits, since, according to Medeiros et al. (2009), phytophagous hemipterans start flocking for reproduction at times when the weather is cloudy or in periods of greater rainfall, and are therefore particularly intense at the beginning of the rainy season.

During the rainy season, surface moisture in the soil promptly impairs the quality and quantity of food resources used by different species of Coleoptera, influencing the survival of organisms in this group, which are identified as bioindicators that are sensitive to changes in the environment and exhibit important activities, such as nutrient cycling, pollination, seed dispersal and the control of parasitic species (NICHOLS et al., 2008). However, the great abundance of these organisms shows that the area studied is still in a good state of conservation.

According to Tabarelli et al. (2010) and Filgueiras, Lannuzzi and Leal (2011), the presence of important indicators of environmental quality in small fragments, such as Lepidoptera, which play an essential role in ecological webs, being defoliators, prey of other invertebrates and vertebrates and reducers of organic matter, highlights the relevance and primordiality of preservation of small fragments for the stability of the integrity of the original insect community, corroborating this study where these organisms were abundant both in the dry season and in the rainy season.

Table 1. Number of specimens distributed in their respective orders, recorded in the Águas da Prata State Park-SP, for the months sampled and for the rainy and dry season separately.

Orders	**Sampling Periods**												**Dry**	**Rainy**
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Season**	**Season**
Blattodea	0	1	0	1	0	0	0	0	0	0	1	1	1	3
Coleoptera	1	5	3	4	3	6	4	8	3	15	7	5	28	36
Dermaptera	2	0	0	0	0	0	0	0	1	0	0	0	1	2
Diptera	1	2	0	1	0	0	0	3	3	1	0	5	7	9
Ephemeroptera	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Hemiptera	3	6	6	2	1	3	3	0	4	4	0	7	13	26
Hymenoptera	2	1	1	2	1	1	0	4	2	0	4	0	10	8
Isoptera	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Lepidpotera	9	3	8	11	4	6	1	2	2	1	5	0	26	26
Mantodea	0	0	0	0	2	0	0	0	0	0	0	0	2	0
Odonata	0	0	0	0	0	0	0	0	0	1	0	1	0	2
Orthoptera	0	0	0	1	1	0	0	0	0	3	0	4	2	7
Phasmatodea	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Thysanoptera	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	19	19	18	22	13	16	8	17	16	25	17	23	93	120

Table 2. Richness (S), Shannon's Diversity (H'), Simpson's Dominance (D) and Uniformity (E) of insect families recorded in Águas da Prata State Park-SP.

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Rainy Season				Dry Season				Total Sampled			
S	H'	D	E	S	H'	D	E	S	H'	D	E
10	1.833	0.8014	0.7961	12	1.836	0.7929	0.7389	14	1.876	0.8012	0.711

Among the families with the most species recorded in the Águas da Prata State Park, four belong to the Coleoptera, with Scarabeidae (n = 13; 20.31%) being the most represented of this group, followed by Curculionidae (n = 11; 17.18%), Coccinelidae (n = 9; 14.06%) and Chrysomelidae (n = 8; 12.5%). Two other abundantly recorded families were Ninphalidae (n = 13) and Erebidae (n = 11) with 25% and 21.15%, respectively, of the representatives of the order Lepidoptera. Coreidae (Hemiptera) also had a high incidence, being represented by 10 species and 25.64% of all organisms of that order (Table 3).

Table 3. Orders, Families, number of individuals, percentage of family within the Order and total percentage of individuals registered in the Águas da Prata State Park, SP.

Order	Family	Specie	% of Family in order	% of Family in total
Blattodea	Blaberidae	*Pycnoscelus* sp.	50	0.93
Blattodea	Blaberidae	*Parahormetica* sp.		
Blattodea	Corydiidae	*Euthyrrhapha* sp.	25	0.47
Blattodea	Ectobiidae	*Chorisoneura* sp.	25	0.47
Coleoptera	Bostrichidae	*Lichenophanes* sp.	1.56	0.47
Coleoptera	Cantharidae	*Chauliognathus* sp.	1.56	0.47
Coleoptera	Carabidae	*Notiobia* sp.	1.56	0.47
Coleoptera	Cerambycidae	*Trachyderes* sp.	6.25	1.90
Coleoptera	Cerambycidae	*Parandra* sp.		
Coleoptera	Cerambycidae	*Mallodon* sp.		
Coleoptera	Cerambycidae	*Dorcacerus* sp.		
Coleoptera	Chrysomelidae	*Monocesta sp.*	12.5	3.85
Coleoptera	Chrysomelidae	*Diabrotica* sp.		
Coleoptera	Chrysomelidae	*Cyrtonota* sp.		
Coleoptera	Chrysomelidae	*Iphimeis* sp.		
Coleoptera	Chrysomelidae	*Systena* sp.		
Coleoptera	Chrysomelidae	*Eumolpus sp.*		
Coleoptera	Chrysomelidae	*Lexiphanes* sp.		
Coleoptera	Chrysomelidae	*Botanochara* sp.		
Coleoptera	Coccinelidae	*Cycloneda* sp.	14.06	4.33
Coleoptera	Coccinelidae	*Eriopis* sp.		
Coleoptera	Coccinelidae	*Exochomus* sp.		
Coleoptera	Coccinelidae	*Harmonia* sp.		
Coleoptera	Coccinelidae	*Hippodamia* sp.		
Coleoptera	Coccinelidae	*Psyllobora* sp.1		
Coleoptera	Coccinelidae	*Psyllobora* sp.2		
Coleoptera	Coccinelidae	*Hyperaspis* sp.		
Coleoptera	Coccinelidae	*Chilocorus* sp.		
Coleoptera	Curculionidae	*Naupactus* sp.	17.18	5.17
Coleoptera	Curculionidae	*Heilipodus* sp.1		
Coleoptera	Curculionidae	*Heilipodus* sp.2		
Coleoptera	Curculionidae	*Sphenophorus* sp.		
Coleoptera	Curculionidae	*Cosmopolites* sp.		

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Coleoptera	Curculionidae	*Thoracus* sp.		
Coleoptera	Curculionidae	*Rhigus* sp.		
Coleoptera	Curculionidae	*Metamasius* sp.		
Coleoptera	Curculionidae	*Otiorhynchus* sp.		
Coleoptera	Curculionidae	*Heilipus* sp.		
Coleoptera	Curculionidae	*Conotrachelus* sp.		
Coleoptera	Dermestidae	*Attagenus* sp.	1.56	0.47
Coleoptera	Elateridae	*Conoderus* sp.	1.56	0.47
Coleoptera	Erotylidae	*Iphiclus* sp.	3.12	0.93
Coleoptera	Erotylidae	*Mycotretus* sp.		
Coleoptera	Lagriidae	*Lagria* sp.	1.56	0.47
Coleoptera	Lampyridae	*Aspisoma* sp.		
Coleoptera	Lampyridae	*Pterotus* sp.	4.68	1.40
Coleoptera	Lampyridae	*Lamprocera* sp.		
Coleoptera	Lycidae	*Calopteron* sp.	3.12	0.93
Coleoptera	Lycidae	*Mesopteron* sp.		
Coleoptera	Scarabaeidae	*Cyclocephala* sp.		
Coleoptera	Scarabaeidae	*Bothynus* sp.1		
Coleoptera	Scarabaeidae	*Bothynus* sp.2		
Coleoptera	Scarabaeidae	*Stenocrates* sp.		
Coleoptera	Scarabaeidae	*Ceraspis* sp.		
Coleoptera	Scarabaeidae	*Geniates* sp.		
Coleoptera	Scarabaeidae	*Chariodema* sp.	20.31	6.10
Coleoptera	Scarabaeidae	*Anomala* sp.		
Coleoptera	Scarabaeidae	*Rutela* sp.		
Coleoptera	Scarabaeidae	*Gymnetis* sp.		
Coleoptera	Scarabaeidae	*Pelidnota* sp.1		
Coleoptera	Scarabaeidae	*Pelidnota* sp.2		
Coleoptera	Scarabaeidae	*Dichotomius* sp.		
Coleoptera	Staphylinidae	*Xanthopygus* sp.	1.56	0.47
Coleoptera	Tenebrionidae	*U.G.*		
Coleoptera	Tenebrionidae	*Poecilesthus* sp.		
Coleoptera	Tenebrionidae	*Strongylium* sp.	7.81	2.35
Coleoptera	Tenebrionidae	*Blapida* sp.		
Coleoptera	Tenebrionidae	*Lobopoda* sp.		
Dermaptera	Anisolabididae	*Euborellia* sp.	33.33	0.47
Dermaptera	Pygidicranidae	*Pyragropsis* sp.	33.33	0.47
Dermaptera	Forficulidae	*Doru* sp.	33.33	0.47
Diptera	Asilidae	*U.G.*	6,25	0.47
Diptera	Bibionidae	*Dilophus* sp.	12,5	0.93
Diptera	Bibionidae	*Plecia* sp.		
Diptera	Calliphoridae	*Lucilia sp.*	6,25	0.47
Diptera	Culicidae	*Aedes* sp.	6,25	0.47
Diptera	Dolichopodidae	*Condylostylus* sp.	6,25	0.47
Diptera	Lauxanidae	*Chaetominettia* sp.	6,25	0.47
Diptera	Micropezidae	*Taeniaptera* sp.	6,25	0.47
Diptera	Neriidae	*Nerius* sp.	6,25	0.47
Diptera	Psychodidae	*Psychoda* sp.	6,25	0.47
Diptera	Stratiomyidae	*Cyphomyia* sp.	6,25	0.47
Diptera	Sciaridae	*Sciara* sp.	6,25	0.47
Diptera	Tachinidae	*Leschenaultia* sp.	6,25	0.47
Diptera	Tipulidae	*Tipula* sp.1	12,5	0.93
Diptera	Tipulidae	*Tipula* sp.2		

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Diptera	Ulidiidae	*U.G.*	6,25	0.47
Ephemeroptera	Baetidae	*U.G.*	100	0.47
Hemiptera	Cercopidae	*Deois* sp.	2.56	0.47
Hemiptera	Cicadellidae	*Acrogonia* sp.	17.95	3.39
Hemiptera	Cicadellidae	*Gypona* sp.		
Hemiptera	Cicadellidae	*Sibovia* sp.		
Hemiptera	Cicadellidae	*Bucephalogonia* sp.		
Hemiptera	Cicadellidae	*Empoasca* sp.		
Hemiptera	Cicadellidae	*Parathona* sp.		
Hemiptera	Cicadellidae	*Molomea* sp.		
Hemiptera	Cicadidae	*Dorisiana* sp.	5.13	0.93
Hemiptera	Cicadidae	*Fidicina* sp.		
Hemiptera	Clastopteridae	*Clastoptera sp.*	2.56	0.47
Hemiptera	Coreidae	*Sphictyrtus* sp.	25.64	4.70
Hemiptera	Coreidae	*Zoreva* sp.		
Hemiptera	Coreidae	*Leptoglossus* sp.1		
Hemiptera	Coreidae	*Leptoglossus* sp.2		
Hemiptera	Coreidae	*Hypselonotus* sp.1		
Hemiptera	Coreidae	*Hypselonotus* sp.2		
Hemiptera	Coreidae	*Spartocera* sp.1		
Hemiptera	Coreidae	*Spartocera* sp.2		
Hemiptera	Coreidae	*Zicca* sp.		
Hemiptera	Coreidae	*Chariesterus* sp.		
Hemiptera	Flatidae	*Poekilloptera* sp.	2.56	0.47
Hemiptera	Largidae	*Largus* sp.1	7.69	1.40
Hemiptera	Largidae	*Largus* sp.2		
Hemiptera	Largidae	*Largus* sp.3		
Hemiptera	Membracidae	*Enchenopa* sp.	7.69	1.40
Hemiptera	Membracidae	*Horiola* sp.		
Hemiptera	Membracidae	*Membracis* sp.		
Hemiptera	Miridae	*Phytocoris* sp.	2.56	0.47
Hemiptera	Miridae	*Horciasinus* sp.		
Hemiptera	Pentatomidae	*Edessa* sp.1	15.38	2.93
Hemiptera	Pentatomidae	*Edessa* sp.2		
Hemiptera	Pentatomidae	*Chinavia* sp.		
Hemiptera	Pentatomidae	*Antiteuchus* sp.1		
Hemiptera	Pentatomidae	*Antiteuchus* sp.2		
Hemiptera	Pentatomidae	*Halyomorpha halys*		
Hemiptera	Reduviidae	*Zelus* sp.1	5.13	0.93
Hemiptera	Reduviidae	*Zelus* sp.2		
Hemiptera	Scutelleridae	*Pachicoris* sp.	2.56	0.47
Hymenoptera	Apidae	*Apis* sp.	33.33	2.93
Hymenoptera	Apidae	*Exaerete* sp.		
Hymenoptera	Apidae	*Trigona* sp.		
Hymenoptera	Apidae	*Euglossa* sp.		
Hymenoptera	Apidae	*Plebeia* sp.		
Hymenoptera	Apidae	*Centris* sp.		
Hymenoptera	Braconidae	*Capitonius* sp.	5.55	0.47
Hymenoptera	Evaniidae	*Evania* sp.	5.55	0.47
Hymenoptera	Formicidae	*Camponotus* sp.	11.11	0.93
Hymenoptera	Formicidae	*Atta* sp.		
Hymenoptera	Halictidae	*Augochlora* sp.	5.55	0.47
Hymenoptera	Ichneumonidae	*Charops* sp.	5.55	0.47

Revista da Universidade Estadual de Alagoas/UNEAL
e-ISSN 2318-454X, Ano 15, Vol. 15, (nº 3), julho-outubro, 2023
https://doi.org/10.48180/ambientale.v15i3.498

Hymenoptera	Sphecidae	*Sceliphron* sp.	5.55	0.47
Hymenoptera	Vespidae	*Agelaia* sp.1		
Hymenoptera	Vespidae	*Agelaia* sp.2		
Hymenoptera	Vespidae	*Polybia* sp.	27.77	2.35
Hymenoptera	Vespidae	*Polistes* sp.		
Hymenoptera	Vespidae	*Brachygastra* sp.		
Isoptera	Termitidae	*Syntermes* sp.	100	0.47
Lepidpotera	Cossidae	*Langsdorfia* sp.	1.92	0.47
Lepidpotera	Crambidae	*Spoladea* sp.	3.84	0.93
Lepidpotera	Crambidae	*Palygrammodes* sp.		
Lepidpotera	Erebidae	*Ctenucha* sp.		
Lepidpotera	Erebidae	*Eucereon* sp.1		
Lepidpotera	Erebidae	*Eucereon* sp.2		
Lepidpotera	Erebidae	*Neotrichura* sp.		
Lepidpotera	Erebidae	*Isia* sp.		
Lepidpotera	Erebidae	*Cosmosoma* sp.	21.15	5.17
Lepidpotera	Erebidae	*Argyroeides* sp.		
Lepidpotera	Erebidae	*Hyalurga* sp.		
Lepidpotera	Erebidae	*Hypercompe* sp.1		
Lepidpotera	Erebidae	*Hypercompe* sp.2		
Lepidpotera	Erebidae	*Hylephila* sp.		
Lepidpotera	Geometridae	*Pantherodes* sp.		
Lepidpotera	Geometridae	*Schidax* sp.		
Lepidpotera	Geometridae	*Melanchroia* sp.	11.54	2.93
Lepidpotera	Geometridae	*U.G.*		
Lepidpotera	Geometridae	*Epimecis* sp.		
Lepidpotera	Geometridae	*Iridopsis* sp.		
Lepidpotera	Hesperiidae	*Urbanus* sp.		
Lepidpotera	Hesperiidae	*Gorgthion* sp.	5.77	1.40
Lepidpotera	Hesperiidae	*Nyctelius* sp.		
Lepidpotera	Lycaenidae	*Hemiargus* sp.	1.92	0.47
Lepidpotera	Megalopygidae	*Podalia* sp.	1.92	0.47
Lepidpotera	Nymphalidae	*Anartia* sp.		
Lepidpotera	Nymphalidae	*Actinote sp.*		
Lepidpotera	Nymphalidae	*Diaethria* sp.		
Lepidpotera	Nymphalidae	*Dryas* sp.		
Lepidpotera	Nymphalidae	*Mechanitis* sp.		
Lepidpotera	Nymphalidae	*Methona* sp.		
Lepidpotera	Nymphalidae	*Hermeuptychia* sp.	25	6.10
Lepidpotera	Nymphalidae	*Ortilia* sp.		
Lepidpotera	Nymphalidae	*Brassolis* sp.		
Lepidpotera	Nymphalidae	*Pyrgus* sp.		
Lepidpotera	Nymphalidae	*Lycorea* sp.		
Lepidpotera	Nymphalidae	*Hamadryas* sp.		
Lepidpotera	Nymphalidae	*Tegosa* sp.		
Lepidpotera	Noctuidae	*Mythimna sp.*	3.84	0.93
Lepidpotera	Noctuidae	*Sosxetra* sp.		
Lepidpotera	Notodontidae	*Sea* sp.	1.92	0.47
Lepidpotera	Papilionidae	*Heraclides* sp.1	3.84	0.93
Lepidpotera	Papilionidae	*Heraclides* sp.2		
Lepidpotera	Pieridae	*Ascia* sp.	3.84	0.93
Lepidpotera	Pieridae	*Phoebis* sp.		
Lepidpotera	Pyralidae	*Tosale* sp.	1.92	0.47

Revista da Universidade Estadual de Alagoas/UNEAL
e-ISSN 2318-454X, Ano 15, Vol. 15, (nº 3), julho-outubro, 2023
https://doi.org/10.48180/ambientale.v15i3.498

Lepidpotera	Riodinidae	*Mesene* sp.		
Lepidpotera	Riodinidae	*Rhetus* sp.	5.77	1.40
Lepidpotera	Riodinidae	*Melanis* sp.		
Lepidpotera	Saturniidae	*Automeris* sp.	3.84	0.93
Lepidpotera	Saturniidae	*Dirphiopsis* sp.		
Lepidpotera	Sphingidae	*Madoryx* sp.	1.92	0.47
Mantodea	Mantidae	*Stagmatoptera* sp.	50	0.47
Mantodea	Vatidae	*Oxyopsis* sp.	50	0.47
Odonata	Calopterygidae	*Hetaerina* sp.	50	0.47
Odonata	Gomphidae	*Phyllogomphoides* sp.	50	0.47
Orthoptera	Acrididae	*Adimantus* sp.		
Orthoptera	Acrididae	*Orphulella* sp.	33.33	1.40
Orthoptera	Acrididae	*Beacris* sp.		
Orthoptera	Anostostomatidae	*Apotetamenus* sp.	11.11	0.47
Orthoptera	Gryllidae	*Gryllus* sp.	11.11	0.47
Orthoptera	Romaleidae	*Xyleus* sp.	22.22	0.93
Orthoptera	Romaleidae	*Prionacris* sp.		
Orthoptera	Tettigoniidae	*Neoconocephalus* sp.	22.22	0.93
Orthoptera	Tettigoniidae	*Stilpnochlora* sp.		
Phasmatodea	Pseudophasmatidae	*Paraphasma* sp.	100	0.47
Thysanoptera	Phlaeothripidae	*Gynaikothrips* sp.	100	0.47

The Scarabeidae family was also recorded as the most abundant among the Coleoptera by Dias (2018) in Semideciduous Seasonal Forest, in the region of Sorocaba in the state of São Paulo. However, Curculionidae (7.18%), Coccinelidae (0.87%) and Chrysomelidae (0.43%) were rarely recorded by the author. Different from the previously mentioned work and corroborating in part with the present study, Fernandes (2022) found Chrysomelidae (31.42%) and Curculionidae (18.91%) as the most representative in forest remnant of the same phytophysiognomy, however, Scarabeidae (2.49%) showed low occurrence.

The high presence of the Ninphalidae family (Lepidoptera) found in the present study can be considered as a pattern in surveys of this group. In similar environments of Semideciduous Seasonal Forest, in different cities in the south of Minas Gerais, Vieira et al. (2020) found this community representing 58.54% of the identified Lepidoptera. This pattern was also pointed out by different studies and in different phytophysiognomies, such as Oliveira, Milani and Souza (2018) who recorded 57% of nymphalids, Andrade et al. (2017) with 73.56%, Silva, Landa and Vitalino (2007) with 46.1% and Araújo et al. (2015) with 73.9%. This fact can be explained by the great diversity of food niches presented by these organisms (BROWN JUNIOR et al., 1999).

Coreids (Hemiptera) have a wide global distribution, with the greatest diversity of species found in the Americas. In tropical regions these organisms are very colorful and can have metallic tones, characteristics that demonstrate warning, and can be large in size between 30 and 40 mm (FERNANDES et al., 2015). These facts, vibrant coloration and relatively large body size, may explain the successful visual encounter of this group in the Águas da Prata State Park.

Revista da Universidade Estadual de Alagoas/UNEAL
e-ISSN 2318-454X, Ano 15, Vol. 15, (nº 3), julho-outubro, 2023
https://doi.org/10.48180/ambientale.v15i3.498

Conclusions

Knowing the entire population of insects in a given location is extremely unlikely, making immediate actions to intervene in natural systems unfeasible, and the best method is to carry out surveys through sampling that allow to generate estimates and characteristics of the present populations.

The registration of important bioindicators of environmental quality in the Águas da Prata State Park, SP, such as the Lepidoptera, highlights the importance and indispensability of preserving this place, because, even from the survey of the entomofauna by the method of scanning and recording photography, it was possible to identify (considering 48.4 hectares a small reserve) a great variety of species. However, the Park has been suffering impacts over the years and gradually disappearing, mainly due to the introduction of agricultural crops (eg coffee) or through solid waste left by the local population and tourists, who have easy access to its interior through of the trails.

The State Park still reflects signs of anthropic and natural modifications that took place at different times and for these reasons became a mosaic of successional situations characteristic of tropical forests (WHITMORE, 1983). In addition, it is located on the margins of the Governador Doutor Adhemar Pereira de Barros Highway (SP - 342), probably suffering its influence, mainly due to the edge effect.

The species richness recorded in this study makes up an invaluable natural resource, and, therefore, the conservation of this area is justifiable, not only because it is included in a State Reserve, but also because of its genetic heritage. In addition, the records obtained in this study are partial, and there is a need to complement them for the cataloging of other species, as rare and even unknown species may occur.

Conflito de interesses

O autor não declarou que existe conflito de interesse nesse estudo.

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