



Effect of fungus *Beauveria bassiana* on three species of warehouse insects affiliated to the order Coleoptera

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Keywords

Beauveria bassiana,
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Abstract

The efficacy of the fungus *Beauveria bassiana* were studied using five concentrations 10^6 , 5×10^6 , 10^7 , 5×10^7 and 10^8 spore/ml. of the fungus *Beauveria bassiana* against three species of stored product insects, Southern cowpea weevil *Callosobruchus maculatus*, Khapra beetle *Trogoderma granarium*, and rust red flour beetle *Tribolium castaneum*. The mortality rate was recorded after exposing these insects to food treated with the aforementioned fungus, during four different exposure periods, which are 2 days, 4 days, 6 days, and 8 days, it was noticed that the killing rate was increasing as the concentration and duration of exposure increased, as the highest mortality was recorded, which was 19.67 insects in the southern cowpea weevil *Callosobruchus maculatus*, due to the concentration of the fungus 10^8 , and after 8 days had passed since the date of the treatment, the highest mortality rate was 10.0 in the Khapra beetle, *Trogoderma granarium* for the fungus concentration 10^8 . At the exposure period 8 days, the highest rate of mortality was 10.00 in the rust flour beetle, *Tribolium castaneum* of the fungus concentration 10^8 at the exposure period 8 days.

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1. Introduction

About a hundred years ago, it was discovered that some fungi have a pathogenic effect for insects (5), and this encouraged the researchers to pay attention to the effectiveness of these fungi in the biological control of insect pests in many countries, China, Russia, and Brazil (12). In view of the abundance of information regarding the environmental needs of these fungi and our knowledge of their action, scientific opinions are unanimous that it is time to use fungi as pesticides against insect pests.

Many types of insect-infecting fungi have been used as insecticides, for example the fungus *Beauveria bassiana* has been used in both China and Eastern Europe as preparations for combating insect pests (11)

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The results of (4) indicated that the different industrial food media have an effect on the treatment with the biological efficiency of fungi against the rusty red flour beetle

And (9) found that there is a direct relationship between the concentration of the fungus *Beauveria bassiana* and the vitality of the larvae treated with it. The temperature 27 ° C and 30 ° C and the humidity 80% and 90% had a significant effect on the toxicity and vitality of the fungus against Potato moth , with a concentration of 10⁶ fungi, were 6.67 and 11.67% after 72 and 96 hours of treatment With fungi(17) found significant differences in the viability of wheat seeds mixed with *Beauveria bassiana* and the percentage of loss after four months of storage, noting that the wheat was artificially infected with red rust flour beetle (*Tribolium castaneum*)and grain weevil.

(14) found that the concentration of 1.6 × 10⁷ spore / ml of *Beauveria bassiana* gave the highest percentage of insect killing after 20 days of treatment for both the major and minor wax worms.

The researcher (3) concluded that there was a decrease in the protein, lipid, and amylase levels of whitefly *Bemisia tabaci* , integuments and the nymphs got a high killing rate of 80-90 after exposure to *Beauveria bassiana* .

2. Materials and methods

The isolation, identification and obtaining of the fungus *Beauveria bassiana* was carried out by Prof. Dr. Atef Sayed Abdel Razzaq in the Microbial Control Laboratories / Department of Pest and Plant Protection / National Research Center / Dokki/ Cairo /Egypt

After sterilizing the body of the sick insect with fungus growth on its body wall by immersing it in a 5% caustic soda solution for several minutes, then washing the sample well with distilled water three times, opening the body of the insect in a dish.

Sterilized, then transferring a small part of the body wall or internal tissues infected with the fungus to a sterile petri dish as well, and then filled with antibiotics such as potato limes with carrots, and barley extract infused with agar (agar mixed with water only).

These environments stimulate the growth of many fungi pathogenic to insects quickly and stabilize their acidity (at a pH of 5.6) to inhibit the growth of the accumulating bacteria, and it is preferable to take the fungus spores from the surface of the insect's outer body with a sterile needle and not to dissect the insect

Development dishes were placed in an incubator at 28 ° C and high humidity, then colonies were examined.

After growing daily, it was dyed with Cotton Blue to identify the type of fungus in the samples taken.

Directly from the surface of the insect and its insects, then it was stored in a refrigerator at a temperature of 4 ° C with the carr and the germs were extracted in the form of a powder usually, and the advantages of the fungus are its tolerance to high temperatures up to 44 ° C and the optimum degree of its growth is 27 ° C .

Five concentrations of Fungi were prepared: 10^6 , 5×10^6 , 10^7 , 5×10^7 and 10^8 spores / ml. Then the insect food was treated with spraying the fungi solution for three replicates and each repetition containing 10 g of food was sprayed with 10 ml of the fungal suspension and then replicates were treated with the comparison treatment with 10 ml of distilled water Only then a day was left in the incubator away from contamination and at a temperature of one milliliter of distilled water only, and then left for a day in the incubator away from contamination and at a temperature of 30 degrees Celsius to dry and contaminate the food item with fungus spores.

3. The effect of fungus *Beauveria bassiana* experiment :

Experimenting with the influence of fungus *Beauveria bassiana* on the life of the three insect species: This experiment was carried out by following the method of (2), with some modifications, and the mortality rate was calculated after (two days, four days, six days, eight days, as was the loss, and the food was weighed after 30 days and the duration of the first generation's development.

4. Results and discussion

The results of the study showed that the mortality rate in the southern cowpea weevil through the use of the fungus *Beauveria bassiana* increased as the dose and duration of exposure increased. The results of Table (1) showed that the mortality rate was 0.00 at all concentrations of fungi for the two exposures time for 2 days and 4 days, while the mortality rate was 16.67 insects, and the fungus concentration was 10^8 . The results of the aforementioned table also showed that the highest number of dead insects after 30 days was 20 for the fungus concentration 10^8 , while the lowest mortality rate was 9.67 insects recorded for the concentration of 10^6 for *B. bassiana*. The results of Table (1) also showed that the lowest food loss was recorded for concentration 10^6 , while the highest loss food recorded for the fungus concentration 10^8 , where the loss reached zero. This study was in agreement with (6), which demonstrated that the values achieved for both Lc_{50} and lt_{50} were of high sensitivity to third larval stage and *Scrobipalpa ocellalella* to B. spores of the fungus B. Bassiana caused a mortality rate of between 76-100% of the concentrations 8×10^4 and 5×10^5 spores / ml. Our results also agreed with (1) sensitivity of eggs to *Pachonoda Fasciata* after treatment with *B. bassiana*, where the relationship was inverse between both the concentration of the fungus and the egg hatching while the relationship was positive between increasing the concentration and killing the larvae, and the sensitivity of the newly hatched eggs was Higher than the sensitivity of old eggs after treatment with fungi. The results were also) in agreement with (7)who indicated that the extermination value of *Nezara viridula* increased as the number of fungi spores and the duration of exposure increased, and that the highest killing rate for *B. bassiana* was 81.25% for concentration 1×10^8 and 50% for concentration 1×10^7 and 30% for 1×10^6 concentration after 16 days of treatment Our products also agreed with all (8), where the fungus showed high efficacy against the beetle turtle beetle after it was mixed with the food of this insect *Cassida vittata*, especially the M8D fungus strain, which gave high mortality rates after testing LC_{50} and LC_{90} Our results also agreed with (20) .

Table 1. Effect of five concentrations of fungus *Beauveria bassiana* against Southern cowpea weevil *Callosobruchus maculatus*

Exposure time (Day)	Mortality rate (from 20 larvae)					
	Fungi Concentration (spore /ml.)					
	10 ⁶	10 ⁶ × 5	10 ⁷	10 ⁷ × 5	10 ⁸	0.0
2	0.0g	0.0g	0.0g	0.0g	0.0g	0.0g
4	0.0g	0.0g	0.0g	0.0g	0.0g	0.0g
6	0.0g	0.67g	1.00fg	1.67ef	2.33e	0.0g
8	9.33d	11.33c	12.00c	15.00b	19.67a	0.33g
F1 population (30day)	9.67e	12.00d	14.33c	17.33b	20.00a	1.00f
food remaining 10gm	8.98a	9.90a	10.00a	10.00a	10.00a	8.90b

Values followed by the same letter do not differ significantly from each other at a probability level of 5%.

The results of table (2) showed that the lowest rate of killing was 0.33 insects, which was recorded after 2 days of treatment with *B. Bassiana* versus *Trogoderma granarium* larvae of the fungus concentrate 10⁶. While the highest killing rate of 10.0 insects was recorded for the fungus concentrations, 5 × 10⁷, and 10⁸ after 8 days of treatment with fungi. Thus, after 30 days, the number of dead insects reached 10, for all concentrations of the fungus. The results of our study agree with what (21) pointed out that the fungus *Beauveria bassiana* causes a killing rate of between 75 and 100% in both the field and the laboratory for both larvae, pupae and integuments of the insect *Scrobopalpa ocellatella*. Our results were also in agreement with (10) of the fungi *Beauveria bassiana*. It is a natural killing agent in suppressing the whole insect of the Alfalfa weevil *Hypera postica*. The fungus showed high killing efficacy reaching 100% at a concentration of 10⁶. Our results also agreed with (23) and (6) that fungi *Beauveria bassiana* was effective against beetle turtle insect. Our results also compared with (2) that the most susceptible ages to the fungus are the larval ages compared to the pupae and adults of the turtle beetle.

Table 2. Effect of five concentrations of fungus *Beauveria bassiana* against Khapra beetle *Trogoderma granarium*

Exposure time (Day)	Mortality rate					
	Fungi Concentration (spore/ml)					
	10 ⁶	5 × 10 ⁶	10 ⁷	5 × 10 ⁷	10 ⁸	0.0
2	0.33k	1.67j	2.00ij	4.67fg	4.33g	0.00g
4	1.33jk	3.00hi	4.00gh	7.00d	7.67de	0.0 L
6	3.00hi	4.33g	7.33ed	8.33bc	9.33ab	0.0 L
8	5.67ef	9.00ab	9.33ab	10.00a	10.00a	1.00jkl
F1 population(30day)	10.00a	10.00a	10.00a	10.00a	10.00a	0.00b
food remaining (10gm)	9.65b	9.78b	9.88ab	9.94a	9.98a	9.31c

Values followed by the same letter do not differ significantly from each other at a probability level of 5%.

The results of Table (3) showed the highest rate of killing in the larvae of the rust red flour beetle 8.33, for the concentration of fungus 10⁸, and the lowest rate 0.00 was recorded for the two concentrations 10⁶ and 5 × 10⁶. The results of the aforementioned table showed that the rate of killing reached 9.67 larvae after 30 days of treatment at a concentration of 10⁸ while the lowest rate for this killing

was 1.67 larvae, which were recorded at concentration 10^6 . Our results were in agreement with (17) by storing wheat grains mixed with five concentrations of *B. bassiana* for five months to study their protection against both rust red flour beetle and rice weevil. The storage loss in untreated seeds was 81.5% while the loss was in Weight 18.4% in seeds treated with the aforementioned fungus. Thus, our results agreed with (14) that the fungus *B. bassiana* was very efficient against several insect species such as the major and minor wax worms and the cotton seed bug. Our results were also in agreement with (15) that *B. Bassiana* caused a very large reduction in potato tuber larvae by 87%. The stock loss in untreated seeds was 81.5% while the loss was in Weight 18.4% in seeds treated with the aforementioned fungus. Our results also agreement with (22), (13).

Table 3. Effect of five concentrations of fungus *Beauveria bassiana* against rust red flour beetle *Tribolium castaneum*

Exposure time (Day)	Mortality rate					
	Fungi Concentration(spore/ml)					
	10^6	5×10^6	10^7	5×10^7	10^8	0.0
2	0.00g	0.00g	0.33fg	1.00efg	1.33ef	0.00g
4	0.00g	1.00efg	1.67e	2.00de	1.67e	0.0g
6	0.33fg	1.67e	1.67e	3.00dd	4.33c	0.0g
8	0.67ef	2.00de	3.00cd	6.33b	8.33a	0.00g
F1 Population(30day)	1.67d	4.00c	5.00c	7.33b	9.67a	0.33e
food remaining 10gm	9.36b	9.53b	9.88a	9.99a	10.00a	8.63c

Values followed by the same letter do not differ significantly from each other at a probability level of 5%.

5. Conclusion

The results of the study of the effect of *B. bassiana* on three species of storehouse insects that the highest killing rates are 100%, which are 100% against Khapra beetle *T. granarium*, 99% against the southern cowpea weevil, *Callosobruchus maculatus*, and 49% against the red rust beetle *Tribolium castaneum*.

Thus, the fungus *Beauveria bassiana* succeeded in preventing and protecting the seeds from losing weight and reducing the damage of insect infestations as much as possible by treating them with the spores of the aforementioned fungus.

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