EFFICIENCY OF QUICK LIME IS A NATURAL CONTROL BAIT AGAINST *GRYLLOTALPA GRYLLOTALPA*, (ORTHOPTERA: GRYLLIDAE) UNDER LABORATORY AND FIELD CONDITIONS.

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ABSTRACT

Quick lime, *Beauveria bassiana, Metarhisium anisopliae,* and Hostathion were used as poisonous semi-hard cake which contains one of each of above-mentioned materials, sugar can molasses and wheat brain (2: 1: 4) against *Gryllotalpa gryllotalpa* adults under laboratory and field conditions. Quick lime was used at quantity of 1, 1.5and 1.75 kg, Quick lime was the most efficient material against *G. gryllotalpa* after 72 hr. when used at the quantities of 1.75 kg and achieved 95% mortality, followed by Hostathion at the concentration of 1.75 ml/l (80%) and both *M. anisopliae* at the concentration of 1.75 $x10^7$ spores /ml., (79%) and *B. bassian*a at the concentration of 1.75 $x10^7$spores /ml(65%).compared to the control. *M. anisoplia*, *B. bassiana* were applied at the concentrations of $1x10^5$, $1.5x10^6$ and $1.75x10^7$ spores / ml respectively. and Hostathion insecticide was applied at the concentration of 1, 1.5and1.75L Starved adults were exposed to the concentrations of LC_{50} without plants in the laboratory for 24, 48 and 72 hr. Hostathion.q and quick lime also achieved higher mortality (59 and 58%) after 72 hrs. compared with any entomopathogens and Hostathion. In the field trails, *G. gryllotalpa* were exposed to double concentrations of the quick lime, fungal entomopathogen, and Hostathion for 2, 4 and 6 days. Fewer grams of quick lime and Hostathion insecticide semi-hard cake were consumed and achieved higher mortality after 6 days compared with the two other biological agents and the control.

Key words: *Beauveria bassinet, Metarhisium anisopliae,* Hostation, [triazophos], *Anacridium aegyptiu*m

INTRODUCTION:

Gryllotalpa gryllotalpa; is well known as dangerous pest against many crops all over the world **(Arkhipov 1984)** and it was found associated with agricultural crops like, soya bean, cowpea and maize. Since it was difficult to observe these crickets causing damage to the growing seedlings **(Veena; and Bhamrah, 2007)**. *G. Gryllotalpa* is a serious pest of potato, cucumber, carrot, strawberry and other crops in gardens in the USSR **(Arkhipov 1984)**. In Fayoum Governorate, Egypt. 2009 these trials were executed to estimate and evaluate the naturally effect of calcium oxide, *Beauveria bassiana*, and *Metarhizium anisopliae* against the *G. gryllotalpa* adults compared with the chemical insecticide Hostathion [triazophos] to protect our crops from it's sever damage. Efficiency of several pathogenic organisms, natural and chemical materials were previously investigated against *G. Gryllotalpa* insect pest **(Baysal, and Cnar 2007)**. The present work was concerned by evaluation the efficiency of each of the natural material, quick lime, entomopathogenic fungi and the recommended insecticide Hostathion against *G. Gryllotalpa* in the laboratory and field. Quick lime was one of the cheapest natural materials in the Egyptian desert. It was known that

Ca0 reacted with water to produce Ca (OH) 2; oxygen and high energy causes death to the aforementioned insect pest.

MATERIALS AND METHODS

I- Laboratory studies:

A- Stock cultures:

1- *Gryllotalpa gryllotalpa*:

Adults of the *G. gryllotalpa* were collected from heavily invested tomatoes crop and reared in the laboratory on tomato seedlings, 30 days old in pots of 10 cm for three generations according to **(Susan *et al* 1988)** .

2- Entomopathogenic fungi:

The two entomopathogenic fungi, *B. bassiana* and *M. anisopliae* were isolated from naturally infested adults of *G. gryllotalpa*, **(El-Husseini *et al* 2004) and (Sabbour and Sahab 2007).** Serial dilutions were prepared to obtain the desired concentrations.

B. Treatments:

Quick lime bait was used at 1.0, 1.5 and 1.75 kg, each was mixed with sugar can molasses and wheat bran at the rates of (2 L:1L:and 4kg).

B. bassiana and *M. anisopliae*. Were used at $1x10^5$, $1.5x10^6$ and $1.75x10^7$ spores /ml. each was mixed with sugar can molasses and wheat bran at the rates of (2 L:1L:and 4kg).

Hostathion was used at 1.0, 1.5 and 1.75 l. each was mixed with sugar can molasses and wheat bran at the rates of (2 L:1L : and 4kg).

The experiments were carried out on Castle Rock tomato seedlings cultivated in plastic pots of 10 cm.

C. Efficiency tests:

1. Effect of quick lime:

Thirty adults of *G. gryllotalpa* in three equal groups were exposed to24, 48 and 72 hr., Insects, were kept in cages on potted plants provided each with 50 gr. of the poisonous bait each at the ratio of (2 L: 1L: and 4kg).

2. Effect of chosen fungi:

Thirty adults of *G. gryllotalpa* in three equal groups were exposed for 24, 48, and 72hrs. Insects were kept in cages on potted tomato plants and provided each with 50 gr. of one of the previous semi-hard cakes of *M. anisopliae* and *B. bassiana* individually.

3. Effect of Hostathion insecticide:

Thirty adults of *G. gryllotalpa* in three equal groups were exposed for 24, 48, and 72hrs. Insects, were kept in cages on potted tomato plants provided each with 50 gr. Hostathion semi-hard cakes.

New pelleted poisonous semi-hard cakes of Hostathion were prepared by mixing the sub lethal concentration at the ratio of (2: 1: 4) to which *G. gryllotalpa* starved adults were exposed in cages. Daily consumption of these adults was calculated.

The researcher quantified the effects of sub lethal concentration (LC_{50}) of quick lime and other sub lethal concentrations of the microbial organisms and Hostathion insecticide by (EPA) Probit Analysis Program was used for calculating LC/EC values Version 1.5 on a number of *G. gryllotalpa* fitness parameters. New cakes of one of each of the quick lime, entomopathogenic fungi, and Hostation were prepared for estimating the freely consumption of the starved adults of *G. gryllotalpa* for 24, 48 and 72hr, by mixing the sub

lethal concentration at (2: 1: 4) and placed in the cages, each with ten adults of *G. gryllotalpa* as a replicate. Daily consumption of these cakes was calculated.

II-Field trials:

In the field, an area of 175m^2 in Fayoum district was equally divided into three replicates as control for each treatment. Each has four beds (1x1m). three doubled concentrations of each tested material were used as follows; quick lime pelleted semi-hard cakes was (2, 3 and 3.5 kg), *M. anisopliaee* and *B. bassiana* ($2x10^5$, $3x10^6$ and $3.5 x 10^7$) and Hostathion at 2, 3 and 3.5/L. The control was untreated and distributed randomly. The beds were transplanted by castle rock tomato from Peto Seed Co. Each bed was planted on both sides at distances of 10 cm and covered by black shade netting. Ten adults of *G. gryllotalpa* were exposed per bed. Semi-hard cake of the mixture of the quick lime and molasses were applied on the beds at distances of ten cm. Each of the other mixtures; entomopathogenic fungi and the Hostathion pesticide, were applied on beds. The field of this trial was inspected after 2, 4 and 6 days of treatment. Dead adults of *G. gryllotalpa* were collected in paper bags and counted.

III-Statistical analysis

The data were analyzed using Probit analysis **(Finny, 1952).** LC_{50} values were estimated for treatments. Analysis of variance (ANOVA) and LSD values were obtained at 0.05 level, using SAS program **(SAS Institute, 1988)**. Statistical calculation was done through SPSS 11 for windows computer program to determine the Correlation and Regression Co-Efficient (r).

RESULTS AND DISCUSSION

A - Efficiency of quick lime bait:

As shown in Table (1) and Figs. (1,2 and 3), death rate of *G. gryllotalpa* adults after 24, hr were 70, 75 and 80% upon exposure to bait at the concentrations of 1, 1.5, and 1.75 kg. of the quick lime, respectively, with the consumption of 30.0, 27.5 and 22.7 gr. After 48, hr .the death rates were 72, 78 and 84 %.with reductive consumption of 32.1, 30.0 and 25.1 gr. After72 hr. these rates increased to 83, 88 and 95% with the consumption of 32.5, 33.2 and 29.1 grams of the bait. Adults consumed 44.0, 44.8 and 46.0 grams of the bait in the control after 24, 48 and 72 hr, respectively, with 0 % death rates . Calculated LC_{50} was 374.2, 428.5 and 398.5 after 24, 48 and 72hr, respectively.

On the other hand, the obtained results in Table 2. Indicated that the death rates of *G. gryllotalpa* adults after 24, hr were 32, 44 and 53% upon exposure to bait at the concentrations of (LC_{50}) of the quick lime at 1.0, 1.5,1.75kg., respectively, with the consumption of 75.5. 70.2 and 65.5 gr. After 48, hr. the death rates were 35, 46 and 54 %.with reductive consumption of 84.2, 80.0 and 75.4 gr. After72 hr. these rates increased to 43, 47 and 58 % with the consumption of 88.5, 85.2 and 80.5 grams of the bait. Adults death rate were 0 % in the control and consumed 89.6, 90.0 and 92.5 grams of the bait in 24, 48 and 72 hr, respectively.

B- Efficiency of Beauveria bait:

Table (1) and figs (1, 2 and 3): showed that the death rate of *G. gryllotalpa* adults after 24, hr. were 46, 52 and 58 % upon exposure to bait at the concentrations of $1x10^5$, $1.5x10^6$, and $1.75x10^7$ spores/ml. of *Beauveria bassiana* respectively, with the consumption of 32.2, 33.2 and 34.3 gr. After

48, hr. the death rates were 53, 57 and 59 %.with consumption of 33.2, 34.2 and 35.5 gr. After 72 hr. These rates increased to 57, 59 and 65 % with the consumption of 34.2, 36.3 and 36.5 grams of the bait, while adults death rate were 0 % in the control and the consumed baits were 44.0, 44.8 and 46.0 grams in 24, 48 and 72 hr, respectively,. Calculated LC_{50} was $5x10^5$, $8x10^3$and $3x10^3$ after 24, 48 and 72hr, respectively.

However, the death rate of *G. gryllotalpa* adults after 24, hr were 23, 25 and 37 % upon exposure to bait at the concentrations of LC_{50} of $1x10^5$, $1.5x10^6$, and $1.75x10^7$ spores/ml. of *Beauveria bassiana* respectively, with the consumption of 77.4, 79.2 and 80.4 gr. After 48, hr. the death rates were 26, 35 and 41 %.with consumption of 85.4, 86.5 and 87.9 gr. After72 hr. these rates increased to 35, 46 and 52 % with the consumption of 89.5, 87.2 and 89.0 grams of the bait while the adults death rate were 0 % in the control and the consumed bait were 89.4, 90.4 and 95.5 grams in 24, 48 and 72 hr, Table. 2., respectively.

C- <u>Efficiency of Metarhizium bait</u>:

Death rate, of *G. gryllotalpa* adults after 24, hr were 52, 62 and 65 % upon exposure to bait concentrations of $1x10^5$, $1.5x10^6$, and $1.75x10^7$ spores / ml of *Metarhizium anisopliae*, respectively, with the consumption of 31.1. 32.6 and 33.1 gr. After 48, hr. the death rates were 61, 64 and 70 %.with reduced consumption of 32.1, 32.6 and 33.9 gr. After72 hr. these rates increased to 69, 71 and 79 % with the consumption of 33.5, 34.3 and 35.0 grams of the bait. Adults in the control consumed 44.0, 44.8 and 46 grams of the bait in 24, 48 and 72 hr, respectively, with 0 % death rate in the control. Calculated LC_{50} values (Table 1) were $3\ x10^4$, $6\ x10^2$ and $9x10^1$ after 24, 48 and 72hr, Table 1. respectively.

Death rate of *G. gryllotalpa* adults after 24, hr were 29, 41and 45 % upon exposure to bait at the concentrations of LC_{50} of $1x10^5$, $1.5x10^6$, and $1.75x10^7$ spores / ml of *Metarhizium anisopliae*, respectively, with the consumption of 77.0. 77.8 and 78.6 gr. After 48, hr. the death rates were 32, 45 and 46 %.with increased consumption of 82.2, 80.6 and 85.2 gr. After72 hr. these rates increased to 42, 47 and 54 % with the consumption of 86.5, 85.1 and 88.0 grams of the bait. Adults were 0 % in the control consumed 89.9, 90.2. and 94.8 grams of the bait in 24, 48 and 72 hr, respectively, with 0.0 % death in the control, Table 2. respectively.

B- <u>Efficiency of Hostathion bait</u>:

Death rate of *G. gryllotalpa* adults after 24, hr were 56, 61 and 67% upon exposure to bait at the concentrations of 1.0 L, 1.5L, and 1.75L. ml of Hostathion, respectively, with the consumption of 31.0. 32.3 and 32.7 gr. After 48, hr. the death rates were 63, 66 and 73 %.with increased consumption of 32.5, 33.4 and 33.8 gr. After72 hr. these rates increased to 71, 77 and 80 % with the consumption of 33.5, 33.8 and 34.5 grams of the bait. Adults consumed 44.0, 44.8 and 46.0 grams of the bait in 24, 48 and 72 hr, respectively, with 0 % death rate in the control. Calculated LC_{50} were 917.4, 505.1 and 359.3 ml. after 24, 48 and 72hr, Table 1.respectively.

Death rate of *G. gryllotalpa* adults after 24, hr was 30, 43 and 47% upon exposure to bait at the concentrations of LC_{50} of 1.0 L, 1.5L, and 1.75L. ml of Hostathion, respectively, with the consumption of 75.1, 75.5 and 75.0 gr. After 48, hr. the death rates were 32, 46 and 53 %.with consumption of 78.4, 77.5 and 80.3.8 gr. After72 hr. these rates increased to 44, 50 and 59 % with the consumption of 80.6, 80.0 and 82.8 grams of the bait. Adults death rate

were 0 % in the control and consumed 89.2, 91.2 and 95.4 grams of the bait in 24, 48 and 72 hr, with 0.0% death in the control, Table 2. respectively.

D- Field application effects:

Quick lime bait:

Table (3) and figs (4, 5 and 6) shows that death rate of *G. gryllotalpa* adults after 2 days were 55, 57 and 60 % upon exposure to bait at the concentrations of the quick lime at the concentration 2.0, 3.0, and 3.5kg., respectively. After 4 days the death rates were 59, 61 and 65%. After 6 days these rates increased to 60, 68 and 75 % while Adults death rates were 0.0 in the control.

Beauveria bait:

On the other hand, the death rate of *G. gryllotalpa* adults after 2 days were 25, 27 and 30 % upon exposure to bait at the concentrations of the *B. bassiana* at the concentration $2x10^5$, $3x10^6$, and $3.5x10^7$ spores/ml., respectively. After 4 days the death rates were 46, 50 and 53 %. After 6 days these rates increased to 48, 53 and 60 % while Adults death rates were 0 % in the control.

Metahizium bait:

Death rate of *G. gryllotalpa* adults after 2 days were 45, 48 and 52 % upon exposure to bait at the concentrations of the *M.anisopliae* at the concentration $2x10^5$, $3x10^6$, and $3.5x10^7$ spores / ml., respectively. After 4 days the death rates were 52, 60 and 60 %. After 6 days these rates increased to 57, 63 and 65 % while Adults death rates were 0 % in the control.

Hostathion bait:

Death rate of *G. gryllotalpa* adults after 2 days were 57, 59 and 65 % upon exposure to bait at the concentrations of the Hostathion at the concentration 2, 3, and 3.5 l. respectively. After 4 days the death rates were 57, 59 and 65 %. After 6 days these rates increased to 60, 64 and 68 % while Adults death rates were 0 % in the control.

Statistical analysis of the obtained data showed significant differences in reducing *G. gryllotalpa* at different concentrations of quick lime, the entomopathogens and the chemical insecticide compared with the untreated control.

Obtained results agree with the findings of Rosa and Alian 2004 who reported that *Beauveria bassiana* is cosmopolitan and opportunistic pathogenic fungus to many insect species and produces a wide variety of toxic compounds such as Beauvericin and Bassianolid.

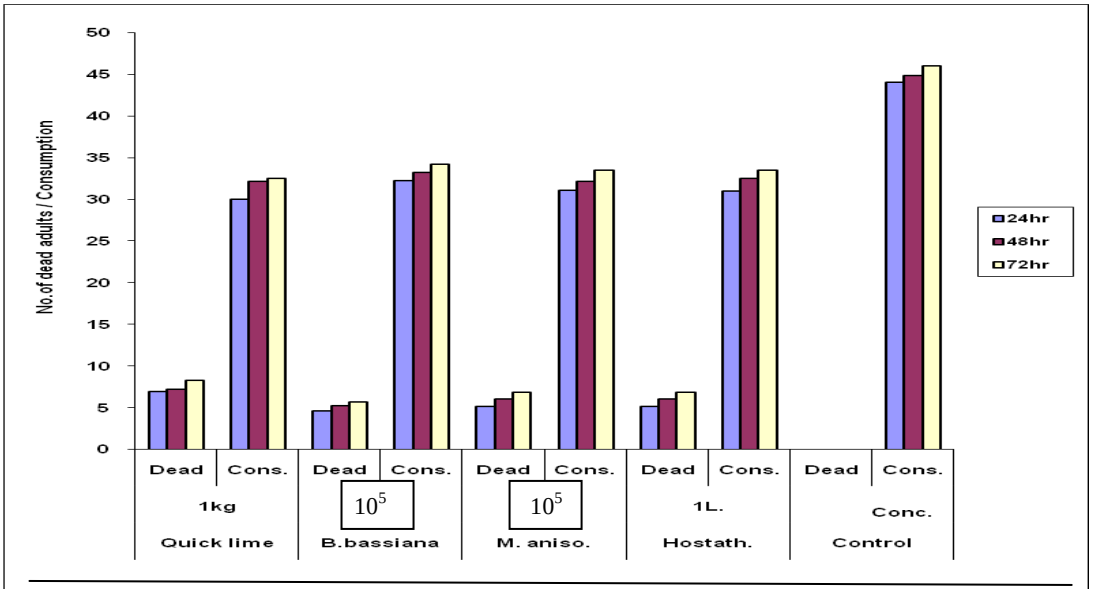
Feng *et al* 1994 found that one such agent is the naturally occurring soil fungus, *Beauveria bassiana* (Balsamo)Vuillemin, which is pathogenic to over 200 species of insects. Much of the success of this entomopathogenic fungus relies on its persistence in the microenvironment in which the pest is found and adequate host targeting by a specific strain **Inglis *et al*. 1997**.

Amitava and Santanupaul 2005 assessed the efficacy of some granular insecticides and biopesticides against mole cricket, *Gryllotalpa* spp on potato cv. reported that the soil insecticides phorate 10G at 15 kg/ha, endosulfan 4G at 1.5 kg/ha, chlorpyriphos [chlorpyrifos] 10G at 0.5 kg/ha and carbaryl 5G at 1.0 kg/ha, and spraying the biopesticides *Metarhizium anisopliae* at 1.8×10^9 spore count per ml per 50 g/ha and *Beauveria bassiana* at 10^8 spore count per 1000 g/ha. Soil insecticides were effective followed by *Metarhizium anisopliae* and *Beauveria bassiana* over the control.

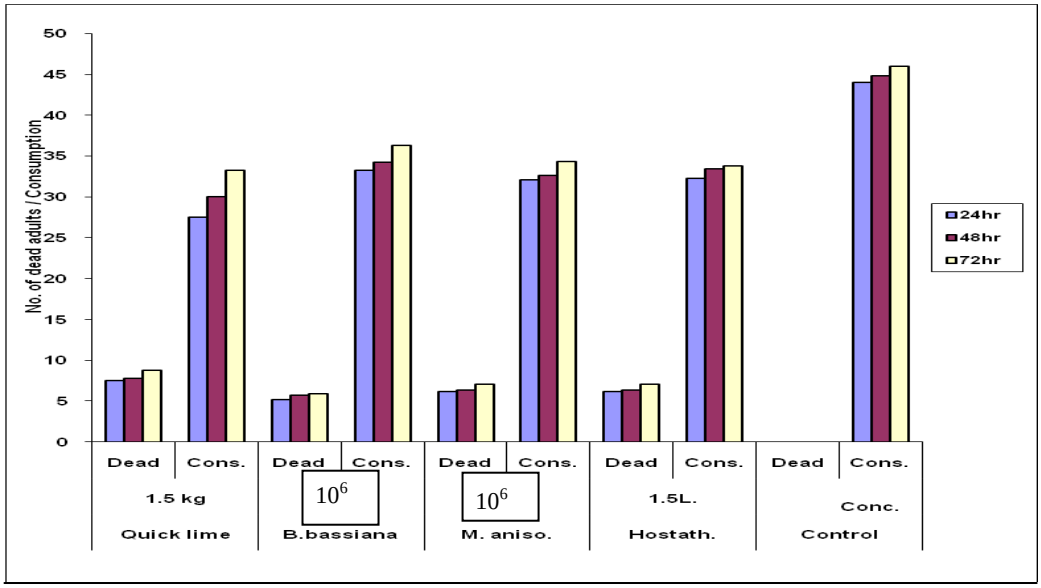
Sarah Rachel and Thompson 2003 reported that although many different chemicals have proven moderately successful in reducing mole cricket damage, they cannot be employed without concerns over the costs and potential environmental impacts. Due to these oil habitat of mole crickets, higher doses and repeated applications of treatments are often needed to achieve acceptable levels of control.

Quick lime was used for the first time is an efficient bait for controlling the abovementioned insect pest. Hostathion insecticide was used as bait in controlling *G. gryllotalpa* **Youssef 1997**, but its persistency polluted the soil for long time after spraying and appeared lower effect compared with quick lime. Therefore, Quick lime and Hostathion *B.bassiana*, *M anisopliae* achieved higher mortality after 72hr in the laboratory and 6 days in the field. Furthermore, quick lime was safety and cheap for the farmers in controlling *G. gryllotalpa.*

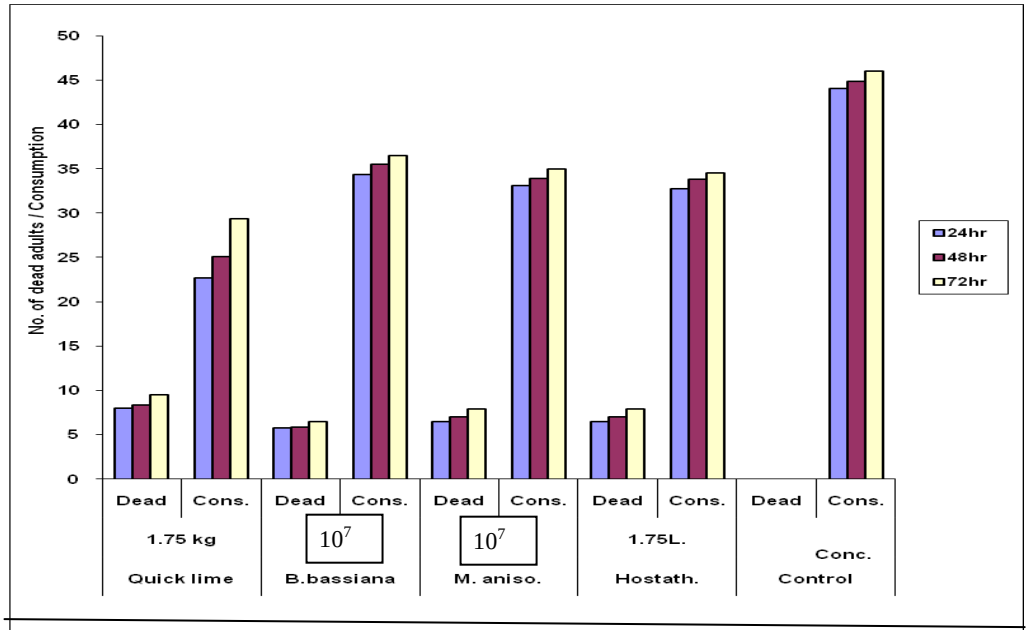
Statistical analysis shows that the correlation and regression co-efficient were(r =0.9).



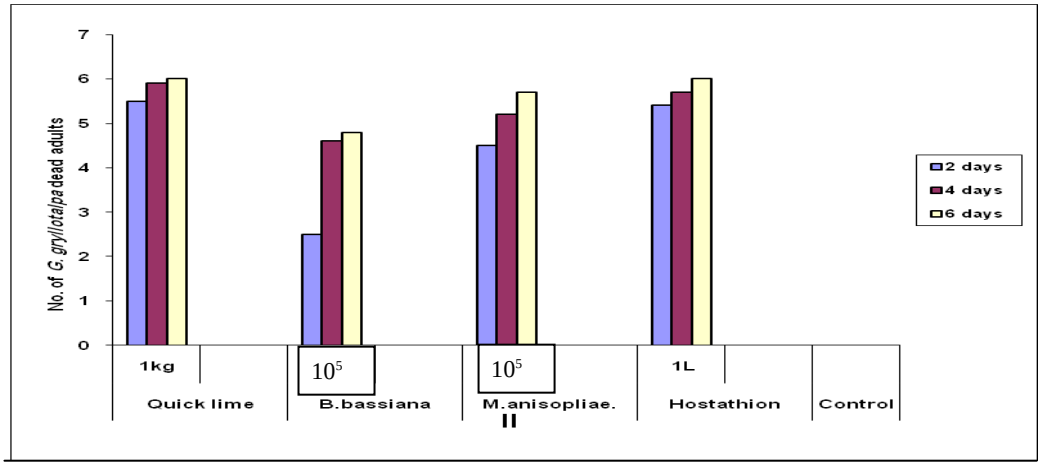
Figs (1): Potency of quick lime, *M. anisopliae*, *B* .bassiana and Hostathion on *G. gryllotalpa* adults in the laboratory.



Figs (2): Potency of quick lime, *M. anisopliae*, *B* .bassiana and Hostathion on *G. gryllotalpa* adults in the laboratory.



Figs (3): Potency of quick lime, *M. anisopliae*, *B* .bassiana and Hostathion on. *G. gryllotalpa* adults in the laboratory.



Figs (4): Consumed of the poisonous semi hard cake in grams of quick lime, *M anisopliae*, *B.bassiana* and Hostathion against adults of *G. gryllotalpa*, in the field.

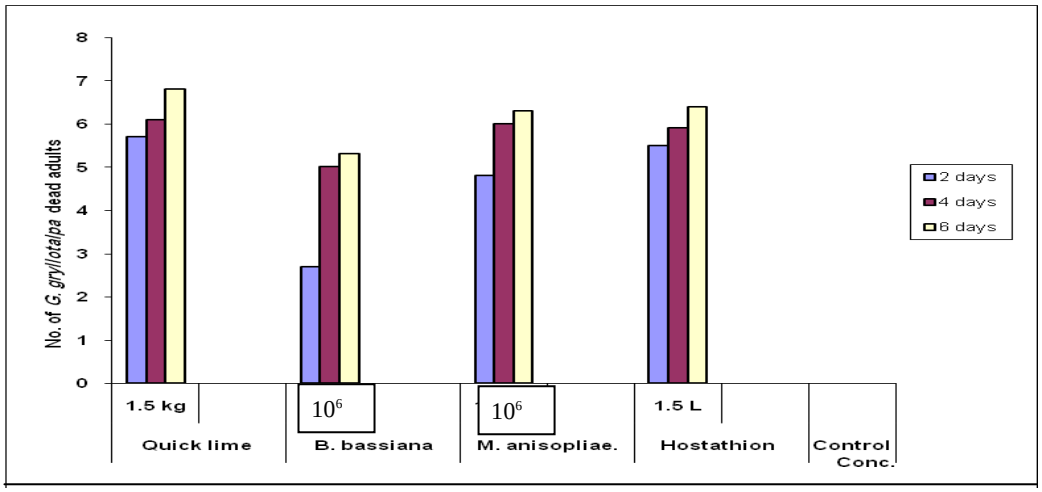


Fig (5): Consumed of the poisonous semi hard cake in grams of quick lime *B. bassiana*, *M anisopliae*, and Hostathion against adults of *G. gryllotalpa* ,in the field.

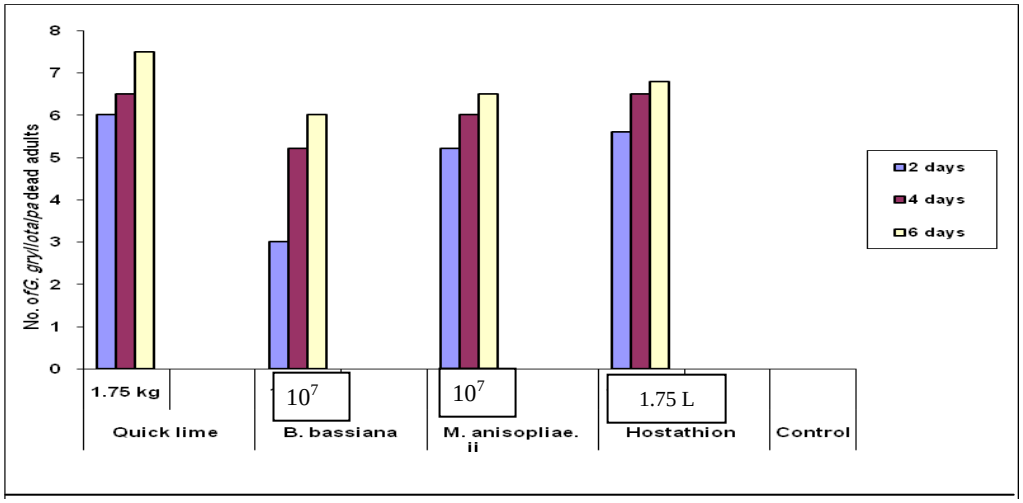


Fig (6): Consumed of the poisonous semi hard cake in grams of quick lime, *M anisopliae*, *B .bassiana* and Hostathion against adults of *G. gryllotalpa* ,in the field.

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تأثير طعم الجير الحي كمادة طبيعية في مقاومة الطور الكامل للحفار معمليا وحقليا

سيد محمد مصطفي الجارحي

معهد بحوث وقاية النبات- مركز البحوث الزراعية – الدقي – جيزة

نهدف هذه الدراسة إلي أستخدام مادة طبيعية وهي الجير الحي والذى عند تفاعله مع الماء الموجود بالمعدة لحشرة *Gryllotalpa gryllotalpa.* الذي ينتج عنه طاقة كبيرة تؤدى إلي موت الطور الكامل للحشرة حيث تم استخدامه بكميات (١و ١.٥ و ١.٧٥ كج) مقارنة بالممرضان الذان تم فصلهما من من الطور السالف الذكر وهما *Beauveria bassiana* و *Metarhizium anisopliae* حيث استخدما بتركيزات١٠x ^{٥} و١.٥ x ١٠ ^{٦} و١.٧٥ x١٠ ^{٧} كونيديا / مل وجراثيم/ مل علي الترتيب مقارنة بالمبيد الكيماوي هوستاثيون بتركيزات (١و ١.٥ و ١.٧٥ لتر) بالإضافة إلي الكونترول. لقد تم تحضير كعكة من خليط كل من أحد هذه المواد السابقة مع مولاس قصب السكر والردة بنسبة (٢ :١: ٤) علي الترتيب حيث تم وضعها في أصص بها نباتات الطماطم في المعمل لمدة ٢٤ و ٤٨ و ٧٢ ساعة حيث تم التعرف علي كمية المادة المستهلكة من خليط كل كعكة علي حدة.

دلت النتائج علي أن المادة المستهلكة من كل من عجينة الجير الحي وعجينة المبيد كانت أقل وأحدثت نسبة عالية في القتل مقارنة بمخلوط الجراثيم لفطر *B. bassiana* وفطر *M. anisopleiae* . دلت النتائج علي أن الاعداد المقتولة في عجينة الجير الحي بعد تعريض الطور السالف الذكر لمدة ٢٤ و ٤٨ و ٧٢ ساعة للثلاثة بتركيزات (١.٠ و ١.٥ و١.٧٥ كجم) كانت أعلي من كل من الممرضان والمبيد الكيماوي حيث كانت النسبة المئوية للأعداد المقتولة بعد مرور ٧٢ ساعة عند تركيز ١.٧٥ kg هي ٩٥ و ٦٥ و٧٩ % للممرضان و٨٠ % طور للمبيد الكيماوي هوستاثيون وكانت الكميات المستهلكة من العجينة هي ٢٩.١ و ٣٦.٥ و ٣٥.٠ و ٣٤.٥ جرامات علي الترتيب بينما كانت الكميات المستهلكة في الكونترول هي ٤٦.٠ جرامات علي الترتيب بينما كانت النسبة المئوية للأعداد المقتولة الأعداد المقتولة في الكونترول (صفر) طور.

كما أظهرت النتائج أيضا أن الأعداد المقتولة في عجينة *M. anisopliae* بعد مرور ٧٢ ساعة عند تركيز ١٠ ^{٧} كانت أكبر من نظيرتها في عجينة *B. bassiana* عند نفس التركيز وأيصا في التغذية المطلقة للطور الكامل بعد التجويع لمدة ٢٤ ساعة علي العجينة فقط وكذلك في الدراسات الحقلية مقارنة بالكونترول.