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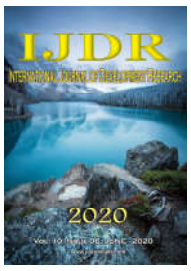

RESEARCH ARTICLE OPEN ACCESS

INSECT POPULATION SURVEY ASSOCIATED WITH COVERING PLANTS: A SYSTEMATIZED APPROACH

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ABSTRACT

The use Millet (*Pennisetum glaucum*) along with crow's-foot grass (*Urochloabrizantha*) are widely used in agriculture as inter-crop ground cover plants for improving soil attributes. The insect population may be indicative of the environmental quality of the region, as there are groups that are considered sensitive to environmental changes. The objective was to identify the entomonofauna incident on the cultivation of Millet (*Pennisetum glaucum*) and crow's grass (*Urochloabrizantha*) as cover crops using different types of traps. To perform the monitoring, 4 types of traps were used: Adhesive, Pitfall, Entomological Network and Luminous. Among the traps used to capture insects, there was a large difference in the amount of individuals collected, due to the number of individuals present in the environment, as well as the habit of each one. During the capture of insects there was great variation in the amount of orders captured. Throughout the period of the experiment it was possible to observe the presence of some insect families of agronomic interest that were present in the environment, but were not captured. The culture of the Millet (*Pennisetum glaucum*) together with the crowfoot grass (*Urochloabrizantha*) in the intercrop soil cover has a great diversity of insects in the entomonofauna and can be used as insect keepers in the agricultural areas.

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INTRODUCTION

The adoption of cover crops has positively influenced agriculture (GOMES *et al*., 2014; PEREIRA *et al*., 2013; ROSSI *et al*., 2013). In the Brazilian Cerrado, the adoption of cover crops for soil protection is advantageous in the off-season (BALBINOT *et al*., 2008). Millet (Pennisetum glaucum**)** and crow's foot grass (*Urochloa brizantha*) *are* an alternative for use as cover plants in addition to contributing to the preservation of natural enemies in off-season conditions (CARVALHO*et al*., 2013; DE LIMA *et al*., 2015). Insects are responsible for food bases, in addition to important activities in the ecosystem, including pollination, dispersion and cycling of organic matter (GULLAN; CRANSTON, 2008). Insects considered natural enemies come from several classes of predatory organisms, parasitoids and pathogens (COSTA *et al*., 2006). In the face of current discussions on food production in a sustainable way, with the minimization of the environmental impacts of agricultural activity, the adoption of cover plants allows the restoration of the balance of the chain between insects (SILVA & BRITO, 2015). Due to the expansion of cultivated areas in Brazil, there was a significant increase in the number of agricultural pests, making farmers dependent on the use of chemicals (SILVA & BRITO, 2015).

The diversity of the flora in the cerrado is one of its main characteristics, being attractive for several species of insects (FERREIRA *et al*., 2009). The population diversity of insects is higher in forest environments (CORASSA *et al*., 2015). Plants have characteristics that are attractive to insects, among them the exhaled aroma and color (CONCEIÇÃO *et al*., 2011; WANGA *et al*., 2013). The conduct of studies surveying the insect population are of paramount importance to understand the dynamics of species of agricultural environments (CRUZ, 2018). Thus, the use of colored traps is an alternative way for monitoring insects, monitoring the behavior and fluctuation of the insect population (FERNADES *et al*., 2009). In the study developed by Da Silva *et al*. (2015), the use of colored traps proved to be efficient for monitoring the population. Santos *et al*., (2016), verified that plants have the ability to attract a great diversity of insects. These plants have attractive potential for beneficial insects, as they offer floral resources, alternative prey, oviposition sites and shelter site, thus, they can contribute to the improvement of agroecosystems. The insect population can be an indicator of environmental quality, it is important to carry out research of entomofauna surveys, to understand the conditions of the biome (MARQUES and CLARO, 2010) From this perspective, the present study aimed to identify the associated fauna incident in the cultivation of

Millet (Pennisetum glaucum) and chickengrass (*Urochloabrizantha*) as cover crops.

MATERIAL AND METHODS

Characterization of the area: The work was carried out in the experimental area of the Federal University of Mato Grosso in the Horticulture sector of the Sinop Campus - MT, located at geographic coordinates 11°51'50.86"S, 55°29'9.82"O; 11°51'51.22"S, 55°29'8.15"O; 11°51'52.48"S, 55°29'8.67"O; 11°51'51.98"S, 55°29'10.08"O, with an area of 1,495m². The sowing of the millet plants (Pennisetum glaucum)) and chicken grass *(Urochloa brizantha),* was carried out on 10/01/2018. The climate of the region according to the Köppen classification is of the Monção type (Am), with rains in summer and dry winter. Average temperatures ranging from 25.4 to 29 °C, with an annual average of 27.6 Cº, and average annual rainfall of 3000 mm (ALVARES *et al*., 2013).

Collection and identification of insects: To collect the nocturnal entomofauna, a light trap fixed to 1.5 m from the soil was installed in the middle of planting. The trap used was luiz de Queiros model, Intral brand, with white light fluorescent lamp of 15 watts, being powered by battery of 12 volts. A collecting bag was attached to the trap funnel, where newspaper paper was cut into strips, to avoid contact between the captured individuals, thus preventing the collected specimens from being damaged. The trap was installed at a height of 1.5 meters from the ground. The samples were collected every five (11)00-30/2018, totaling 9 (nine) collections. The light trap was switched on at 5:00 p.m. and turned off at 7:00 the next morning. For the collection of insects living in the epidaphic layer, nine Pitfall traps were buried at ground level on the soil. For the preparation of the traps, disposable cups of 200 ml were used. Inside the trap was added a solution with neutral detergent at the concentration of 3.0% to break the surface tension and prevent the escape of insects. The yellow adhesive traps were installed at a height of 1.2 m fromthe ground, with a contact area of 60 cm^2 considering the two contact faces of the trap, the collection and replacement was performed every 5 days.The collected material was added in a plastic container with a capacity of 150-300 milliliters (variable according to the amount of insects collected) in alcohol solution 70% separated by traps. The Entomological Network (Puça) was also used for the collection of insects, the equipment had a rod made of resistant aluminum, with basket diameter of 40cm, basket length of 80cm and cable length of 100 cm. The scan in the area was zigzag and performed every 5 days, according to the days of collection of the other traps. For the active collection method, the Entological Network was used to capture insects associated with culture and in mid-flight. The scan was performed randomly in the environment at 07:00 and 17:00. The insects collected in the traps were packed in vials with a capacity of 150-300 milliliters (variable according to the amount of insects collected), containing 70% alcohol and taken to the Entomology Laboratory of the Federal University of Mato Grosso, where screening was performed for further identification. The identification was performed at the family level, using a dichotomous key proposed by SOUZA (2007). It was not possible to identify the insects at the family level of the individuals captured in the adhesive trap, because the number of individuals captured was high and diversified, and they were guided by the handling, making it impossible to identify parts/structures essential to perform the identification, so we could only identify these individuals at the level of order.

RESULT AND DISCUSSION

Among the traps used in the capture of insects there was great variation in the quantities collected, this is due to the amount of individuals present in the environment, as well as the habit of each one. After quantification of the collected insects, it was observed that the adhesive trap was the one that captured the most individuals, with 2,904 in total, followed by the Luminous, Entological Network and Pitfall with 1,430, 796 and 633 respectively (Figure 1).

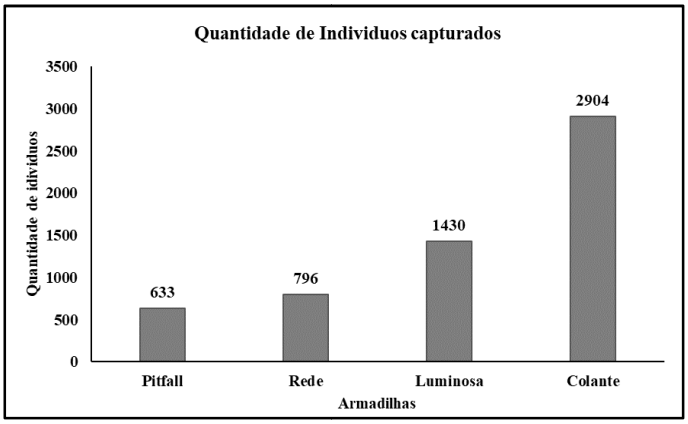

Figure 1. Total number of individuals captured in millet cover plants (Pennisetumglaucum)) and chicken grass (Urochloabrizantha), after 45 days of collection during the period from 16/10 to 30/11/2018. Sinop, MT

The yellow adhesive trap captured a large number of hymenoptera individuals, in the same way as in the study by Silva et al. (2013), where the yellow trap was responsible for capturing the largest amount of insects of this order. In order to relate the number of insects collected and the meteorological variables, the following elements were used: average temperature, maximum and minimum. Although the readings were performed daily, the mean values of the intervals between each collection were considered for the presentation of the results (Figure 2).

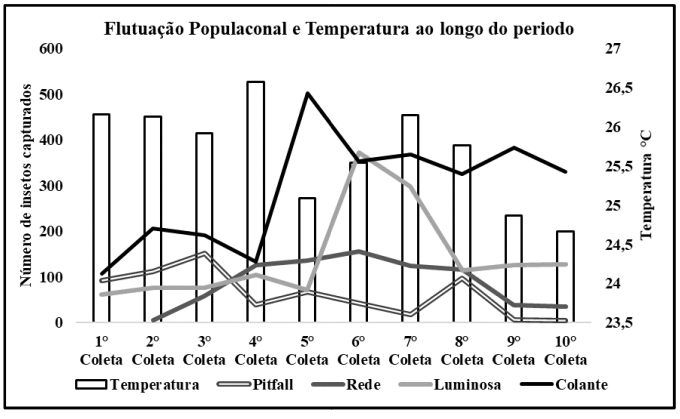

Figure 2. Total number of individuals captured through traps (Pirfall, Entological, Luminous and Adhesive Network) and average temperature of the period (11/10 to 30/11/2018). Sinop, MT

The yellow adhesive trap was the most effective in the collection of insects, capturing mainly Lepidoptera and Hymenoptera (Figure 2).

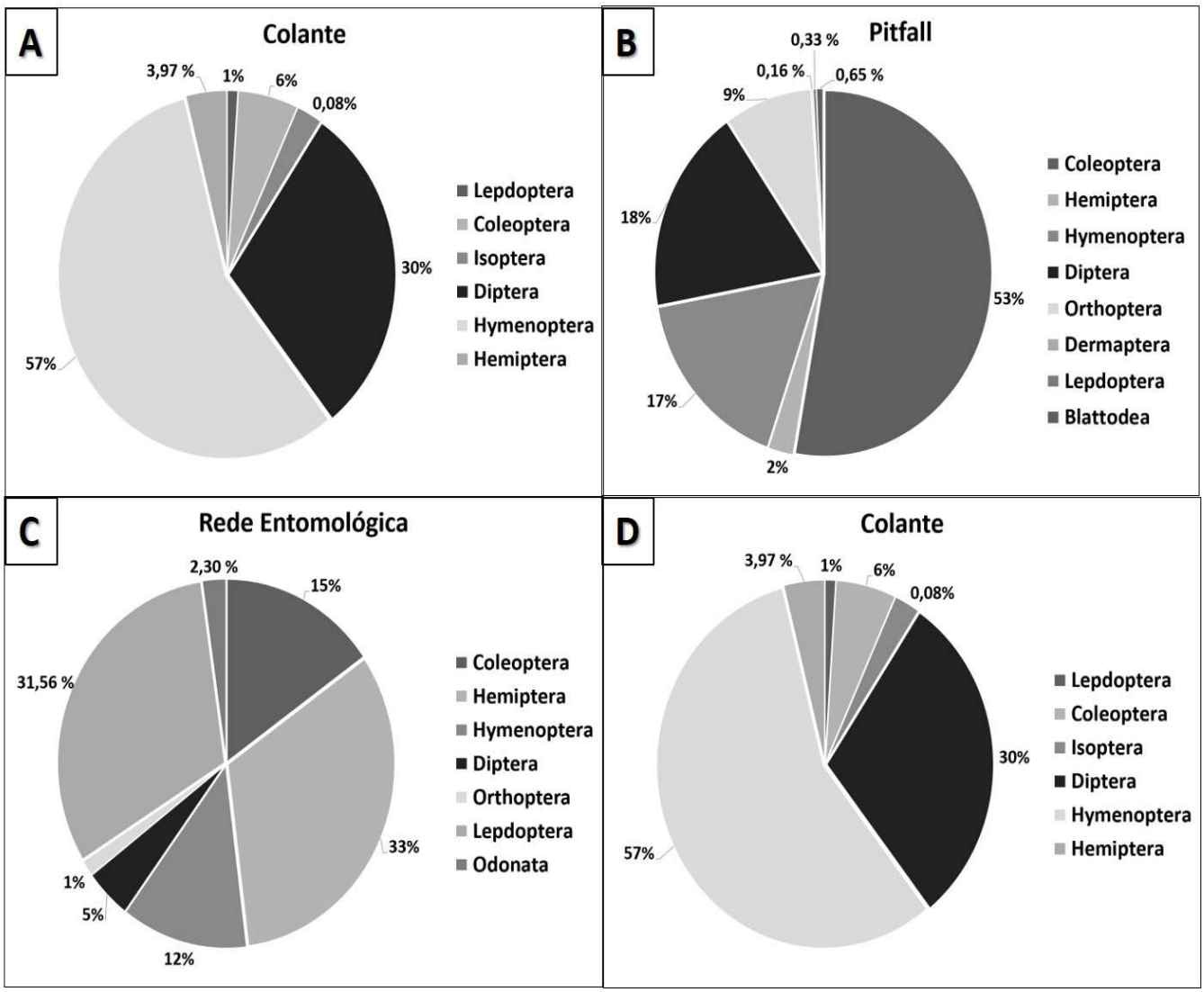

Figure 3. Percentage of captured insects classified in order in each type of trap adopted, Adhesive (A), Pitfall (B), Entological Network (C) and Luminous (D)

These data reinforce that its efficiency is related to the capture of flyinginsectss. Santos and Zequi (2018) verified that the increase in temperature favored the presence of lepidopterans and hymenopteros, which corroborates the result found. According to temperature data, it is observed that the number of insects collected by the adhesive trap was the most responsive to temperature variations during the period, demonstrating that the insect population is sensitive to temperature variation as reported by Santos & Zaqui, 2018.

During the period of conducting the experiment it was possible to observe the presence of some insects of agronomic interest that were present in the environment, but were not captured by the traps. Among them we can highlight the presence of the species. *Apis mellifera* (Hymenoptera: Pidity). During the capture of the insects there was great variation in the amount of orders captured, this result already expected. In the adhesive trap, the orders with the highest number of individuals collected were Hymenoptera and Lepdoptera with 57 and 30% respectively (Figure 3 - A).

In the Pitfall trap, the peak of insect capture was observed in the 6th collection (Figure 2) coinciding with lower temperatures recorded in the period. The orders with the highest number of captured individuals were Coleoptera and Diptera with 53 and 18% respectively. Within the Order Diptera the Muscidae family was the most captured, however this family is not parasitoid (Table 1).

In the count of individuals collected in the Entological Network, orders that predominated were Coleoptera and Lepidopterans with 33 and 32.56% respectively, differently from what occurred in the light trap, where the orders that presented the highest number of individuals were Hemiptera and Coleoptera with 58 and 25% respectively.

As mentioned earlier, due to technical difficulties and impossibility, it was not possible to perform the identification at the family level of the insects captured in the adhesive trap, so they do not appear in the count of Table 1, only being performed the identification at the order level and referred to in Figure 3.

Thema great abundance of families of insecoughs demonstrating the importance of planting in the intercrop of species of cover plants, as being one of the characteristics is the enrichment of the entomonofauna present in the area.

Table 1. Quantification and identification at the order and family level of individuals collected in the Traps Luminous, Entological Network and Pitfall

Family	Pitfall	Entological Network	Light
	Coleoptera		
Scarabeadae, Scarabeadae	159	3	56
Chrysomelidae	72	3	1
Bruchidae, New	42	0	0
Curculionidae	1	10	0
Passalidae, New	5	0	23
Staphylinidae	3	0	0
Tenebrionidae	18	0	7
Meloidae, New Year	6	7	0
Lagriidae, New	1	37	0
Carabidae	15	2	104
Cicindelidae, New	1	5	2
Coccinillidae	0	37	0
Cerambycidae	0	4	59
Chrysomelidae	0	18	0
Melyridae, Texas	0	0	8
Elateridae, New Year	0	0	57
Brentidae, New	0	0	2
Hydrophilidae	0	0	2
	Hemiptera		
Pentatomidae	10	124	678
Alydidae, Texas	4	111	20
Largiidae, Florida	1	0	0
Coreidae, New Year	0	9	0
Cercopidae, Florida	0	8	38
Cydnidae, New	0	10	0
Brentidae, New	0	2	0
Reduviidae, New Year	0	2	2
Veliidae, New	0	4	1
Scutelleridae, New Year	0	0	3
	Hymenoptera		
Vespidae, New	29	59	81
Scoliidae, Scoliidae	10	0	0
Formicidae	63	36	11
Apidae	1	2	1
Anthophoridae	0	2	0
Ichneumonidae	0	1	1
Miridae District	0	1	0
Pompilidae, New	0	0	10
Pompilidae			
Evaniidae, New	0	0	6
Braconidae	0	0	11
	Isoptera		
RhinoTermitidae	0	0	1
Termitidae, New Year	0	0	34
	Diptera		
Muscidae	66	37	0
Dolichopodidae	3	0	0
Lonchaeidae, California	1	0	0
Calliphoridae	4	0	0
Syrphidae, New York	13	0	0
Calliphoridae	4	0	0
Sarcophagidae	21	0	0
	Orthoptera, New Year		
Gryllidae	42	10	0
Acrididae	9	2	0
Tettigoniidae	1	0	0
	Dermaptera, New		
Forficulidae, New Year	1	0	0
	Lepdoptera District		
Hesperiidae, New Year	1	0	0
Pyralidae, New	1	120	53
Nymphalidae	0	5	0
Saturniidae	0	73	0
Saturniidae	0	62	0
Lycaenidae	0	1	0
	Blattodea District		
Rhinothedee	3	0	0
Termitidae, New Year	1	0	0
	Odonata		
Libellulidae	0	1	0
Calopterygidae	0	18	0

Conclusion

The milletcrop (Pennisetum glaucum**)** together with the grass crow's foot (*Urochloabrizantha*) in soil cover in the intercropping, presents a great diversity of insects in the entomonofauna,and can be used as insect manutendedores in agricultural areas.

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