DIVERSITY OF CURCULIONIDAE (COLEOPTERA) IN FORESTED SAVANNA FRAGMENT IN THE URBAN PERIMETER OF CUIABÁ-MT

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ABSTRACT: (DIVERSITY OF CURCULIONIDAE (COLEOPTERA) IN FORESTED SAVANNA FRAGMENT IN THE URBAN PERIMETER OF CUIABÁ-MT). The Curculionidae family presents a close relationship to its food resources and importance as primary decomposers in forest ecosystems. This research aimed to analyze the occurrence and diversity of this family in a fragmented forest savanna environment within the city of Cuiabá-MT. In this work, 18 pitfall traps were randomly arranged. The treatments used were different concentrations of ethanol (20º, 40º, 60º, 80º and 92,8º INPM), balanced from 92.8º INPM ethyl alcohol and control traps with only water + salt + neutral detergent. The collections were carried out biweekly, from January to December 2013. A total of 8,968 individuals of the Curculionidae family were collected, distributed in eight genera and 14 species belonging to the subfamilies Platypodinae, Cryptorhynchinae, Molytinae and Scolytinae, the latter being richest in species (10). *Xyleborus affinis* showed dominance and abundance over the other species collected, with a percentage of 93.24%. The dry season presented 6,708 individuals collected, corresponding to 74.80%. Among the treatments containing ethanol as an attractive, the 60º INPM concentration was the one with the highest number of species collected (10), presenting a higher diversity of species, as well as lower dominance. As most Curculionidae occurred in the dry period, this indicates that rainfall is a population regulator of these insects.

Keywords: Savanna, monitoring, pitfall, weevils, wood-boring beetles.

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INTRODUCTION

Coleoptera are found in all biogeographic regions of the world occupying practically all niches of natural and modified environments, occupying several trophic levels and presenting different dietary habits (SANTOS, 2005), being considered as important indicators of the quality of the environment. It is believed that the analysis of these insects can be carried out in researches that aim to evaluate environmental impact and forest fragmentation effects (GALDINO-DA-SILVA et al., 2016).

To know elements such as the richness and abundance of the functional groups present in tropical ecosystems, characterized by the complexity of their dynamics and stability, is determinant for the maintenance of these environments and their biodiversity (MEURER et al., 2013).

Among the natural agents responsible for the cycling of plant material are several groups of insects from different coleopteran families, such as Histeridae, Nitidulidae, Curculionidae, contributing to the cycling and incorporation of nutrients into the soil. According to Gusmão (2011), in forest environments, whether natural or planted, there is a chance of occurring insects considered pests, given the existence of specific ecological niches.

Some xylophagous coleoptera, also called wood-boring beetles, can disrupt tree growth, since they are vectors of disease. They introduce a symbiotic fungus that grows in the plant tissue that assists in the decomposition of wood (PAZ, 2006).

The alteration and fragmentation of the vegetation succeeds a change and loss of the biodiversity, with insects being one of the groups most affected. Among these insects, the Curculionidae family stands out because it has a close relationship with its food resources and importance as primary decomposers in forest ecosystems (RODRÍGUEZ et al., 2017).

Thus, the study of the Curculionidae family was carried out, in order to analyze the occurrence and diversity of this group in a fragmented environment of native vegetation in the city of Cuiabá, state of Mato Grosso.

MATERIALS AND METHODS

The traps were set up in a preserved fragment of forested savanna, in the neighborhood of Coxipó-da-Ponte, in Cuiabá-MT, under the coordinates 15º35'46"S and 56º05'48"W. Köppen classifies the climate in type Aw, characteristic of the Cuiabá lowland, with an average temperature of 25º C and an average annual rainfall of 1,400 mm.

This work employed pitfall traps, because of its very simple collection trap characteristics, being easy to be transported and installed, and of low cost, proving efficiency and effectiveness.

On the field a total of 18 randomly arranged traps were installed in a completely random statistical design, the treatments used were different concentrations of ethanol (20º, 40º, 60º, 80º and 92,8º INPM), balanced from ethyl alcohol 92.8º INPM and control traps with only water + salt + neutral detergent.

The gatherings were carried out in a fortnightly manner, from January to December 2013, and all collected material was identified with the number and date of collection and were then transported to the Forest Protection Laboratory of the Federal University of Mato Grosso (LAPROFLOR / FENF). In the laboratory, the collected material was submitted to a screening process, where only Coleopterans, including curculionidae, were selected and stored in Petri dishes, all material was separated and labeled according to the date of collection and treatment, after sorting, the selected material was dried in an oven at 60º C for 72 hours, according to the collection dates.

Quantitative and qualitative studies of the species that occurred in the research were carried out. Seasonality was analyzed between the periods of greatest climatic difference, being the dry season (May to October) and the rainy season (November to April).

For the ethanol concentrations, the diversity indexes of Shannon-Wienner, Pielou equitability and Simpson dominance were calculated. These population indices were performed using the DivEs software - Diversity of Species version 4.4.8 (RODRIGUES, 2018), in addition to the graphical cluster analysis of concentration similarities using software R version 3.5.1 (CORE TEAM, 2018).

RESULTS AND DISCUSSION

The presented study collected 8,968 individuals of the family Curculionidae, distributed in eight genera and 14 species belonging to the subfamilies Scolytinae, Platypodinae, Molytinae and Cryptorhynchinae (Table 1).

Of these, the most representative subfamily in this study was Scolytinae, with richness of 10 species (71.43%) collected. In studies carried out by Rocha et al. (2011), Dorval et al. (2012) and Meurer et al. (2013), in the state of Mato Grosso, in savanna environments, it was observed a greater abundance of Scolytinae in this region.

Therefore Rocha et al. (2011) considered that Scolytinae is adapted to the environmental conditions of the region. Of the 14 species collected, 12 were represented by a percentage of less than 1%, only *Xyleborus ferrugineus* and *Xyleborus affinis* obtained superior abundance, with greater emphasis for the latter.

The phytosanitary conditions, the forest species that occurs on site and the availability of food, are factors that influence the population densities of the insect fauna associated with the environment (DORVAL et al., 2004).

The results presented for the Curculionidae in this research were affected by a high abundance of *X. affinis*, since this species obtained dominance and superior occurrence to the other species collected, with a percentage of 93.24% (Table 1).

This species presents this pattern of dominance among ambrosia beetles, with tolerance to dry and disturbed areas, and becomes more abundant the closer it is to the soil (MACEDO-REIS et al., 2016; MACHADO & COSTA, 2017).

The levels of fragmentation of an area define the habitat complexity, thus the more complex the more stable the communities.

It’s known that isolated fragments in urban perimeter diminish the mutualistic interactions that could enrich biodiversity (CAJAIBA & SILVA, 2014).

TABLE 1 - Subfamilies, genera and species with their respective quantities in periods of annual drought and rain, Cuiabá-MT, 2013.

Curculionidae	Periods		Total	
	Drought	Rain	Annual	%
SCOLYTINAE				
Corthylus sp.	1	-	1	0.01
Cryptocarenus heveae (Hagedorn, 1912)	1	2	3	0.03
Cryptocarenus seriatus Eggers, 1933	-	1	1	0.01
Hypothenemus bolivianus Eggers, 1931	-	1	1	0.01
Hypothenemus eruditus Westwood, 1836	31	3	34	0.38
Microcorthylus minimus Schedl, 1950	-	2	2	0.02
Xyleborus affinis Eichhoff, 1867	6,241	2,121	8,362	93.24
Xyleborus ferrugineus (Fabricius, 1801)	295	104	399	4.45
Xyleborus spinosulus Schedl, 1934	2	-	2	0.02
Xyleborus spp.	66	9	75	0.84
PLATYPODINAE				
Platypus sp.	1	1	2	0.02
MOLYTINAE				
Spermologus copaiferae Marshall, 1938	56	16	72	0.80
Spermologus funereus Pascoe, 1871	6	-	6	0.07
CRYPTORHYNCHINAE				
Eubulus sp.	8	-	8	0.09
Total	6,708	2,260	8,968	100

In the dry season, 6,708 individuals were collected, corresponding to 74.80%. Among the species there was prominence of *X. affinis* in the dry period, with 6,241 individuals.

These results are similar to those obtained by Dorval et al. (2017) in a study carried out in a closed arboreal savanna of Cuiabá-MT, attributing this abundance to the behavioral habit of these species in the dry period, in which the climatic factors affect their survival, thus making them look for favorable conditions in the litter, mainly for being a mythophagous species and drought can be detrimental to its symbiotic fungus.

The subfamily Molytinae was the second richest in quantity, with two species of the genus *Spermologus*, which stands out in the family because its species are predators of several types of seeds, some of which cause economic damage to cultivation (ANTUNES, 2017).

The number of Curculionidae individuals occurred in greater amount between the month of May, considered the beginning of the drought period, and the month of October, considered end of the drought period (Figure 1). In these months the amount of precipitation is low and the temperature is high, favoring a population increase of these insects. This result is similar to that analyzed by Dorval et al. (2017), when it was observed that the population of *X. ferrugineus* and *X. affinis* in closed arboreal savanna occurred in greater abundance in the drought months in the same region of this study.

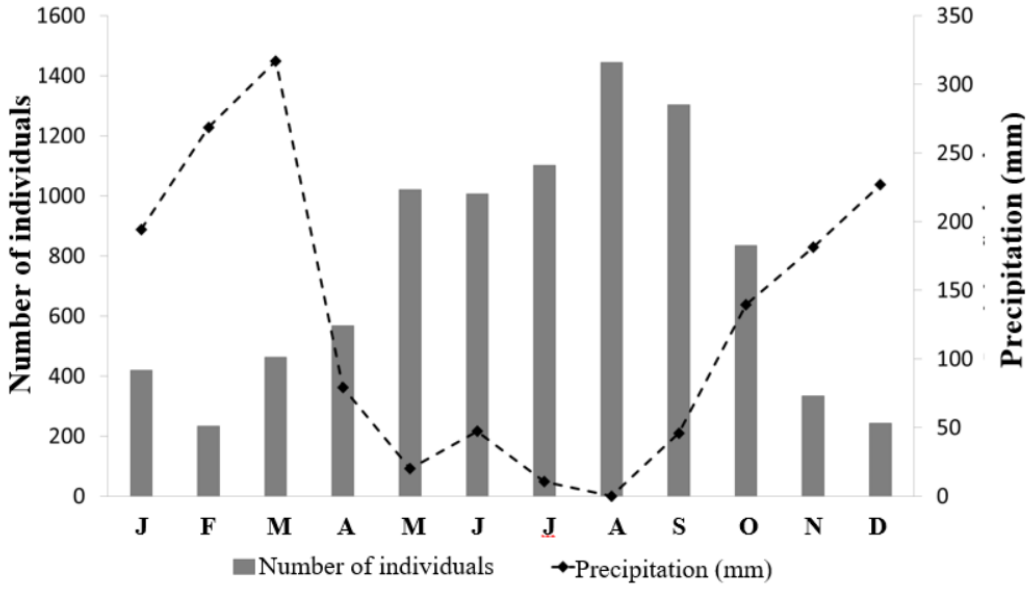

FIGURE 1 - Population fluctuation of Curculionidae individuals due to precipitation, Cuiabá-MT, 2013.

It is observed that a population peak in the Curculionidae family occurs in the month of August, where the rainfall is almost null, demonstrating that the density of this family in the research region occurs much as a function of the amount of rainfall. And, according to Dorval et al. (2017), explains that rainfall acts as a population regulator of insects, modifying environmental conditions and the occurrence of insect fauna.

This population variance may be correlated to *X. affinis*, as observed, this species obtains 93.24% of the individuals collected. The highest population peak of *X. affinis* occurs in August and the presence of this species is a concern for the monocultures in the state of Mato Grosso (DORVAL et al., 2012).

According to the above-mentioned author, these insects are affected by the period of high precipitation, changing behavior and becoming an obstacle to their displacement. This may explain the considerable decrease in the amount of individuals collected in the month of greater rainfall and the fact that the months of least occurrence of individuals (February and December) are within the rainy season.

Analyzing the population variance of the collected species, it is observed that the majority of these present an increase in the abundance of individuals collected in the months of low precipitation. According to Dorval et al. (2012) this may be influenced by the long drought period in the region, which contributed to a greater availability of food, or by water stress of the trees, which becomes susceptible to the attack and colonization of wood-boring beetle species.

In relation to ethanol concentrations in the traps, the control treatment had a higher diversity and specie evenness when compared to the ethanol treatments (Table 2). This occurred because in this treatment, only three species were collected and the dominance was the smallest, in order to present overestimated rates.

TABLE 2 - Concentration of ethanol according to the number of species and diversity indexes of Shannon-Weaner, Pielou equitability and Simpson dominance, Cuiabá-MT, 2013.

Population Index	Concentration of ethanol (ºINPM)					
	Control	20º	40º	60º	80º	92.8º
Number of Species (S)	3	8	7	10	7	9
Diversity of Shannon-Wienner (H')	1.38	0.54	0.46	0.57	0.36	0.34
Evenness of Pielou (J')	0.87	0.18	0.16	0.17	0.13	0.11
Dominance of Simpson (d)	0.40	0.84	0.88	0.83	0.91	0.91

Among the treatments containing ethanol as an attractive, the ethanol concentration at 60º INPM was the one that stood out with the highest number of species collected (10), presenting a greater diversity of species, as well as lower dominance.

Treatment of 92.8º INPM presented the most unequal population density. In this treatment the dominance was higher, because it was where the largest amount of *X. affinis* occurred (2,002 individuals). Souza et al. (2016) adjusted by linear regression the ideal concentration for *X. affinis* and observed that increasing the ethanol content increases the attractiveness of the trap for collecting this species.

The low rates of diversity and equitability are due to the amount of *X. affinis* collected in the ethanol treatments, since this species presented a high rate of dominance, with a mean of 93.35% of the occurrence of individuals in these treatments.

It is observed that the Simpson index tends to be higher when the diversity of habitat is indicated as smaller, in an inverse tendency, the evenness approximates to the diversity.

The cluster diagram (Euclidean Distance) grouped concentrations of 40º and 60º INPM with greater similarity due to the greater similarity of the species collected in these treatments, being the control treatment farthest from the others (Figure 2). The use of different concentrations of ethanol is important for the survey on the richness of the Curculionidae family, since the isolated treatments can not sample all the species collected in the study (JORGE et al., 2017).

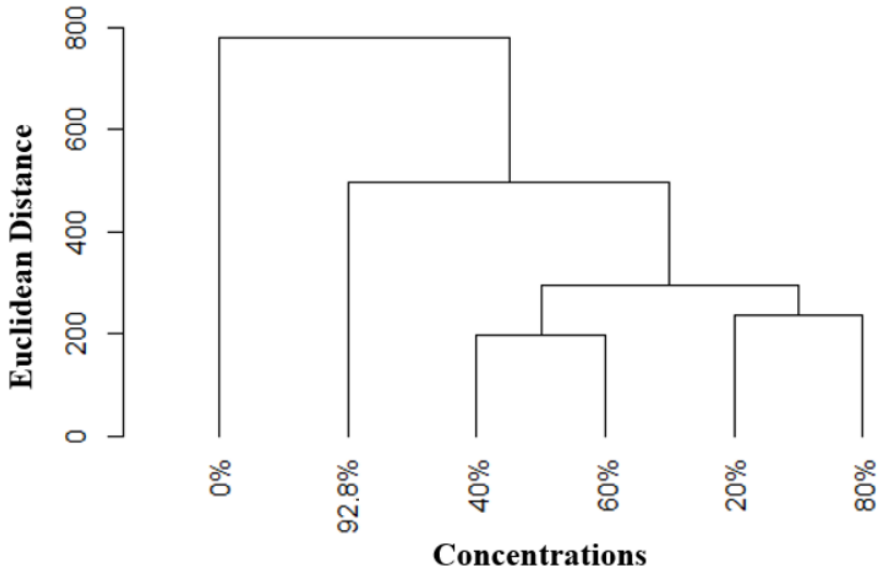

FIGURE 2 – Cluster dendrogram, evaluating the Euclidean distance between different concentrations of ethanol, Cuiabá-MT, 2013.

The highest concentration (92.8º INPM) is grouped differently from the other concentrations, a result similar to that of Gusmão (2011), as ethanol 92.8º INPM was also used as attractive bait, in escolitídeo-Curitiba ethanolic traps, presenting a low collection response of Scolytinae.

CONCLUSIONS

The highest amount of Curculionidae collected in the leaf litter occurred during the period of lower rainfall, indicating the adaptive capacity of these insects due to the environment conditions, having the pluviometric precipitation act as a population regulator.

The concentration of ethanol at 60º INPM proved as more efficient for the collection of Curculionidae in the forested savanna, with greater richness and diversity of species.

Due to its dominance on the leaf litter, the Wood-boring beetle, *Xyleborus affini*, presented as adapted to the environment.

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