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Evaluation of the effect of the Azadirachta indica leaf syrup on the control of the caterpillar in Trichoplusia ni in the community of Phandira, Dunda, District of Macossa in Republic of Mozambique.

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Abstract

A descriptive experimental study was carried out to have a bird eye view on the effect of the syrup made from leaves of Azadirachta (*Margosa*) indica A. Juss (Neem) on the control of the caterpillar (*Trichoplusia ni*) in cabbage seedlings, and the plot method was applied to the samples of 250 seedlings. The trial was carried out between January and May 2022 and a Randomized Complete Block Design (RCBD was used, with 4 treatments, making a total of 15 experimental units (plots). The area was divided into 3 randomized blocks and each block with 5 plots where the sowing was carried out in lines with a 15 cm compass between lines in the same plot and the seeds were released within each line, without having a space between the seeds within the lines once dealing with a nest. Three parameters were evaluated, **Population density, Infestation level and Medium attack level**. The collected data were submitted to statistical processing using (SISVAR 5.6) and analysis of variance and Tukey's test at 5% of significance, however, significant differences were found for the parameters degree of infestation (GI) and number of caterpillars (NL) related to the percentage of caterpillar mortality when submitted to different doses of Neem extract application.

Keywords: *Effect, Azadirachta indica A.Juss, Cabbage, Caterpillar measures span.*

1. Introduction

In Mozambique, cabbage is a well-known and established vegetable, produced mainly by farmers in the family sector (RULKENS, 1996), ranking third after tomatoes and onions. Potential cabbage production areas in the country are the Incomati, Umbeluzi and Limpopo river valleys in the south, the plateau regions of Manica and Angónia in the center and the Lichinga region in the north (INE, 2002)

Cabbage is important as it contributes to increasing the income of the family sector and provides a balanced diet and can be consumed raw as a salad and also cooked. However, as in other regions of the world, its production faces adversities, especially with regard to pests, especially the caterpillar measure span (Trichoplusia ni) which its presence in the crop causes damage, that is, it pierces the leaves, making them unfit for consumption, because in addition to depreciating the product, it can cause total crop loss (Villas Bôas et al., 1990).

The incidence of pests in vegetable production fields contributes to lower productivity and consequent fall, which can exceed 60% of total production in cases such as tomatoes and cabbage (Guimarães, 1990)
In Mozambique, the control method most used by farmers is chemical, as it is considered to be more practical, fast, and efficient in reducing the population density of the pest. However, the indiscriminate use of these products has resulted in pesticide residues above the norms in the products sold in the markets, increased worker intoxication and production costs, in addition to causing.

Natural pesticides are proven to be effective in controlling pests and diseases in plants. They have a low cost for their effect, thus reducing the cost of vegetable production. They do not harm the environment; their compounds are easily degraded. It significantly reduces the risk of contamination of the sprayer of the spray and of domestic anemia that coexists in the property. It is a traditional knowledge that must be preserved for future generations, guaranteeing the autonomy of the rural producer before the market of chemical pesticides.

In this context, due to the lack of knowledge on the use of synthetic and natural pesticides on the part of the producers and the deficient supply of them by the local suppliers allied to the low purchasing power, there is a need to create alternatives capable of minimizing the losses of the seedlings in the hot bed using the syrup of margosa leaves as a natural pesticide due to the allelopathic properties, to combat pests and diseases caused by bacteria, fungi, nematodes

in different cultures, therefore, it is accessible to the producer and exists in abundance in the community.

Thus, vegetables are in great demand for the application of pesticides (NAKANO, 1999) since chemical control is the main (or the only) tactic of adopted pest control. However, control can be compromised due to side effects caused by the exclusive use of insecticides. The discovery and use of insecticides that present new modes of action can considerably contribute to the replacement of traditionally used products (NAKANO, 1999) and favor the management of insect resistance to insecticides through the rotation of compounds within an integrated management program. of pests in vegetables. And because of this, studies aimed at the discovery of pesticides that are less aggressive to man and the environment have been developed, and for the present study the syrup from the leaves of the margosa (Azadirachta indica) was tested.

2. Objective of study

In this above context, the primary objective is to evaluate the effect of the combination of different groups of low toxicity insecticides for the control of cabbage moth an alternative control measure, environmentally sound and economically advantageous study for producers, consumers, and communities. rural and urban.

3. Materials and Methods

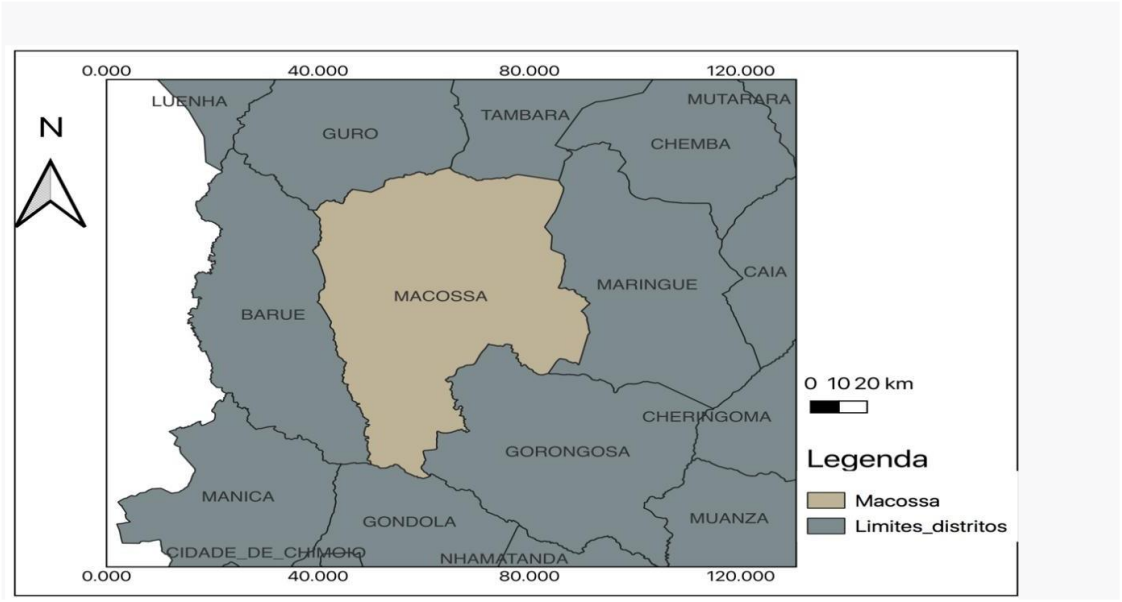
A descriptive experimental study is undertaken to find out the effect of Azadirachta indica a.juss leaf syrup on the control of the caterpillar measures - palms in cabbage plant, was carried out in the community of Dunda in Macossa.

A field trial was set up in the community to test the natural pesticide (Azadirachta indica) and 1 synthetic pesticide (Cypermethrin). The universe is made up of 16 cabbage baskets.

3.1 Description of the study area

The research was carried out in the community of Dunda in the district of Macossa. Macossa in the province of Manica, in Mozambique. It has geographical boundaries connected, to the north with the districts of Guro and Tambara, to the west with the District of Báruè, to the south with the District of Gondola and to the east with the Districts of Gorrongoza, Maringue and Chemba of the Province of Sofala , as shown in Figure 1.

Figure 1. Location of the study area.



Source: Author, 2021.

The climate of the district is sub-humid dry in general, with an average annual rainfall of 800 to 1000 mm, with a short to moderate wet period, ranging from 4 to 5 months (December to March), and the dry period somewhat long. (May to November), reaching up to 7 months. The average relative humidity of the air is from 60/65 to 70% and the average annual temperature varies from 22 to 26ºC.

3.2 Scientific Procedures Performed

Four treatments were used to test margosa syrup at four doses (0; 50; 100 and 150 grams of margosa extract or syrups per liter of water). In the same experiment, the dose of 0 g/L of water served as a negative control (without spray application) and cypermethrin as a positive control because it is one of the treatments commonly used by the local population at a dose of 0.5g/ L. Observations were made for treatment after applications every 15 days with margosa every 15 days for treatments with cypermethrin.

Soil preparation was carried out manually with a hoe in the period between the last fortnight of August 2022. It consisted of a minimum tillage of 10 cm in depth. The next phase, which will culminate with the establishment of the nursery bed on the 14th day of February, will be using the Var cabbage crop. The breeding ground of 3 blocks of 5 meters in length and 1.5 meters in width each, spaced 30 centimeters apart, making up a total production area and usable area of 15.3 and 7.35 m2, respectively, with each block having an area of 5 m2 consisting of 5 plots measuring 0.7 x 0.7 m2 (area of each plot = 0.49 m2) is prepared.

The margosa leaves were harvested and crushed in a pestle to obtain the green mass, and this was measured with the help of a dynamometer at different doses of 50g and 100g per liter of

water, these doses were prepared in different containers and kept for application on the next day to allow for greater synergy. For its application in the treatments in seedlings, the Neem mixture was added to a spoon in per 1 liter of water.

Before preparing the solution, the sprayer with a capacity of 16 was calibrated. 5 liters of clean water were introduced into the tank and 12 of the 16 were sprayed, leaving approximately 2 liters of water left in the sprayer, and the required water was recorded. To spray the beds, the amount of water used in the calibration process will be divided, therefore 3 liters evident.

In total, 9 treatments were carried out with Azadirachta indica syrup and 4 treatments with cypermethrin, with 22 liters of water being used for both active substances, which made an equal amount of syrup, namely, 18 liters of syrup for margosa, being 9 for the higher dose and 9 for lower dose and 4 liters of cypermethrin syrup.

After application, the random sampling technique was used, and the object of study was the caterpillar measures - palms and later three important parameters were evaluated for study: Population density number of larvae per plant (larvae density) for each treatment will be calculated with the ratio between the total number of larvae found on observed plants and the total number of plants observed in the same treatment using the following formula:

$$DL = \frac{Number\ of\ larvae present \in the\ plants observed}{Total\ Number\ of\ plants observed}$$

Where: DL-Density of Larvae

Infestation level: The level of parasitism per plant (level of infestation) was calculated as the percentage ratio between the number of attacked leaves and the total number of leaves on each plant, found by the following formula:

$$¿ = \frac{Number\ of\ attacked leaves}{Total\ number\ of\ sheets} * 100$$

Where: NI-Infestation Level

E Average attack level for determining the average attack level of the funnel caterpillar. The damage caused was measured using a pre-determined scale from Segundo KASPER (1965) to calculate the degree of infestation modified by MESQUITA (2012):

And the following formula will be used:

1 and 2: Low damage level

$$\text{average attack level} ¿ \frac{\Sigma Ei * NPNEi}{Total\ number\ of\ plants}$$

3 and 4: Medium damage level

5 and 7: High damage level

Where:
Ei-Scale I (i=1,2,…..t)

(NPNSi)-Number of Plants in Scale i

The collected data were submitted to analysis of variance (ANOVA) by the F test, by the SISVAR v10 software and the differences between means were compared by the Tukey test at 0.05 of significance. To analyze the repellency test, a graph was constructed showing the variation of repellency as a function of storage periods using the Microsoft Excel tool.

4. Results and Discussion

In the evaluation of the effect of the Azadirachta Indica syrup on the control of the caterpillar (Trichoplusia ni) in the lettuce containing the cabbage crop (Brassica oleracea v. Capitata) in function of its different concentrations, in the locality of Dunda, the analysis of variances showed significant effects on all parameters evaluated over the 35 days of life in the nursery at the level of 5% probability by Fisher's test (Population density, percentage of infested plants and Mean Attack Level) as shown in table 1.

Table 1: **Summary of the analysis of variance table of the means of the evaluation parameters of the different concentrations of the A. indica spray at 35 days after sowing.**

FV1	Medium squares			
	GL2	DP3	NMA4	%PI5
Concentration	4	0.36 *	18.25 *	9.72*
CV experimental (%)		12.25	8.51	8.51

1. Source of variation, **2**. Degrees of freedom, **3.** Population density, **4.** Mean attack level, **5**. percentage of infested plants (* significant at 0.05 probability and not significant also at 5% probability).

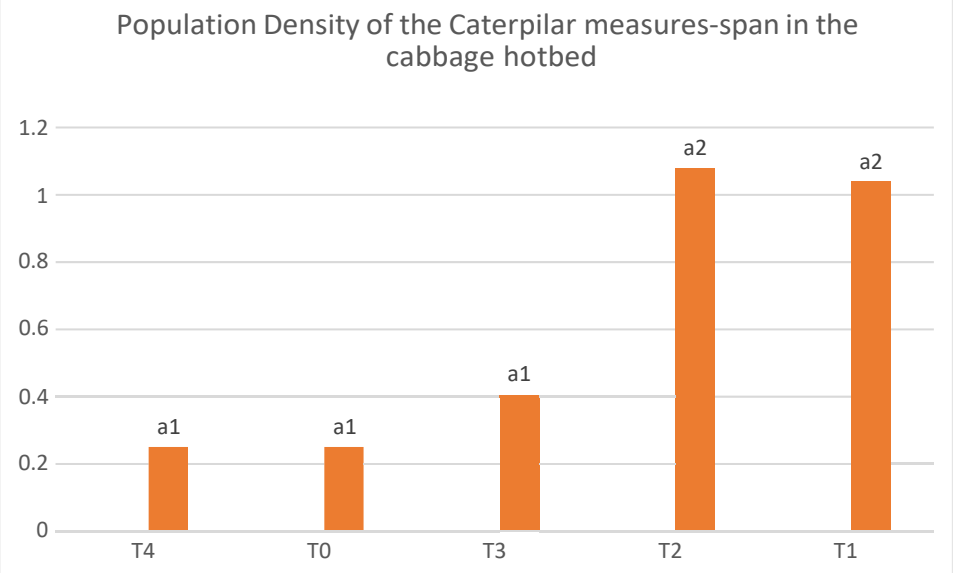
4.1 Population Density (DP)

According to graph 1, treatments T4 (dose of 150 g/L) and T3 (dose of 100 g/L) presented the lowest mean values, and they did not differ statically from each other or from the positive control (use of chemical formulation based on cypermethrin 0 L/ha) by Tukey test at 5% probability. However, the treatments were lower than the mean values obtained by the T2 (50 g/L dose) and T1 (without application of neem syrup) treatments, being statistically different from the others, although the latter did not differ from each other by the test. of Tukey at 5% probability.

The results showed that with increasing concentration, the population density reduced from average values of 1.08 and 1.04 to values between 0.25 and 0.45 larvae per seedling, thus indicating a control efficiency with doses ranging from 100 to 150 grams of leaves of neem

per liter of water (g/l). However, the non-application of this solution leads to a situation of maximum population density of 1.08 caterpillars/plant, which is not desirable to happen in the plants, as it affects the productivity of the culture by destroying the leaves that are the photosynthetic machine for the production of non-structural carbohydrates.

Graph 1: **Evaluation of the population density of the caterpillar mid-span in the cabbage crop in the hotbed after the application of the Azadirachta indica syrup**



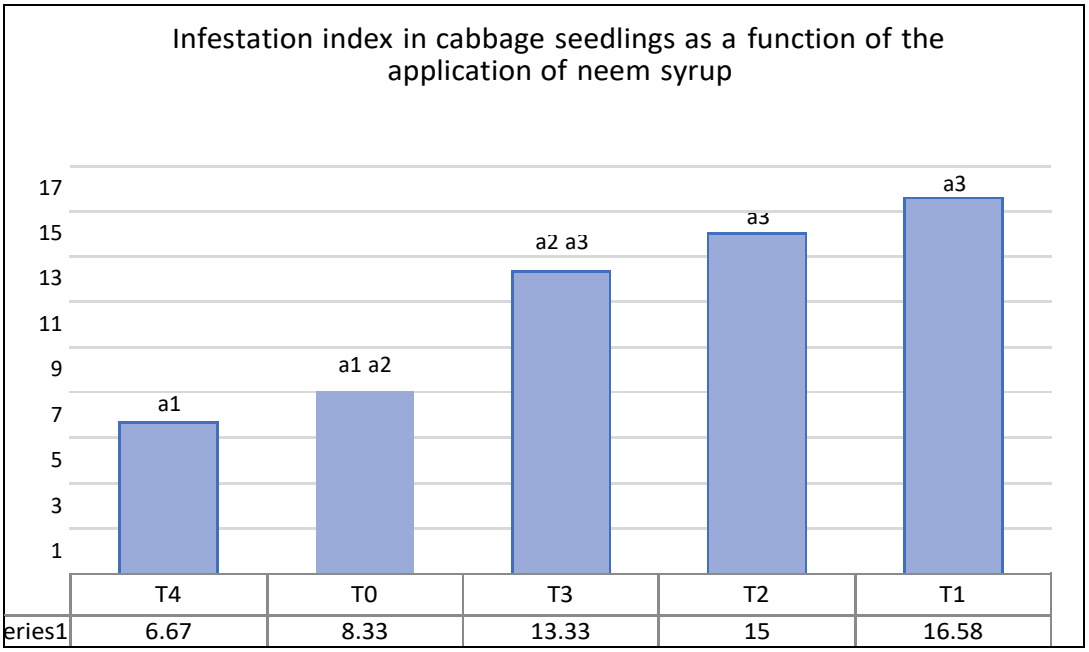
Source: Author

Therefore, the results showed that the maximum doses tested in this experiment are the ones that best control the population density of caterpillars, despite not being statically different with the local control, that is, the two have the same effect on the control of the caterpillar.

4.2 Percentage of infested plants (%)

The ANOVA results, in relation to the parameter percentage of infested plants or level of infestation, in the evaluations carried out in the control plots, a higher percentage of infested plants was observed in relation to the controlled plots, where it was verified that the treatment 150 g/L (T4) in all doses of neem leaf syrup had the lowest percentage in relation to the others, 0 (T1) and 50 g/L (T2), respectively, which were statistically different despite the latter having similar effects by Tukey's test, that is, there was no significant difference between treatments T1 and T2 at a significance level of 5% probability, as shown in graph 2.

Graph 2: **Evaluation of the level of infestation of the plants by the caterpillars after the application of the neem leaf spray on the cabbage seedlings.**



Source: Author

However, the results showed that with increasing concentration, the level of infestation of the plants by the caterpillars also suffered a reduction of approximately 17.00 infested seedlings when no control measure was applied for approximately 7.00 plants with a dose of 150 g/l showing with this, its control efficiency by about 59%, that is, a reduction of about 2.45 times compared to the control as shown in graph 2.

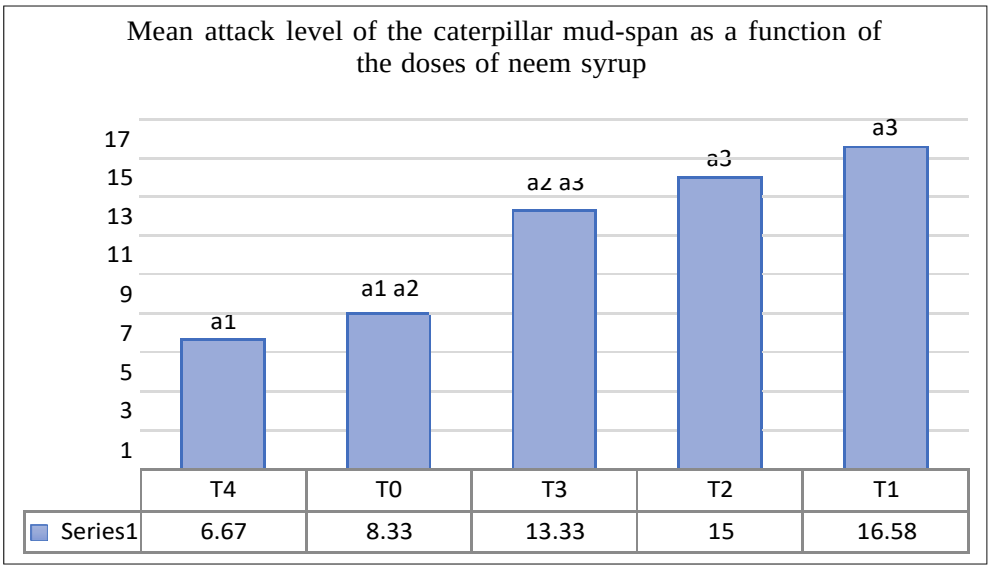
In addition to the control that was tested which was 0 g/l (no dose applied) a control treatment was also tested that is being used by the local population which is a chemical formulation of cypermethrin and the results showed that the maximum dose and the positive control (cypermethrin) is the one that controls the best, which proves that this dose has the same effect as the chemical formulation with a concentration of 0.5 L/ha in the control of the mid-foot caterpillar.

Similar results were obtained by Oliveira (2007) when they sought to investigate the efficiency of plant products (A. indica: 2% aqueous extract and 1% oil; M. azedarach L.: 2% aqueous extract; Q.amara L.:aqueous extract 2%) in the control of S. frugiperda where they showed significant and promising effects in the control of the funnel caterpillar, affecting its development.

4.3 Medium Attack Level (NMA)

Not very different from the situation of the other variables already discussed above, the average level of attack of the caterpillars measure-span in the cabbage nursery, the results also showed significant effects by Fisher's test at 5% probability (Table 3) showing more efficiently in the maximum concentrations of 150 and 100g/l, as these by themselves did not differ statistically ($p > 0.05$) by the Tukey test at 5% probability, which in turn showed a low level of attack in relation to other concentrations below that (Graph 3). However, increasing the dose of neem syrup provides a reduction in the average level of attack from scale 7 (about 80% of cabbage leaves damaged) which is the highest level of damage to scale 1 (20% of leaves damaged) which is the lowest level, i.e. considerably free of attacks according to Williams' classification (1992). However, compared to the chemical formulation cypermethrin 0.5 ml/l, the results were similar showing the same efficiency at the average level of attack as seen in Graph 3. As these results showed satisfaction, as it gives local producers a cheaper alternative. and ecologically acceptable due to its easy disintegration in nature.

Graph 3: Evaluation of the average level of the mid-span caterpillar in the cabbage seedlings in the hotbed after the application of the neem leaf spray



However, the results showed that with increasing concentration, the level of infestation of the plants by the caterpillars also suffered a reduction of approximately 17.00 infested seedlings when no control measure was applied for approximately 7.00 plants with a dose of 150 g/l showing with this, its control efficiency by about 59%, that is, a reduction of about 2.45 times

compared to the control as shown in graph 2. In addition to the control that was tested which was 0 g/l (no dose applied) a control treatment was also tested that is being used by the local population which is a chemical formulation of cypermethrin and the results showed that the maximum dose and the positive control (cypermethrin) is the one that controls the best, which proves that this dose has the same effect as the chemical formulation with a concentration of 0.5 L/ha in the control of the mid-foot caterpillar. Similar results were obtained by Oliveira (2007) when they sought to investigate the efficiency of plant products (A. indica: 2% aqueous extract and 1% oil; M. azedarach L.:2% aqueous extract; Q. amara L. : aqueous extract 2%) in the control of S. frugiperda where they showed significant and promising effects in the control of the funnel caterpillar, affecting its development.

5. Conclusion

Convergent results were obtained by Veanholi (2012) who, when studying the effect of neem extracts on the control of the fall armyworm, observed that the effect of the extracts was significant only at 15 DAS. After carrying out this study, it was possible to conclude as follows:

1. The neem doses had a positive effect on the control of the midfoot caterpillar in the broth containing cabbage culture.
2. The doses (concentrations of 100 to 150 grams of neem leaf syrup per liter of water) are the ones that best control the caterpillar in all analyzed variables.
3. The non-use of doses of 100 to 150 grams per liter of water for the control of the caterpillar measures a very high average level of attack characterized by the scale 7.

6. Conflicts of interest

The authors have no conflict of interest to report.

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