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Inventory

Diversity of spiders (Arachnida: Araneae) of an urban forest fragment in the Atlantic rainforest (São Paulo, Brazil)

Stefan R. Dias[1]*, Cibele Bragagnolo[1,2], Antônio D. Brescovit[3] & Fabiana E. Casarin[2]

[1]Universidade Federal de São Paulo, Programa de Pós-graduação em Ecologia e Evolução, Rua Prof. Artur Riedel, 275, Jd. Eldorado, 09972-270, Diadema, SP, Brasil.
[2]Universidade Federal de São Paulo, Departamento de Ecologia e Biologia Evolutiva, Rua Prof. Artur Riedel, 275, Jd. Eldorado, 09972-270, Diadema, SP, Brasil.
[3]Instituto Butantã, Laboratorio Especial de Coleções Zoológicas, Av. Vital Brasil, 1500, Butantã, 05503-900, São Paulo, SP, Brasil.
**Corresponding author: srd_bio@hotmail.com*

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Abstract: The abundance of spiders in most terrestrial ecosystems makes them good indicators of habitat changes because they are common animals in most terrestrial ecosystems. Due to the importance of knowing the diversity of spiders for conservation efforts and the lack of studies on the spider fauna in urban parks, this work aimed to collect and identify the diversity of spiders present in an isolated fragment of native Atlantic Rainforest vegetation, in an urban area on Diadema, São Paulo. We used pitfall traps over 28 days and active nocturnal search for two hours per night over 6 nights as collection methods. We found a total of 328 individuals, of which 118 adult spiders were assigned to 13 families and 37 morphospecies. Species of families Nemesiidae, Theraphosidae and Deinopidae were found, which are not expected in urban areas. The highest values of abundance were found for the Theridiidae family, with 59 individuals and Araneidae with 28, totaling 73.7% of the total sampled, with *Nephilingis cruentata* and *Parasteatoda tepidariorum* being the most abundant morphospecies, with 15 and 11 adult individuals collected, respectively. The richness found in this work was 37 morphospecies and according to the diversity estimators Chao 1 and 2 and Jacknife 1 and 2, it was estimated that the richness of the Diadema Botanical Garden is between 44 and 54 species, a result close to the number of species collected, which indicates that the sampling effort of this work was satisfactory. This work is one of the few inventories of spider fauna in urban fragments of the Atlantic Rainforest and the first study in the Diadema city, one of the cities with the highest population density in the country. It is important to empathize that the results showed a rich and diverse araneofauna when compared with other similar studies, even in an extremely isolated fragment in one of the cities with the highest population density in the state. Public policies specifically aimed at the conservation of these areas should be encouraged so that their preservation is secured.
Keywords: *Synanthropic Spiders; Faunistic Survey; Diadema, Araneofauna.*

Diversidade de aranhas (Arachnida: Araneae) de um fragmento florestal urbano de Mata Atlântica (São Paulo, Brasil)

Resumo: As aranhas são um dos predadores generalistas mais abundantes na maioria dos ecossistemas terrestres, tornando-as bons indicadores de mudanças de habitat, uma vez que são animais comuns na maioria dos ecossistemas terrestres. Devido à importância do conhecimento da diversidade de aranhas para os esforços de conservação e à falta de estudos sobre a aracnídeos em parques urbanos, este trabalho teve como objetivo coletar e identificar a diversidade de aranhas presentes em um fragmento isolado de vegetação nativa da Mata Atlântica, em um ambiente área urbana de Diadema, São Paulo. Utilizamos armadilhas de queda ao longo de 28 dias e busca noturna ativa durante duas horas por noite, ao longo de 6 noites como métodos de coleta. Encontramos um total de 328 indivíduos, dos quais 118 aranhas adultas foram distribuídas em 13 famílias e 37 morfoespécies. Foram encontradas espécies das famílias Nemesiidae, Theraphosidae e Deinopidae, que não são esperadas em áreas urbanas. Os maiores valores de abundância foram encontrados para a família Theridiidae, com 59 indivíduos e Araneidae com 28, totalizando 73,7% do total amostrado, sendo *Nephiliengis cruentata* e *Parasteatoda tepidariorum* as morfoespécies mais abundantes, com 15 e 11 indivíduos adultos coletados, respectivamente. A riqueza encontrada neste trabalho foi de

37 morfoespécies e de acordo com os estimadores de diversidade Chao 1 e 2 e Jacknife 1 e 2, estimou-se que a riqueza do Jardim Botânico de Diadema está entre 44 e 54 espécies, resultado próximo ao número de espécies coletadas, o que indica que o esforço amostral deste trabalho foi satisfatório. Este trabalho é um dos poucos inventários da aracnídeos em fragmentos urbanos de Mata Atlântica e o primeiro estudo na cidade de Diadema, uma das cidades com maior densidade populacional do pais. É importante ressaltar que os resultados mostraram uma araneofauna rica e diversa quando comparado com outros estudos similares, mesmo em um fragmento extremamente isolado em uma das cidades com maior densidade populacional do estado. Políticas públicas voltadas especificamente à conservação dessas áreas devem ser incentivadas para que sua preservação seja garantida.
Palavras-chave: *Diadema; Aranhas Sinantrópicas; Levantamento Faunístico; Araneofauna.*

Introduction

The Atlantic rainforest is one of the most diverse ecosystems in the world, harboring around 7% of all known fauna and flora richness, with many endemic species (Oliveira-Filho and Fontes 2000). Eisenlohr et al. 2015, Munévar et al. 2020 this region is of great importance for Brazil, as it is house to more than 60% of the human population and is responsible for almost 70% of the national Gross Domestic Product (GDP) (CI-Brasil et al. 2000). The deforestation of the Atlantic rainforest is a reflection of the territorial occupation and the intense exploitation of natural resources, the concentration of population and the largest urban and industrial centers that led to a great reduction in the natural vegetation cover, resulting in landscapes now strongly fragmented (Fonseca 1985, Hirota 2003, Pinto et al. 2006).

Most of the diversity of the Atlantic Forest is today found in the remnants of vegetation, composed of forest fragments in protected areas in forest and urban parks (Wener 2011, Nielsen et al. 2014, Melo et al. 2021). These remnants, usually located in Conservation Units and forest fragments in rural or urban areas, offer essential refuges for native flora and fauna, allowing the conservation of part of the biodiversity from often rare and endangered species (Myers et al. 2000, Lundholm & Richardson 2010, Wener 2011, Nielsen et al. 2014, Rezende et al. 2018, Melo et al. 2021).

Considering urban parks, these are responsible for an improvement in the city's climate, lowering local temperatures, due to the vegetation that is responsible for the reduction of wind speed and the evaporation of soil moisture, as well as for the improvement of the quality of the environment's air (Shinzato & Duarte 2018, Gaudereto et al. 2018).

Few studies have dealt with the spider fauna in urban fragments of the Atlantic Forest, such as Petrelli et al. (2013), on the campus of the Federal Institute of Education, Science and Technology in the city of São Roque, where was found 205 individuals distributed in 12 families. Brazil et al. (2005) studied three neighborhoods in Salvador - BA, collecting 677 individuals, distributed in 10 families. In 2008, Indicatti & Brescovit found in the municipality of São Paulo 416 species distributed in 43 families, with 24 species distributed in six families for the Mygalomorphae infraorder and 392 species in 37 families for the Araneomorphae infraorder. Also in this work, the authors detected about 100 new species, indicating that even in urban areas there is an unknown diversity that is relevant to be studied (Indicatti & Brescovit 2008).

Thus, due to the importance of knowing the diversity of spiders for conservation efforts, since they are the most abundant generalist predators in most terrestrial ecosystems. That makes them good indicators of habitat changes as they are common animals in most terrestrial ecosystems and very useful for studies comparing recently disturbed areas with older forests (Baldissera & Silva 2010), ecological niche modeling and climate change (Moradmand & Yousefi 2022). The lack of studies on the spider fauna in isolated fragments of the Atlantic rainforest in an urban area, the following question was raised: What is the richness of the spider fauna present in an isolated fragment of native Atlantic Forest vegetation, in one of the cities with the highest population density in Brazil (IBGE 2022)? And yet, what is the relationship of alpha diversity when compared to other spider surveys in urban parks?

Materials and Methods

1. Study area

The Atlantic Forest fragment studied is located in the botanical garden of Diadema city, São Paulo (23°43'10.8"S 46°36'38.8"W) (Figure 1), whose average annual temperature ranges from 13ºC in winter to 28ºC in summer, with average annual rainfall of 1,496 mm (climate-data.org 2021). The Botanical Garden was inaugurated in October 2000, in Jardim Inamar and has an area of 26,312 m² (26,3 ha) of preserved area with a dense rainforest vegetation, typical of the Atlantic rainforest and 3,000 m of trails (Petena et al. 2015) and is at an altitude of 800 m.

2. Sampling methods

The material was collected using nocturnal active search and pitfall traps between April 2018 and March 2019. The nocturnal active search was carried out in 6 different transects shortly after dusk, around 19:20h, and consisted of an active search in several types of microhabitats, such as litter, in decomposing trunks, inside cavities, under stones and in understory vegetation up to a height of two meters. The sampling was made in a 30m × 10m transect, each 100 m apart from each other totaling 300 m² of sampled area per transect (Nogueira et al. 2006). Each transect sampling lasted two hours with only one collector per transect, totaling a sampling effort of 12 hours of collection. Pitfall traps were used to collect spiders that forage on the ground, using 500ml plastic pots buried in a row at regular intervals, at ground level with a plastic cover to prevent the entry of rainwater, containing preservative liquid (90% alcohol 70% and 10% formaldehyde 4%) and a drop of detergent to break the surface tension. A total of 20 pitfalls were used with a space of 2 meters between them arranged in 4 rows, totaling an area of 48 m². The traps were kept for seven consecutive days and then collected. Each pitfall set were considerate a sample, Thus, in total, 4 samples were taken in different places, totaling a sampling effort of 192 m² along 28 days of collection.

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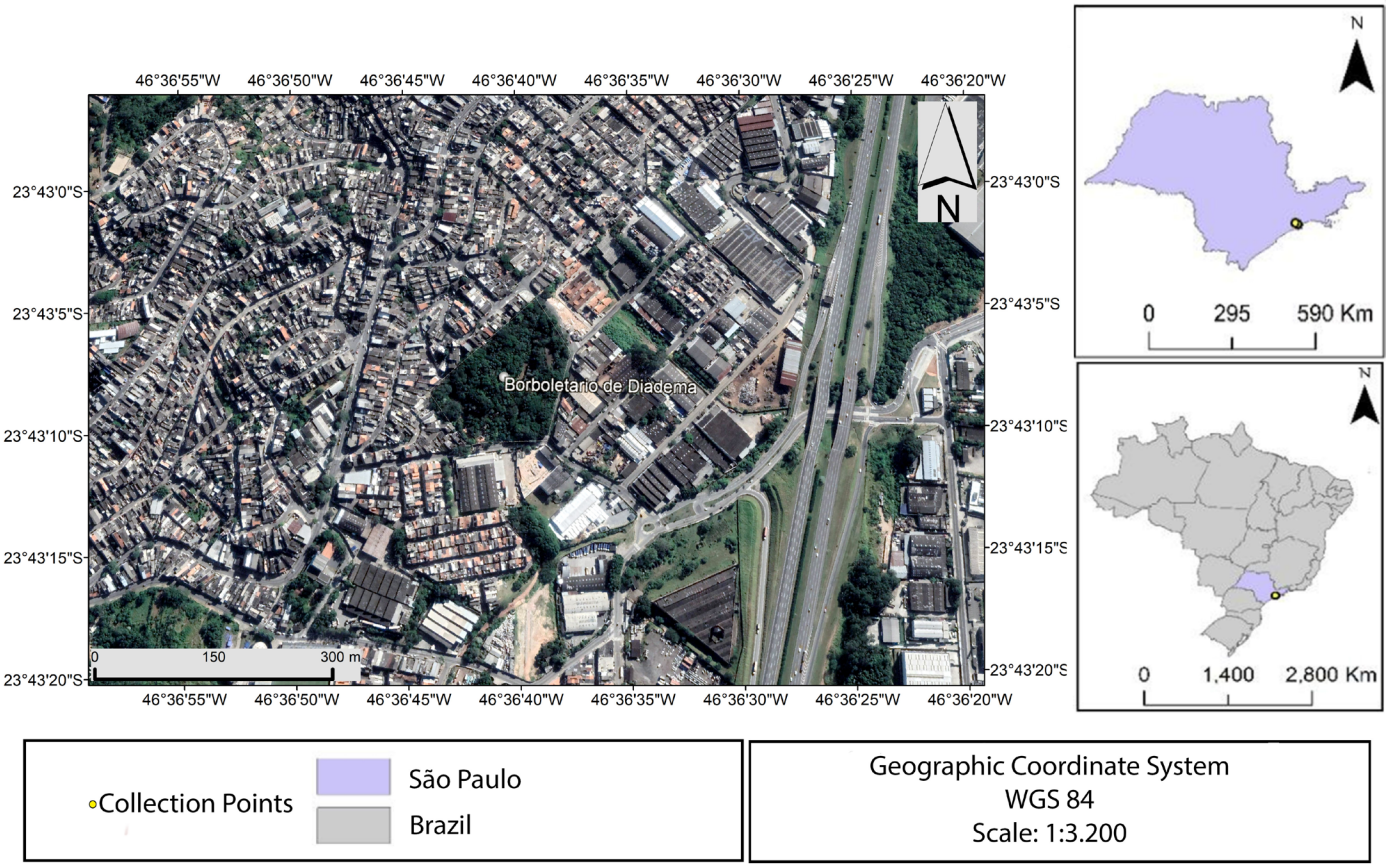

Figure 1. Location of the Botanical Garden of Diadema, SP; a strip of Atlantic Forest in an urban environment. Credits in the image.

3. Sorting, identification and preservation of material

All material collected was taken to the Zoology Laboratory of Universidade Federal de São Paulo (UNIFESP), at the José de Filippi unit in Diadema (SP) to be sorted, then taken to the Laboratory of Special Collections, at the Butantan Institute, where the spiders were identified at the family level and subsequently identified/morphotyped, with the aid of a dichotomous key by Brescovit et al. (2002) and a Zeiss Stemi Dv4 stereo microscope. The morphotyped individuals were deposited in the Butantan Institute collection (IBSP, curator, A. D. Brescovit) while the sub-adult individuals that could not be morphotyped were deposited in the didactic collection of (UNIFESP) Campus Diadema.

4. Data analysis

Estimates of alpha diversity (species richness) were performed based on those used by Candiani et al. (2005), these being the first-order non-parametric Jack-Knife test (JACK1), second-order Jack-Knife test (JACK2), Floor 1 and Floor 2 and Bootstrap, using the EstimateS 9.1.0 program (Corwell 2013).

Results

In total, 328 individuals were collected, of which 118 were adults, 83 females and 35 males; in addition to 210 young individuals. The 118 adults were morphotyped, resulting in 13 families distributed in 37 morphospecies and a total of 13 singletons and 5 doubletons (Table 1, Figure 2).

Table 1. Estimates of species richness of observed and estimated spiders for the Botanical Garden of Diadema, SP. N = 118 individuals.

Estimated Richness	
Chao 1	46 spp.
Chao 2	44 spp.
Jack 1	50 spp.
Jack 2	54 spp.
Bootstrap	44 spp.

The richest families were Theridiidae with 16 morphospecies and Araneidae with 6 morphospecies, while the families Anyphaenidae, Ctenidae, Deinopidae, Lycosidae, Mimetidae, Salticidae, Theraphosidae and Thomisidae had only one morphospecies found (Table 2, Figure 3).

In general, the highest abundance values were found for the families Theridiidae, with 59 individuals and Araneidae with 28, totaling 73.7% of the total sampled, with *Nephilingis cruentata* (Fabricius 1775) and *Parasteatoda tepidariorum* (Koch 1841) being the most abundant morphospecies with 15 and 11 adult individuals collected respectively (Table 2).

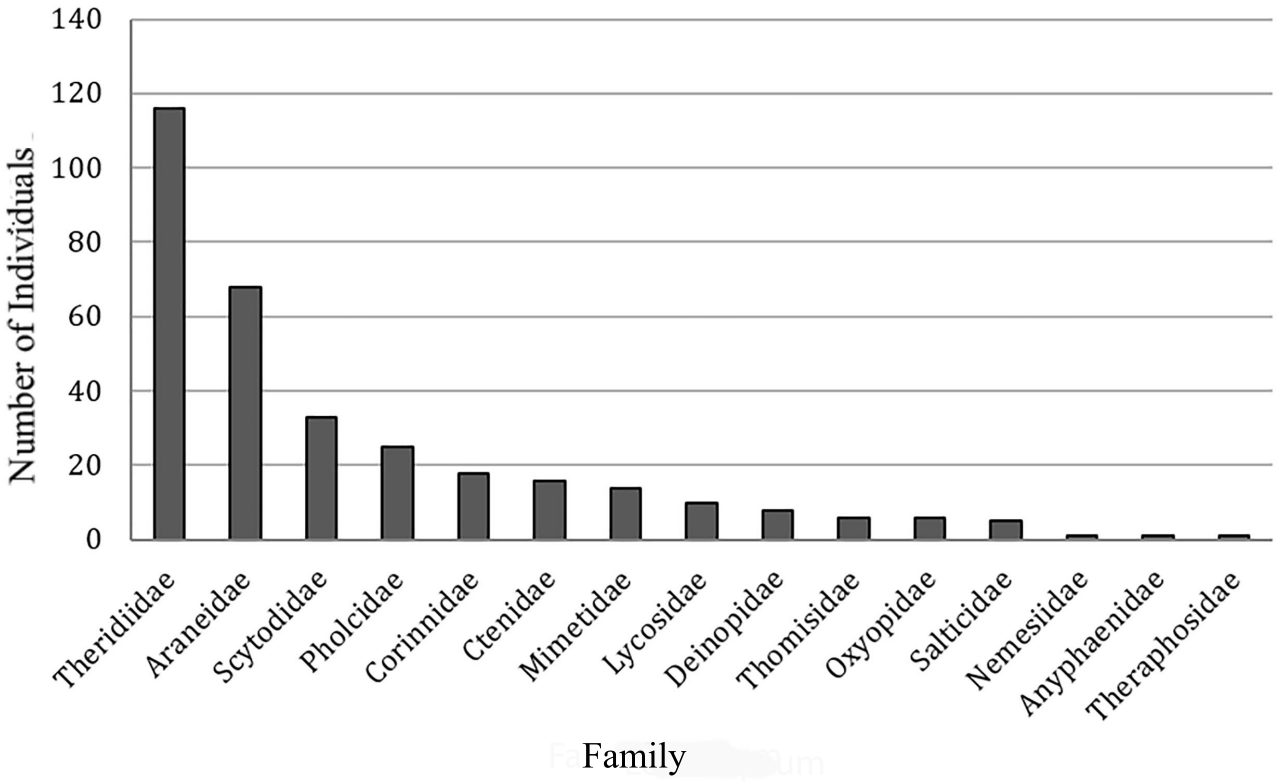

Figure 2. Total abundance of spiders found in the park. N = 328 individuals.

Species richness estimates were based on the sum of the results of both collection methods and ranged from 44 to 54 species. The Chao 2 estimator was the lowest with 44 species and Jackknife 2 the highest with 54 species, which presented a curve with a tendency towards stability (Table 1, Figure 4).

Discussion

The total richness found in this paper was 37 morphospecies, a surprisingly large number when compared to other works focused on urban forests such as Candiani et al. (2005) where the Butantan Institute Forest, the Previdência Park and the CUASO forest were studied. with 23, 28 and 31 morphospecies found respectively (Table 3) and a total sampling effort of 200 samples on each. This result becomes even more expressive if you take into account that due to the large number of juveniles, singletons and doubletons (Table 1) and that Candiani sampled on all seasons, while this work focused mainly on autumn and winter, generally colder months where spiders tend to have less activity (Schaefer, 2009). It can be an indicative that the area can still be slightly under sampled, which suggests that the diversity of spiders in the botanical garden may be even greater than which is expected. It is also notable that the largest number of juveniles collected was through pitfall. Another factor that may have contributed to the under sampling would be the fact that half of the collections were made in the cold months, between April 25th and July 4th, in these months, most of the spider species rarely leave their refuges due to the cold temperatures (Foelix 2010). Candiani et al. (2005) state that the areas studied by them are quite degraded, and the "Parque da Previdência" had already suffered three fires outbreaks during its history, in addition to the constant disturbance caused by the disposal of domestic waste in its premises, which would have resulted in the low diversity of these sites. The comparison of studies in urban areas and the present study indicates the importance of preserving the Botanical Garden and reinforces how important the preservation of urban parks is for the conservation of local biodiversity since even a small preservation area, like this park, can house a high number of species. Furthermore, it is important to emphasize that, due to their predatory habit, spiders play an important role in the control of urban pests (Riechert 1999), including disease vectors, as indicated by the studies carried out by Strickman et al. (1997), who studied the effect of spider predation on the population of mosquitoes of the genus Aedes. Thus, maintaining the diversity of spiders contributes to the control of other insects in urban areas.

Among the families found, Deinopidae, Theraphosidae and Nemesiidae stand out, all of which are absent in other surveys in urban areas, such as Candiani et al. (2005), which indicates that they are not species normally found in environments with high human activity. Additionally, Indicatti & Brescovit in 2008 found 12 species of Theraphosidae, with only one considered synanthropic (Raven 2010), while Nemesiidae has two of the seven species found considered synanthropic (Indicatti & Brescovit 2008). The presence of these families can be an indication of the state of preservation of the Botanical Garden, since these spiders usually build a single burrow in their entire life and expand it as they grow (Souza-Silva et al. 2014). It also highlights the presence of spiders typically found in urban environments

Table 2. List of species/morphospecies collected in the Botanical Garden in Diadema city, SP.

Family	Collection method	Abundance	Abundance %
Anyphaenidae			
Anyphaenidae sp.1	Active	1	0,85
Araneidae			
Acacesia yacuiensis	Active	3	2,25
Araneidae sp.1	Active	3	2,25
Araneidae sp.2	Both methods	4	3,39
Bertrana sp.1	Active	1	0,85
Nephilengis cruentata	Active	15	12,71
Trichonephila clavipes	Active	3	2,25
Corinnidae			
Castianeira sp.1	Pitfall	1	0,85
Ianduba varia	Pitfall	2	1,7
Myrmecium sp.1	Pitfall	1	0,85
Ctenidae			
Ctenus ornatus	Both methods	4	3,39
Deinopidae			
Deinopis sp.1	Both methods	3	2,25
Lycosidae			
Lycosa erythrognatha	Both methods	3	2,25
Mimetidae			
Gelanor zonatus	Active	2	1,7
Pholcidae			
Pholcidae sp.1	Both methods	4	3,39
Smeringopus pallidus		3	2,25
Salticidae			
Corythalia sp.1	Active	1	0,85
Scytodidae			
Scytodes globula	Active	2	1,7
Scytodidae sp.1	Active	1	0,85
Theraphosidae			
Acanthoscurria sp.1	Pitfall	1	0,85
Theriididae			
Craspedisia cornuta	Active	2	1,7
Cryptachaea hirta	Active	4	3,39
Cryptachaea sp.1	Active	3	2,25
Cryptachaea sp.2	Active	7	5,93
Dipoena sp.1	Pitfall	2	1,7

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Emertonella taczanowskii	Active	3	2,25
Euriopis sp.1	Active	1	0,85
Neopisinus longipes	Active	9	7,62
Neopisinus sp.1	Active	5	4,23
Nesticus rufipes	Active	5	4,23
Parasteatoda tepidariorum	Active	11	9,32
Tidarren sisyphoides	Active	1	0,85
Theridiidae sp.1	Active	1	0,85
Theridion bisignatum	Active	1	0,85
Theridion sp.1	Active	3	2,25
Thwaitesia affinis	Active	1	0,85
Thomisidae			
Tmarus sp.1	Active	1	0,85
Total		**118**	

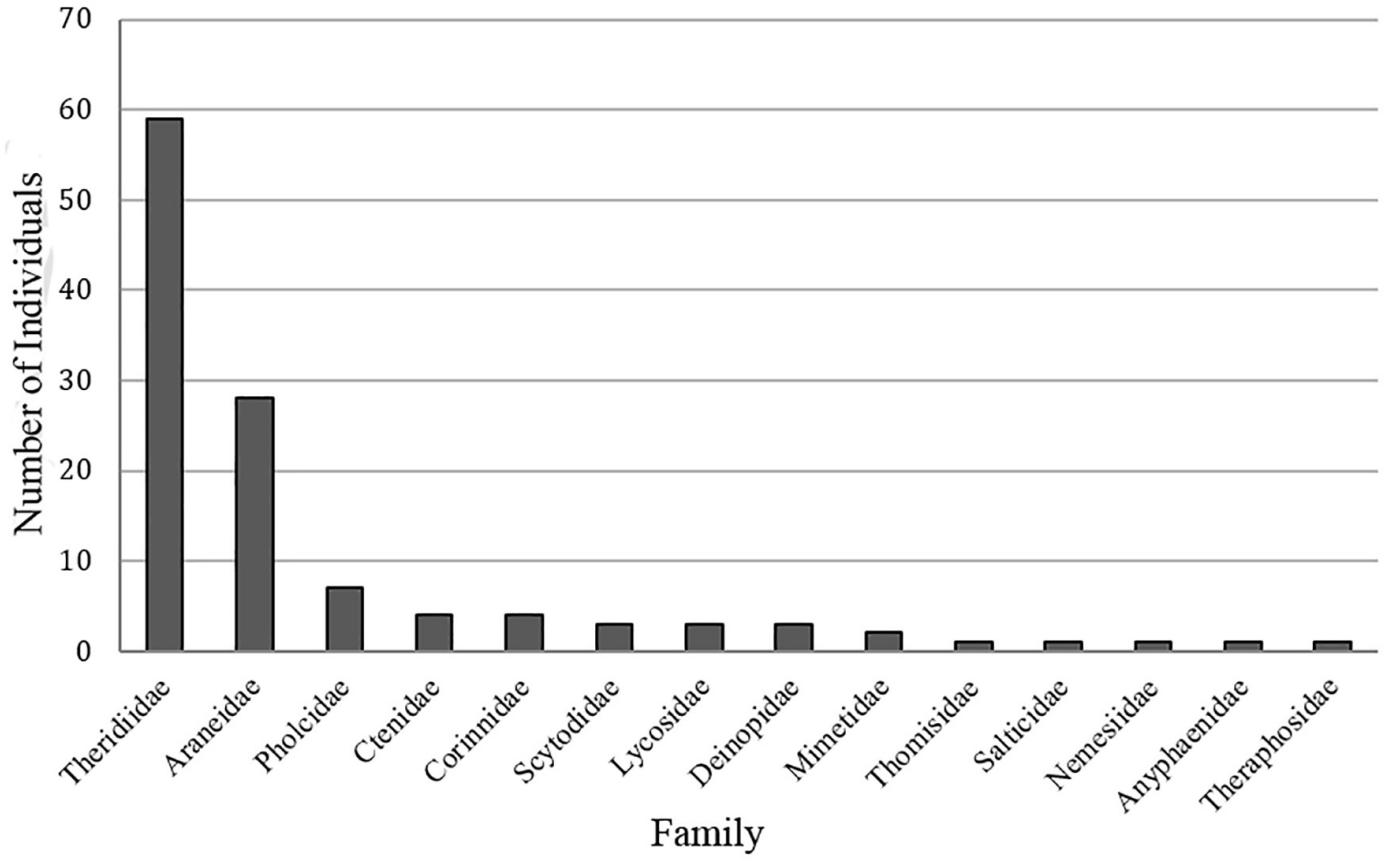

Figure 3. Abundance of morphotyped spiders, collected between April 2018 and March 2019, N: 118 individuals.

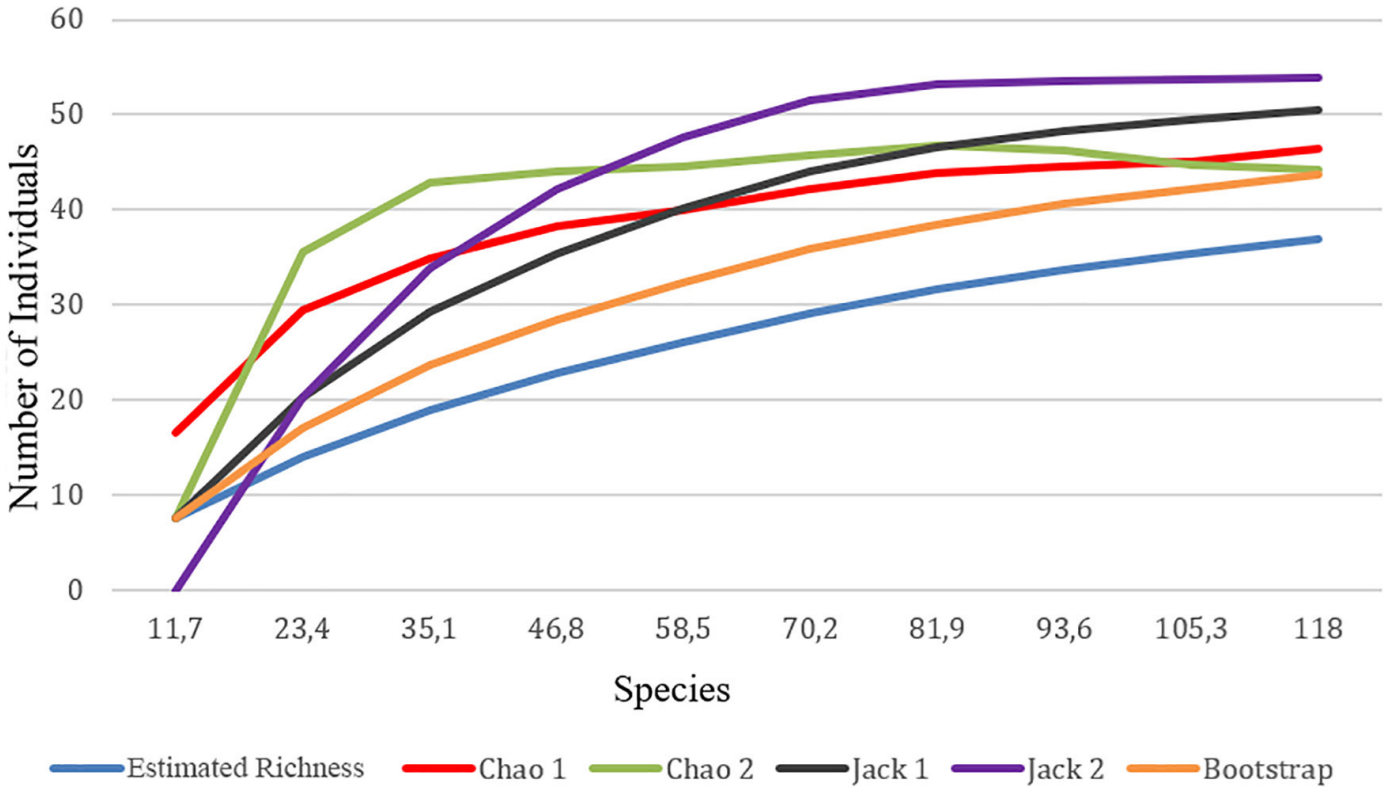

Figure 4. Estimates of species richness of observed and estimated spiders for the Botanical Garden of Diadema, SP. N = 118 individuals.

Table 3. Comparison of urban parks according to collection methodology, season and richness.

Sampling Site	Sampling Method	Seasons	Richness
Instituto Butantan	Pitfall	All	23
CUASO	Pitfall	All	31
Parque da Previdencia	Pitfall	All	28
Borboletario de Diadema	Active/ Pitfall	Autumn and Winter	37

on the premises of the Borboletario, such as *Nephilingis cruentata*, *Smeringopus pallidus* (Blackwall 1858) and *Parasteatoda tepidariorum* (Koch 1841). These spiders are commonly found inside houses and in gardens and their presence is mainly due to the fact that the back of the Borboletário faces the walls of houses in the neighborhood, which would also explain the presence of spiders of the genera *Corythalia, Scytodes* and several species of the Theridiidae family, especially of the genus *Nesticodes* (Nentwig 1983). Due to the trails that permeate the entire park, it can be assumed that the edge effect permeates the entire extension of the Botanical Garden, which ends up favoring more tolerant and generalist species (Magalhães et al. 2020), such as spiders of the Theridiidae family. The structure of their webs means that they need less space to build, which suggests that they are less affected by temperature variation in more open habitats (Nentwig 1983, Petcharad et al. 2016, Baldissera et al. 2020). Such factors could explain the great abundance and richness of this family in the botanical garden, represented by 59 individuals and 16 morphospecies. At the same time, this same effect caused the diversity of Araneidae to be lower than expected, as they are orb-shaped spiders need more space to make their webs and, according to Baldissera et al. (2020). The structure and composition of vegetation at the edge of the forest can be considerably modified by wind and other microclimatic alterations and, therefore, would be avoided by most orb-weaver spiders.

This work was the first study of the Araneofauna in Diadema and will serve as a basis for future studies focused on conservation and biodiversity in urban parks, reinforcing the importance of conservation of fragments of urban forests as relict areas, fundamental for the preservation of biodiversity and improvement of local quality of life. In this way, public policies aimed specifically at the conservation of these areas should be encouraged so that their preservation is secured.

Associate Editor

José Mermudes

Author Contributions

Stefan R. Dias: conceptualization; data sampling; sorting and identification; methodology; discussion; writing – original draft; Writing – review & editing.

Cibele Bragagnolo: conceptualization; methodology; discussion; writing – review & editing.

Antônio D. Brescovit: sorting and identification; discussion.

Fabiana E. Casarin: conceptualization; data sampling; methodology; discussion; writing – review & editing.

Conflicts of Interest

The author(s) declare(s) that they have no conflict of interest related to the publication of this manuscript.

Ethics

This study did not involve human beings and/or clinical trials that should be approved by one Institutional Committee.

Data Availability

Supporting data are available at <https://ipt.sibbr.gov.br/sibbr/resource?r=unifesp_arachnida_diadema_01&v=1.0>.

Referencesss

BALDISSERA, R. & SILVA, V. 2010. Diversity and composition of arbustive spiders in an Atlantic Forest fragment and two adjacent areas. Neotropical Biology and Conservation. 5: 77–85. 10.4013/nbc.2010.52.02.

BALDISSERA, R; OLIVEIRA DE QUADROS, S; GALETI, G; LOPES RODRIGUES, E; LAZZAROTTO, L & DE OLIVEIRA, A. 2020. Spider assemblage structure and functional diversity patterns in clear-cut, logged and undisturbed areas in a large Atlantic Forest remnant. Canadian Journal of Forest Research 50: 608–614.

BRAZIL, T. K; ALMEIDA-SILVA, L. M; PINTO-LEITE C.M; LIRA-DA-SILVA, R. M; PERES, M. C. L. & BRESCOVIT, A. D. 2005. Aranhas sinantrópicas de três bairros da cidade de Salvador, Bahia, Brazil (Arachnida, Araneae). Biota Neotropica. 5(1): 163–169.

BRESCOVIT, A. D; BONALDO, A. B; BERTANI, R. & RHEIMS, C. A. 2002. 4.3 Araneae. In: Amazonian Arachnida and Myriapoda. Identification keys to all classes, orders, families, some genera, and lists of known terrestrial species. Adis, J. (org.). Pensoft Publisher, Sofia, Moscow. 303–343.

CANDIANI, D. F; INDICATTI, R. P. & BRESCOVIT, A. D. 2005. Composição e diversidade da araneofauna (Araneae) de serapilheira em três florestas urbanas na cidade de São Paulo, São Paulo, Brasil. Biota Neotropica., Campinas. 5(1): 111–123.

CI-BRASIL (CONSERVATION INTERNATIONAL DO BRASIL), FUNDAÇÃO SOS MATA ATLÂNTICA, FUNDAÇÃO BIODIVERSITAS, IPÊ, SMA-SP & SEMAD-MG. 2000. Avaliação e Ações Prioritárias para Conservação da Biodiversidade da Mata Atlântica e Campos Sulinos. MMA/SBF, Brasília.

COLWELL, R. K. 2013. EstimateS: Statistical estimulation of species richness and shared species from samples. Version 9.1.0.

EISENLOHR, P. V; OLIVEIRA-FILHO, A. T & PRADO, J. 2015. The Brazilian Atlantic Forest: new findings, challenges and prospects in a shrinking hotspot. Biodiversity and Conservation 4(9): 2129–2133.

FOELIX, R.F. 2010. Biology of Spiders. Oxford, University Press, 3rd ed.

FONSECA, G. A. B. 1985. The vanishing Brazilian Atlantic Forest. Biological Conservation. 34: 17–34.

GAUDERETO, G. L; GALLARDO, A. L. C. F; FERREIRA, M. L; NASCIMENTO, A. P. B. & MANTOVANI, W. 2018. Avaliação de serviços ecossistêmicos da Gestão de áreas Verdes: promovendo cidades saudáveis e sustentáveis. Ambiente & Sociedade. 21: 1–20.

HIROTA, M. M. 2003. Monitoring the Brazilian Atlantic Forest cover. In Galindo-Leal C. & I. G. Câmara (eds.). The Atlantic Forest of South America: biodiversity status, threats, and outlook. Center for Applied Biodiversity Science and Island Press. Washington, D.C. 60–65.

IBGE – INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. Censo Brasileiro de 2022. Rio de Janeiro: IBGE, 2023.

INDICATTI, R. P. & BRESCOVIT, A. D. 2008. Aranhas (Arachnida, Araneae) do Município de São Paulo In MALAGOLI, Leo R., BAJESTEIRO, Fernanda Blauth, WHATELY, Marussia. Além do concreto: contribuições para a proteção da biodiversidade paulistana. São Paulo, Instituto Socioambiental.

LUNDHOLM, J. T & RICHARDSON, P. J. 2010. Habitat analogues for reconciliation ecology in urban and industrial environments. Journal of Applied Ecology. 47: 966–975.

MAGALHÃES, I; THIAGO, C & SANTOS, A. 2020. Identificação de Fragmentos Florestais Potenciais para a delimitação de Corredores Ecológicos na bacia hidrográfica do Rio Itapemirim, ES por meio de técnicas de Sensoriamento Remoto. Revista Brasileira de Geografia Física, 13(2): 595–612.

MELO, T. S; MOREIRA, E. F; LOPES, M. V. A; ANDRADE, A. R. S; BRESCOVIT, A. D; PERES, M. C. L. & DELABIE, J. H. C. 2021. Influence of Urban Landscape on Ants and Spiders Richness and Composition in Forests. Neotrop Entomol 50: 32–45.

MORADMAND, M., YOUSEFI, M. 2022. Ecological niche modelling and climate change in two species groups of huntsman spider genus Eusparassus in the Western Palearctic. Sci Rep 12: 4138.

MUNÉVAR, A; CARDOSO, P; PIÑANEZ, E. Y. M. G. & ZURITA G. A. 2020. Spiders (Arachnida: Araneae) in the semideciduous Atlantic Forest: An ecological and morphological trait dataset for functional studies. Biodiversity Data Journal. [S.l: s.n.].

MYERS, N; MITTERMEIER, R. A; MITTERMEIER, C. G; FONSECA, G. A. B & KENT, J. 2000. Biodiversity hotspots for conservation priorities. Nature 403: 853–858.

NENTWIG, W. 1983. The prey of web-building spiders compared with feeding experiments (Araneae: Araneidae, Linyphiidae, pholcidae, Agelenidae). Oecologia 56: 132–139.

NIELSEN, A. B; BOSCH, M; MARUTHAVEERAN, S. & BOSCH C. K. 2014. Species richness in urban parks and its drivers: a review of empirical evidence. Urban Ecosyst 17: 305–327.

NOGUEIRA, A. A; PINTO-DA-ROCHA, R & BRESCOVIT, A. D. 2006. Comunidade de aranhas orbitelas (Araneae, Arachnida) na região da Reserva Florestal do Morro Grande, Cotia, São Paulo, Brasil. Biota Neotropica, 6(2): 3–24.

OLIVEIRA-FILHO A. T. & FONTES M. A. L. 2000. Patterns of floristic differentiation among Atlantic Forests in southeastern Brazil and the influence of climate. Biotropica. 32(4): 793–810.

PETENA, A; VIESBA, L. M; SANTANA, S; VIEIRA, J. & VIESBA, E. 2015. O Borboletário Laerte Brittes de Oliveira enquanto ferramenta de educação ambiental informal em Diadema, SP. In: Anais do Encontro de Educação Ambiental do Grande ABC. Santo André: Semasa. 1: 105–121.

PETCHARAD, B; MIYASHITA, T; GALE G. A; SOTTHIBANDHU S & BUMRUNGSRI S. 2016. Spatial patterns and environmental determinants of community composition of web-building spiders in understory across edges between rubber plantations and forests. J. Arachnol. 44: 182–193.

PETRELLI, M. S; SANTOS, E. B; ALVES, G. J. T. & PEREIRA, M. 2013. Levantamento preliminar da araneofauna do Instituto Federal de Educação, Ciência e Tecnologia de São Paulo (campus São Roque).Scientia Vitae. 1(1): 12–18.

PINTO, L; BEDE, L; PAESE, A; FONSECA, M; PAGLIA, A. & LAMAS, I. 2006. Mata Atlântica brasileira: Os desafios para a conservação da biodiversidade de um hotspot mundial. In: ROCHA, C.F.D; BERGALLO, H.G; VAN SLUYS, M. & ALVES, M.A.S. (eds), Biologia da conservação: Essências. Rima Editora: 1: 91–118.

RAVEN, R. J. 2010. A review of the Mygalomorphae: biology, morphology and systematics. Book of Abstracts of the 18th International Congress of Arachnology, Jul 11–17.

REZENDE, C. L; SCARANO, F. R; ASSAD, E. D; JOLY, C. A; METZGER, J. P; STRASSBURG, B. B. N; TABARELLI, M; FONSECA, G. A. & MITTERMEIER, R. A. 2018. From hotspot to hopespot: An opportunity for the Brazilian Atlantic Forest. Perspectives in Ecology and Conservation. 16(4): 208–214.

RIECHERT, S. E. 1999. The Hows and Whys of Successful Pest Suppression by Spiders: Insights from Case Studies. The Journal of Arachnology, 27(1): 387–396.

SCHAEFER, M. 2009. Winter ecology of spiders (Araneida). Zeitschrift für Angewandte Entomologie. 83: 113–134.

SHINZATO, P. & DUARTE, D. H. S. 2018. Impacto da vegetação nos microclimas urbanos e no conforto térmico em espaços abertos em função das interações solo-vegetação-atmosfera. Ambiente Construído, Porto Alegre. 18(2): 197–215.

SOUZA-SILVA, M; SILVA, I. G. & BRESCOVIT, A. D. 2014. Bionomic aspects of Prorachias bristowei (Araneae: Mygalomorphae: Nemesiidae): burrow density and shape, food items, body size and reproduction. Studies on Neotropical Fauna and Environment, 49(2): 106–113.

STRICKMAN, D; SITHIPRASASNA, R & SOUTHARD D. 1997. Bionomics of the spider, Crossopriza lyoni (Araneae, Pholcidae), a predator of dengue vectors in Thailand. The Journal of Arachnology. 25: 194–201.

WENER, P. 2011. The ecology of urban areas and their functions for species diversity. Landsc Ecol Eng 7: 231–240.

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