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A Comparative Study of the Chemical and Biological Control of the *Pentodon Bispinifrons* Reitter, (Coleoptera: Scarabaeidae)

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ABSTRACT
The study was conducted on a group of adults of *Pentodon bispinifrons* Reitter, as it was treated by Nogos at three concentrations (5, 10, 15) ppm and *Beauveria bassiana* fungus under the influence of three different temperatures: 10, 20 and 30 °C. The results showed that the insect killing rates remained low at the three temperatures when using the Nogos pesticide, while the results when using the fungus extract *B. bassiana* showed that the killing rate was low at 10 °C but increased at 20 °C as it reached 40% after 8 days after the treatment, while it reached 80% at a temperature of 30 °C after 6 days of treatment.

Keywords: *Pentodon bispinifrons* Reitter, Nogos, *Beauveria bassiana*

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INTRODUCTION

The family insects Scarabaeidae are one of the large and important families of the Coleoptera order. Chandra (2000) mentioned that some species of this family infest various crops, forests, pastures, plant roots and rotting wood in the larval and adult phases, some of them also feed on Fungivorous and others on Herbivores and Carnivores. The use of pesticides in the chemical control of insects may have many damages to a some of beneficial insects such as predators, intruders, and bees that live in the same environment in which harmful insects live. However, chemical control may be the only way or is one of the methods that must be followed to reduce The Critical Impact of the pest (Sanborn *et al*., 2002).

One of the most important pesticides used today and available in the local market that have a wide range of impact on different insects is Nogos, which is one of the organophosphorus pesticides that have a deadly effect on many harmful insects that feed on economic crops, especially the crops which belongs to the Solanaceae family and causes great losses (Daoud and Elhaidari, 1986). Recently, the fungus *Beauveria bassiana* began to be used according to biological control programs, whose results are often better than chemical control, as the most pathogenic fungus strain was selected for the target pest in controlling many insects due to this fungus has deadly effect for insects (Gabarty *et al*., 2014).

Many researchers have pointed to the importance of biocontrol by using pathogenic fungi for insects in the control of complete and incomplete insect's phases of larvae and nymphs as well as the static phases of eggs and virgins (Anand and Tiwary, 2009). Pathogenic fungi for insect characterize with their low cost, high efficiency, specialization, and non-targeting of vital enemies, in addition to not polluting the ecosystem (Lacey *et al*., 2001).

The present study aims to evaluate the efficacy of control using the chemical pesticide Nogos and *B. bassiana* on the scarab beetle *P. bispinifrons* Reitter.

MATERIALS AND METHODS

Collection of Samples:

The study was conducted on a group of adults of the insects of the beetle species *P. bispinifrons* Reitter, which were collected from the city of Sulaymaniyah during the period from 1/10/2019 to 1/12/2019 by using the direct collection process manually, where the insects that were attracted to light at night, were collected after it fell on the ground using a brush and bottles of 500 ml with an airtight plug. This bottle contains a piece of animal droppings (Dung), and the insect was diagnosed using the special classification keys of researchers (Gasca-Alvarez and German, 2010).

Chemical and Biological control:

Chemical control using Nogos pesticide. The pesticide was obtained in an emulsion of 98% purity and was produced by BDH Company.

Biological control using the *B. bassiana* fungi. The fungi colony was obtained from the Plant Protection Department / College of Agriculture / University of Baghdad. The colony was grown in clean Petri dishes and sterilized by Autoclave at 121 °C and atmospheric pressure 1 lb./ Inch^2 for 15 minutes. These dishes were containing the culture medium Sabourauds Dextrose Agar (SDA) with Chloramphenicol antibiotic of 250 mg/ L to prevent bacterial growth (Olivera and Neves, 2004). Then, the fungicide suspension (Spore Suspension) was prepared by using a petri dish containing the growing fungi colony and 5 mL of sterile distilled water added to it and added a solution of 80 Tween at concentration 0.05%. Then the spores were harvested by (Loop). Mixed the spores with the distilled water well, and then filtered the contents of the petri dish with a piece of sterile gauze cloth installed on a sterile glass funnel placed on a sterile conical flask of 50-ml. To ensure all the spores came down, was added 5 mL of sterile distilled water to the sides of the gauze, and then keep the fungicide suspension in the refrigerator until use (Kirkland *et al*., 2004).

Study the effect of Nogos on *P. bispinifrons* Reitter:

After obtaining the sufficient number of insects, were divided into three groups, each group contains three replicates, and each replicate has five insects. Insects were treated with three concentrations of Nogos (5, 10, 15) ppm by spraying. Each group was treated by the three concentrations of the pesticide placed at three different temperatures (10, 20, 30) °C, in addition to the control group, where it was treated with distilled water only and placed at a temperature of 25 °C, and the readings were taken after the passage of (2, 4, 6, 8, 10) days of treatment.

Study of the effect of *B. bassiana* fungus on *P. bispinifrons* Reitter:

After obtaining the fungal extract of *B. bassiana*, the insects were treated by this extract, where the insects were divided into three groups and each group contains three replicates and in each repeater five insects, each repeater was exposed to different temperatures (10, 20,

30) °C in addition to the control group was treated with distilled water only and placed at a temperature of 25 °C and readings were taken after the passage of (2, 4, 6, 8, 10) days of the treatment.

Statistical analysis:

The experiment was designed on the basis of Complete Randomized Design, and the results were analyzed by using the SPSS statistical program, also used the Least Significant Difference Test (L.S.D) to compare the averages at the 5% probability level (Zulfiqar and Bala, 2016).

RESULT AND DISCUSSION

Temperature is one of the determining factors for growth and development of insects in general, and the use of control, whether chemical or biological, is largely determined by the climate, temperature and timing (Arnold, 1960). Figure (1) shows the treatment of a group of scarab beetles were treated with Nogos at three concentrations are (5, 10, 15) ppm and at a temperature of 10 °C. Figure (4) where it was treated repeater from the beetle insects by *B. bassiana* fungus and at a temperature of 10 °C, we will find that the killing percentages were low and did not increase significantly, after ten days of treatment the killing rates remained low for both Nogos and the fungus extract where did not exceed 20%. For Nogos, this indicates that the pesticide is ineffective in low temperature conditions, as well as for the fungus extract, as the killing rate in this temperature is very low and the reason may be that the *B. bassiana* is idle at low temperatures, and it is unable to penetrate the insect's body to cause injury (Ekesi *et al.*, 1999).

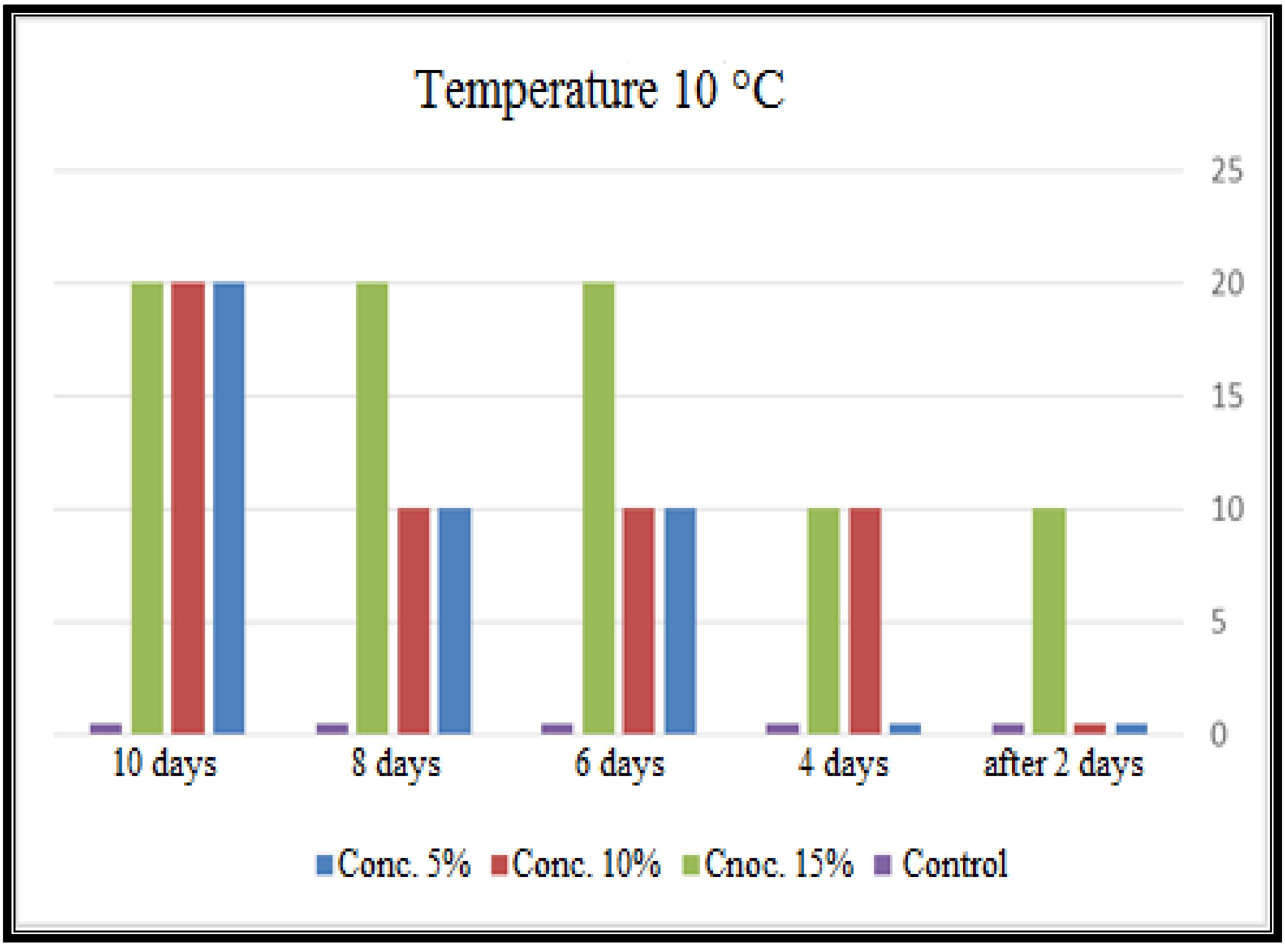

Figure 1: Effect of Nogos pesticide on scarab beetle at 10 °C

The results of the statistical analysis showed that the differences between the three pesticide concentrations in the insect killing rate were not significant, while the ratios were significant between the pesticide and the fungicide extract at ($P< 0.05$). Figure (2) in which the Nogos pesticide was used with the same previous concentrations but at highest temperature 20 °C, and Figure (4) in which the fungal extract was used on another repeater of the insect at a temperature of 20 °C, it was found that the results did not differ significantly from the temperature of 10 °C, and the killing ratios were close when the concentration was raised to 15 ppm for the Nogos pesticide. This indicates that the rise in temperature did not affect the pesticide's effectiveness in increasing the killing ratios of an insect, while the fungal extract of *B. bassiana* showed a remarkable increase in the killing rates at 20 °C, as the killing rate reached 40% after eight days of treatment, which is a good killing rate compared to the temperature of 10 °C. We can conclude that the rise in temperature increased the activity of the fungus to the level that enabled it to penetrate the insect's body and kill it, and these results are congruent with Wu *et al.* (2016) that high temperature increases the possibility of the fungus to kill insects.

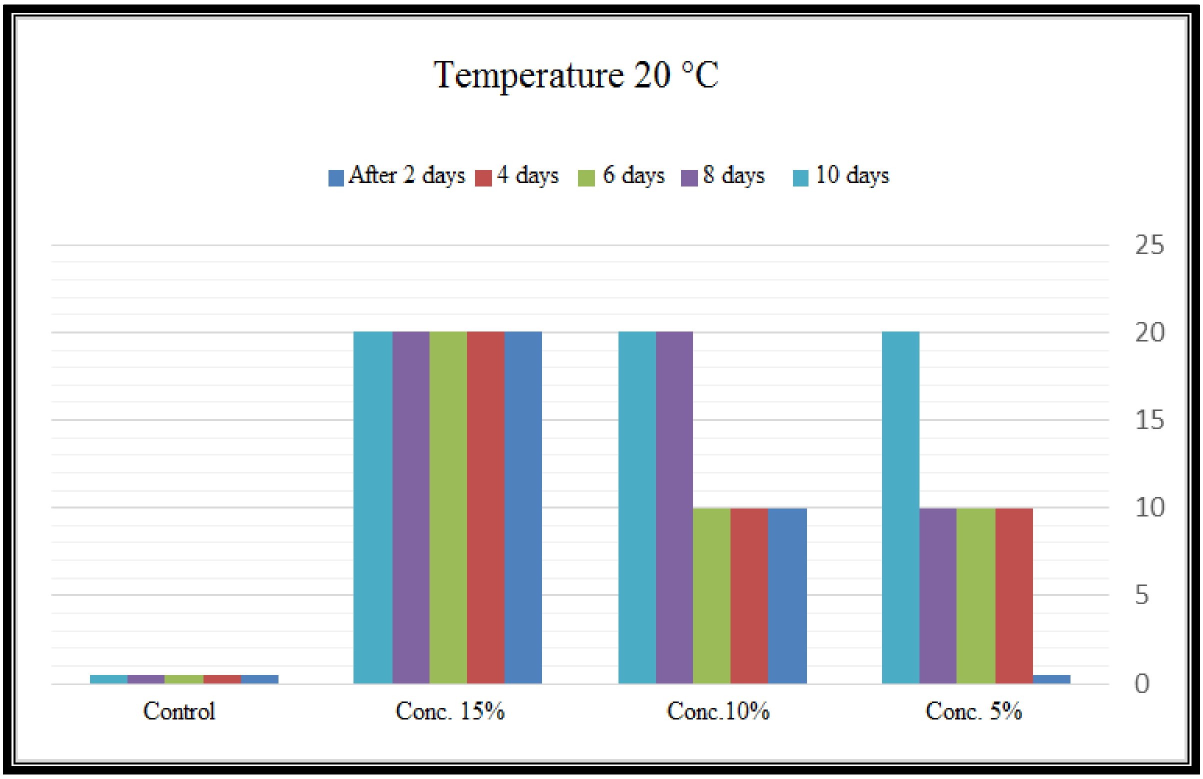

Figure 2: Effect of Nogos Insecticide on Scarab Beetle at 20 °C

The statistical analysis of data showed that there were high significant differences between the killing ratios of Nogos and the fungicide, as well as between the pesticide and the control group. The temperature is a determining factor in the insect's biological control process, as the increase in temperature to 30 °C led to increase the killing rate of the fungal extract as it reached 80% after six days of treatment (Figure 4), while it was not the same for Nogos, as the killing rates did not rise significantly at a temperature of 30 °C (Figure 3), which indicates that treatment with Nogos is not significantly affected by temperature. Therefore, control can be carried out by using Nogos at any time of the year, while the *B. bassiana* fungus cannot be used in biocontrol at low temperatures, because the killing rate decrease to the lowest level when temperatures drop (Norris *et al.* (1999).

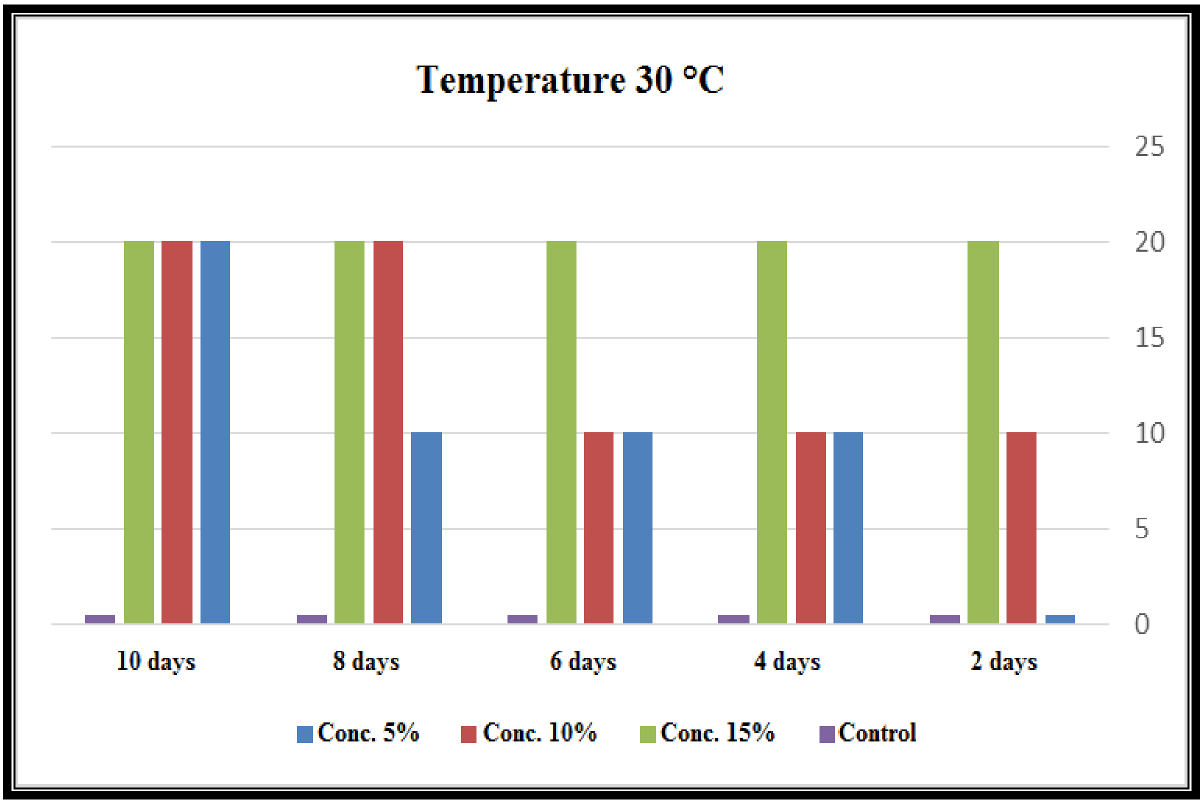

Figure 3: Effect of Nogos pesticide on scarab beetle at 30 °C.

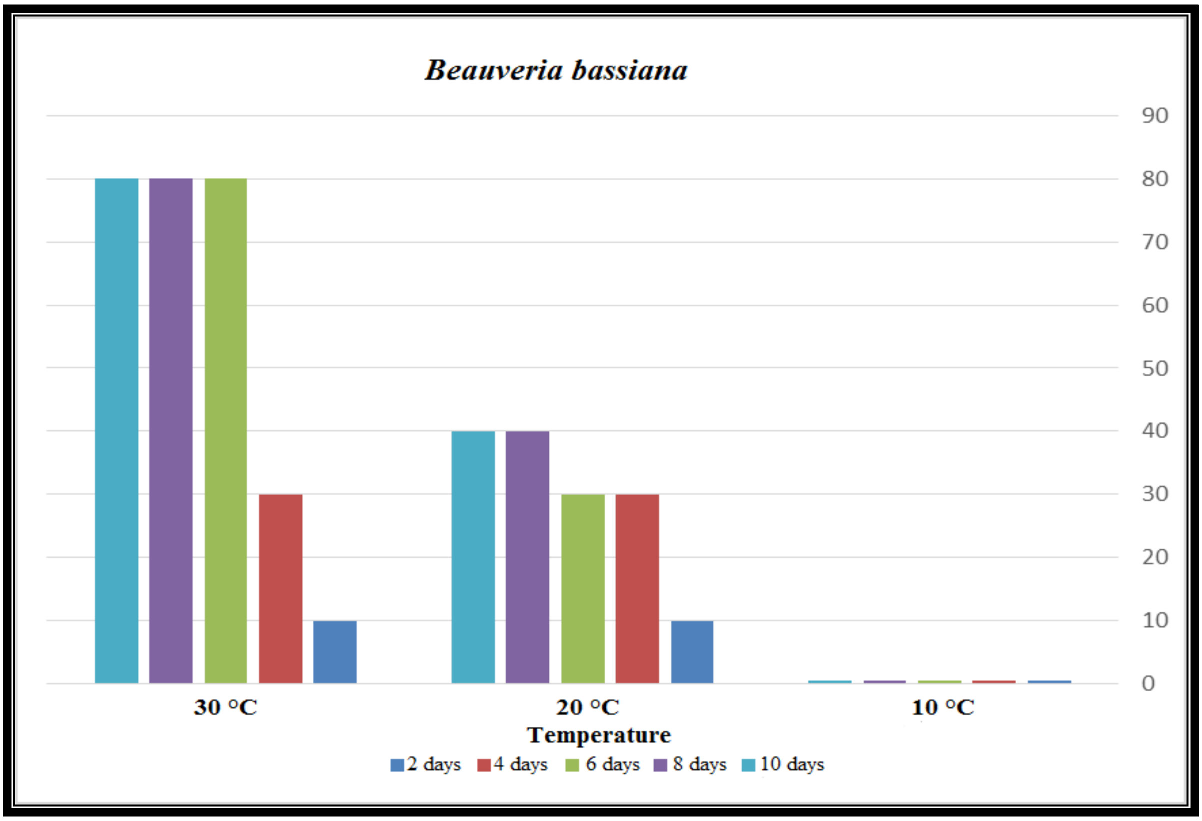

Figure 4. Effect of *B. bassiana* fungus on scarab beetle at 10, 20 and 30 °C.

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