

Evaluation of the Efficacy of *Beauveria bassiana* in Controlling the *Periplaneta Americana* in Iraq

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Abstract

The current study was conducted from the ninth month of the year 2019 to the end of the sixth month of 2020 aiming and evaluating the effectiveness of the fungus *Beauveria bassiana* in controlling the *Periplaneta americana*.

More than 250 samples were collected, and the most of them were collected for the purpose of studying Biology control. The fungus *Beauveria bassiana* was used in the control, where the fungus was used in four different concentrations and kneaded by mixing with water and dilution, where the concentrations were used (0.25×10^7 , 0.5×10^7 , 0.75×10^7 , 1×10^7) and all recorded death rates of 100% in nymphs after the passage of (244,168,120,96) respectively, and in adults, a murder rate was recorded after (244,192,144,120) hours respectively, and there were significant differences in the percentage of homicide between adults and nymphs.

Keywords : *Periplaneta americana*. *Beauveria bassiana* . Cockroaches

Introduction

Cockroaches have survived on Earth for more than 300 million years, almost without change. There are approximately 3,500 species of cockroaches around the world, 50 of them are considered household pests, and the remains of their food secrete foul-smelling secretions in their places, but they are not pests. Therefore, it is dangerous, it is found in abundance near areas where there is often stagnant water or areas where there is usually constant humidity such as toilets, kitchens and sewage, and cockroaches often feed on human faeces, garbage and sewage. Cockroaches cause allergies in children and transmit pathogens such as asthma, diarrhea, leprosy and polio^(1, 2, 3).

The cockroach is one of the most common pests in city environments which is closely related to food that carries and spreads highly antimicrobial bacteria and can act as a vector for many microorganisms that affect public health⁽⁴⁾. Although the cockroach is not the most important vector of disease, but it has a role in transmitting some diseases such as allergies as well as the spread of diseases such as: cholera, leprosy,

dysentery, diarrheal diseases and plague, cockroaches carry filth and pathogens on their legs and bodies and contamination of food upon contact^(5, 6).

The control of cockroach groups depends on the control of insecticides, which are among the oldest methods, such as the use of pyrethroids, organophosphates, organic chlorine, carbamates, and stomach toxins, such as hydramethlone and sulfuramide⁽⁷⁾.

Entomopathogenic fungi has been in use for several years as a biological control tool for many insect pests as alternatives or supplements to chemical pesticides⁽⁸⁾. Among these species is *Beuvara bassiana*, as commercial preparations of this fungus have proven successful in controlling many pests, as insects infect a disease known as White muscardin⁽⁹⁾.

The aims of the current study: -

3- Evaluation of the efficiency of *Beuvara bassiana* in controlling and controlling cockroaches.

Materials and working Methods

Cockroach collection and breeding

Male and female cockroaches were collected from three different areas of the city of Samarra, namely Al-Mu'tasim sub-district, Al-Huwaish district, and the city center of Samarra. 300 cockroaches were collected through the net and hand traps, and by using chemicals to push the cockroach out of the sewage streams, insects were raised and multiplied in plastic containers with dimensions 25 x 40 A poison in which wood structures were placed to accommodate the cockroach in the form of tunnels were covered with a layer of dull cloth⁽¹⁰⁾.

It was placed inside a room in a dark place with the provision of appropriate conditions, from a temperature ranging between 25-45 ° C and a relative humidity of 65-70%. The appropriate note is to change the water and food every ten days to avoid rotting the bread⁽¹¹⁾.

The source of the fungus *B. bassiana*: -

The fungus was obtained from the Ministry of Agriculture / Plant Protection Department, the biotechnology project as a commercial product, and it was used according to the instructions issued by the Department of Prevention by dissolving (5) grams of the powder in a liter of distilled water, after which the dilution process was carried out to concentration by adding distilled water to Main focus (Department of Plant Protection, 2019).

Control of *Periplaneta americana* and nymphs: -

The mushrooms were cultivated on an agricultural medium to ensure the effectiveness of the fungus. Potato agar was used as an agricultural medium for the fungus. Five adult insects were placed in transparent plastic containers and three replications were made. The insects were sprayed with different mushroom concentrations for each container and the concentrations were 0.25 x ⁷10, 0.5 x ⁷10 x 0.75, ⁷10. 1 x ⁷10 spore / ml and with three replicates for each concentration. The control repeater was sprayed with distilled water only. The containers were placed in an incubator at a temperature of 2 ± .28

° C and a relative humidity of 5 ± 70% to maintain the water content of the cockroaches and mushrooms and the cockroach was monitored for a period of ten Days and record results every 12 hours.

Fighting the *Periplaneta americana* Nymphs: -

Five two-week old nymphs were placed in transparent plastic containers. The cockroach was sprayed at 1 concentrations: 0.25 × ⁷10, 0.5 × ⁷10 × 0.75 × ⁷10, 1 × ⁷10 and with three replicates for each concentration. The control repeater was sprayed with distilled water only. The containers were placed in an incubator on A temperature of 2 ± 28 ° C and a relative humidity of 5 ± 70% to maintain the water content of the roach and mushrooms. The insects were monitored for a period of ten days, and the results were recorded every 12 hours.

Microbial control with *B. bassiana* of adults and nymphs *Periplaneta americana*.

The results of Table (1) show that the highest concentration of killing is the concentration 1 × ⁷10, and the lowest concentration in terms of the killing rate is the concentration of 0.25 × ⁷10. The concentration of 1 × ⁷10 gave the highest percentage of killing after passing 48 hours, at a rate of 0 6%, followed by a concentration of 0.75 × ⁷10 spore / ml, at a rate of killing 40%, then a concentration of 0.5 × ⁷10 spore / ml, and the concentrations were recorded at 0.5 × ⁷10.0, 0.75 × ⁷10, 1 × ⁷10 spore / ml, the rate of killing after The passage of 72 hours (80,60,40)%, respectively. After the passage of 96 hours, the concentrations were recorded (0.25 × ⁷10, 0.5 × ⁷10, 0.75 × ⁷10, 1 × ⁷10) spore / ml killing rate (100,80,40,20). %, Respectively, after 120 hours, the two concentrations (0.25 × ⁷10.0, 0.5 × ⁷10) were recorded as a spore / ml killing percentage (80.60)% respectively, and the concentration reached 0.5 × ⁷10 to a 100 killed percentage after 168 hours and the concentration reached 0.25 × ⁷10 spore / ml to 100% killing after 240 hours.

Table(1) of the effects of the fungus *B. bassiana*, whole *Periplaneta americana* nymphs.

	Extract concentration	Time / hour										Average focus
		24	48	72	96	120	144	168	192	216	240	
Beauveria bassiana fung	0.25×710	0.0	20	20	60	60	60	60	60	60	100	16.0 C
	0.5×710	0.0	0.0	20	40	80	80	100				24.0 B
	0.75×710	0.0	40	60	80	100						28.0 A
	1×710	0.0	60	80	100							22.5 B
Average killing for an <i>Periplaneta americana</i> <i>B. bassiana</i>	5.0 f	22.5 cB	38.8 bB	60.0 aA	60.0 aA	0.0 eB	25.0 cA	20.0 dB	0.0 eA	0.0 eA		
Average general killing of an <i>Periplaneta americana</i>	5.0 f	26.3 c	54.4 a	52.5 a	40.0 b	12.5 e	0.0	22.5 B	0.0 g	0.0 g		

* Small horizontally similar letters mean no significant differences between them

* Similar vertically large letters mean no significant differences between them

Table (2) shows the effect of the fungus on *Periplaneta americana* adults in all concentrations, where the highest concentration of 1 x 710 spore / ml was recorded, a 40% killing rate after 48 hours, and a concentration of 0.25 x 710 spore / ml, a 20% killing rate, after 72 hours. The concentrations recorded (0.25 x 710, 0.5 x 710, 0.75 x 710, 1 x 710) spore / ml killed a percentage of (60,60,20.20)%, respectively, but after

96 hours the concentration was recorded (0.5 x 710, 0.75 x 710, 1 x 710) (spore / ml killing rate) 80,80,60%, respectively, but after 120 hours the concentrations were recorded (0.5 x 710, 0.75 x 710, 1 x 710) spore / ml killing percentage) 100, (80.40)%, respectively, and after 144 hours, the two concentrations (0.25 x 710, 0.5 x 710) recorded a spore / ml killing percentage (100,80) respectively, and the concentration reached

Table (2) of the effects of the fungus *B. bassiana*, whole *Periplaneta americana* adults.

	Extract concentration	Time / hour										Average focus
		24	48	72	96	120	144	168	192	216	240	
Beauveria bassiana fung	0.25×10 ⁷	0.0	0.0	20	20	60	60	60	60	60	100	16.0 C
	0.5×10 ⁷	0.0	0.0	20	40	80	80	80	80	100		24.0 B
	0.75×10 ⁷	0.0	20	40	80	80	100					28.0 A
	1×10 ⁷	0.0	40	60	80	100						22.5 B
Average killing for an <i>Periplaneta americana</i> B. bassiana		0.0 eA	0.0 eA	20.0 dB	25.0 cA	0.0 eB	60.0 aA	60.0 aA	38.8 bB	22.5 cB	0.0 eA	
Average general killing of an <i>Periplaneta americana</i>		5.0 f	0.0 g	0.0 g	22.5 d	0.0 g	12.5 e	40.0 b	52.5 a	54.4 a	26.3 c	5.0 f

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* Similar vertically large letters mean no significant differences between them

(0.5 x 10⁷) spore / ml to 100% killing after 192 hours. As for the concentration (0.25 x 10⁷) spore / ml, it reached a 100% killing rate after 240 hours. It was found through the results of the study that the nymphs were more susceptible than the whole insects to the fungus, and this is due to the frequent shedding that causes the nymph to undergo periods of weakness in the Q-layer in the initial stages after moulting, which facilitates the process of penetration by the hepatitis of *B. bassiana*. It was also found that the effect of reducing the concentration of the fungal suspension was significant on the severity of the infection, and that the correlation was positive between the percentage of killing and the concentration of the sporophyte suspensions of the fungus, and the dilution could be considered an important factor in the efficiency of the fungus in eliminating the *Periplaneta americana*.

(12)

The study showed that increasing the duration of exposure is another determinant factor for increasing the efficiency of the fungus so that the spores can grow and begin to penetrate the cockroach's qi and penetrate into the internal tissues of the cockroach, as well as making holes in the q-layer and thus increasing the chance of the cockroach being exposed to water loss, and the direct influence of environmental conditions as a result of exposure to the body wall. To the damage caused by the penetration of the hyacinths of the fungus to the wall of the body. (13)

The results of this study gave clear evidence of the possibility of using the fungus *B. bassiana* in controlling and eliminating the *Periplaneta americana* under specific conditions and times that depend on moderate temperatures and suitable humidity, which is a prerequisite for the control procedure, because the fungus needs specific conditions of temperature and humidity to enable it to activate its efficiency in infestation. The insect and its elimination. (14)

pointed out about the effect of fungi on the life roles of mosquitoes, as the fungus succeeded in controlling mosquitoes as well as succeeding in controlling the spread of malaria.

Conclusions

The possibility of using microbial control to reduce the spread *Periplaneta Americana*.

Fung *B. bassiana* can be used to control the spread of the *Periplaneta Americana*.

Recommendations

Conducting further studies using microbial control to reduce cockroach spread

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

Conflict of Interest: None

Funding: Self-funding

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