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INFLUÊNCIA DA SAZONALIDADE EM ESPÉCIES DE PERCEVEJOS (HEMIPTERA-HETEROPTERA) ASSOCIADOS À LOBEIRA (SOLANUM LYCOCARPUM A. ST. HIL - SOLANACEAE) NO CERRADO BRASILEIRO, ESTADO DE MINAS GERAIS.

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RESUMO

Solanum lycocarpum A. St-Hil (fruto do lobo ou lobeira) (Solanaceae) é um arbusto perene típico do cerrado brasileiro, sob constante corte e queimada devido a atividades antrópicas para o desenvolvimento da agricultura e pecuária. Apresenta atributos medicinais terapêuticos para seres humanos e animais selvagens principalmente como anti-helmínticos. Pouco se sabe sobre a fauna de insetos associada a S. lycocarpum, e nenhum estudo foi realizado sobre os percevejos (Heteroptera) associados à ela. Para o estudo, os percevejos foram amostrados em dez locais na mesorregião do Triângulo Mineiro e Alto Paranaíba por um ano em dois períodos sazonais de seca e chuva. Em cada localidade, 20 arbustos de S. lycocarpum foram selecionados. A amostragem foi realizada com o auxílio de uma rede de batimento. No total, foram amostrados 593 indivíduos pertencentes a 22 gêneros e 25 espécies, distribuídos em quatro famílias: Miridae, Pentatomidae, Reduviidae e Tingidae. A hipótese de que as assembléias de Heteroptera associadas à lobeira não alteram os parâmetros ecológicos foi testada levando em consideração a variação ambiental causada pela sazonalidade (abundância relativa, riqueza de espécies, diversidade Shannon, diversidade Simpson, uniformidade de Shannon e dominância de Simpson). Os resultados mostraram que a associação de percevejos com a lobeira é positiva para a estabilidade da dinâmica ecológica do grupo. O fruto do lobo é uma espécie perene que possui folhas, flores e frutos durante todo o ano, gerando pouca variação na disponibilidade de recursos para as espécies associadas. Apesar dos efeitos antrópicos, incêndios e corte, os resultados mostraram que não houve pressão suficiente para modificar a estrutura da assembléia de Heteroptera. Assim, a lobeira mostrou-se uma espécie significativa para manter a estrutura ecológica de Heteroptera, mesmo sob pressões sazonais e antropogênicas.

PALAVRAS-CHAVE: Assembleia de Heteroptera, Miridae, Pentatomidae, Reduviidae, sazonalidade, Tingidae.

INFLUENCE OF SEASONALITY IN PLANT BUG SPECIES (HEMIPTERA - HETEROPTERA) ASSOCIATED WITH LOBEIRA (SOLANUM LYCOCARPUM A.ST.HIL. - SOLANACEAE) IN THE BRAZILIAN CERRADO, MINAS GERAIS STATE.

ABSTRACT

Solanum lycocarpum A. St-Hil (wolf's fruit or lobeira) (Solanaceae) is a perennial shrub typical of the Brazilian Cerrado (savanna), under constant cutting and burning due to anthropic activities for the development of agricultural and livestock farming. It presents therapeutic medicinal attributes for humans and wild animals primarily as an anthelmintics. Little is known about the insect fauna associated with *S. lycocarpum*, and no study has been conducted on the true bugs (Heteroptera) associated with it. For the study, the true bugs were sampled from ten points in the mesoregion of Triangulo Mineiro and Alto Paranaiba for one year in two seasonal periods of drought and rain. In each locality, 20 shrubs of *S. lycocarpum* were selected. Sampling was carried out with the aid of a beat net. In total, 593 individuals belonging to 22 genera and 25 species were sampled, distributed in four families: Miridae, Pentatomidae, Reduviidae, and Tingidae. The hypothesis that the Heteroptera assemblages associated with lobeira do not alter the ecological parameters was tested taking into account the environmental variation caused by seasonality (relative abundance, species richness, diversity Shannon, Simpson diversity, Shannon evenness, and Simpson dominance). The results showed that the association of the assembly of true bugs with the lobeira is positive for the stability of the ecological dynamics of the group. The wolf's fruit is a perennial species that keeps its leaves, flowers, and fruits throughout the year, generating little variation in the availability of resources for associated species. Despite the anthropic effect of fires, the results showed that there was not enough pressure to modify the structure of the Heteroptera assembly. Thus, lobeira was proved as a significant species to maintain the ecological structure of Heteroptera assembly, even on seasonal and anthropogenic pressures.

KEY WORDS: Heteroptera assembly, Miridae, Pentatomidae, Reduviidae, seasonality, Tingidae.

General characteristics of lobeira

In Brazil, the family Solanaceae comprises 34 genera and 488 species, eight subspecies and 12 varieties, of which 228 are endemic in the country (FLORA DO BRASIL, 2020). The genus *Solanum* Tourn. Ex. L. is the largest among the Solanaceae, represented in Brazil by 283 species and two varieties, with 138 of these endemic to the country (FLORA DO BRASIL, 2020).

Solanum lycocarpum A. St-Hil. (wolf´s fruit or "lobeira") is a perennial shrub typical of Cerrado, a vast tropical savanna ecoregion of Brazil, and can measure up to 4 meters in height. It has cylindrical, woody and tortuous branches. The leaves are hard and prickly, and the fruits have a globose shape measuring 8 to 12 centimeters in diameter (Prates et al. 2012).

Solanum lycocarpum has a distribution in the respective Brazilian regions and states: Northeast (Bahia), Central-West (Distrito Federal, Goiás, Mato Grosso do Sul and Mato Grosso), Southeast (Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo) and South (Paraná). It occurs in the phytogeographical domains of the Cerrado and Atlantic Forest in anthropic disturbance vegetation (STEHMANN et al., 2015).

The "lobeira" grows and develops in unfavorable environmental conditions such as acid and nutrient-poor soils, supports arid climate and long periods of drought in addition to annual burn cycles (TAVARES et al., 2014). "Lobeira" is recognized as a pioneer species (Martins 2005) in devastated areas with high colonization power, offering resources for floristic succession and interaction with fauna (RICKLEFS, 2003). The restoration of the degraded regions of Cerrado is currently a subject of great interest. Thus, *S. lycocarpum* is indicated as a "Nurse Plant" in the restoration of degraded areas of Cerrado, both because of its ecological characteristics and also because of its low operational cost (Lopes 2010). The wolf's fruit is considered a resource for the maintenance of bees' guilds because of its continuous flowering pattern, which will lead to the improvement and sustainability of plants of economic interest and wild plants (TAVARES et al., 2014).

The fruit according to Almeida et al. (1998), has high importance in the diet and survival strategy of the Guará wolf, *Chrysocyon brachyurus* (Illiger 1815) (Carnivora: Canidae). It can act both as food sources and as a vermifuge, preventing the development of a dangerous nematode parasite *Dioctophyma renale* (GOEZE, 1782). Therapeutic properties of the "lobeira" are known by its pharmacological therapeutical properties effects as a hypoglycemic, anti-inflammatory and antirheumatic herb, and has been recommended as a treatment of asthma, influenza and cold (PRATES et al., 2012).

Solanum lycocarpum also has vermicidal properties for leishmaniasis, schistosomiasis, and strongyloidiasis, significant socioeconomic problems for Brazil (MIRANDA, 2010). In spite of all these ecological, medicinal and pharmacological potentials, the "lobeira" is a highly marginalized plant in the territory of the state of Minas Gerais. It has been suffering constant cuts, withdrawals, and burns due to anthropic activities in the use of soil for agricultural and livestock farming areas. The lobeira are often found in limited numbers in the margins of roads, areas of pastures and abandoned areas.

General characteristics of insect fauna

The temporal variations in different conditions and resources can positively or negatively influence the biodiversity structure of a given locality (BEGON et al., 2006). The seasonal variation on insects assemblies is very discussed in the literature (WOLDA, 1988, SOUTHWOOD et al., 2004, DANKS, 2007), is an essential factor in determining the characteristics of Neotropical ecosystems. The seasonal variation in the biome Cerrado is characterized by a dry period with human activity in the use of fire and heavy rainfall in the rainy season (MARQUIS et al., 2002).

Many biotic and abiotic factors can influence the abundance of insects throughout the year, and the rainfall regime as a significant one (WOLDA, 1988; PINHEIRO et al., 2002). Pinheiro et al., (2002) and Silva et al., (2001) reported that in the Cerrado, during the rainy season, there is a greater abundance of herbivorous insects compared to other periods, and characterized by the start of production of new leaves and flowers in a large number of plant species with an increase in food resources.

Little is known about the insect fauna associated with lobeira. Knowledge covers the bees Apidae and Andrenidae families (ROUBIK, 1989), the genus *Atta* ants (PINTO, 1998); larvae of Lepidoptera (DINIZ et al., 2001), Membracidae and other Auchenorrhyncha (MOREIRA & DEL CLARO, 2005, MACEDO et al., 2009). No studies were performed regarding Heteroptera plant bugs.

Heteroptera act directly on the selective pressure of plant species by feeding habits, causing injuries in the plant tissue, reproductive organs, and seeds. Some species exhibit co-evolution with plant species by specialization to the plant's resources (BROWN Jr., 1987). Insect assemblies associated with plants exhibit changes in the availability of resources and tend to decrease the ecological parameters of biodiversity. Thus, there is a decrease in the stability of the interactions, allowing negative effects if this assembly does not present high resistance and or high resilience to the seasonal changes. The lobeira exhibits structural stability that can act as a micro-habitat that maintains a stable ecological structure of insect assemblies.

The hypothesis that the Heteroptera assemblages associated with lobeira do not alter the ecological parameters against environmental variation caused by seasonality was tested here. It was assumed that the presence of leaves, flowers, and fruits throughout the year produces a micro-habitat that reduces the seasonal effects of the environment and offers the stability of true bugs assemblies. This study analyzed the importance of the lobeira in structuring the ecological parameters in the Hemiptera-Heteroptera assemblies.

Study areas

To survey true bugs associated with “lobeira” ten points were sampled (Site1-Site10) in a year, in two periods of dry and rainy seasons, respectively (Figure 1). In the rainy season insects were collected in January, and in the dry season in July.

The samplings occurred where there were groups of lobeiras in pasture areas in municipalities of the mesoregion of Triângulo Mineiro and Alto Paranaíba.

Areas of municipalities sampled (Figure 1and Table 1):

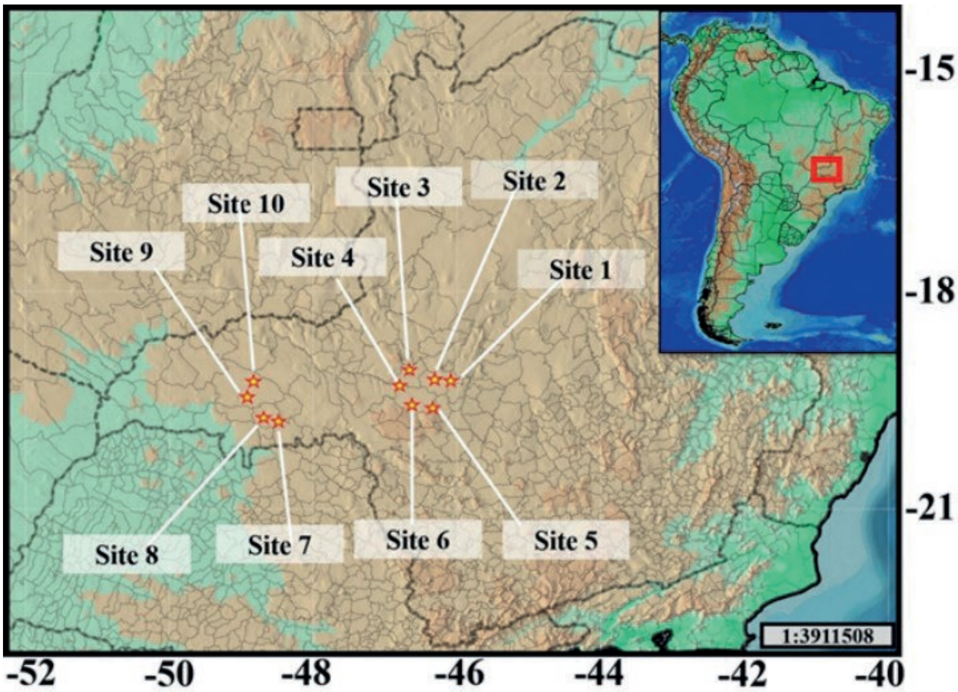

Figure 1- Sampling area in Mesoregion of Alto Paranaíba and Triângulo Mineiro. Sites 1 - 10 = sampled sites.

Local	Municipalities	Coordinates
Site1	São Gotardo, MG	19º 12’ 43.0’’ S/ 46º 05’ 40.0’’ W
Site 2	Rio Paranaíba, MG	19º 12’ 03.3’’ S/ 46º 14’ 44.6’’ W
Site 3	Serra do Salitre, MG	19º 05’ 49.2’’ S/ 46º 39’ 09.3’’ W
Site 4	Serra do Salitre, MG	19º 16’ 33.0’’ S/ 46º 49’ 05.8’’ W
Site 5	Ibiá, MG	19º 35’ 40.1’’ S/ 46º 19’ 36.3’’ W
Site 6	Ibiá, MG	19º 35’ 13.6’’ S/ 46º 36’ 43.4’’ W
Site 7	Conceição das Alagoas, MG	19º 46’ 31.0’’ S/ 48º 28’ 04.2’’ W
Site 8	Campo Florido, MG	19º 44’ 42,4’’ S/ 48º 38’ 21.7’’ W
Site 9	Prata, MG	19º 25’ 51.9’’ S/ 48º 53’ 17.6’’ W
Site 10	Prata, MG	19º 15’ 01.5’’ S/ 48º 49’ 31.7’’ W

Table 1: Geographic coordinates of municipalities in the state of Minas Gerais, where samplings were made.

Sampling

In each location, 20 exemplars of *S. lycocarpum* were selected, ranging from 2.5 to 3 meters high. The sampling was carried out with the aid of a beat net, placed under the cup of the lobeira with approximately 20 beats in different places of the plant. The content collected in the nets were placed in clear plastic bags (80 cm x 60 cm) containing newspaper stripes to prevent contact between insects and excess moisture, and cotton soaked in Ethyl Acetate to kill the specimens. The collected material was taken to the laboratory for screening, mounting, and storage of specimens. For dry mounting, the larger insects were pinned, while smaller ones were glued to triangular tips of cardboard paper for double mounting. The material was then oven-dried at 40° C for five days and then labeled.

The identification of Heteroptera carried out by authors of this research: Miridae: Ferreira; Pentatomidae: Grazia & Fernandes; Reduviidae: Gil-Santana and Tingidae: Costa. All entomological material is deposited at the Regional Museum of Entomology (UFVB) of Federal University of Viçosa.

Data analysis

For the sampling performance of each period, a rarefaction curve was calculated based on data of species richness and abundance. Then, with relative abundance data for each taxon, a non-metric multidimensional scaling (NMDS) was performed, based on the similarity measure of Bray-Curtis, to verify the similarities of the sites sampled and between the studied periods. The temporal comparisons used ecological parameters, such as relative abundance, species richness, Shannon diversity, Simpson diversity, Shannon Equitability, and Dominance Simpson. These index analyzes and calculations were performed in PAST® software (HAMMER et al., 2001). Based on the data of the ecological parameters (using them as variables), the comparative temporal analyses were carried out using the ANOVA parametric test or non-parametric Kruskal-Wallis test. The type of test chosen was conducted after checking whether or not the sampled data reached the premises (normality: Shapiro-Wilk test (SW) and homoscedasticity: Levine test (LV) required for each type of test.

For the parameters of Dominance (SW: dry p = 0.10, rain p = 0.04, LV: p = 0.52), Equity (SW: dry p = 0,10, rain p = 0,01; p = 0.34), Simpson diversity (SW: dry p = 0.10, rain p = 0.04, LV: p = 0.52) and Abundance (SW: dry p = 0.01, rain p = 0.69, LV: p = 0.93), the Kruskal-Wallis test was used. For the Shannon diversity parameters (SW: dry p = 0.44, rain p = 0.47, LV: p = 0.77) and species richness (SW: dry p = 0.43, rain p = 0, 75; LV: p = 0.50), the analysis of variables (ANOVA) was used. In order to analyze the composition of the richness of each food guild between the seasonal periods, temporal comparisons were also made to observe if between the periods there were differences in the structure of the food guilds. The Kruskal-Wallis non-parametric test was used for this last analysis (predator: SW dry p = 0.71, SW rain p = 0.66, LV p = 0.05, phytophagous: SW dry p = 0.19, SW rain p = 0.01, LV p = 0.35 / dry: SW predator p = 0.71, phytophagous SW p = 0.19, LV p = 0.01; SW predator p = 0.66, phytophagous SW p = 0.01, LV p = 0.30). All comparative analyzes (including their assumptions tests) were done in Statistica 7 software (STATSOFT, 2005).

Total sampled 593 individuals distributed in four families, 22 genera and 25 species: Miridae: *Adxenetus minensis* Carvalho & Ferreira, 1973 (Fig. 6A), *Allommatus guaranianus* Carvalho & Ferreira, 1973 (Fig. 6B), *Ceratocapsisca* sp. (Fig 6C), *Hyaliodes glabratus* (Distant, 1888) (Fig.6D), *Phytocoris bergrothi* Reuter, 1892 (Fig 6E), *Phytocoris* sp.1 (Fig 6F), *Phytocoris* sp.2 (Fig 6G), *Proba* sp. (Fig. 6H), *Rhinacloa* sp. (Fig. 6I) and *Taedia semilota* (Stål, 1860) (Fig. 6J); Pentatomidae: *Arvelius porrectispinus* Breddin, 1909 (Fig.7A), *Edessa rufomarginata* (De Geer, 1773) (Fig.7B), *Euschistus heros* (Fabricius, 1798)

(Fig.7C), *Nezara viridula* (Linnaeus, 1758) (Fig. 7D), *Oebalus ypsilongriseus* (De Geer, 1773), *Piezodorus guildinii* (Westwood, 1837) (Fig.7F), *Podisus nigrispinus* (Dallas, 1851) (Fig.7G), *Supputius cincticeps* (Stål, 1860) (Fig.7H); Reduviidae: *Atopozelus opsimus* Elkins 1954 (Fig.8A), *Heza insignis* Stål, 1859 (Fig. 8B), *Montina confusa* (Stål, 1859) (Fig.8C), *Zelus leucogrammus* (Perty, 1833) (Fig.8D); Tingidae: *Corythaica monacha* (Stål, 1858) (Fig.9A), *Leptopharsa heveae* Drake & Poor, 1935 (Fig.9B), *Telemonemia scrupulosa* Stål, 1873 (Fig. 9C). Differences were found between periods (dry and rainy).

In the dry period, the most abundant species was *Rhinacloa* sp. (46.58%), and the species with lower abundance were *Euschistus heros*, *Phytocoris bergrothi*, *Phytocoris* sp1. *Phytocoris* sp.2 *Proba* sp., *Piezodorus guildinii*, *Podisus nigrispinus* and *Leptopharsa heveae* (all with 0.24%). The most significant family was Miridae with ten species, and the smaller representativeness was Reduviidae, with two species.

In the rainy season, the most abundant species was *Edessa rufomarginata* (41.53%), and the species with lower abundance were *Heza insignis*, *Nezara viridula* and *Leptopharsa heveae* (all with 0.54%). The most significant family was Pentatomidae with six species, and the one of smaller representativeness was Tingidae, with two species (Table 2).

Table 2 - List of species (Heteroptera) associated with lobeira in periods of drought (LS) and rainfall (LC). * = predators; ** = phytophagous.

Taxonomy Classification	LS 1	LS 2	LS 3	LS 4	LS 5	LS 6	LS 7	LS 8	LS 9	LS 10	LC 1	LC 2	LC 3	LC 4	LC 5	LC 6	LC 7	LC 8	LC 9	LC 10
MIRIDAE																				
***Adxenetus minensis* Carvalho & Ferreira, 1973.	0	0	0	0	1	2	2	6	0	0	1	0	0	4	0	0	0	0	0	0
***Allommatus guaranianus* Carvalho & Ferreira, 1973.	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	3	0	0	0
**Ceratocapsisca* n.sp.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
**Hyaliodes glabratus* (Distant, 1888)	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
**Phytocoris bergrothi* Reuter, 1892	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
**Phytocoris* sp. *1*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
* *Phytocoris* sp. 2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Proba* sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
***Rhinacloa* sp.	0	0	0	0	0	36	25	2	25	103	1	9	2	3	0	0	0	0	1	1
***Taedia semilota* (Stål, 1860)	0	0	0	0	7	6	0	0	0	0	2	2	2	0	6	6	0	0	2	2

PENTATOMIDAE																				
***Arvelius porrectispinus* Breddin, 1909**	0	2	1	0	1	1	2	2	7	29	0	0	0	3	0	0	5	0	0	2
***Edessa rufomarginata* (De Geer, 1773)**	3	3	3	0	0	4	2	1	40	10	4	2	4	3	3	7	13	4	22	14
***Euschistus heros* (Fabricius, 1798)**	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	2
***Nezara viridula* (Linnaeus, 1758)**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
***Oebalus ypsilongriseus* (De Geer, 1773)**	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0
***Piezodorus guildinii* (Westwood, 1837)**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Podisus nigrispinus* (Dallas, 1851)**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
***Supputius cincticeps* (Stål, 1860)**	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
REDUVIIDAE																				
***Atopozelus opsimus* Elkins 1954.**	0	0	0	0	0	1	2	0	0	1	1	1	1	0	0	0	0	0	0	0
***Heza insignis* Stål, 1859**	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
***Montina confusa* (Stal, 1859)**	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
***Zelus leucogrammus* (Perty, 1833)**	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
TINGIDAE																				
***Corythaica monacha* (Stål, 1858)**	0	0	0	0	0	39	1	0	1	0	4	1	0	0	1	24	0	0	0	2
***Leptopharsa heveae* Drake & Poor, 1935**	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0
***Teleonemia scrupulosa* Stål, 1873**	1	1	0	0	0	0	1	12	3	1	0	0	0	0	0	0	0	0	0	0
total species collected in localities	4	6	3	1	3	12	7	6	7	7	8	7	4	5	3	5	5	1	3	7

Figure 2 shows the sampling efficiency between the rainy and dry seasons. There was an asymptote tendency for both periods, suggesting that the samplings were satisfactory. The similarity relationship between sites and seasons, there was a higher similarity between sites in the rainy season and higher dispersion in the dry season. In the specific analysis on the dry season, there was a dissimilarity between sites 4 and 5, and in the rainy season, the most divergent sites were 7 and 8 (Figure 3).

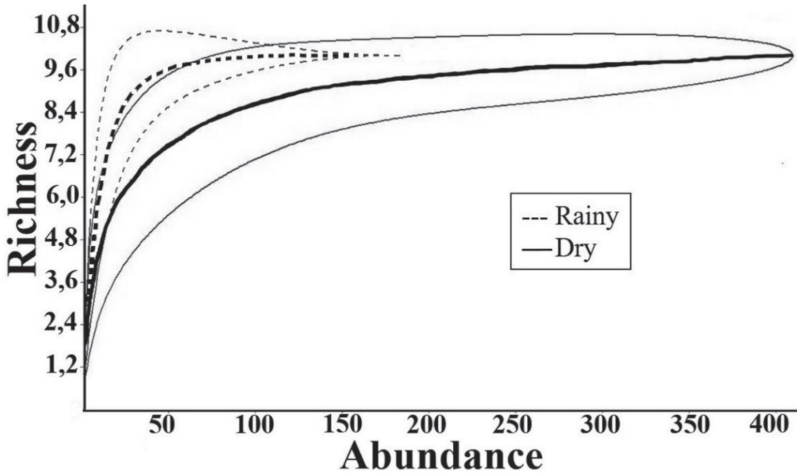

Figure 2 - Curve of the collector for the samplings carried out in the dry and rainy periods. Midline representing the mean and outside lines the standard deviation.

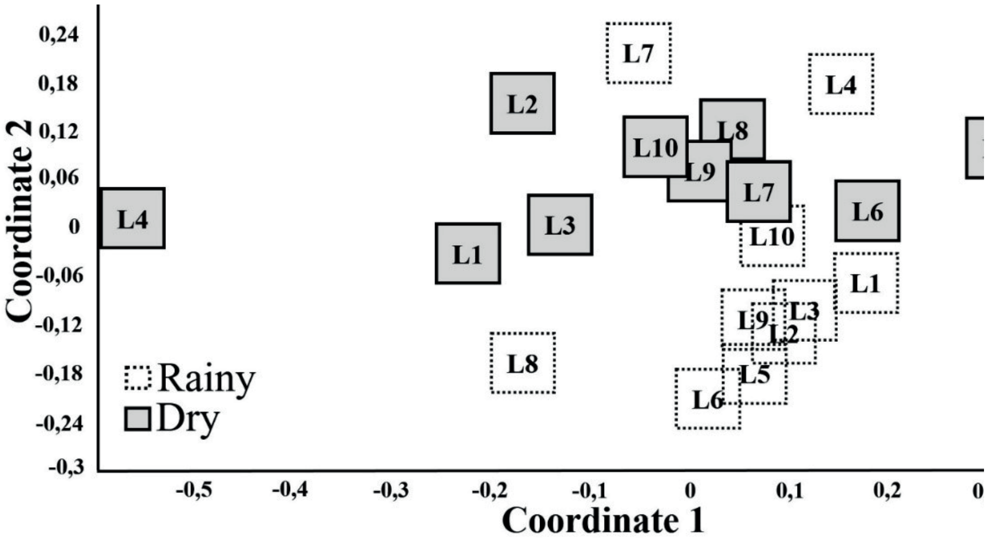

Figure 3 – Similarity analysis made among sites (L) in dry and rainy seasons.

The comparative analysis between the seasonal periods did not show significant differences in any of the ecological parameters analyzed: equitability ($p = 0.34$), dominance ($p = 0.52$), Simpson diversity ($p = 0.52$), diversity Shannon ($p = 0.77$), abundance ($p = 0.93$) and richness ($p = 0.50$) (Figure 4).

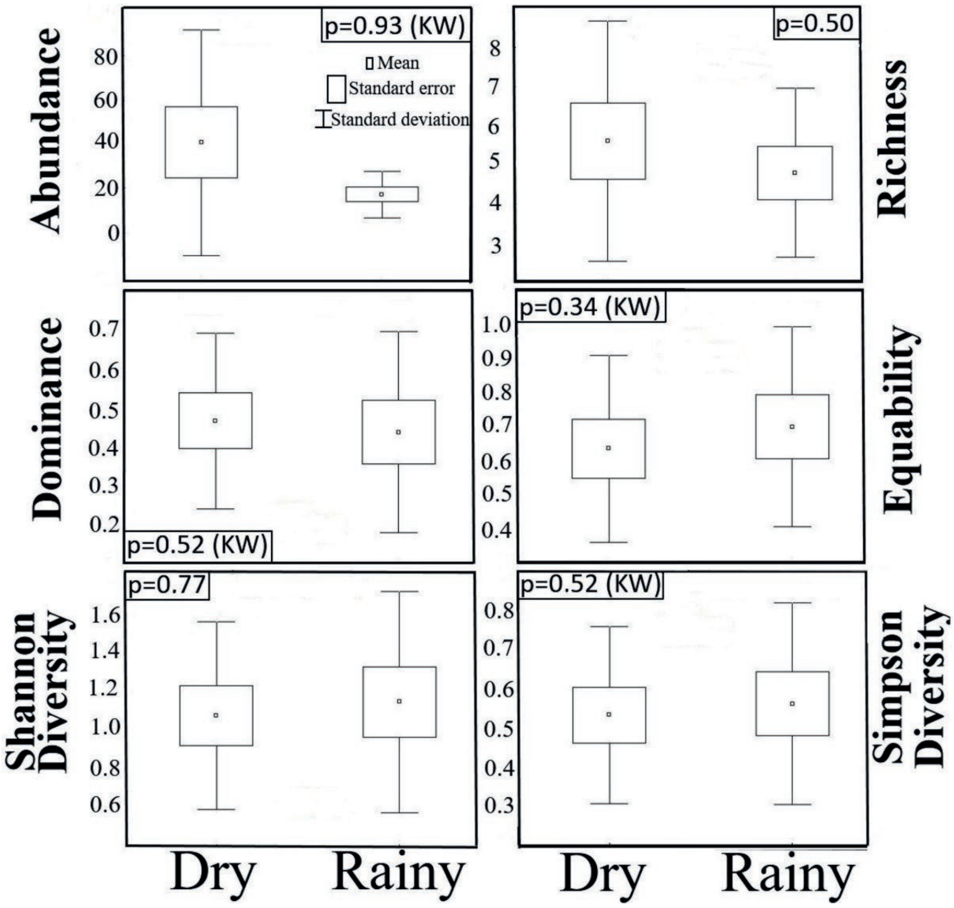

Figure 4 - Comparative Analysis for the ecological parameters between the dry and rainy seasons. KW= Kruskal-Wallis (performed only the date not reached the premises to parametric analysis) e KW absent= ANOVA.

In the comparative analysis between the guilds of food habits, there were significant differences between the species richness for each guild in both periods. However, a continuing relationship of phytophagous richness was maintained lower than that of predators. Each guild did not show significant variation between the seasonal periods (Figure 5).

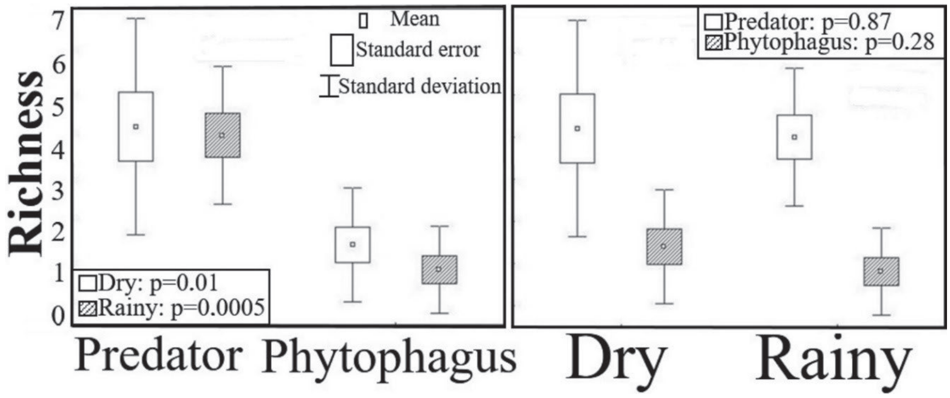

Figure 5 - Kruskal Wallis comparative analysis of species richness in each guild between the seasonal periods.

Based on the results, the association of Heteroptera assembly with lobeira was positive for the stability of ecological dynamics. This result disagrees with Franco's (2002) prerogative where the plant is characterized as a microhabitat and seasonality can alter the ecological structure of associated insects by changes in plant development at some periods of the year, affecting the availability of water and nutrients. Cornelissen & Fernandes (2001) also report that there is seasonal variation in plant structures, such as in rainy season, where most plants increase the production of leaves and branches making the resources more abundant for herbivorous insects. Consequently, insect assemblages can change their structural composition. However, we must take into account the specificity of each plant in the relationship with the assembly of associated insects.

The hypothesis established by the results is that the lobeira is a microhabitat for the assembly of Heteroptera because it is a perennial plant that maintains its leaves, flowers, and fruits throughout the year (Campos 1994). Thus, the lobeira has little variation in the availability of resources for the associated species, and it is clear the importance of the plant in the dynamics of assemblies against various environmental stresses. The hypothesis of stability in the structure of Heteroptera assemblies can be sustained by the non-intraguild variation between the seasonal periods (Fig. 5). According to Elton (1958), the stability of a community is recognized by the structure of the trophic web, in which enough maintenance of resources enables the stability of relationships and trophic levels. So, biodiversity and ecological parameters can remain with little variation over a more extended period time due to resource availability and the low rate of competition. The lobeira with its stable characteristics allows a low variation in the ecological parameters of the associated communities (e.g., richness, abundance, equitability, species diversity, and dominance) due to the wide availability of resources and the low seasonal effect. The environmental stability created by lobeira, the main factor governing the structure of assembly is the biological or ecological interactions among species. In this case, ecological interactions structure community dynamics (Ricklefs, 2009) where the resources provided by lobeira preclude non-harmonic ecological interactions.

The dissimilarity between the sites 4 and 5 in the dry period (Figure 3) can be explained by the local anthropogenic effects, such as burning pastures before the start of samples (personal communication, LSFF). However, the results showed that fire did not cause intense pressure to modify the structure of the assembly of true bugs. The lobeira did no change in their structures, maintaining the same pattern of leaves, flowering, and fruit. Tavares et al. (2014) observed the same in the association of bees with *S. lycocarpum*.

The divergence between sites 7 and 8 during the rainy season may be related to the paring plants. Many farmers regard the lobeira as an “invasive pest” pastures and implement procedures for “clearing” areas where livestock will be concentrated at some periods (personal communication, LSFF). Even so, based on results, there was no significant.

In brief, it can be assumed that the proposed hypothesis was confirmed, as in all analyzes for the different parameters, there was no significant difference between the seasonal periods. The lobeira can be considered as an important species to maintain the ecological structure of the Heteroptera assembly, even under seasonal and anthropogenic pressures.

The preservation of lobeira is essential to act positively on associative biological interactions and maintain stable and controlled non-harmonic interactions that negatively affect the ecological parameters.

Actions for lobeira preservation should be carried out, such as maintenance of this plant in natural environments and agroecosystems. It is also important to create areas to lobeira crop with purposes to develop researches, environmental and pharmacological studies, enabling the maintenance of associated insect fauna and the conservation of biodiversity in the Cerrado biome.

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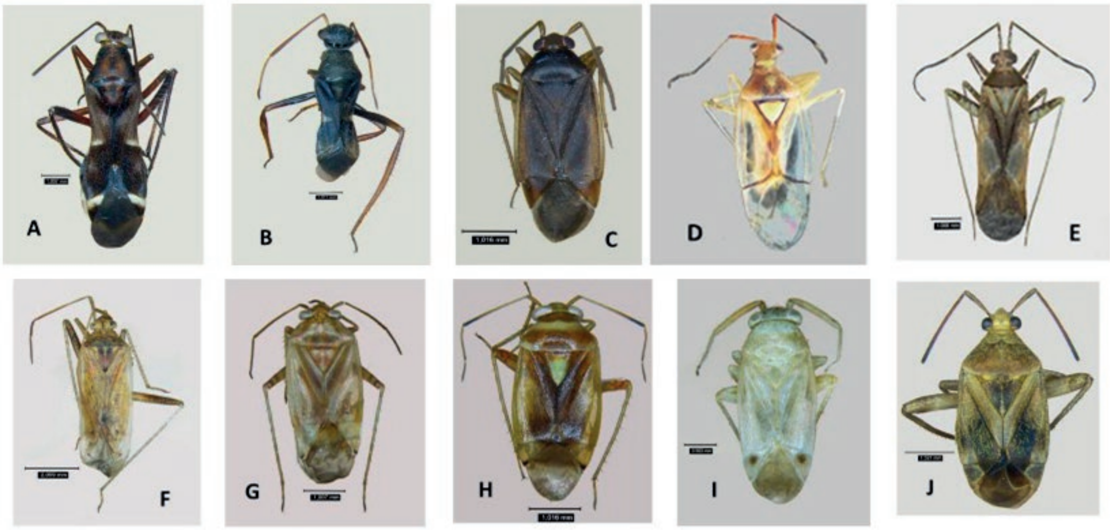

Figure 6 - Miridae species found in lobeira: A - *Adxenetus minensis*, B - *Allommatus guaranianus*. C - *Ceratocapsisca* sp., D - *Hyaliodes glabratus*, E - *Phytocoris bergrothi*, F - *Phytocoris* sp., G - *Phytocoris* sp. 2, H - *Proba* sp., I - *Rhinacloa* sp. e J – *Taedia semilota*.

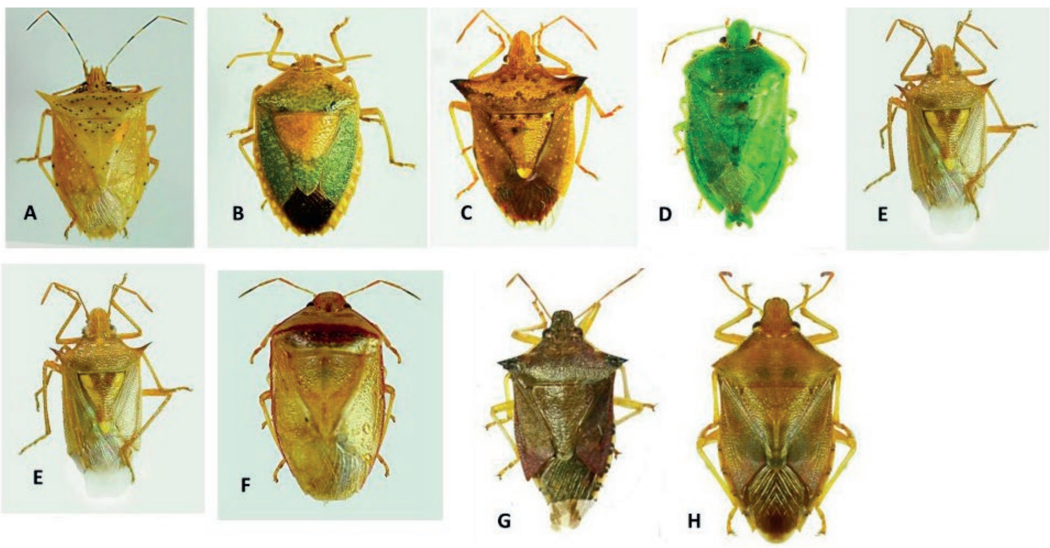

Figura 7 - Pentatomidae species found in lobeira: A - *Arvelius porrectispinus*, B - *Edessa rufomarginata*, C - *Euschistus heros*, D - *Nezara viridula*, E - *Oebalus ypsilongriseus*, F - *Piezodorus guildinii*, G - *Podisus nigrispinus*, H - *Supputius cincticeps*.

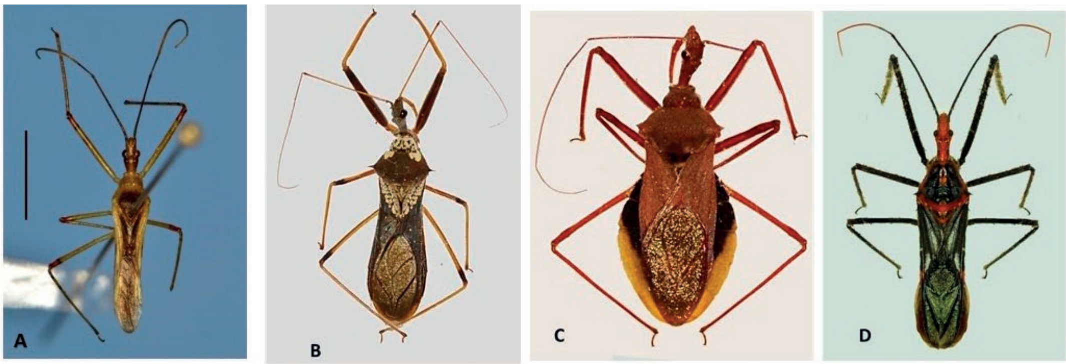

Figura 8 – Reduviidae species found in lobeira: A – *Atopozelus opsimus*, B - *Heza insignis*, C - *Montina confusa*, D - *Zelus leucogrammus*.

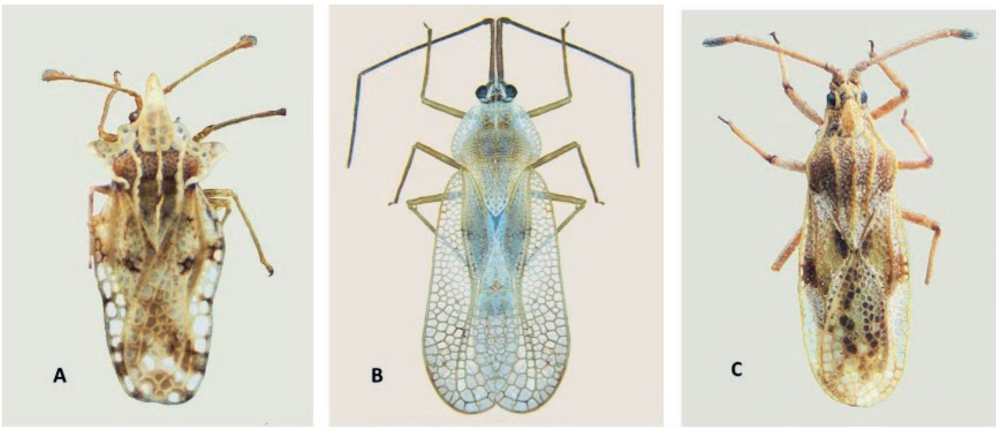

Figura 9 – Tingidae species found in lobeira: A - *Corythaica monacha*, B - *Leptopharsa heveae*, C - *Teleonemia scrupulosa*.

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