



Effect of the entomofungus *Beauveria bassiana* on different stages of Angoumois moth *Sitotroga cerealella*

HussamAldin Abdullah Mohammad, Safaa Zakaria Baker , Hind Numan Harhosh
Plant Prot., Agric. College, Baghdad Univ., Iraq

معلومات البحث

تاريخ الاستلام
2017/6/1
تاريخ القبول
2017/10/2

Keywords

Beauveria
bassiana
Sitotroga
cerealella

Abstract

This experiment was conducted in 2016, to investigate the effect of entomofungus *Beauveria bassiana* on different stages of Angoumois moth *Sitotroga cerealella*. The Results showed that eggs hatching percentage was zero % in three concentrations of fungus *Beauveria bassiana*, while in the control treatment was 96%. The average of larval mortality was 16.0 % in the concentration 1×10^6 spore/ml and the lowest percentage Larval mortality was 3.0 % in control treatment. The lowest a verge of pupa emergence was 8.3% in concentration 1×10^6 spore /ml, while heighest in control was 96.3 %.The height mortality of adult percentage in the concentration 1×10^6 spore /ml was 96.6 %, while in control treatment was 16.6 % after 96 hours at the fungus treatment.

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تأثير الفطر الممرض *Beauveria bassiana* على الاطوار المختلفة لعثة الانجوموال *Sitotroga cerealella*

حسام الدين عبد الله محمد ، صفاء زكريا بكر ، هند نعمان حرجوش

المستخلص

في تجربة اجريت عام 2016 في مختبر الدراسات العليا / كلية الزراعة - جامعة بغداد - اوضحت النتائج ان نسبة فقس البيض المعامل بمعلق الفطر *B.bassiana* وبالتركيز الثلاثة بلغت صفر % بينما في معاملة المقارنة بلغت 96% ومعدل القتل لليرقات 16.0% في التركيز 106×1 بوغ / ملتر اما اقل نسبة قتل فكانت في معاملة المقارنة والتي بلغت 3.0%. اقل معدل لخروج البالغات من العذارى المعاملة فكانت 8.3% بالتركيز 106×1 بوغ / ملتر اما اعلى معدل الخروج للعذارى بلغت 96.3% بمعاملة المقارنة . اعلى معدل للقتل بالغات فأن بالتركيز 106×1 بوغ / ملتر فأن 96.6% اما اقل معدل للقتل فأن 16.6% في معاملة المقارنة بعد 96 ساعة في معاملة الفطر

Introduction

The wheat plant *Triticum aestivum* is considered an important crops, its used in human food as bread, biscuits, pastures and many foods spread in the world (Hudson et al. 1981), the wheat consider main food resource of human and domestic animals it has high calorie of carbohydrate and provide for adults more than 50 % from needs of proteins (Al- younis 1993).

Wheat was attacked by many pest caused damage to 55 % from main products in some areas (fornal et al 2007) . from these pests caused damage are

the insects and important once was Angoumois moth *Sitotroga cerealella* it's consider an important insects and widely spread in the world and caused damage to stored seeds (Togola et al. 2010) .

The grain moth attacked the plant in field when it's mature stage and transferred with the infected wheat seeds to stores, its consider primary insects and its attack mainly wheat , barley , Rice , corn , sweet corn , and another stored crops (Howlaider, Matin 2014) . The grain moth belong to order Lepidoptera, the Larvae feed on cereals that consume from and human its causes losses in the

crops about 40% from all stored cereals (Bushra and Astam 2017) .

We know that pesticides caused more damage to environment and non-target organism so the scientists found promising alternative pesticides that less harm to human and friendly ecology (Kaur *et al.* 2011) . The most promising methods used the entomofungus like *Beauveria bassiana* that attack about 100 species from insects, and easy to producing and culturing on many artificial media and forming many conidia in million numbers which infect insects causing diseases called white muscarden so suggestion this fungus to control Angoumois moth in cereal stored. Biological control the use of living organisms parasitoid , predators , pathogen and competitors to suppress pest population below levels that would occur naturally . Biological control programs are intended to suppress invasive through use the entomofungus like *B.bassiana* to control economic insects. This fungus has been attacked about 700 insects in culding Angoumois grain *S.cerealella*

Materials and Methods:

This experiments was Conducted in higher studies laboratory of Entomology in college of agriculture, Baghdad University in the year 2016.

The culture of Angoumois moth was carried from ministry of Science and technology, while the fungus is product from IPM program ministry of agriculture Iraq.

The Culture placed in incubator at 28 ± 2 C° and R.H 70 ± 5 % in all experiment below.

The percentage of fungus spores was 1×10^7 spore /ml , one gram of powdered fungus dissolved in one liter of distilled water stirrer for 10 minutes and

leaved to one hour . pull up one milliliter of fungus suspension and added to test tube contains 9 ml distiller water ,then the concentration was 1×10^6 spore /ml then pull up from this suspension one ml and added to test tube contain 9 ml distilled water then the concentration was 1×10^5 spore / ml then we get a new concentration 1×10^2 spore / ml (Lacey 1997).

Effect of suspension of *B.bassiana* on different stags of Angoumois moth *S.cerealella*

Ten eggs were used 30 eggs as treatment and with three replicates for each treatment. three and control treatment with water only. Spray the eggs with three concentrations 1×10^2 and 1×10^4 and 1×10^6 spore /ml using hand sprayer capacity 100ml from distance 15 cm . then the eggs that put in petridistus (9 cm) were treated by fungus suspension treated eggs placed in petri dishes 9 cm diameter, recorded percentage of mortality of eggs and followed still adult emergence. In the same way treated the first larval instar of Angoumois moth *S. cerelella* with fungus suspension in the same conc. And replication then put the larvae in Petri dish 9 cm and put 5 gram of grindery wheat for feed larvae recording the number of larva mortality daily for 30 days. Then Putin incubators in 28 ± 2 C° and 70 ± 5 % humidity.

Treatment of pupae

Five pupae of *S.cerelella* with three replicate for each treatment, the pupa spray 10 ml of suspension of fungus *B. bassiana* in the three concentrations 1×10^2 , 1×10^4 and 1×10^6 spore /ml while the control spray with water only . the number of dead and alive pupae recorded until became adults .

The adult's treatment

Five pairs of adult (male and female) were taken in the age 24 hours after emergence from pupa sprays in the three conc. of fungus suspension taken 10 ml in hand sprayer the control spray with water only. Every Petri dish added 5 gram of grindery wheat to make adults laying eggs on the cereal. The number of dead and alive of adults recorded for 10 days.

Statically analysis: -

Data were analyzed using SAS program with CRD experiment compared by L.S.D at 0.05 Level (SAS 2012)

Results and Discursions: -

Table (1) refers that percentage of eggs hatching in three concentration of fungus was zero % while in control was 96.0 % the fungus concentration caused mortality to eggs because the shell of eggs is not contain any antifungal material it caused easy penetration the conidia to in egg and the conidia can also penetrate from micropyle.

Navon (2000) stated the shell of insects eggs consisted of many proteins and saccharide and some eggs have one micropyle like diptera insects and another have 35-45 micropyle like locust.

Vincent (2009) found eggs shell consisted of vitelline and its suitable for germination for conidia of *B.bassiana*.

Galim *et al.* (2009) mentioned the effect of conidia fungus *Metarhizium anisopliae* on hatching percentage due to present polar and not polar Lipids in the exolayer of egg shell that cause to germinate conidia of fungus because this material resource of energy to forming the appressorium how make the conidia stable on cuticle then penetrate to egg and feed on egg content.

Mohammd (2007) reported the conidia of fungus *B.bassiana* caused 100 % mortality to eggs of mosquitoes *Culex pipiens* in all concentration used.

Table (1). Effect of suspension of *B.bassiana* on hatching

Treatment	Hatching% of eggs		
	Exposure time(day)		
	2	4	6
Control	10.0	70.0	16.0
1x10 ²	0.0	0.0	0.0
1x10 ⁴	0.0	0.0	0.0
1x10 ¹⁶	0.0	0.0	0.0
LSD 0.05	9.41	9.41	5.43

Effect of suspension of fungus *B.bassiana* on first larval instar of angoumious moth *S.cerealella*

Table (2) show mortality of first instar on grindery wheat when treated in concentration 1x10², 1x10⁴, 1x10⁶, spore /ml the heightpercentage of mortality

with concentration 1×10^6 spore /ml was gave 16.8 % while in concentration 1×10^4 spore /ml was gaved 9.6% in concentration 1×10^2 spore /ml was 4.0 %, the statically found high significant between concentrations and control .

The percentage of distorted Larvae was height in concentration 1×10^6 spore /ml it was 72.2 % while in concentration 1×10^4 spore /ml was 52.2 % the percentage of distorted larvae in control was zero.

The percentage of pupa was in control 69.6% while in concentration 1×10^6 spore /ml was zero % .

The adult , emergence was 48.0 % in control treatment while in 1×10^6 and 1×10^4 spore /ml was zero % . That may be due to that first instar larvae was very sensitive because the cuticle is not tanning and easy to germination tube of conida of fungus to penetrate integument to hymocel by

using digestive enzymes and mechanical pressure on it Results showed that the mortality percentages of the larvae increased with an increased concentration of fungal suspension.

Assaf *et al.* (2011) when studying the fungus *Paecilomyces farinosus* on insect *Melasoma papule* the percentage of mortality to first instar larvae was 95% in concentration 1×10^8 spore /ml. Jasim (2002) when studying fungus *B.bassiana* on *Rhizopertha domonica* found that the efficacy increasing and also mortality when the concentration of fungus increase it was 96,94,84,16 % in concentration 4×10^5 , 3×10^5 , 2×10^5 spore /ml. Elek (1993) say that the height mortality was in the first instar at larvae *Rhizopertha dominica* because it was sensitive to fungi including *B.bassiana*.

Table (2). Effect of fungus suspension of *B. bassiana* on first larval instar of *S. cerealella*

Treatment	%mortality Larvae after treatment	%Distorted larvae	%Forming pupae	% Emergence Adults
Control	3.0	0.0	85	84
1×10^2	4.0	16.8	14.6	7.1
1×10^4	9.6	18.2	6.6	0.0
1×10^6	16.0	19.2	0.0	0.0
L.S.D	4.5	2.73	18.1	11.9

Effect of fungus, suspension in three concentrations 1×10^2 , 1×10^4 , 1×10^6 of *B. bassiana* on pupa of *S.ceralella* .

Table (3) indicats that when was sprayed the suspension of *B.bassiana* the less percentage of emergence of adults was 8.3% in concentration 1×10^6 spore /ml and the same percentage 8.3 % in

concentration 1×10^4 spore /ml while the heiest percentage of emergence in control treatment it was 96.3 %

Albaita (2007) used suspension of fungus *B.bassiana* with concentration 3.4×10^{-6} spore /ml the mortality of pupa was 70% to insect *callsobruchus maculates* .Salih *et al.* (2010) used

suspension of *B.bassiana* in concentration 1×10^{-1} spore /ml to control pupa of *musca domestica* and the mortality was exhibited 36.6 % .

Table (3) Effect of *B.bassiana* concentration 1×10^2 , 1×10^4 , 1×10^6 spore /ml on pupa of *S.cerealella*

Treatment	% Formed pupae	% Emergence Adults
Control	96.3	75.2
1×10^2	47.4	28.3
1×10^4	35.5	8.3
1×10^6	8.3	8.3
L.S.D 0.05	28.6	26.6

Effect of *B.bassiana* concentrations 1×10^2 , 1×10^4 1×10^6 spore /ml on mortality adults *S. cerealella*

The data in table (4) the data in the was significant difference of mortality between three concentration of fungus 1×10^2 , 1×10^4 , 1×10^6 spore /ml it were 43.3 , 56.6 , 70.0 % respectively and also difference found between concentration and control treatment.

After 8 hours the mortality of adults was 63, 73.3 , 83.3 % respectively for three concentration respectively in control treatment was 3.3 % .

After 96 hours the mortality of adults treated with three concentration of fungus *B.bassiana* were 86.6 , 86.6 , 96.6 % respectively while in control was 16.6 % .

Table (4). Effect of *B.bassiana* concentration 1×10^2 , 1×10^4 , 1×10^6 spore /ml on adults *S. cerealella*

Treatment	Adult mortality %		
	Exposure time(hour)		
	24	48	96
Control	3.3	3.3	16.6
1×10^2	34.3	63.3	86.6
1×10^4	56.6	73.3	86.6
1×10^6	70.0	83.3	96.6
L.S.D 0.05	18.8	17.1	10.8

These differences in mortality among different instars may be related to enzymatic activity. It has been reported that the activity of detoxification enzymes varies considerably among and within developmental stages. The activity low in egg stage, increased with each larval instar and then declines to zero at pupation (Ahmad, was 1986; Mullin, 1988). Kaur et al (2011) mentiaed the virulence of *B. bassiana* was tested against second, third and 4th instar larvae of *S. litura* using three concentrations i.e. 2.03×10^8 , 4.03×10^6 and these

1.47×10^5 spores/ml, All treatments resulted in significantly higher mortality than control and ,higher mortality in second instar larvae than third and fourth instar larvae and gave negative effects of fungal infection of *Beauveria bassiana* on growth and development of *Spodoptera litura* resulted in significant reduction in adult emergence ,Likewise, Hafez et al. (1997) documented decrease in emergence of *P. operculella* , from 100 % in control to zero percent at 16.5×10^8 conidia/ml

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