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# Evaluation of different insecticides for the control of giant borer (Telchin licus) eggs in sugarcane crop

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## ABSTRACT

In Brazil, one of the pests responsible for significant losses in sugarcane crops is the giant borer, with a higher incidence in the North and Northeast regions, but it has already been evidenced in the Southeast. Even though the region is the first in the country to produce sugarcane on a large scale, its occurrence is recent. However, this pest has an endophytic habit, that is, it feeds on the stalk, opening ascending galleries in its larval and pupal period, remaining for two to ten months at this stage, making it difficult to manage assertively to control this caterpillar. Thus, this work proposes new means to combat the pest, evaluating different insecticides to control moth eggs, as this stage is one of the only times when the pest is unprotected in the clumps of sugarcane.

**Keywords:** Ovopposition, Productivity, Mechanism of action.

## INTRODUCTION

Sugarcane (*Saccharum officinarum*) is one of the world's main commodities (SANTOS; WOULD; GUZZO, 2017), and is of great importance to Brazilian agriculture due to the record sugar exports. In addition, it contributes directly to the combustion of cars via ethanol, contributing to the environment by reducing CO2 emissions and as a by-product it has the generation of energy from bagasse (Embrapa, 2022).

However, the *poaceae* is susceptible to the giant borer, *Telchin licus* (Drury) (Lepidoptera: Castniidae), which is considered one of the main pests of sugarcane (SILVA-BRANDÃO et al., 2013), it had its first reports in the North and Northeast regions, but has already been evidenced in the southeast of Brazil (ALMEIDA et al., 2007). The most harmful phase of the pest is in its larval stage, as they feed on the host crop, opening ascending galleries destroying the xylem and phloem conducting vessels, in addition to reducing the vegetative vigor, causing drying of the tips, better known as dead heart, and evidencing weight loss of the grass (VILAS BOAS, ALVES, 1988).

In this way, it results in a hollow stalk, providing loss of agricultural and industrial productivity, in addition to migrating from one tiller to another when the food reserve runs out.

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This act damages the sugarcane field, resulting in failures (BENEDINI, CONDE, 2008). One of the factors that directly influences the population increase of the pest is the climate and precipitation rates (CONDE, BENEDINI, 2008). The Northeast region is the one with the highest incidence of the pest, since it has favorable conditions of temperature and luminosity (CRAVEIRO, 2009).

The adult stage of the giant borer is a moth, however, it has peculiar characteristics typical of butterfly, such as spindle-shaped antennae, and diurnal habits, its activities are in the hottest period of the day, between 11 am and 3 pm., outside these times the moths are at rest, the same happens on rainy or cloudy days (WADT, 2012). The adult stage of the moth lasts an average of 10 to 15 days, they only appear in the summer, and deposit about 50 to 100 eggs each, in clumps of the host culture (SALMERON, 2022). It is important to note that the oval stage is a stage of development in which the pest is exposed, at the bases of the clumps. (SANTOS; WOULD; GUZZO, 2017).

However, the wings of *T. licus* are dark brown and black, covered by iridescent scales, that is, they change color according to the angle and intensity of light, so the moth becomes shiny and showy (COSTA et al., 2015). According to Wadt (2012), there are numerous factors for the occurrence of mating of the species, such as its pheromone, although it alone is not enough, and requires visual attraction, the movement of the insect and the presence of sunlight.

Based on this, the following problem arises: how to eliminate *T. licus* in sugarcane fields, reaching its first stage, the egg, where it becomes a viable means of control because it is exposed in clumps. With this in mind, different chemical, biological and larvicidal molecules were tested. Hence the following question: will one of them be the long-awaited solution to control this pest that has been so feared by sugarcane producers?

Thus, this work is justified by the fact of the difficulty encountered to control this pest, currently there is only one product registered on the market to control the caterpillar of the giant borer, and it is not very efficient. With this, the search for efficient molecules and controls, aiming to reach another stage of the pest and that can control or eliminate it from sugarcane fields.

The present work aims to evaluate different insecticides for the control of giant borer eggs in sugarcane crops. Presenting the following specific objectives, such as controlling *T. licus*, and finding new efficient molecules in control to eliminate the pest in the field efficiently.

## MATERIALS AND METHODS

LOCATION AND DEVELOPMENT OF THE EXPERIMENT

The work was conducted in December 2022, in an area located in Pedro Afonso – TO. According to Köppen, the climate of this region is predominantly of the Aw type, and is characterized by having a dry and a rainy period, however, it presents its maximums in the summer, and is classified as a humid tropical region, and dry winters, with average annual temperatures of 26.1°C (Embrapa, 2016).

For the development of this work, an entomological net was needed to capture the moths, and a box adapted for the transport of adults from the field (Figure 1), a fence so that the females could ovoposit (Figure 2). The eggs were collected every 24 hours. 9 treatments were made with 3 replications, totaling 27 plots, in each plot 50 eggs were laid, totaling 1,350 eggs. The insecticides used as treatment were: Boveril, Revolux, Maxsan, Octane, Altacor, Bifenthrin, Larvitree (Biossintech), Metarril and Water (Figure 3).

Figure 1. Moth transport box.


Figure 2. Fenced for egg-positing females.

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Figure 3. Insecticides used for the development of the experiment.

Source: Authors (2022)

To assist in the assembly of the experiment, 27 sachets were made with the voil cloth, and in each of them 50 eggs were placed, and they were dipped in the products/treatments for 5 seconds. It is worth mentioning that the dosage used was in accordance with what is recommended by the package insert. Soon after the dip, the sachets were placed on filter paper identified with the names of the products (Figures 4 and 5), in order to absorb the moisture, after a few minutes the eggs were transferred to the containers labeled with the names of the treatments and the replications, to assist in the evaluations (Figure 6).

It is worth noting that the first two replicates were made with 48-hour eggs, and the last repetition with 24-hour eggs. The assembly of the experiment was carried out entirely on the same day, and during the 21 days of evaluations, two drops of water were placed in each plot, in order to maintain the humidity in the weak. It is noteworthy that the franks were closed with the voile cloth in a room with room temperature (Figure 6).

Figure 4. First egg repetition of 48 hours, after being dipped in insecticides, for 5 seconds.

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Figure 5. Second and third replications with 24-hour eggs, after being dipped in insecticides, for 5 seconds.


Figure 6. Experiment set up.


Source: Authors (2022)

MECHANISM OF ACTION OF INSECTICIDES.

Among the insecticides used are three groups: chemical, biological, and larvicide. In the set of chemicals, which act by contact and ingestion in sugarcane crops, there is Altacor, used to control several pests, including the giant borer, with chlorantraniliprole as its active ingredient (FMC, 2022); Revolux, widely used to control the sugarcane borer (*Diatraea saccharalis*) and its active ingredient is *methoxyfenozide + spinetoram* (CORTEVA, 2019);  Maxsan, which is used to control root leafhopper (*Mahanarva fimbriolata*), and its active ingredient *dinotefuron + pyriproxyfem* (IHARA, 2023); and Bifenthrin, which is used in culture to control termites, mites, and mites, its active ingredient is *bifenthrin* (NORTOX, 2022).

Among the microbiological ones, which are entomopathogenic fungi that act in the infection of insect integuments, Boveril was used, which acts in the stages of the coffee borer, such as larvae, pupae, and adults, and its active ingredient is *Beauveria bassiana* PL63 (KOPPERT, 2022); Octane, which is used to control corn leafhoppers,  its active ingredient is

*Isaria fumosorosea* ESALQ-1296 (KOPPERT, 2022); Metarril, which acts in different stages of the host, larva, nymphs, pupae and adults, its active ingredient is *Metarhizium anisopliae* E9 (KOPPERT, 2022). Because they are fungi, they can affect pests and the like in any crops with the occurrence of the pest. In search of innovations, a Larvitree from Biossintech was also used, a sustainable product that aims to eliminate mosquitoes.

EVALUATION OF THE EXPERIMENT

The evaluations were made daily by counting the larvae hatched in each plot, as shown in Table 1.

Table 1: Final result of the evaluations, number of eggs hatched.

| **Hatched Eggs** | **Repetitions** | | | | |
|---|---|---|---|---|---|
| **Treatments** | **1** | **2** | **3** | **Grand Total** | **Average** |
| Boveril | 18 | 9 | 11 | 38 | 12,67 |
| Revolux | 10 | 7 | 7 | 24 | 8,00 |
| Maxsan | 0 | 0 | 0 | 0 | 0,00 |
| Octane | 1 | 2 | 1 | 4 | 1,33 |
| Altacor | 4 | 4 | 2 | 10 | 3,33 |
| Bifentrina | 6 | 6 | 4 | 16 | 5,33 |
| Biossintech | 7 | 8 | 8 | 23 | 7,67 |
| Metarril | 10 | 13 | 16 | 39 | 13,00 |
| Witness | 9 | 7 | 4 | 20 | 6,67 |
| **Grand Total** | **65** | **56** | **53** | **174** | **-** |

Source: From the authors (2022)

Analyzing the results presented in Table 1, it is noted that only Maxsan did not have the presence of larvae, the others were not completely effective in this regard, and four treatments, Boveril, Revolux, Biosintech (Larvitree) and Metarril had higher hatching results than the control itself. The following figures show the stages of the treatments.

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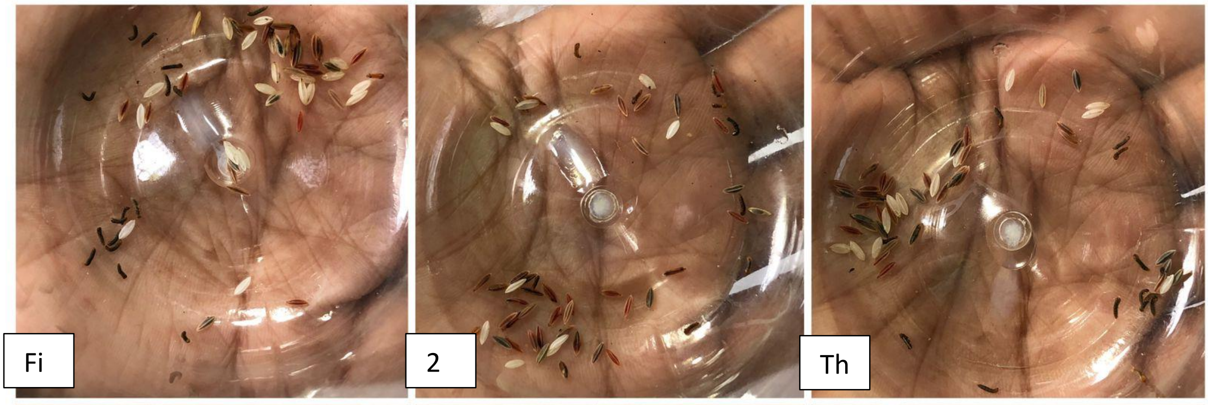
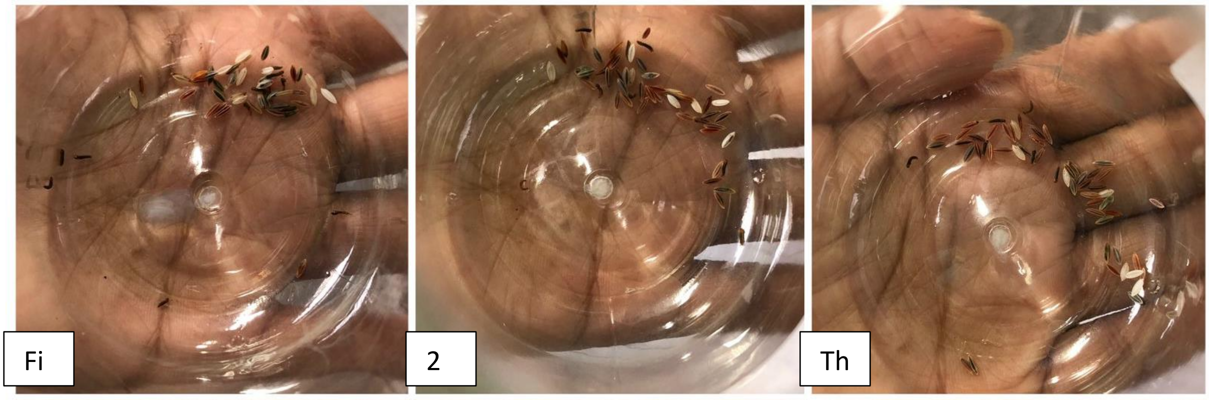
Figure 7: Last evaluation of Boveril treatment, three replications.



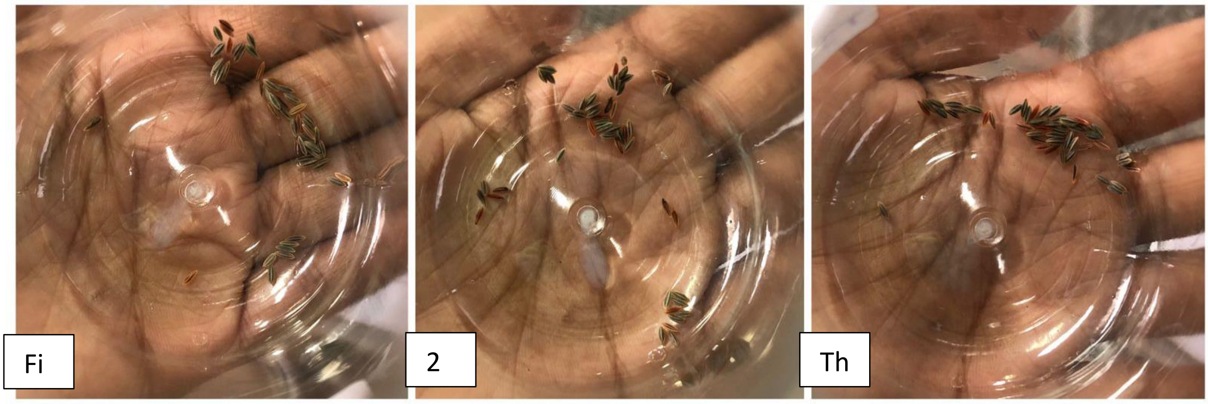

Source: Authors (2022)

Figure 8: Last Revolux treatment evaluation, the three replications.



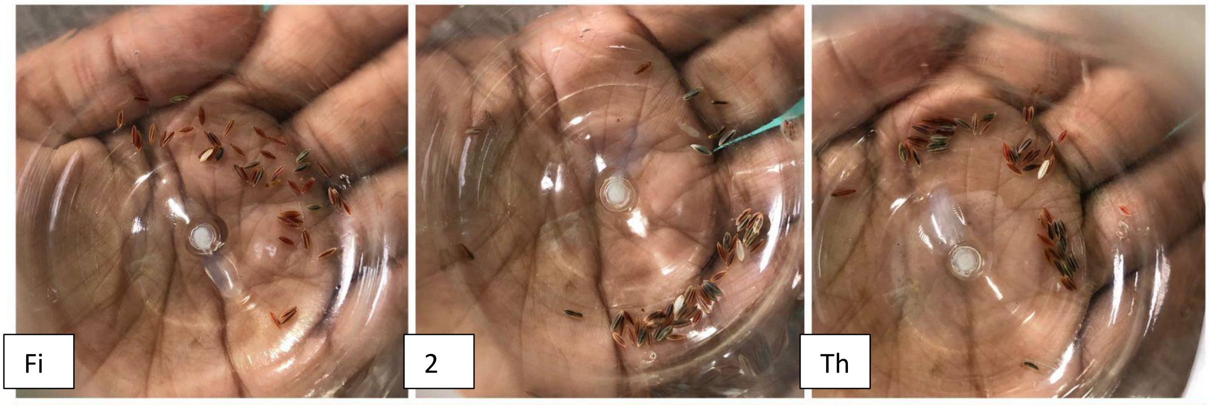

Source: Authors (2022)

Figure 9: Last evaluation of Maxsan treatment, three replications.



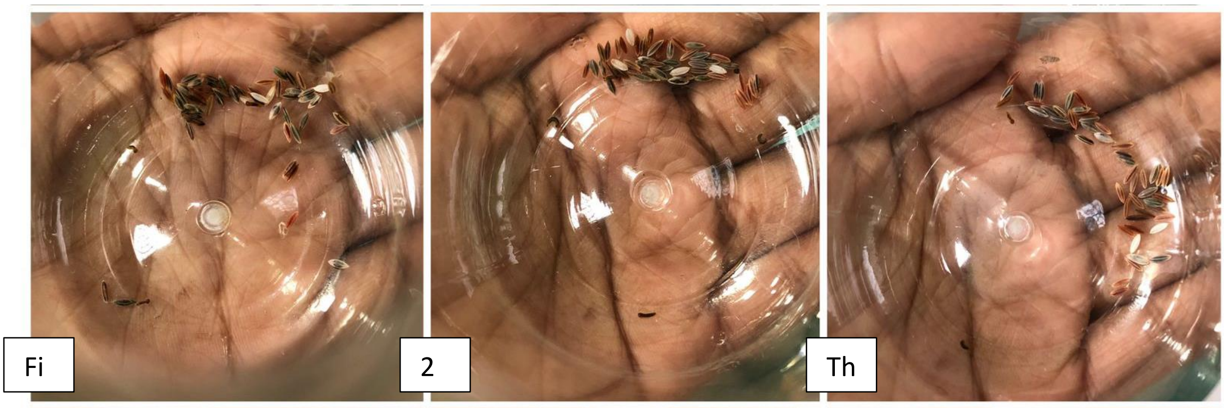

Source: Authors (2022)

Figure 10. Last Octane treatment evaluation, three replications.



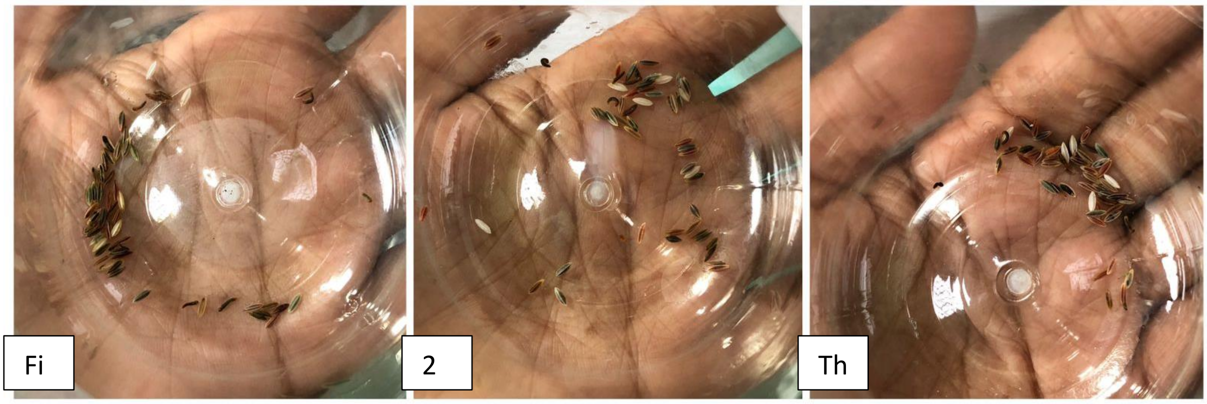

Source: Authors (2022)

Figure 11. Last evaluation of Altacor treatment, the three replications.




Source: Authors (2022)

Figure 12. Last evaluation of Bifenthrin treatment, the three replications.




Source: Authors (2022)

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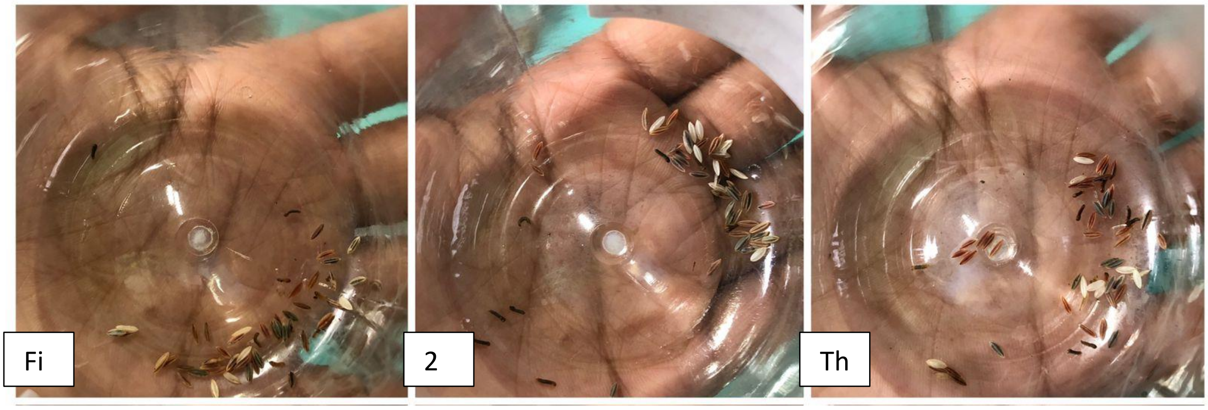
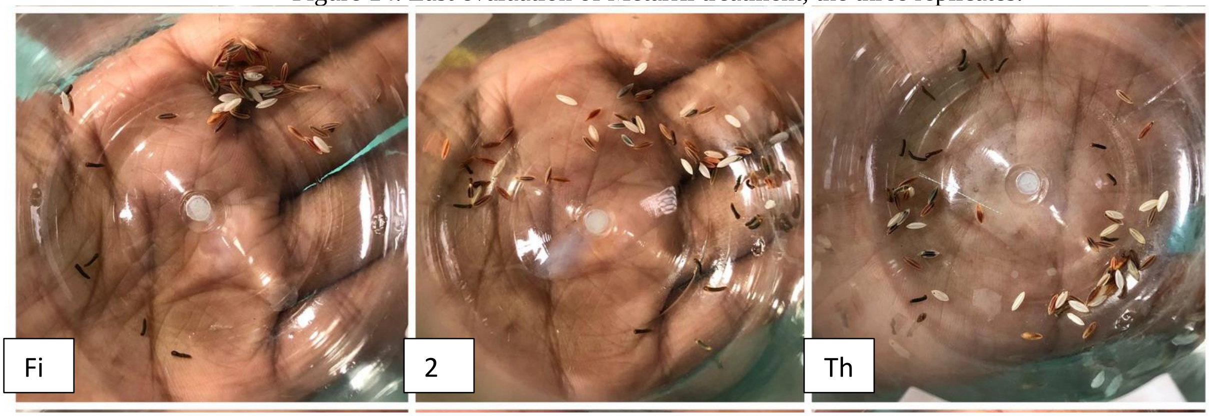
Figure 13. Last evaluation of Biossintech larvitree treatment, the three replications.



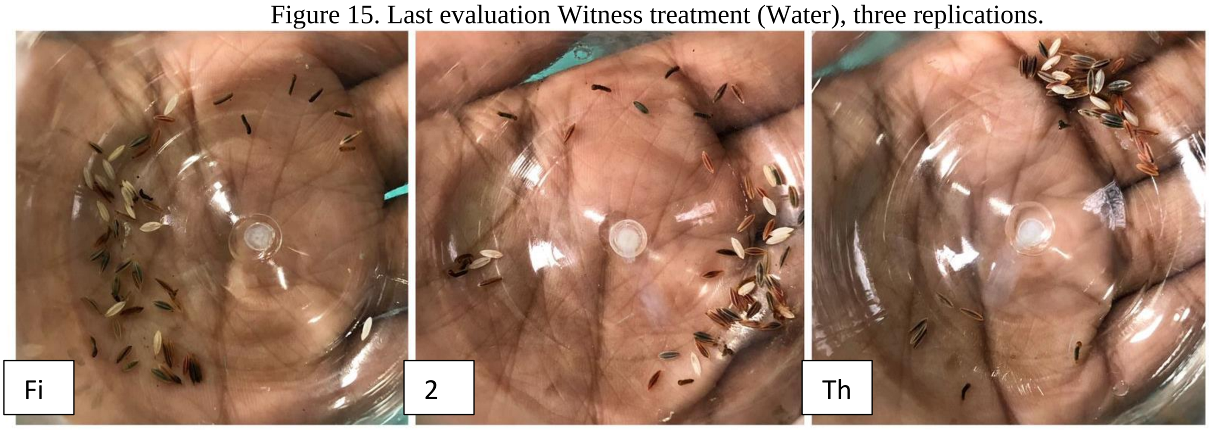

Source: Authors (2022)

Figure 14. Last evaluation of Metarril treatment, the three replicates.




Source: Authors (2022)

Figure 15. Last evaluation Witness treatment (Water), three replications.




Source: Authors (2022)

## RESULTS AND DISCUSSIONS

To evaluate the data collected in the field, the statistical program Sisvar (2008) was used in order to assist in accurate and reliable answers. Analysis of variance (ANOVA) was calculated, in which results were presented where treatments diverged from the others (Table 2), but did not indicate in which of the treatments the difference is significant. For this, it was

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necessary to perform the tests of comparisons between the means of the treatments (multiple comparisons), and the Tukey test was necessary to evaluate the variable number of eggs hatched.

**Table 2:** ANOVA Statistical Data

| Analysis of Variance Table | | | | |
|---|---|---|---|---|
| FV | GL | SQ | QM | Fc Pr>Fc |
| Treatment | 8 | 492.666667 | 61.583333 | 12.420 0.0000 |
| He repeated | 2 | 8.666667 | 4.333333 | 0.874 0.4363 |
| Error | 16 | 79.333333 | 4.958333 | |
| Total Corrected | 26 | 580.666667 | | |
| CV (%) = | 34.55 | 580.666667 | | |
| Overall Average: | 6.4444444 | | Number of observations: | 27 |

Source: Authors 2023

Analysis of variance proves that the Fcalculated (12.420) is greater than the Ftabulated (0.0), that is, the initial hypothesis (H0- that all means are equal) is rejected through the F test at 5% probability. Thus, it proves that there are treatments with a significant difference, that is, it is statistically different from the others (H1). Note whether the Coefficient of Variance (CV) was high (34.55), but this shows that the collected data had significant differences, due to variation in the data collected.

Table 3: Tunkey Test

| **Treatments** | **Number of eggs hatched** | **Average** |
|---|---|---|
| Maxsan | 0 | 0,00a1 |
| Octane | 4 | 1,33a1 a2 |
| Altacor | 10 | 3,33a1 a2 a3 |
| Bifentrina | 16 | 5,33a1 a2 a3 |
| Witness | 20 | 6,67 a2 a3 a4 |
| Biossintech | 23 | 7,67 a2 a3 a4 |
| Rebolux | 24 | 8.00 A3 A4 |
| Boveril | 38 | 12.67 a4 |
| Metarhizuim | 39 | 13,00 a4 |
| **TOTAL** | 174 | - |

Source: Authors 2023

According to the results of Tukey's Test (table 3), Maxsan was the treatment that presented the best result, with a 100% mortality of the eggs, according to Ihara (2021), the insecticide controls all stages of the leafhopper, eggs, nymphs and adults, with a shock effect it becomes an excellent ovicide and, therefore, it provides a lower percentage of eggs hatched in the field of the key pest. This characteristic may evidence this positive response in the treatment of giant borer eggs.

The other treatments that stood out were Octane, a biological product with active ingredient *I. fumosorosea*, which was tested by the Institute of Tropical Pathology and Public Health (2008) to control *Aedes aegypti* and showed strong ovicidal activity. Other active ingredients tested were *B. bassiana* and *M. anisopliae*, from the products Boveril and Metarril and showed characteristics contrary to *I. fumosorosea*, as they did not present a positive response to ovicidal activity (TAI, LUZ, 2008). This may justify the two worst results, being worse than the witness.

It is also worth mentioning that Maxan, Octane, Altacor, and Bifentine, did not show significant difference, at 5% of significance by Tukey's Test, Altacor, is the only product registered to control T . *licun, embrapa (2010) states that in addition to the larvicidal effect, it also has a strong ovicidal and ovilarvicidal action, that is, the caterpillar when hatching from the egg, consumes part of the chorion (eggshell) intoxicating itself and paralyzing the food activity, Bifentine for action in mite eggs, presented 100% egg mortality (*ALBUQUERQUE, el. AL, 2003). However, Tukey's test (5%) shows that only Maxsan had a significant difference from the control, all the others are statistically equal.

## CONCLUSION

In view of the facts mentioned, the efficiency of Maxsan is proven, since of the 450 eggs distributed in three replications tested with the highlighted product, there was no hatching of larvae, that is, it had 100% mortality of the eggs, thus showing that in addition to being efficient in the control of the spittlebug, its ovicidal characteristics was efficient in the control of the eggs of the giant borer.

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