Effect of Citrullus colocynthis seed oil against the scale insect (Parlatoria blanchardi) on date palms (Phoenix dactylifera(

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Abstract
A laboratory study was carried out to investigate the biological effects of Citrullus colocynthis seed oil on Parlatoria blanchardi, a scale insect infesting date palms (Phoenix dactylifera). The oil was at concentrations of 5%, 10%, 15%, and 20%, and mortality rates were assessed at 2, 4, 6, and 8 days post-treatment. Results demonstrated significant variations in the oil's impact across different concentrations and treatment durations. The 20% concentration exhibited the highest efficacy. After eight days, mortality rates reached 84.96% for first nymphs, 81.87% for second nymphs, 78.22% for third nymphs, 73.79% for fourth nymphs, and 64.93% for adult insects. These findings suggest the potential of Citrullus colocynthis seed oil as a natural control agent for Parlatoria blanchardi and potentially other insect pests.
Keywords: Citrulls colocynthis , date palm, parlatoria blanchardi.

Introduction

The cultivation of date palm trees Phoenix dactylifera is primarily found in the Middle East and North Africa regions. There are currently over 200 million palm trees planted globally, covering an area of approximately 1,290,401 hectares. In 2018, the estimated production of dates was 8,625,812 tons. Date palm is widely recognized as one of the most significant fruit trees worldwide.

Date palm trees are susceptible to various insect pests, one of which is the white scale bug P. blanchardi [1]. This particular insect species shows a preference for palm trees that are 2-3 years old and has been known to inflict significant damage to date palm trees in Iraq [4]. These insects are classified as piercing-sucking insects and can produce multiple generations within a single year. They are classified under the order Homoptera and the family Diaspididae. Approximately 8,000 species have been classified and recognized. These insects are tiny, measuring between 1-2 mm in length. They are typically discovered beneath wax covers that they create for self-protection. They have the appearance of lustrous objects that resemble pearls, measuring 5 mm in size. Typically, adult female insects exhibit limited mobility. These organisms parasitize plants by extracting plant sap from various areas of the palm tree. This process leads to severe infection and ultimately the death of the affected portions of the plant. As a result, date production is significantly impacted [3.[

Many chemical pesticides are used to combat this insect, and due to their effects on plants, humans, animals, and the environment, excessive use of pesticides has led to the accumulation of harmful residues in the ecosystem [5] Therefore, those interested have turned to using pesticides of plant origin due to their rapid decomposition into non-toxic substances and the low incidence of insect resistance to them [7] Therefore, the study aimed to evaluate the effectiveness of Citrulls colocynthis seed oil in some aspects of the life

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performance of the P. blanchardi on date palms in the laboratory.

Materials and methods

The fruits of C. colocynthis were harvested at their fully ripe stage in late March 2024 from several locations in the southern desert of Muthanna Governorate in southwestern Iraq. The fruits were dried in shady and well-ventilated settings, crushed, and their seeds were extracted. Subsequently, the seeds were ground using an electric grinder. A quantity of 100 grams of seed powder was obtained and subjected to extraction using a Soxhlet device. The organic solvent n-hexane was employed for a duration of 24 hours , The solution underwent filtration using a Buechner funnel and Whatman No. 2 filter paper. The liquid that passed through the filter was reduced in volume by removing the solvent under reduced pressure at a temperature range of 40-50°C using a rotary evaporator with a vacuum system. The predicted oil content was approximately 30-36% according to [8.[

Four concentrations of C. colocynthis were prepared, including 5% (5ml oil, 10ml DMSO and 85ml distilled water), 10% (10ml oil, 10ml DMSO and 80ml distilled water), 15% (15ml oil, 10ml DMSO and 75 ml distilled water) (and 20%, (20ml oil, add 10ml DMSO and 70ml distilled water) then added 0.25 ml/L of citowetas a binder and dispersant to evaluate the effects of these concentrations on insects in the laboratory.

A group of palm leaves infected with scale insects were brought from the palm trees located in orchards overlooking the Euphrates River in Al-Muthanna Governorate. The leaves were washed and cleaned well to remove the dust stuck to them. 30 ml of each concentration was taken separately and placed in a small hand sprayer. Then drops of Tween were added to help the liquid stick to the leaves. The leaves were sprayed and completely covered with the liquid. Each leaf was placed in a sterile test tube and was closed with cotton. There were three replicates for each concentration in addition to the control treatment, which consisted of spraying distilled water only on the leaves , Four time periods (2, 4, 6 and 8) days were used for this experiment, the tubes were placed in an incubator with a temperature of 30 ± 1 °C and the percentage of leaves was checked according to the previously mentioned time periods. Counting the number of insects killed by observing them at rest under a dissecting microscope and then using [2] equation to calculate the ratio:

corrected for death % =(% death in treatment - % death in control)/(100-% death in control) ×100%

Results and discussion

Table (1) Variance analysis results show that C. colocynthis oil at different concentrations and at different stages has a significant impact on the mortality of the first nymph of p. Blanchardi on the date palm leaf, These treatments achieved an increase in the percentage of first nymph killing, with the 20% ml/L treatment reaching the highest average of 84.96% after 8 days of treatment, and falling to the lowest rate at the 5% ml/L concentration. 52.07%, It can be clearly seen from the same table that after 8 and 6 days, there was no significant difference in the death percentage of first-instar nymphs in the two treatments, which were 5 and 10% ml/L respectively, and the average death percentages were 67.04 and 67.20% respectively. In addition to significant differences among the other treatments, significant differences in the interaction coefficients were also observed, meaning that all treatments tested had overlapping effects

on the percent killing of the first nymphal instar.

Different concentrations and treatment times also significantly affected the mortality of second-instar nymphs of insects. The concentration 20% ml/l was the highest after 8 days of treatment, reaching to 81.77% , It decreased to the lowest concentration rate of 5% ml/l after two days of treatment, with an average of 48.57%. No significant differences appeared between the concentrations of 10% and 15% after 4 and 6 days of treatment, with averages of 64.24 and 64.21%, respectively, The interaction had a significant effect between the different concentrations and time periods (Table 2.(

In Table (3), we noticed that extracts at different concentrations and time periods had significant effects on the mortality of insect third nymphs, When the concentration was increased to 20% ml/l after 8 days of treatment, the pest killing rate increased by an average of 78.22%; when the concentration was 5% ml/l , it was reduced to the lowest after two days of treatment, and the killing rate was 44.95%. Compared with the control treatment where insect killing was not recorded, two Study factors also had a significant impact on insect mortality.

The data presented in Table (4) demonstrates statistically significant variations in the killing rates of the fourth nymphal stage of the insect when exposed to different concentrations. The highest mortality rate observed in the treatment was 20%, while after 8 days of treatment, the mortality rate reached 73.79%. Additionally, after two days of treatment, the killing rate was recorded at 40.23%. The interaction between the concentrations and different time periods produced a pronounced effect, which became evident.

When testing the effectiveness of extracts at different concentrations and time periods on insect adults (Table 5), there was a clear significant effect, After 8 days of treatment at a 20% ml/l concentration, the adult mortality killing rate reached 64.93%. After 2 days of treatment at a 5% ml/l concentration, the killing rate dropped to 35.95%. No killing were recorded in the control treatment. It is also noted from the same table that there were no significant differences in the percentage of insect adult killing at concentrations of 5 and 10% ml/l , with averages of 46.88 and 46.99% after 6 and 2 days of treatment, respectively, as well as treatment at concentrations of 10 and 15% ml/l after 6 and 2 days, which reached 49.93 and 49.76%, respectively. Regarding the interaction between the two factors studied, this is significant because the results showed that the 20% concentration had the highest killing rate of adult insects after 8 days of treatment compared to different treatments. The percentage of deaths increased with increasing extract concentration and exposure time used in the study.

Killing rates of insect nymphal stages and adults may be due to increased concentration of oil in the extract (the oil each insect obtains through feeding) or increased exposure time, which has a negative impact on the life activities of the insect. The action of the system causes the insect's body to stop, causing poisoning and suffocation, the reason may be that the insect is completely paralyzed due to inhibition of oxidases or destruction of nerve cell function, resulting in increased killing rate [7] Studies have shown that bitter melon oil causes lethargy and progressive paralysis after 6 hours of treatment. After 12 hours, the insect's legs begin to tremble, indicating a general nervous system defect, after which it becomes fixed in place. A fluid

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is expelled from its body and then gradually dies, depending on the concentration of the oil and the time of exposure to the oil .

Table 1. Effect of C. colocynthis seed oil on the mortality of the first nymphs of P. blanchardi on date palm at different time periods.

% concentration ml/L	Treatments duration (day)				concentration rate
	2	4	6	8	
0.0	0.0	0.0	0.0	0.0	0.0
5	52.07	55.18	63.07	67.04	59.34
10	57.87	61.83	67.20	72.02	64.73
15	64.03	67.92	74.96	77.86	71.19
20	69.99	73.83	79.16	84.96	79.98
Average time	48.79	51.75	56.88	60.38	54.45
L.S.D	Interaction	Time	concentration		
	0.195	0.174	0.791		

Table 2. Effect of C. colocynthis seed oil on the mortality of the second nymphs of P. blanchardi on date palm at different time periods

% concentration ml/L	Treatments duration (day)				concentration rate
	2	4	6	8	
0.0	0.0	0.0	0.0	0.0	0.0
5	48.57	52.02	59.26	63.12	55.75
10	59.77	58.79	64.24	68.05	62.70
15	61.28	64.24	71.91	74.06	67.87
20	66.83	70.93	77.25	81.87	74.22
Average time	47.29	49.20	54.53	57.42	52.11
L.S.D	Interaction	Time	concentration		
	0.383	0.343	0.767		

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Table 3. Effect of C. colocynthis seed oil on the mortality of the third nymphs of P. blanchardi on date palm at different time periods.

% concentration ml/L	Treatments duration (day)				concentration rate
	2	4	6	8	
0.0	0.0	0.0	0.0	0.0	0.0
5	44.95	47.93	55.26	59.29	51.86
10	56.02	54.25	60.77	64.76	58.96
15	58.08	60.00	68.87	70.20	64.29
20	62.95	67.41	72.94	78.22	70.38
Average time	44.41	45.92	51.57	54.49	49.10
L.S.D	Interaction	Time	concentration		
	0.127	0.114	0.254		

Table 4. Effect of C. colocynthis seed oil on the mortality of the fourth nymphs of P. blanchardi on date palm at different time periods

% concentration ml/L	Treatments duration (day)				concentration rate
	2	4	6	8	
0.0	0.0	0.0	0.0	0.0	0.0
5	40.23	43.90	51.71	54.05	47.47
10	51.20	47.75	55.41	60.80	53.79
15	53.90	55.80	64.69	65.83	60.06
20	58.72	63.11	68.09	73.79	65.93
Average time	40.81	42.11	47.98	50.89	45.45
L.S.D	Interaction	Time	concentration		
	0.217	0.194	0.434		

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Table 5. Effect of C. colocynthis seed oil on the mortality of the adults of P. blanchardi on date palm at different time periods

% concentration ml/L	Treatments duration (day)				concentration rate
	2	4	6	8	
0.0	0.0	0.0	0.0	0.0	0.0
5	35.95	39.26	46.88	48.77	42.71
10	46.99	43.03	49.93	56.00	48.99
15	49.76	51.09	59.65	60.24	55.19
20	45.0	58.73	63.14	64.93	60.20
Average time	37.34	38.92	43.92	45.99	41.42
L.S.D	Interaction 1.487		Time 0.665	concentration 0.744	

Conclusions

Considering the compounds contained in the extract and the extent of their compatibility and interaction with the living enemies present with the pest, it is possible to conclude that Citrulls colocynthis seed oil has a distinct effectiveness against crawling nymphal stages and adults of the scale insect parlatoria blanchardi using concentrations (10, 15 and 20)% after 4, 6, and 8 days of treatment. This calls for conducting more studies on this extract in combating insects sucking plant juice as one of the applied components because it is of plant origin and safe to use, no risk to the environment and non-target organisms.

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