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Evaluation of the effect of the Azadirachta indica leaf syrup on the controlof the caterpillar in Trichoplusia ni in the community of Phandira, Dunda,Districtof Macossa inRepublicofMozambique.

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Abstract

A descriptive experimental study was carried out to have a birdeyeviewontheeffectofthesyrupmadefromleavesofAzadirachta (*Margosa*) indica A. Juss(Neem) on the control ofthe caterpillar (*Trichoplusia ni*) in cabbage seedlings, and the plotmethod was applied to the samples of 250 seedlings. The trial wascarried out between January and May 2022 and a RandomizedCompleteBlockDesign(RCBDwasused,with4treatments,making a total of 15 experimental units (plots). The area wasdivided into 3 randomized blocks and each block with 5 plotswhere the sowing was carried out in lines with a 15 cm compassbetween lines in the same plot and the seeds were released withineach line, without having a space between the seeds within thelines 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% ofsignificance, however, significant differences were found for theparameters degree of infestation (GI) and number of caterpillars(NL)relatedtothepercentageofcaterpillarmortalitywhens ubmittedto differentdoses ofNeemextractapplication.

Keywords:*Effect,AzadirachtaindicaA.Juss,Cabbage,Ca*

1. Introduction

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

Cabbage is important as it contributes to increasing the income of the family sector andprovides a balanced diet and can be consumed raw as a salad and also cooked. However, as inother 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 causesdamage, that is, it pierces the leaves, making them unfit for consumption, because in additiontodepreciatingtheproduct,itcan causetotalcroploss (Villas Bôasetal.,1990).

The incidence of pests in vegetable production fields contributes to lower productivity andconsequent fall, which can exceed 60% of total production in cases such as tomatoes andcabbage(Guimarães, 1990)
InMozambique,thecontrolmethodmostusedbyfarmersischemical,asitisconsideredtobe 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 inthe products sold in the markets, increased worker intoxication and production costs, inadditionto causing.

Natural pesticides are proven to be effective in controlling pests and diseases in plants. Theyhave a low cost for their effect, thus reducing the cost of vegetable production. They do notharm the environment; their compounds are easily degraded. It significantly reduces the riskof contamination of the sprayer of the spray and of domestic anemia that coexists in theproperty.Itisatraditionalknowledgethatmustbepreservedforfuturegenerations,guaranteeingt heautonomyoftherural producerbeforethemarket of chemicalpesticides.

In this context, due to the lack of knowledge on the use of synthetic and natural pesticides onthe part of the producers and the deficient supply of them by the local suppliers allied to thelow purchasing power, there is a need to create alternatives capable of minimizing the lossesof the seedlings in the hot bed using the syrup of margosa leaves as a natural pesticide due totheallelopathicproperties,tocombatpestsanddiseasescausedbybacteria,fungi,nematodes

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

Thus, vegetables are ingreat 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 considerablycontribute to the replacement of traditionally used products (NAKANO, 1999) and favor themanagement of insect resistance to insecticides through the rotation of compounds within anintegrated management program. of pests in vegetables. And because of this, studies aimed atthe discovery of pesticides that are less aggressive to man and the environment have beendeveloped, and for the present study the syrup from the leaves of the margosa (Azadirachtaindica)was tested.

2. Objectiveofstudy

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

3. MaterialsandMethods

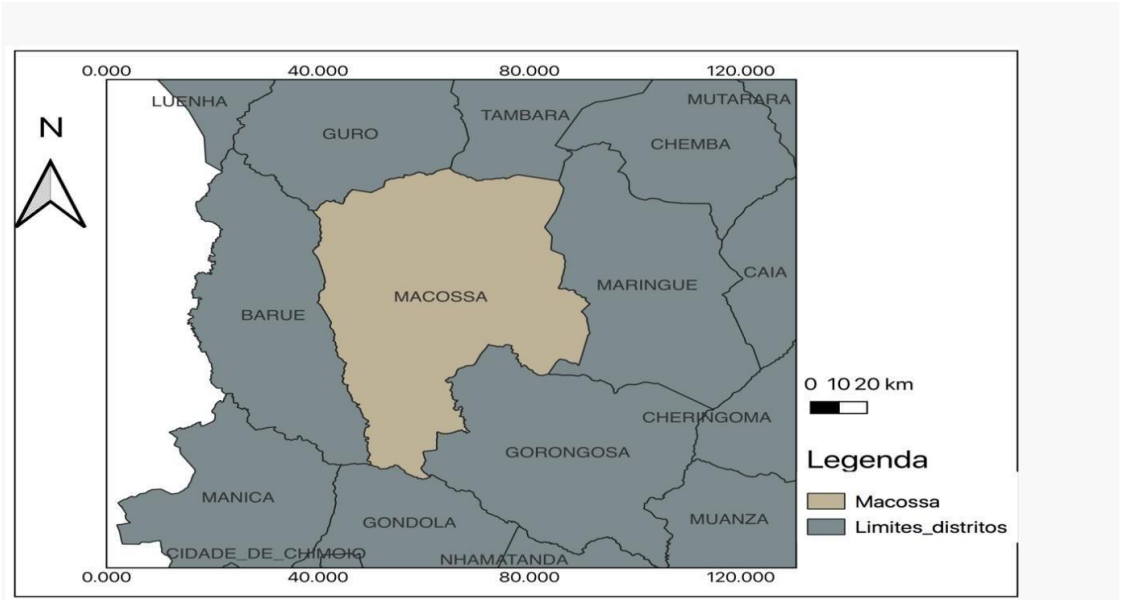
A descriptive experimental study is undertaken to find out the effect of Azadirachta indicaa.juss leaf syrup on the control of the caterpillar measures - palms in cabbage plant, wascarriedout in the communityof Dundain Macossa.

A field trial was set up in the community to test the natural pesticide (Azadirachta indica) and1synthetic pesticide(Cypermethrin). Theuniverseis madeup of16cabbagebaskets.

3.1 Descriptionof thestudyarea

The research was carried out in the community of Dunda in the district of Macossa. Macossain the province of Manica, in Mozambique. It has geographical boundaries connected, to thenorth with the districts of Guro and Tambara, to the west with the District of Báruè, to thesouth with the District of Gondola and to the east with the Districts of Gorrongoza, MaringueandChemba ofthe Provinceof Sofala, as shownin Figure1.

Figure1.Locationofthestudyarea.



Source:Author,2021.

The climate of the district is sub-humid dry in general, with an average annual rainfall of 800to 1000 mm, with a short to moderate wet period, ranging from 4 to 5 months (December toMarch),andthedryperiodsomewhatlong.(MaytoNovember),reachingupto7months.The average relative humidity of the airisfrom 60/65 to70% andthe average annualtemperaturevariesfrom22 to 26ºC.

3.2 ScientificProceduresPerformed

Four treatments were used to test margosa syrup at four doses (0; 50; 100 and 150 grams ofmargosa extract or syrups per liter of water). In the same experiment, the dose of 0 g/L ofwater served as a negative control (without spray application) and cypermethrin as a positivecontrol because it is one of the treatments commonly used by the local population at a dose of0.5g/ L. Observations were made for treatment after applications every 15 days with margosaevery15 daysfortreatments with cypermethrin.

Soil preparation was carried out manually with a hoe in the period between the last fortnightof August 2022. It consisted of a minimum tillage of 10 cm in depth. The next phase, whichwill culminate with the establishment of the nursery bed on the 14th day of February, will beusing the Var cabbage crop. The breeding ground of 3 blocks of 5 meters in length and 1.5meters in width each, spaced 30 centimeters apart, making up a total production area andusable area of 15.3 and 7.35 m2, respectively, with each block having an area of 5 m2consistingof 5plots measuring0.7x0.7 m2(areaof each plot=0.49 m2) is prepared.

The margosa leaves were harvested and crushed in a pestle to obtain the green mass, and thiswasmeasuredwiththehelpofadynamometeratdifferentdosesof50gand100g perliterof

water, these doses were prepared in different containers and kept for application on the nextday to allow for greater synergy. For its application in the treatments in seedlings, the Neemmixturewas added toaspoon in per1 literofwater.

Before preparing the solution, the sprayer with a capacity of 16 was calibrated. 5 liters ofcleanwaterwereintroducedintothetankand12ofthe16weresprayed,leavingapproximately 2 liters of water left in the sprayer, and the required water was recorded. Tospraythebeds,theamountofwaterusedinthecalibrationprocesswillbedivided,therefore3liters evident.

In total, 9 treatments were carried out with Azadirachta indica syrup and 4 treatments withcypermethrin, with 22 liters of water being used for both active substances, which made anequalamountofsyrup,namely,18litersofsyrupformargosa,being9forthehigherdoseand9 forlower doseand4 liters of cypermethrin syrup.

After application, the random sampling technique was used, and the object of study was thecaterpillar measures - palms and later three important parameters were evaluated for study:Population density number of larvae per plant (larvae density) for each treatment will becalculated with the ratio between the total number of larvae found on observed plants and thetotalnumberofplants observed in the sametreatment usingthe followingformula:

$$DL=\frac{Numberoflarvaepresent\in theplantsobserved}{TotalNumberofplantsobserved}$$ Where:DL-DensityofLarvae

Infestation level: The level of parasitism per plant (level of infestation) was calculated as thepercentageratiobetweenthenumberofattackedleavesandthetotalnumberofleaves oneach plant, found bythefollowingformula:

$$¿=\frac{Numberofattackedleaves}{Totalnumberofsheets}*100$$

Where:NI-InfestationLevel

E Average attack level for determining the average attack level of the funnel caterpillar. Thedamagecausedwasmeasuredusingapre-determinedscalefromSegundoKASPER(1965)tocalculate thedegreeof infestation modified byMESQUITA(2012):

Andthefollowingformulawill beused:

1and2:Lowdamagelevel

average attack level$¿\frac{\Sigma Ei*NPNEi}{\overline{Totalnumberofplants}}$

3and4:Mediumdamage level

5and7:Highdamagelevel

Where:
Ei-ScaleI(i=1,2,…..t)

(NPNSi)-NumberofPlants inScalei

The collected data were submitted to analysis of variance (ANOVA) by the F test, by theSISVARv10softwareandthedifferencesbetweenmeanswerecomparedbytheTukeytestat 0.05 of significance. To analyze the repellency test, a graph was constructed showing thevariationofrepellencyas afunction ofstorageperiodsusingtheMicrosoftExceltool.

4. ResultsandDiscussion

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) infunction of its different concentrations, in the locality of Dunda, the analysis of variancesshowedsignificanteffectsonallparametersevaluatedoverthe35daysoflifeinthenurseryat thelevelof5%probabilitybyFisher'stest(Populationdensity,percentageofinfestedplantsand Mean AttackLevel) as shown in table1.

Table 1: **Summary of the analysis of variance table of the means of the evaluation parameters of thedifferent concentrationsof the A.indicasprayat35 daysaftersowing.**

FV1	Mediumsquares			
	GL2	DP3	NMA4	%PI5
Concentration	4	0.36 *	18.25 *	9.72*
CVexperimental (%)		12.25	8.51	8.51

1.Sourceofvariation, **2**.Degreesoffreedom, **3.**Populationdensity,**4.**Mean attack level,**5**.percentageofinfestedplants(*significant at0.05probabilityandnotsignificantalsoat 5% probability).

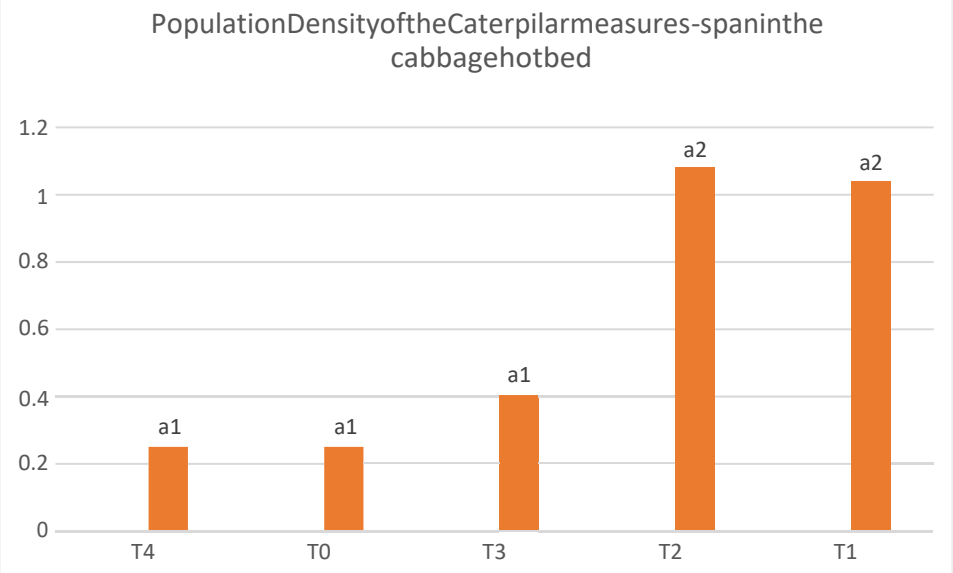
4.1 PopulationDensity(DP)

According to graph 1, treatments T4 (dose of 150 g/L) and T3 (dose of 100 g/L) presented thelowest mean values, and they did not differ statically from each other or from the positivecontrol (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 (50g/L dose) and T1 (without application of neem syrup) treatments, being statistically differentfrom 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 fromaverage values of 1.08 and 1.04 to values between 0.25 and 0.45 larvae per seedling, thusindicatingacontrolefficiencywithdosesrangingfrom100to150gramsofleavesofneem

per liter of water (g/l). However, the non-application of this solution leads to a situation ofmaximumpopulationdensityof1.08caterpillars/plant,whichisnotdesirabletohappeninthe plants, as it affects the productivity of the culture by destroying the leaves that are thephotosyntheticmachine forthe production ofnon-structural carbohydrates.

Graph1:**Evaluationofthepopulationdensityofthecaterpillarmid-spaninthecabbagecropinthehotbedafter theapplicationofthe Azadirachtaindicasyrup**



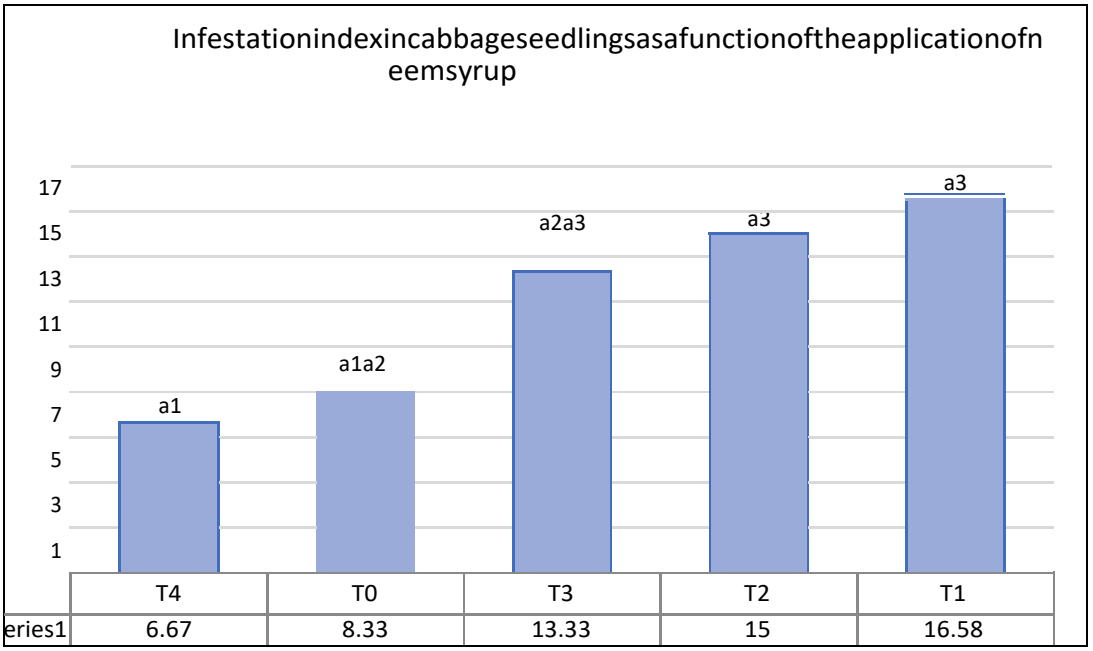
Source:Author

Therefore, the results showed that the maximum doses tested in this experiment are the onesthat best control the population density of caterpillars, despite not being statically differentwiththelocalcontrol,thatis,thetwohavethesameeffectonthecontrolofthecaterpillar.

4.2 Percentageofinfestedplants(%)

The ANOVA results, in relation to the parameter percentage of infested plants or level ofinfestation, in the evaluations carried out in the control plots, a higher percentage of infestedplants was observed in relation to the controlled plots, where it was verified that the treatment150 g/L (T4) in all doses of neem leaf syrup had the lowest percentage in relation to theothers,0(T1)and50g/L(T2),respectively,whichwerestatisticallydifferentdespitethelatterhavi ng similareffectsby Tukey'stest,thatis,therewasnosignificantdifferencebetweentreatments T1andT2atasignificancelevelof5%probability, asshowningraph2.

Graph2:**Evaluationofthelevelofinfestationoftheplantsbythecaterpillarsaftertheapplicationoftheneemleaf sprayon the cabbage seedlings.**



Source:Author

However, the results showed that with increasing concentration, the level of infestation of theplants by the caterpillars also suffered a reduction of approximately 17.00 infested seedlingswhen no control measure was applied for approximately 7.00 plants with a dose of 150 g/lshowing with this, its control efficiency by about 59%, that is, a reduction of about 2.45 timescomparedto thecontrol as shown in graph 2.

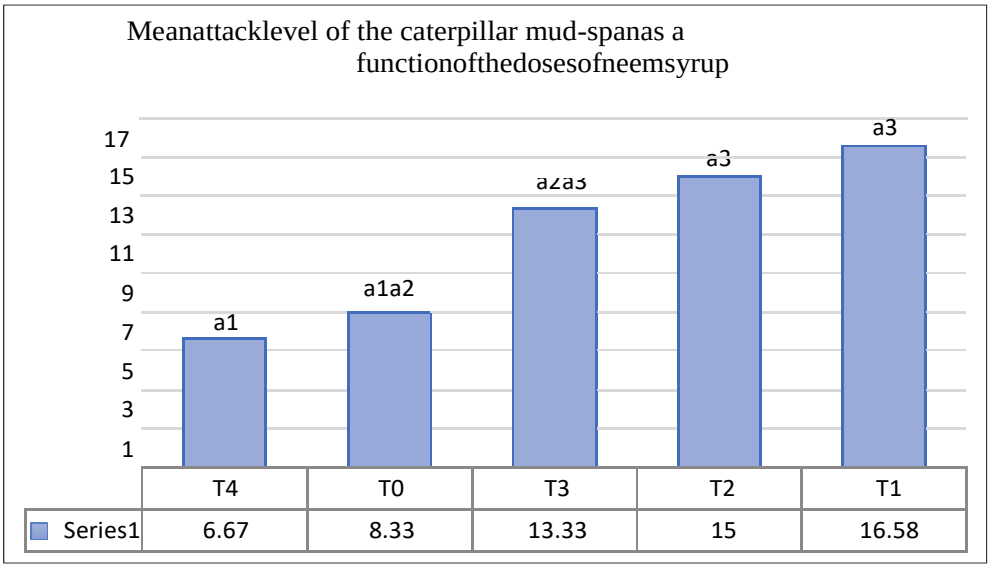
Inaddition to the control that wastestedwhich was0g/l(no doseapplied) a controltreatment was also tested that is being used by the local population which is a chemicalformulation of cypermethrin and the results showed that the maximum dose and the positivecontrol (cypermethrin) is the one that controls the best, which proves that this dose has thesame effect as the chemical formulation with a concentration of 0.5 L/ha in the control of themid-footcaterpillar.

SimilarresultswereobtainedbyOliveira(2007)whentheysoughttoinvestigatetheefficiency 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 theyshowed significant and promising effects in the control of the funnel caterpillar, affecting itsdevelopment.

4.3 MediumAttackLevel(NMA)

Not very different from the situation of the other variables already discussed above, theaverage level of attack of the caterpillars measure-span in the cabbage nursery, theresultsalso showed significant effects by Fisher's test at 5% probability (Table 3) showing moreefficiently in the maximum concentrations of 150 and 100g/l, as these by themselves did notdiffer statistically ($p > 0.05$) by the Tukey test at 5% probability, which in turn showed a lowlevel of attack in relation to other concentrations below that (Graph 3). However, increasingthe dose of neem syrup provides a reduction in the average level of attack from scale 7 (about80% of cabbage leaves damaged) which is the highest level of damage to scale 1 (20% ofleaves damaged) which is the lowest level, i.e. considerably free of attacks according toWilliams'classification(1992).However,comparedtothechemicalformulationcypermethrin 0.5 ml/l, the results were similar showing the same efficiency at the averagelevel of attack as seen in Graph 3. As these results showed satisfaction, as it gives localproducers a cheaper alternative. and ecologically acceptable due to its easy disintegration innature.

Graph 3: Evaluation of the average level of the mid-span caterpillar in the cabbage seedlings in thehotbedafter the applicationof the neemleaf spray



However, the results showed that with increasing concentration, the level of infestation of theplants by the caterpillars also suffered a reduction of approximately 17.00 infested seedlingswhen no control measure was applied for approximately 7.00 plants with a dose of 150 g/lshowingwith this, its control efficiencybyabout59%, that is, areductionofabout 2.45times

compared to the control as shown in graph 2. In addition to the control that was tested whichwas 0 g/l (no dose applied) a control treatment was also tested that is being used by the localpopulation which is a chemical formulation of cypermethrin and the results showed that themaximumdoseandthepositivecontrol(cypermethrin)istheonethatcontrolsthebest,whichprovesthatthisdosehasthesameeffectasthechemicalformulationwithaconcentration of 0.5 L/ha in the control of the mid-foot caterpillar. Similar results wereobtained by Oliveira (2007) when they sought to investigate the efficiency of plant products(A. indica:2% aqueousextractand 1%oil;M.azedarachL.:2%aqueousextract;Q. amaraL.

: aqueous extract 2%) in the control of S. frugiperda where they showed significant andpromisingeffects inthe controlofthefunnelcaterpillar,affectingitsdevelopment.

5. Conclusion

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

1. Theneemdoseshadapositiveeffectonthecontrolofthemidfootcaterpillarinthebrothcontaiiningcabbageculture.
2. Thedoses(concentrationsof100to150gramsofneemleafsyrupperliterofwater)arethe ones thatbestcontrol thecaterpillarinall analyzedvariables.
3. Thenon-useofdosesof100to150gramsperliterofwaterforthecontrolofthecaterpillarmeasuresaveryhigh averagelevelofattackcharacterizedbythescale7.

6. Conflictsofinterest

Theauthorshavenoconflictofinterest to report.

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