Evaluation of the effectiveness of some pesticides and bioagents against Parlatoria date scale

*Parlatoria blanchardi* Targ (Homoptera: Diaspididae) on date palm *Phoenix dactylifera*

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Abstract

This study conducted to evaluate the effectiveness of some pesticides and Entomopathogenic fungi *Beauveria bassiana* (Naturalis-L) and Entomopathogenic bacteria *Bacillus thuringienesis* (Antario KAB) in different methods (irrigation, injection and spray) against *Parlatoria blanchardi* Targ on date palm in Ghammas /Al-Shamiya District/ Al-Qādisiyah Governorate/ Iraq during agriculture season 2019-2020. The results showed that the pesticide TIAM 25% WG was more significant than other chemical pesticides in mortality of *P. blanchardi* which reached to 69.34 % when was using in spray method. However, the results of using mixed pesticide with bioagent showed that the treatment TIAM 25% WG + *B. bassiana* sprayed on data palm in the field significantly different from other treatment, which reached 78.56% in average and the mortality was 82.40 after 7 days of treatment.

Keywords: *Parlatoria blanchardi*, *Beauveria bassiana*, *Bacillus thuringienesis*

1. Introduction

It is believed that Iraq is the origin and the birthplace of the data palm tree *Phoenix dactylifera* about 5,000 years ago and it was important food historical value [1]. Iraq produced about 432,000 tons of dates from nearly 8 million trees in 2006 [2], whereas produced about 440,000 tons of dates in 2007, most of it for export [3]. It is distributed in many countries around the world including dry and sub-humid countries, but the Arab countries have more than 75% of the global production of dates is in 2008; about 40% of dates produced in Gulf countries (including Iraq) and about 35% is in North Africa countries, such as Egypt and Sudan [4]. Iraq was the top of producer dates palm 1960s worldwide, but due to ecosystems, pests and environmental conditions, Iraq was backed to 9 top of produces around the world and loss a few millions of palm trees [5]. For example, Iraq produced about (618.8, 646.1 and 639.3 tones/year) in 2017, 2018 and 2019, respectively [6]. Also, the data palm trees suffering from many agriculture pests which affect the grow and yield of this tree [7]. Many insect pests are damaging palm trees. The important insect pest of the leave of palm trees is *Parlatoria blanchardi* Targ, which belong to the order of Homoptera and the family of Diaspididae [8]. It obligate pest for palm trees leaves and difficult to control because of the pest has a cover which helps insect from pesticides and natural enemies [9].

In Iraq, the first study on the scale insects deducted by Green [10], after that 46 species of Diaspididae were reported from Iraq fauna by Bodenheimer [11], Bodenheimer [12], Hussain [13], Derwesh [14], Al Ali [15]. The distribution of *P. blanchardi* in some fruit’s trees and specifically on palm data trees. This species causes direct damage by sucking the plant sap and feeding by injection the adults and nymphs their mouthparts [16]. The Parlatoria date scale infested the oldest leave and change it to yellow colour, that will affect the quantity and quality of trees production [17, 18]. The most common method used to control the Parlatoria date scale is chemical pesticides, but there is an attempt to use biological control such as predators, parasitoids, and Entomopathogenic which is environmentally friendly. This study aims to evaluate the effectiveness of some treatment methods and chemical and entomopathogenic bacterial and fungi to control *Parlatoria blanchardi* in field conditions.

2. Materials and Methods

2.1. Field evaluation of pesticides TIAM and IMIDOR by irrigation, injection and spray methods
The species *P. blanchardi* was confirmed by Dr Ali A. Kareem (Plant Protection Dept. Faculty of Agriculture, Kerbala University. The experiments were conducted in palm tree date field on September 2020 in Goyha village/ Ghammas / Al-Qādisiyyah Governorate during September 2019. Twenty-one infected tree (never treated in pesticides), were selected for this study. The number of insects on selected leaves was counted 24 hours before treatment. Both pesticides were used in methods mentioned before (Table 1).

**Table 1.** The concentrations, methods and details of used pesticides.

| Common name | Commercial name | Method of treatment | Concentrations |
|-------------|-----------------|---------------------|----------------|
| Thiamethoxam | TIAM 25WG | irrigation | 4 g/tree |
| Imidacloprid | IMIDOR 200 SL | irrigation | 6 mL/tree |
| Thiamethoxam | TIAM 25WG | injection | 4 g/20 ml distilled water |
| Imidacloprid | IMIDOR 200 SL | injection | 6 g/20 ml distilled water |
| Thiamethoxam | TIAM 25WG | spray | 0.4 g/L |
| Imidacloprid | IMIDOR 200 SL | spray | 0.5 g/L |
| CONTROL | -------- | Water only | -------- |

The results were counted one day before treatment and then 3, 7, 10, 15 and 21 days after treatment. Three leaflets were selected randomly from each tree for each replicant and in total 9 leaflets for the single method of treatment. The leaflets were taken and put in polyethylene case, which marked with all the details of treatment. The number of insects was counted from selected 2 cm² of leaflets using a dissecting microscope. The efficiency of pesticides was calculated using Henderson and Tilton [19] equation below.

\[ \text{Corrected \%} = \left( 1 - \frac{n \text{ in Co before treatment} \times n \text{ in T after treatment}}{n \text{ in Co after treatment} \times n \text{ in T before treatment}} \right) \times 100 \]

Where : n = Insect population , T = treated , Co = control

2.2. The effectiveness of using Entomopathogenic fungi and bacteria and integrated them with pesticides

This experiment was done in Al-Nabhan village/ Ghammas / Al-Qādisiyyah Governorate during the same time mentioned above. Twenty-one trees were used for sprayed by commercial bioagent of *Bacillus thuringienesis* and *Beauveria bassiana* (Table 2).

**Table 2.** The concentrations, commercial and species name of Entomopathogenic agents.

| Commercial name | Species | Concentrations | Company          |
|-----------------|---------|----------------|-----------------|
| Antario KAB     | *Bacillus thuringienesis* | 1 g/L | Russell England |
| Naturalis-L     | *Beauveria bassiana* | 3 mL/L | Belchim England |

For evaluate mixed between pesticides and entomopathogenic agents against *Parlatoria* sp. We selected TIAM pesticide mixed with *B. thuringienesis* and *B. bassiana* in three treatment methods irrigation, injection, and spray (Table 3). The mortality of insects and the efficiency of pesticides were recorded as mentioned above in (2-1).

**Table 3.** Details of integrated methods applied to control *P. blanchardi*.

| Treatment | Method of treatment | Concentrations |
|-----------|---------------------|----------------|
| TIAM      | Irrigation          | 4 g/Tree       |
| +         | +                   |                |
| Antario KAB | Spray              | 1 g/L          |
| TIAM      | Injection           | 4 g/Tree       |
| +         | +                   |                |
| Antario KAB | Spray              | 1 g/L          |
| TIAM      | Spray               | 0.4 g/Tree     |
| +         | +                   |                |
2.3. Statistical analysis
The experiments were designed by Randomized Complete Block Design (RCBD) and the mean comparisons were performed using the LSD test at 5% level of significance (P < 0.05) using SAS (2003).

3. Results and Discussion
3.1. Field evaluation of pesticides TIAM and IMIDOR by irrigation, injection and spray methods to control *P. blanchardi*

The results in Table (4) showed that all the chemical pesticides were affected in the field with different methods against *Parlatoria* sp. The TIAM 25 WG pesticide was more significant when using in spray method, which reached 69.34%, whereas IMIDOR 200 SL gave less mortality in irrigation method 42.74% compared with control. The time of treatment was significantly after 21 days of treatment (Table 5). The result of interaction between treatment and the time showed that the TIAM 25 WG significantly reduced the number of insects on leaflets, with 71.84 efficiencies of pesticides after 15 days of injection. However, the low result of the interaction of treatment and time was in IMIDOR 200 SL when using irrigation method, which recorded 15.40 % after 3 days of treatment. This result was supported by many research. Al.saaidy and Ali [20] reported that the pesticide Thiamethoxam was significantly reducing the number of a different stage of *P. blanchardi*, which was 39.71, 53.35, and 55.17% after 1, 3, 7 days of irrigation, respectively. Also, AL.Jboory I. J, Adnan I.A.Siamari [21], confirmed that the Thiamethoxam was significantly controlled *Ommattisus binotatus lybicu* DeBerger on Plam Date Tree when used in irrigation, spray, and injection, but there was not infested after 25 days of injection treatment. Also, our results were supported by Mohammadali, Alyousuf [22] who found the Thiamethoxam more efficient to control *Bemisia tabaci* in the field. The significant efficacy of Thiamethoxam pesticide could be due to its long-term active against *P. blanchardi*, that due to it is dissolved gradually within the plant tissues [23]. Thiamethoxam, effects on sucking mouthparts insects, causes quick mortality on *Parlatoria* sp started within two days of treatment [24]. The use of different methods for the pesticides makes it possible for Integrated pest management (IPM) for control *P. blanchardi*.

| Treatment          | Time/Days | Average |
|--------------------|-----------|---------|
| TIAM 25 WG/ Irrigation | 15.79      | 69.92   |
| IMIDOR 200SL/ Irrigation | 15.40      | 59.58   |
| TIAM 25WG/ Injection | 33.53      | 71.84   |
| IMIDOR 200 SL / Injection | 24.87      | 70.91   |
| TIAM 25WG/ Spray    | 71.27      | 69.07   |
| IMIDOR200 SL / Spray | 59.87      | 59.44   |
| Average of time     | 36.79      | 64.20   |

L.S.D, 0.05 for treatment = 8.312, Time/Days = 7.588, interaction = 18.587

3.2. The effectiveness of using Entomopathogenic fungi and bacteria and integrated with pesticides

The result in Table 5 showed that all the treatments were effective to control *P. blanchardi* in the field. The high significant treatment was TIAM 25WG combined with *B. bassiana* when sprayed which reached 78.56%. However, the lowest mortality was 52.79% in treatment TIAM 25WG (sprayed) combined with *B. bassiana* (Irrigation). There was no significant within the
time of treatment. The interaction between the treatments was significant. The treatment of combined TIAM 25WG with *B. bassiana* were reached 82.40% after 7 days of sprayed, whereas the treatment of use TIAM 25WG/ Irrigation with *B. thuringienesis* spray was given lost mortality 22.76. This study was supported with the result of Mohammadali, Alyousuf [22] who reported the high mortality of using Thiamethoxam pesticides against *Bemisia tabaci*. Also, this result was similar to Mislit, Mohammed [25], Al-Zurfi [26], Mohammed, Kadhim [27], who found that the *B. bassiana* was more significantly affected different stages of storage product insects. The variance in the effectiveness of *B. bassiana* might at consequences of their varied proteins of the majority of insect’s body wall cuticle [28]. Henceforth, the degrading goings-on of proteases might expression a role in the express penetration of insect’s cuticle, which reproduces the virulence of *B. bassiana* [29].

There were a high association between the proteolytic action and virulence of many isolates of *B. bassiana* against insects [30].

Barrania and Abou-Taleb [31] reported that using Thiamethoxam pesticide against *Aphis gossypii* and *B. tabci* were effectively inhibition produce pyriproxyfen and novaluron. Therefore, it is possible to used bioagent with friendly pesticides to control *P. blanchardi*.

**Table 5.** The percentage of effectiveness of the pesticides and bioagents using in different methods of treatment against *P. blanchardi*.

| Treatment                  | Time/Days | Average |
|---------------------------|-----------|---------|
|                           | 3         | 7       | 10     | 15     | 21     |
| TIAM 25WG/ Irrigation     | 31.14     | 57.41   | 58.16  | 68.70  | 70.07  | 57.10  |
| + *B. bassiana* spray     |           |         |        |        |        |
| TIAM 25WG/ Irrigation     | 22.76     | 52.41   | 53.31  | 67.63  | 67.83  | 52.79  |
| + *B. thuringienesis* spray | 37.79 | 61.19   | 65.26  | 78.03  | 78.77  | 64.21  |
| TIAM 25WG/ Injection      | 35.22     | 53.79   | 54.94  | 68.93  | 67.83  | 56.17  |
| + *B. bassiana* spray     |           |         |        |        |        |
| TIAM 25WG/ Spray          | 77.87     | 82.40   | 80.29  | 77.60  | 74.65  | 78.56  |
| + *B. thuringienesis* spray | 72.35 | 75.71   | 72.97  | 71.00  | 70.08  | 72.62  |
| Average of time           | 46.35     | 63.82   | 64.15  | 71.98  | 71.56  | 67.05  |

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