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DIVERSITY OF INSECTS IN PITFALL TRAPS IN THE CITY OF UBERABA/MG

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Afonso Pelli[1], Ana Laura Batista Fernandes[2], Ana Luiza de Lima Toledo[3], Anna Luísa Sousa Borges[4], Adrielle Nazário da Silva[5], Andressa Rayssa Martins Alvez[6], Antonio Thiago Arraes Campos[7], Carlos Daniel Rezende Reston[8], Cristian de Araújo Santos[9], Daniel Marques Macedo[10], Giovanna Luisa Vieira Reis[11], Isabella Machado Barcelos[12], Isabel Queiroz[13], José Marques Bueno Júnior[14], Julia Victoria Bonifácio Cabrieira[15],

[1] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
afonso.pelli@uftm.edu.br
[2] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[3] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[4] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[5] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[6] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[7] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
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Federal University of Triângulo Mineiro
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Federal University of Triângulo Mineiro
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Federal University of Triângulo Mineiro
[12] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[13] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[14] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro
[15] Discipline of Ecology of Insect Vectors of Diseases
Federal University of Triângulo Mineiro

Luciano Henrique de Paiva[16], Luiza Rodrigues Miquelino[17], Maria Luiza Pereira Escareli[18], Mélany Eduarda Maraia[19], Tamires Correa Marchi[20]

ABSTRACT

Insects play roles in society, ranging from threats to health and agricultural production to vital contributions to the economy and the environment. The study of entomology encompasses several areas and provides subsidies to understand ecosystem processes. The investigation of insect biodiversity in urban areas is relevant to promote appropriate management and control practices. The use of traps, such as pitall traps, offers an effective approach to collecting data on insect fauna, allowing for the identification of species and the assessment of potential environmental impacts. The research was carried out in three different locations in Uberaba/MG, characterized by a tropical climate with higher rainfall in the summer. The collection of insects was carried out using pitfall traps in three locations: *Campus* I of the Federal University of Triângulo Mineiro, the Hospital de Clínicas of the Federal University of Triângulo and residence near a conservation area with Vereda vegetation. For a week, the traps were positioned near light sources. After collection, the insects were counted and identified in the laboratory. The research showed a high presence of arthropods of the megadiverse Orders, such as Coleoptera, Diptera, Lepidoptera, Hymenoptera and Hemiptera. The predominance of these Orders was favored by the presence of developed wings, ease of dispersal and an anthropophilic relationship. Notably, the city's central building (*UFTM Campus* I) had the highest density of arthropods. The study points to the importance of monitoring arthropod biodiversity to understand the impact of human activities and changes in the environment.

Keywords: Entomology. Biodiversity. Entomofauna.

[16] Discipline of Ecology of Insect Vectors of Diseases Federal University of Triângulo Mineiro
[17] Discipline of Ecology of Insect Vectors of Diseases Federal University of Triângulo Mineiro
[18] Discipline of Ecology of Insect Vectors of Diseases Federal University of Triângulo Mineiro
[19] Discipline of Ecology of Insect Vectors of Diseases Federal University of Triângulo Mineiro
[20] Discipline of Ecology of Insect Vectors of Diseases Federal University of Triângulo Mineiro

INTRODUCTION

Insects play a key role in society, as they can cause health problems and affect agribusiness production (Lima et al., 2024; Oliveira, 2012). Throughout history, the diversity and unique characteristics of insects have provided valuable lessons about survival. Some of them contribute significantly, either by directly providing food to humanity (Macedo et al., 2020; Macedo et al., 2022), contributing to nutrition, being components of industrial materials, or even generating economic and environmental advantages, such as pollination and seed dispersal, which allows the maintenance of gene flow. In addition, it is possible to identify and analyze environmental changes, which are the result of natural or anthropogenic factors, by analyzing the diversity and abundance of insect fauna (Carvalho et al., 2019; Franzim et al., 2017; Peixoto et al., 2016).

The origin of the group took place at the beginning of the Ordovician Period, 479 million years ago (Prokop, Nel, Engel, 2023). In this period, there was an explosion in biodiversity, with the structuring of complex food chains and the emergence of species that would later leave the oceans and conquer the terrestrial environment. According to Karl Kjer (2014), insects would not have been able to fly until 406 million years ago, this fact occurred only when land plants were also prepared for the symbiotic and coevolutionary relationship, which characterizes an ecosystem.

Many theories in ecology have derived from studies on insects. Entomology is the study of them. Entomologists are the people who study them, and observe, collect, create, and experiment with them (Gullan, Cranston, 2017). The research done by entomologists covers the full spectrum of biology disciplines, including evolution, ecology, behavior, anatomy, physiology, biochemistry, and genetics (Bertelsmeier, 2021; Silva, Pelli, 2019).

The Orders are large taxonomic groups, which have an uneven distribution of insect species. Five main Orders stand out, due to the richness of species: beetles (Coleoptera), flies and mosquitoes (Diptera), wasps, bees and ants (Hymenoptera), butterflies and moths (Lepidoptera), and stink bugs (Hemiptera, encompassing Homoptera and Heteroptera). The other Orders of living insects, the "minor" Orders, comprise from a few to a few thousand species described (Almeida et al., 2021; Almeida, Ribeiro-Costa, Marinoni, 1998).

The characteristics of certain insects make them useful models in understanding general biological processes (Pelli-Neto et al., 2021). Consequently, some species in particular have been used as indicators in studies related to both adverse environmental impacts and restoration and enhancement initiatives (Costa et al., 2006; Correia, 2002; Brussaard et al., 2007; Silva, Pelli, 2019). In the context of ecology, insect collections are carried out in order to analyze and observe their characteristics.

Precipitation or soil traps, known as 'pitfalls', according to the description of Aquino et al. (2006), are widely used in research with terrestrial arthropods. The installation time of this type of trap depends on the weather conditions, the type of soil, and the level of moisture present. Under regular conditions, installation usually takes less than five minutes. These traps offer several advantages, such as the simultaneous collection of macrofauna organisms and some elements of the mesophauna. In addition, they can be directed to animals that are active at night. However, there are also drawbacks to be considered, especially the fact that they do not have the same effectiveness in sampling all taxonomic groups. Beetles, ants, young orthoptera, myriapods, spiders, and other larger arachnids tend to be captured more frequently, while winged insects seem to be able to escape. These traps are also vulnerable to damage caused by mammals, birds, and the action of people (Moreira; Huising; Bignell, 2010).

There are selective traps that employ different types of lure lures and bait placement techniques, as well as non-selective traps, in which the catch occurs randomly. Adaptations can be varied and include protection from elements such as the sun and rain. Some of them have catch containers covered by a screen with suitably sized meshes, while others may contain liquid preservatives. This liquid can be a mixture of water, liquid detergent and 3% formaldehyde, which facilitates capture, causing arthropods to sink quickly and avoid escaping from traps, due to the breakdown of the surface tension of the water.

Due to the variety of insects present in the urban space (Silva, Pelli, 2021; Silva, Pelli, 2020; Silva, Gomes, Pelli, 2020), it is important to know and identify them both for knowledge retention, about the classification of families, orders, and species, as well as self-care and protection, whether focused on the individual or economic factors (Araújo, Pelli, 2024).

The objective of this study was to make a preliminary survey of insect biodiversity in an urban area in the municipality of Uberaba, Minas Gerais.

MATERIALS AND METHODS

The research was carried out in three different places in Uberaba (MG). The city has a tropical climate. There is much more rainfall in summer than in winter. The climate is classified as Aw according to Köppen and Geiger. The average annual temperature in Uberaba is 22.9 °C. The average annual rainfall is 1681 mm. Uberaba is located in a temperate zone, which makes it difficult to categorize the seasons.

The collection was conducted in three different locations using pitfall traps. In these specific locations, three larger plastic containers and three smaller plastic containers were

placed in an appropriate structure in the collection environment. Inside these containers, a solution composed of water with detergent, aiming to break the surface tension, and alcohol was used. The locations chosen for data collection include a room on *Campus* 1 (Figure 1) of the Federal University of Triângulo Mineiro (UFTM), the Hospital de Clínicas (Figure 2) and a residence near the center of the city of Uberaba/MG (Figure 3).

Figure 1. Pitfall trap positioned in a closed room, with windows, on *Campus* I of the Federal University of Triângulo Mineiro.

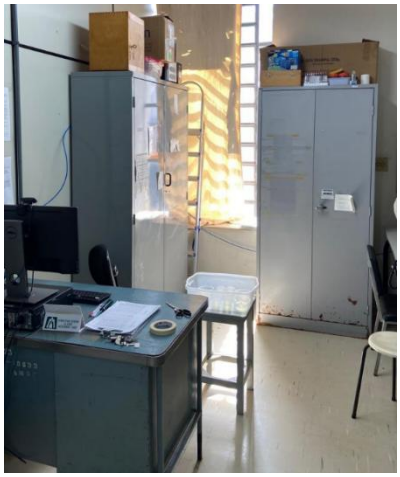

Figure 2. Room where the trap was placed at the Hospital de Clínicas of the Federal University of Triângulo Mineiro. Hospital professional positioning the trap.



Figure 3. Trap positioned in a residence near the center of the city of Uberaba/MG.



The collection period covered one week and the traps were strategically positioned near a light source, configuring themselves as the only attractive stimulus for the insects. After completing this phase, the researchers converged on the university laboratory, where they proceeded to the meticulous counting and taxonomic identification of the insects by means of a specific key. This taxonomic analysis process, conducted in a laboratory environment, aimed to characterize the entomological diversity obtained during the collection, providing data for the understanding and interpretation of the research results.

RESULTS

According to the different locations where the pitfall traps were installed, the data from the collections in each location were collected. They were: residence near a footpath, a building in the city center (*Campus* 1 of UFTM) and in the clinical hospital of the Federal University of Triângulo Mineiro, in the hospital's newborn formula preparation room; Uberaba, Minas Gerais.

Through the results, it was possible to observe in the residence near a footpath the capture of 32 insects in the large jars and 14 insects in the small jars. That said, in the larger jars, the largest collection of Hymenoptera Linnaeus, 1758, with 12 insects, was obtained. In sequence, Nematocera Latreille, 1825, with 8 representatives. Soon after, Formicidae Latreille, 1809, with 7 insects. The Order Homoptera Boisduval, 1829, with 2 insects. The order Collembola Lubbock, 1869, with 1 representative. The order Trichoptera Kirby, 1813, with 1 representative. And the order Cyclorrhapha Sharp, 1894, also with 1 insect. In the smaller jars, the order Hymenoptera Linnaeus, 1758, with 6 insects, was the one with the highest capture. Followed by the Order Homoptera Boisduval, 1829, with 2 representatives. The orders Collembola Lubbock, 1869; Heteroptera Linnaeus, 1758;

Nematocera Latreille, 1825; Cyclorrhapha Sharp, 1894; Coleoptera Linnaeus, 1758 and Araneae Clerck, 1757, with 1 insect each. Thus, a total density of 32 insects was obtained for the weak large ones, with a richness of 7 orders and a density of 14 insects for the small flasks, with a richness of 8 orders.

The collection of traps in the building in the city center (*Campus* 1 of UFTM) showed the collection of 64 insects in large jars and 19 insects in small jars.

Analyzing the larger vials, we obtained Diptera, Linnaeus, 1758, and Nematocera Latreille, 1825, with 8 representatives; Heteroptera Linnaeus, 1758, with 5 representatives; Homoptera Boisduval, 1829 with 4 representatives; Orthoptera (Olivier, 1811) and Hymenoptera Linnaeus, 1758 with 3 representatives; Staphylinidae Latreille, 1802 and Trichoptera Kirby, 1813 with 2 representatives and Collembola Lubbock, 1869, Thysanura Latreille, 1796, Blattaria Burmeister, 1829, Lepidoptera Linnaeus, 1758, Cyclorrhapha Sharp, 1894, Curculionidae Latreille, 1802 and Strepsiptera Kirby, 1813 with 1 representative each (Table 1).

In the smaller jars, the sub-order Nematocera Latreille, 1825, appears with 3 representatives; Heteroptera Linnaeus, 1758, Homoptera Boisduval, 1829 and Trichoptera Kirby, 1813 with 2 representatives each; and, lastly, Staphylinidae Latreille, 1802 with only 1 representative. Thus, the total density was 64 insects for the weak large ones, with a richness of 16 Orders and a density of 19 insects for the small flasks, with a richness of 6 Orders.

Table 1. Results of the collections from each locality in relation to the insects, total density and richness of the different flasks.

	Residence		*Campus* I		Hosp. Clinics		
	FG	FP	FG	FP	FG	FP	Total
Collembola Lubbock, 1869	1	1	1				3
Thysanura Latreille, 1796			1				1
Orthoptera (Olivier, 1811)			3				3
Blattaria Burmeister, 1829			1				1
Heteroptera Linnaeus, 1758		1	5	2			8
Homoptera Boisduval, 1829	2	2	4	2			10
Trichoptera Kirby, 1813	1		2	2			5
Lepidoptera Linnaeus, 1758			1				1
Diptera, Linnaeus, 1758			8		1		9
Nematocera Latreille, 1825	8	1	8	3			20

Cyclorrhapha Sharp, 1894	1	1	1				3
Coleoptera Linnaeus, 1758		1	22	9			32
Staphylinidae Latreille, 1802			2	1			3
Curculionidae Latreille, 1802			1				1
Strepsiptera Kirby, 1813			1				1
Hymenoptera Linnaeus, 1758	12	6	3				21
Formicidae Latreille, 1809	7						7
Araneae Clerck, 1757		1					1
Total Density	32	14	64	19	1	0	130
Wealth	7	8	16	6	1	0	19

Note: FG: large bottle; FP: small bottle.

At the Hospital das Clínicas (HC) the presence of no insect was detected in the small flasks and the presence of only 1 insect collected in the large flask, this one being from the Order Diptera of the species *Musca domestica* Linnaeus, 1758, that is, in the HC, in general the total density was 1 insect and richness of only one Order.

DISCUSSION

The results obtained in the building in the city center (*Campus* I of UFTM) pointed to 83 insects covering both bottles. It is possible to notice the predominance of Coleoptera, both in the larger and smaller jars (22 and 9 insects, respectively), and this Order is recognized as the largest and most diverse. These insects are distributed in practically all habitats around the world.

Some of the Orders with the fewest representatives were Collembola Lubbock, 1869, Thysanura Latreille, 1796, Blattaria Burmeister, 1829, Lepidoptera Linnaeus, 1758.

Therefore, the range of insects in this region is due to the fact that the building (*Campus* 1 of UFTM) is an old construction with many closed environments and close to an area for the sale of food products.

A total of 46 insects were collected in the residence near Vereda, from the small and large jars that had, respectively, eight and seven Orders. Such values are justified due to the proximity to the riverine ecosystem characteristic of the Cerrado biome, which plays a fundamental socio-environmental role in the State of Minas Gerais (Pimenta, Vilela, Pelli, 2021; Nimer, Brandão, 1989).

Among these results, the abundance of insects in both flasks was of the order Hymenoptera Linnaeus, 1758, with 18 representatives. This group encompasses several

species, including bees, hornets, carpenter bees, wasps, ants, among others, each designated by different regional terms that identify its group, genus, or species. In the Brazilian context, it is estimated that the potential richness of this order is numerically high, reaching about 70 thousand species described (Rafael et al., 2012).

The Orders with the lowest occurrence, with only one representative, were Heteroptera Linnaeus, 1758, Trichoptera Kirby, 1813, Coleoptera Linnaeus, 1758 and Araneae Clerck, 1757.

Finally, the traps placed at the Hospital de Clínicas obtained only one insect of the Order Diptera, Linnaeus, 1758 of the species *Musca domestica Linnaeus*, 1758. This result is due to the fact that the hospital environment maintains cleanliness in hospital environments is an effective prevention and control measure, aiming to interrupt the epidemiological chain of infections. However, even with the rigor of local hygiene, a house fly was collected, and only one animal can

CONCLUSION

In the present study, a higher incidence was observed for those belonging to the megadiverse Orders, namely: Coleoptera (32), Diptera (9), Lepidoptera (1), Hymenoptera (21) and Hemiptera, encompassing Homoptera and Heteroptera (18). Therefore, they have characteristics such as the presence of well-developed wings, the easy dispersion of these individuals in the environment and the anthropophilic relationship established by them, which may be the determining factor for these to be the orders with the largest number of specimens captured.

It is concluded that the highest density of insects and richness of Orders is present in the building in the center of the city (*Campus* I of UFTM). With a total of 83 animals collected, in the two jars, and a diversity of 22 Orders. Among these, the Order Coleoptera Linnaeus, 1758, is dominant, with approximately 37% of the insects captured in total in this environment. Therefore, it can be stated that *Campus* I of UFTM was the one that was most successful in collecting insects, and the Order Coleoptera was the most predominant.

It is understood that insects can be in all environments having necessary ecological roles, many of them being key pieces. Thus, the theme of the research becomes important as the collections of insects make it possible to track biodiversity to be able to know how much anthropic actions are interfering in the existence of these organisms and, from this, to understand the changes that the world is going through.

A relevant fact that drew attention was the occurrence of a domestic Musca in the "Milk Station" room, where the bottles of babies and pre-matures are prepared. It is known

that this species is a mechanical vector of numerous itiological agents of different pathologies.

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