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THE EFFECT OF EFFICACY OF SOME PLANT POWDERS, BIOLOGICAL TREATMENTS AND SOME NANOSCALE APPLICATIONS IN THE CONTROL OF ORYZAEPHILUS SERRINAMENSIS BEETLE

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***Abstract**:*
This laboratory study was conducted to demonstrate the effect of the biocide effect of Trichoderma harzianum, silver nanoparticles in the third larval age and the Oryzaephilus full-size beetle, and five concentrations of the biocide T. harzianum (250, 500, 1000, 2000, 4000) ppm and five Concentrations of silver nanoparticles are (1000, 2000, 3000, 5000, 10000, and 20000) ppm.
The results showed that the fungicide T. harzianum had the most recent killing rates for all concentrations, as the highest killing rate for the third larval age was 96.7% at 4000 ppm during 72 hours of treatment, while the lowest killing rate for the third larval age was 16.7% at the concentration 250 ppm during 24 hours of treatment. As for the camels, the highest killing rate with the fungicide was 86.7% at the concentration of 4000 ppm during 168 hours of treatment, while the lowest killing percentage for the adult beetle was 0% at the concentration of 250 ppm within 24 hours of the treatment, as for the effect of particles Silver nanoparticles were the highest killing percentage for the third larval age 100.0% at the concentration of 5000 ppm within 72 hours of the treatment, while the lowest killing percentage for the third larval age was 13.3% at the concentration of 1000 ppm within 24 hours of the treatment.
As for the adult beetle have reached the highest rate of killing 88.7% when concentrating 20000 ppm within 72 hours of treatment and concentrating 500 and 1000 ppm during 144 hours of treatment. The lowest killing rate of the adult beetle was 16.7% when concentrating 5000 ppm during 24 hours of treatment.

Key words: surinamensis Oryzaephilus, Trichoderma harzianum, silver nanoparticles.

INTRODUCTION

Warehouse insects are of great economic importance because they cause financial losses estimated at millions of dollars annually, and are considered one of the dangerous insect pests of the multitude of their types and their wide spread in all countries of the world and under various circumstances, the reason for this wide spread is that their feeding is not limited to one substance but rather varies to include all stoked things. There is a group that feeds on cheese, meat, dried fish, hides of all kinds, feathers, carpets, natural and artificial silk, furniture as well, dates, whether wet, dry or semi-dry, which negatively affects it and causes severe damage to these crops during its storage, the Oryzaephilus is Important insect pests

that infect wheat grains, barley, yellow corn and oilseeds such as sesame, as well as dry fruits such as dates, dried figs and even tobacco (Haji Ismail, 2014)

Researchers have begun recently to find new and effective ways to control these pests by developing safe alternatives to pesticides, and among these methods is the use of biological control agents, and these factors are living organisms that are used as natural enemies to reduce the density of pest numbers (animal or plant) to limit that reduce Of economic loss (Ware and Carpenter, 2004). Bacteria, viruses, fungi, protozoa, and nematodes are natural enemies that attack, damage and destroy pests (Marglit & Goldberg, 1977) (Jameel, ea al , 2019).

The rapid technological progress at various levels has brought about a tremendous revolution in all fields. In the field of insect control, new methods have produced for us that relied on nanotechnology in particular, as humanity has gone through many scientific revolutions and progressed in the fields of life, and in the last two decades it has witnessed the start of the fifth scientific revolution, namely Nanotechnology (Paul et al., 2016).

MATERIALS AND METHODS OF WORK

Insect collection and breeding
The adults of Oryzaephilus surinamensis, were collected from the dried fruits of Samarra, which were obtained from the city of Samarra. The insect farms are raised in the incubator at a temperature of 232 ° C and a relative humidity of 5 ± 70%. These containers were covered with a piece of cloth and the edge was tied with rubber belts and left for a suitable period for the multiplication to reach the appropriate number of insects.

The culture was constantly renewed in order to obtain the piles used in the laboratory experiments and to get rid of the alienated skins (Al-Hadithi, 2016).

Testing the effect of the biocide Trichoderm harzianum on the third larval age and the adult beetle O. surinamensis
Four concentrations of the biopesticide T. harzianum (250, 500, 1000, 2000, 4000) ppm were prepared to test its effect on the third larval stage and the adult beetle surinamensis Oryzaephilus. The concentrations that were prepared were placed in clean and sterile spray plastic bottles and for each concentration a bottle was taken. 30 larvae and 30 adult insects per treatment with three replications per concentration. The plates containing the larvae and adult beetle were sprayed by 3 sprinkles at a distance of 10 cm. The control treatment was prepared by spraying with sterile distilled water only, and the dishes were incubated with an incubator at a temperature of 2 ± 32 ° C and a humidity of 5 ± 70 The following were followed up, and the dishes were examined every 24 hours up to 168 hours, and the results were recorded to extract the percentage of homicide (Amin, 2009).

Preparation of silver nanoparticles
1- Prepare a solution (1600ml, 1 * 10-3M) of AgNO3 and add to a baker's capacity of 2500ml.
2- Heat the solution to a boil with constant stirring with a magnetic stirrer for 15 minutes
3- We reduce the temperature to less than the boiling point to 85 ° C, then add the lemon leaf extract solution (as a reducing substance - clean and wash with distilled water approximately 5 g / 250 ml) in the form of drops and continue to stir with force until the gray color appears, as shown in Figure (10).

4- We leave the solution to cool down, after that we collect the product and wash several times with distilled water, and after the completion of the washing, the solution is placed in an ultrasound machine for 30 minutes.
5- We filter and dry the solution, and the final weight is 2.55 g (Sileikaite et al., 2006) (Fadhil et al .,2019).

Testing the effect of silver nanoparticles on the third larval age of O. surinamensis
Four concentrations of silver nanoparticles were prepared to test their effect on the third larval stage of the O. surinamensis beetle (1000, 2000, 3000, 5000) ppm, and the concentrations that were prepared were placed in clean and sterile plastic spray bottles and for each bottle concentration, 30 larvae were taken for each treatment With three replications for each concentration, the dishes containing the larvae were sprayed by 3 sprays at a distance of 10 cm. The control treatment was prepared by spraying with sterile distilled water only, and the dishes were incubated in an incubator at a temperature of 2 ± 32 ° C and a humidity of 5 ± 70% with the follow-up and the dishes were examined within 24 hours. , 48, 72 hours and the results were recorded to extract percentages of homicide.

Testing the effect of silver nanoparticles on the adult O. surinamensis
Four concentrations of silver nanoparticles were prepared to test their effect on the adult beetle, which are (5000, 10000, 20000) ppm. Concentration, and the dishes containing the larvae were sprayed with 3 sprays at a distance of 10 cm, the control treatment was prepared by spraying with sterile distilled water only, and the dishes were incubated in an incubator at a temperature of 2 ± 32 ° C and a humidity of 5 ± 70% with the follow-up and the dishes were checked during 24, 48, 72 Hours and results are recorded to extract percentages of kill.

RESULTS AND DISCUSSION
The effect of the fungicide Trichoderm harzianum on the third-year larvae of the O. surinamensis beetle.

The results of our current study showed in Table (9) that the highest percentage of killing of third age larvae is 96.7% at concentration 4000ppm after 72 hours of treatment, and that the lowest killing rate of third age larvae was 16.7% at concentration of 250 ppm after 24 hours of treatment, with significant differences compared With the control treatment in which no killing occurred, it is concluded that increasing the concentration and duration of exposure leads to an increase in the rate of killing third-year larvae of the O. surinamensis beetle.

The results of our current study are in agreement with the study of Samurai (2020) when studying the effect of the Biocount-T biocide on T. harzianum on the larvae of the third age of the Trogoderma granarium beetle. Killing within 72 hours at the same concentrations (0.0, 30.0, 46.7, 53.3)%, respectively.

It is also agreed with Alderi (2017) when studying the effect of the fungus Lecanicillium lecanii on the larvae of the O. surinamensis, as the results showed that the mortality rates of larvae in the newer stages were high and reached 60% at a concentration of 1 x 103 spore / ml, due to the fact that the chitinous wall of the modern larvae of the beetle has fewer tanning materials than the advanced stages, and this makes the fungus process easier Penetrating the larva's body and consuming its internal contents, which leads to its death.

Table (9) percentages of killing of third-year larvae of the O. surinamensis beetle treated with the biocide Trichoderm harzianum

Concentration / Time	Kill percentages according to time / hour			Average killing according to concentration
	24	48	72	
250	16.7	36.7	56.7	**36.7 D**
500	13.3	40	66.7	**40.0 D**
1000	36.7	56.7	76.7	**56.7 C**
2000	53.3	66.7	86.7	**68.9 B**
4000	56.7	73.3	96.7	**75.6 A**
Average kill according to time	**35.3 C**	**54.7 B**	**76.7 A**	

* The same capital letters in the same row means that there are no significant differences between them.

** Small, similar letters in one column mean that there are no significant differences between them.

The effect of the biocide T. harzianum on O. surinamensis

The results of our current study showed in Table (10) that the highest killing rate of integuments is 86.7% at 4000ppm concentration after 72 hours of treatment, and that the lowest killing rate for third age larvae was 0.0% at 250 ppm after 24 hours of treatment with significant differences compared with control treatment. In which no killing occurred, and it is concluded that increasing the concentration and duration of exposure leads to an increase in the percentage of camelids killing of the O. surinamensis beetle.

Our study agreed with the Darraji study (2018) on the efficacy of some biological pesticides, including the fungal suspension Lecanlcillum lecanii and the commercial preparation Biocount-T for the fungus T. harzianum on some stages of the whitefly on the tomato plant, as the concentration recommended by the producing company was used with a usage rate of 1 g / Liter, as the study showed a direct relationship between mortality percentages and the period of exposure, and the study also showed that there is a variation in sensitivity between the phases of the whitefly with respect to the commercial preparation and the spore suspension

Table (10) Percentage of killing percentages of sawfish chestnut beetle treated with the biocide T. harzianum

250	0	0	6.7	10	33.3	46.7	56.7	40 a
500	0	0	6.7	10.0	33.3	56.7	66.7	**38.6 A**
1000	**0**	**10**	16.7	16.7	43.3	66.7	76.7	**32.9 B**
2000	0	10.0	16.7	26.7	53.3	76.7	86.7	**24.8 C**
4000	0	10.0	20.0	26.7	56.7	76.7	86.7	**21.9 c**
Average kill according to time	**74.7 A**	**64.7 B**	**44.0 C**	**18.0 D**	**13.4 D**	**6.7 E**	**0 F**	

* The same capital letters in the same row means that there are no significant differences between them.

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Effect of different concentrations of silver nanoparticles on the third age of **O.** Surinamensis.
The results of our current study showed in Table (13) that the highest percentage of killing of third age larvae is 100.0% at a concentration of 5000ppm after 72 hours of treatment, and that the lowest killing rate of third age larvae was 13.3% at concentration of 1000 ppm after 24 hours of treatment with significant differences compared to With the control treatment in which no killing occurred, it is concluded that increasing the concentration and duration of exposure leads to an increase in the rate of killing third-year larvae of the beetle. The results of our current study agree with the study of Aidi (2019) on the effect of biologically prepared silver nanoparticles on larvae of C. quinuefasciatus, as it was shown that Bit-AgNPs prepared by commercial bacterial isolate Bacillus thuringiensis produced a killing rate at concentrations 1000, 2000, 3000 ppm reached 96.3%, 97.9% and 99.6% respectively.

Table (13) killing percentages of third-year larvae of the **O. surinamensis.** beetle treated with silver nanoparticles

Time / Concentration	Kill percentages according to time / hour			Average killing according to concentration
	24	48	72	
1000	13.3	36.7	60.0	36.7 E
2000	16.7	50.0	76.7	47.8 D
3000	26.7	66.7	86.7	57.8 C
5000	46.7	73.3	100.0	73.3 B
Average kill according to time	**31.8 C**	**65.0 B**	**87.2 A**	

* The same capital letters in the same row means that there are no significant differences between them.

** Small, similar letters in one column mean that there are no significant differences between them.

Our results are also in agreement with Shahzadi et al. (2017) where Bit-AgNPs at concentrations of 1, 500, 1000, and 5000 ppm gave high mortality rates against aegypti larvae. A.

The results are consistent with what was mentioned by Al-Nuaimi (2018) regarding the effect of silver nanoparticles on the second larval stage at concentrations 1000, 2000, 3000 and 4000 ppm, as it ranged in killing rates from 60% at 250 ppm to 96.6% at 4000 ppm.

Effect of different concentrations of silver nanoparticles on adult O. surinamensis beetles
The results of our current study showed in Table (14) that the highest killing rate of adult beetle is 86.7% at a concentration of 20000ppm after 72 hours of treatment, and that the lowest killing rate of complements was 16.7% at a concentration of 5000 ppm after 24 hours of treatment, with significant differences compared with the control treatment. There was no killing, and it is concluded that increasing the concentration and the duration of exposure leads to an increase in the percentage of killing of the **O. surinamensis** .

Table (14) percentage killing percentages of **O. surinamensis beetles** treated with silver nanoparticles:

Time / Concentration	Kill percentages according to time / hour			Average killing according to concentration
	24	48	72	
5000	16.7	33.3	56.7	**35.6 C**
10000	26.7	50.0	76.7	**51.1**

				B
20000	50.0	66.7	86.7	**67.8 A**
Average kill according to time	**31.1 C**	**50.0 B**	**73.4 A**	

* The same capital letters in the same row means that there are no significant differences between them.

** Small, similar letters in one column mean that there are no significant differences between them

The results are consistent with what was mentioned by Al-Nuaimi (2018) regarding the effect of biologically prepared silver nanoparticles on adult T. granarium at concentrations 1000, 2000, 3000, 4000 ppm, as the highest percentage of kamalat loss was 66.6% at 4000 ppm and the ratios ranged between 20% to 60% for concentrations of 500, 1000, 2000 and 3000 ppm

CONCLUSIONS

For what the results have shown, the following can be concluded:

1. The larval stage is most sensitive to parameters of the gametes.
2. There is a direct relationship between increasing the concentration, the exposure period, and increasing in the killing rates of the insect stages.
3. Silver nanoparticles surpass the biocides in causing high killing rates for larval and adult age of surinamensis. O.

RECOMMENDATIONS

1. In order to support biological control programs and reduce environmental pollution, it is recommended to use other fungal and bacterial pesticides that pathogen to insects in the control of the surinamensis. O.
2. It is recommended to conduct research on studying the effect of silver nanoparticles on other insects of the Coleoptera order and other orders.
3. Conducting tissue sections of the roles of the beetle with a serrated chest to demonstrate the physiological effect of silver nanoparticles on it.

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