



EFFICIENCY OF TWO ISOLATES OF THE FUNGUS *LECANICILLIUM LECANII* AND THE FUNGUS *BEAUVERIA BASSIANA* AGAINST ORIENTAL YELLOW SCALE *AONIDIELLA ORIENTALIS* IN LABORATORY AND FIELD

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Abstract

The percentage of mortality for crawlers (nymphs) stage of oriental yellow scale *Aonidiella orientalis* when using korea isolates and local isolates of the entomofungus *Lecanicillium lecanii* was 91.2 and 83.4%, while was 77.5% of local isolates of the fungus *Beauveria bassiana* after 7 days of treatment. The mortality of adults stage was 78.3, 69.8 and 61.5% for the korea and local isolates of *L. lecanii* and *B. bassiana* respectively for the same period. The mortality for korea isolates *L. lecanii* in concentration 1×10^9 spore/pore 1ML/ml + summer mineral oil (Nautilus) after 3, 5, 7 and 21 days of treatment in the field test on crawlers stage was 85.1, 89.5, 93.1 and 97.5% respectively. On the other hand the mortality for adults stage in same concentration and isolates was 74.6, 81.8, 86.3 and 90.6% respectively. when using *B. bassiana* + summer mineral oil the mortality crawlers stage, the results were 73.7, 80.3, 85.6 and 94.4 % respectively, while it was 66.2, 75.4, 80.2 and 86.4% respectively in adults stage.

Key words: *Aonidiella orientalis*, two isolates *L. lecanii*, *B. bassiana*, pathogenic effect.

Introduction

Citrus considered an important fruit trees in the world, it's have high value of carbohydrate and organic acid especially citric acid and amino acid and it was rich in vitamin C, B and A. And another beneficial Compounds to human. Citrus trees attacked by many pests like insects and plant pathology and nematode. Bodenheimer, (1951) recorded about 100 species of pests that attacked citrus trees in medial east regions included Iraq, the pests, scale insects, Mealy bugs, aphid, Mediterranean fruit fly, white fly and some species of mites. Ebeling, (1959) collect about 875 species of insects attacked citrus trees in the world about 72 species consider key pests. An important insects was oriental yellow scale *Aonidiella orientalis* it's consume many plants as hosts the adult and nymph, first stage and second stages crawlers feed by sucking sap of plant and then the plant tissue became damage and spot of leaf and fruit and became dropped and causes many damage and plant diseases (Watson and Williams, 1988). So that some researchers use Biological control to control this pest's especially microbial control. They

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use Entomopathogenic fungi like *Beauveria bassiana* and *Lecanicillium lecanii* to control scale insects. Zhang, (2004) found the fungus *L. lecanii* causes many diseases for group coccids. Flaih, (2007) say that the fungus *B. bassiana* was effective on oriental yellow scale insects *A. orientalis* the mortality was 60 and 85% in crawlers stage in Iraq. While AL-hamdany, (2012) found that the fungus *B. bassiana* caused mortality 83% to white scale insect *Plarotoria blanchardi* on date palm trees in Iraq. AL- Ani, (2015) used two isolates of *L. lecanii* on white scale insect *Plarotoria blanchardi* from eggs to adults stage in the concentration 1×10^8 spore / ml. The mortality was 93.4% after 14 days of spraying the Korea isolates and 90.7% for Local isolates of fungus. Some researchers use summer mineral oils to control scale insects. Soylu, (1980) used the oils opron and porkan on white fly of citrus *Dialeurodes citri* and it was effective on its. Grafton - Gardweel and Reagan, (1995) use mineral oil (Sunspray 6EC) in concentration 1.2% was effective on crawlers stage of Armored scale during May and June and the mortality was 57.0%. AL- jassany *et al.*, (2000) used summer oils (semerol) to control *A.orientalis* on citrus trees in spring the mortality was 85.0% to crawlers

stage. So we used the summer oils with the entomofungus to increase effectiveness.

Material and Methods

A Survey was done in citrus orchard in Selman-back region Baghdad Iraq in 2018-2019 to collected the dead insects of oriental yellow scale *A. orientalis* to know the caused against dead of insect. The mortality caused by fungus *Beauveria bassiana* and *Lecanicillium lecanii* isolates in laboratory. And used Koch postulates then proof the two fungus caused the mortality and control with korea isolates from Korea company Korea - Bio. Growth the isolates on potato dextrose Agar (PDA) and used two Concentration for each fungus the korean isolates 1×10^7 and 1×10^9 spore / ml. And local isolates 1×10^7 and 1×10^9 spore / ml for fungus *L. lecanii* and the fungus *B. bassiana* 1×10^7 and 1×10^9 spore / ml. Spraying the fungi of crawlers and adult stage by hand sprayer. The results corrected (Abbott's Formula, 1925). We used 10 insects for three replicate to each treatment of fungus and control spread with water only. The puts the treated leaves of citrus in incubator under $25 \pm 2^\circ\text{C}$ the results recorded after (3, 5, 7 days) from treatment and recorded percentage of mortality. The high Concentration 1×10^9 spore / ml for each fungus used in the field test. We selects then trees of citrus infected with oriental yellow scale *A. orientalis* in Baghdad then sprayed in of the fungi with summer mineral oil (Nautilus) in Concentration (12) ml for 6 Ltr. as:

1. Fungus *L. lecanii* 1×10^9 spore/ml+summer oil (12 ml).
2. Fungus *B. bassiana* 1×10^9 spore/ml+summer oil (12 ml).

As 6 Liter for each treatment for three replicate. For each isolates and the control sprayed with water only, the percentage mortality recorded after (3,7,14 & 21 days) from treatment the results corrected with Abbott's Formula, (1925).

Results and Discussion

Table 1, showed that korean isolates is better the local isolates. The average mortality % in 3, 5 and 7 days was 62.8, 75.4 and 91.1% of Korean isolates while the local isolates was 53.5, 66.1 and 83.2% respective in crawlers stage. While the average mortality % in of the *B. Bassiana* was 45.1, 57.8 and 77.4% in 3, 5 and 7 days. It was significant between the treatment and the isolates and Concentration. Chen *et al.*, (2012) used the fungus *L. lecanii* in the Concentration 1.4×10^4 to 1.4×10^8 on crawlers fig scale *Eriococcus tokaedae* Kuwanon the was 45.7% for the Concentration 1.4×10^4 spore / ml when they used the fungus isolates from dead insects. The mortality higher and it be 84.1% in the same Concentration.

The results at table 2, indicate highest mortality % of adults was 83.4% after 7 days in korea isolate of the fungus *L. lecanii* in conc. 1×10^9 spore / ml while local

Table 1: The percentage Mortality % of different isolates of the fungus *L. lecanii* and the fungus *B. bassiana* on crawlers stage of oriental yellow scale *A. orientalis* in laboratory.

Mortality %			Conc. spore / ml	Type isolate
Period in days after treatment				
7	5	3		
84.1	66.2	54.6	1×10^7	<i>L. lecanii</i>
97.5	83.2	71.3	1×10^9	Korean
91.2	75.4	62.8	Average	
79.2	59.4	51.0	1×10^7	<i>L. lecanii</i>
85.4	72.4	55.1	1×10^9	Local
83.4	66.1	53.5	Average	
75.2	53.5	40.8	1×10^7	<i>B.</i>
80.1	62.6	49.1	1×10^9	<i>bassiana</i>
77.5	57.8	45.1	Average	
Between Treatments 7.3*; Between Concentration 6.9*; Between periods 11.6*; Between Treatments and Concentration 4.5*; Between periods and Concentration 6.3*; Between Treatments and periods 8.2*; interaction between Treatments and Concentration and periods 8.5*.				L.S.D. values

isolates of *L. lecanii* was 74.1% in conc. 1×10^9 spore / ml in the fungus *B. bassiana* was 64.1% in same Concentration after 7 days of treatment. AL-Hamdany, (2012) found the mortality % of White scale insect the *Plarotoria blanchardi* when he used the fungus *B. bassiana* was 83.0%. AL-Ani, (2015) say that the mortality % of adult of *Plarotoria blanchardi* was 95.2 and 97.4% of two isolate korea and local isolates from fungus *L. lecanii*.

Table 2: The percentage Mortality % of adults stage of oriental yellow scale *A. orientalis* spraying in different Concentration of the fungus *L. lecanii* and the fungus *B. bassiana* in laboratory.

Mortality %			Conc. spore / ml	Type isolate
Period in days after treatment				
7	5	3		
73.2	55.4	36.4	1×10^7	<i>L. lecanii</i>
83.4	61.5	50.8	1×10^9	Korean
78.3	58.4	44.5	Average	
65.6	41.2	33.2	1×10^7	<i>L. lecanii</i>
74.1	53.2	40.4	1×10^9	Local
69.8	47.2	36.8	Average	
59.2	48.2	26.7	1×10^7	<i>B.</i>
64.1	53.6	31.2	1×10^9	<i>bassiana</i>
61.5	50.9	29.9	Average	
Between Treatments 8.1*; Between Concentration 6.7*; Between periods 13.2*; Between Treatments and Concentration 7.8*; Between periods and Concentration 8.6*; Between Treatments and periods 5.2*; interaction between Treatments and Concentration and periods 10.2*.				L.S.D. values

Table 3: The percentage Mortality % of the crawlers stags of oriental yellow scale *A. orientalis* used the fungus *L. lecanii* and the fungus *B. bassiana* with summer oil in the field.

Efficiency %				Conc. spore / ml	Type isolate
Period in days after spraying					
21	7	5	3		
97.5	93.1	89.5	85.1	1×10 ⁹ + summer oil	<i>L. lecanii</i> Korean
94.4	85.6	80.3	73.7	1×10 ⁹ + summer oil	<i>B. bassiana</i>
Between Treatments 4.6*; Between periods 5.8*; interaction between Treatments and periods 7.2*.					L.S.D. values

Table 3, indicate that the percentage mortality % of crawlers of oriental yellow scale *A. orientalis* was increased it was 85.1 and 73.7% after 3 days of treatment its increased to 89.5% and 80.3% after 7 days in Concentration 1×10⁹ spore / ml to the isolates *L. canii* and *B. bassiana* respectively. Alves and Bateman, (2000) say that when used summer oil with fungus to spore of fungus must be effective to long time than when never used. Easwaramoorthy and Jayaraj, (1978) say that the fungus *L. lecanii* was effective when used oils with the fungus and the mortality was 97.6% to control scale insect *Coccus viridis* on coffee plants. In the table 3 show that mortality % of crawlers was 97.5% in the fungus *L. lecanii* and it was 94.4% in the fungus *B. bassiana* after 21 days of treatment in same Concentration 1×10⁹ spore / ml it was significant between the treatment and the isolates and Concentration.

In the table 4, observed that the percentage mortality % of adults of oriental yellow scale *A. orientalis* was increased in days of treatment it was 74.6, 81.8, 86.3 and 90.6% in day 3, 7, 14 and 21 days after treatment by the fungs *L. lecanii*. And it was 66.2, 75.4, 80.2 and 86.4% in day 3, 7, 14 and 21 days after treatment by the fungs *B. bassiana*. Cannard *et al.*, (2002) use sex isolates of *B. bassiana* and *Metarhizium anisopliae* on citrus mealy bugs *Planococcus citri* the mortality was increased to 93.3% when used mineral oil with the fungi.

Table 4: The percentage Mortality % of the fungus *L. lecanii* and the fungus *B. bassiana* with summer oil on adults stage of oriental yellow scale *A. orientalis* in the field.

Efficiency %				Conc. spore / ml	Type isolate
Period in days after spraying					
21	7	5	3		
90.6	86.3	81.8	74.6	1×10 ⁹ + summer oil	<i>L. lecanii</i> Korean
86.4	80.2	75.4	66.2	1×10 ⁹ + summer oil	<i>B. bassiana</i>
Between Treatments 3.7*; Between periods 4.9*; interaction between Treatments and periods 7.8*.					L.S.D. values

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