



The effect of plant pesticide Tondxir against the stored product Moth, *Ephestia cautella* (Walker) (Lepidoptera: Pyralidae)

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Received: July 3, 2023	Abstract T Many plant extracts could be considered natural, effective methods for controlling insect pests instead of synthetic chemicals. The current examination was designed to assess the mortality percentages of the plant-based pesticide Tondxir on the date moth <i>Ephestia cautella</i> . A series of experiments were carried out in the laboratory to evaluate the pesticide Tondxir's effectiveness in controlling the second and fifth larval stages and the adults of the date moth. The highest percentage of mortality rates for the second larval stage reached 100% after 5 days at a concentration of 3 ml/liter. However, the mortality rates of the fifth stage and the adult of <i>E. cautella</i> reached 42.14% and 17.50% after two weeks of treatment. A direct relationship was found between the increase in mortality rates with increasing pesticide concentration. The highest percentage of mortality was increased in the fifth larval stage of <i>E. cautella</i> , and they reached 42.14% at the third concentration, compared with the rest of the concentrations. The lowest mortality rate was for the concentration (1ml/liter), as the mortality rate reached (26.07) after 14 days of treatment.
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Introduction

Stored materials are an important source of the human body's needs to produce energy, especially dates and grains that can withstand storage. The possibility of preserving these materials from infection with insect pests is one of the most important difficulties faced by specialists in storage operations [1, 2]. In addition to the great nutritional importance of dates, they are important in building the human body as they contain sugars, proteins, vitamins, fats and mineral salts. Buxton recorded The date moth for the first time in Iraq in 1920 [3]. The larvae of the date moth infect the dates falling from the palm trees and the dates left behind after harvesting, from which the infection begins in the orchard and continues to the presses and stores throughout the year [4]. explained the two main factors that make the pest dangerous to stored dates are the insect's resistance to chemical insecticides and the nature of the larvae in terms of feeding inside the stored dates. It was one of the biggest pests in the store, so it had to be



managed with specific fogging and regularly with consistent pyrethrums. The fogging affects the exposed lesion stages and cannot affect the stages inside the fruit.

By fogging, the date moth develops and grows inside shelters [5]. The idea of using plant extracts as an effective natural means to control insects due to their low toxicity to the solvent, and the insect did not resist [6]. The modern directives of the study in the field of research focused on natural plant compounds that effectively control insects. Therefore, when plants contain secondary compounds, they control store pests because the Iraqi environment includes plants rich in effective compounds of medical importance that can be used to combat Insects [7]. Pesticides of plant origin have been used as alternatives to chemicals. These plant-based pesticides are less toxic to humans, yet they have a deadly and repellent effect, as humans have long used some plants as repellents or killers for insects harmful to stored materials. The objects of study are to evaluate three concentrates of Tondxir against different stages of *E. cautella*.

Materials and Methods

Insect collection and rearing

A sample of the date moth, *E. cautella*, local type (B), was obtained from the laboratories of the Entomology Department at the Ministry of Science and Technology on artificial food consisting of 81% wheat groats, 12% glycerine, 6% molasses, and 1% dry yeast [8, 9]. Two handers and fifty gm of processed food were placed in a glass vial with a diameter of 11 cm and a height of 12 cm, and 15 pairs of adult insects, aged between 24-48 hours, were released into it. Then a plastic cap was placed over the mouth of the bottle; in the middle of it, there was a hole 2 cm in diameter for ventilation, and it was covered with a muslin cloth, or (the opening of the can is closed with a piece of soft cloth). It was fixed with a rubber band to prevent insects from escaping from the can. It was placed in an incubator at a temperature of 25 ± 2 C, a relative humidity of $60 \pm 5\%$, and a lighting period of (8: 16) hours for 25 days [10] to follow the larval stages starting from the eggs and reaching the adult stage.

Preparation of different concentrations of Tondxir pesticide

Three different concentrations of Tondxir pesticide were prepared: (1, 2, and 3) ml/L. These concentrations were diluted with a liter of distilled water and then shaken well for 15 minutes. The three concentrations of Tondxir were placed in hand sprayers with a capacity of 100 ml to be ready for treatment.

The effect of Tondxir pesticide on the mortality of the second and fifth larval instars of *E. cautella*

Ten individuals of 2nd and 5th larval stages I were placed separately in plastic Petri dishes with dimensions (16×9) cm containing a filter paper. The dishes with different instar larvae were sprayed with concentrations of Tondxir 1, 2, and 3 ml/L in an amount of (1) ml of each concentration, at the rate of four replications for each treatment. If the spraying process was complete, the larval instars were left for 15 minutes



to dry. As for the control treatment, the larval instars (the second and fifth) were sprayed separately with distilled water and left for 15 minutes to dry. Then the treated larval instars were transferred with a small brush from each replicate to plastic Petri dishes containing 5 g of processed food. Then the treated dishes were transferred to the incubator at $25 \pm 2^\circ\text{C}$ and 60-70% a humidity. Percentage mortality of larval stage was recorded after (1, 3, 5, 7, 9, 11, 14) days after spraying.

The effects of Tondexir pesticide on the mortality of the *E. cautella* adults

Ten adults of *E. cautella* were taken in a plastic petri dish with dimensions (16 x 9) cm containing filter paper. The dishes were sprayed with concentrations of Tondexir in an amount of 1 ml of each concentration, with three treatments of (1, 2, and 3 ml/L), each treatment four replications (10 adults for each replicate), using a manual sprayer with a capacity of 100 ml, and the treated adults were left for 15 minutes to dry. In addition, in the control treatment, they were sprayed with distilled water only and then left for 15 minutes to dry. After that, it was transferred with a small brush to plastic Petri dishes containing the manufactured food item 5 gm by four replicates. Then the dishes were placed in the incubator at a temperature of $25 \pm 2^\circ\text{C}$ and relative humidity of 60-70%, and after passing (1, 3, 5, 7, 9, 11, 14) days of treatment, the corrected percentages of loss were calculated.

Statistical analysis

The data were analysed statistically using the Completely Randomized Design, and a factorial experiment was implemented. Significance was tested using the Least Significant Difference (L.S.D) at the probability level ($P \leq 0.05$) to show the significance of the results [11]. The depreciation percentages were corrected according to [12].

$$\% \text{ corrected depreciation} = \frac{\% \text{ of loss in treatment} - \% \text{ of loss in control treatment}}{100 - \% \text{ for loss in the control treatment}} \times 100$$

Results and Discussion

The effect of Tondexir pesticide on the mortality of the second and fifth larval instars of *E. cautella*

Tables (1 and 2) indicates the effect of overlapping concentrations of Tondexir on the mortality of the second larvae stages of *E. cautella*; the concentration effect was observed, as it caused an increase in the mortality rate of the larval stages of the insect with an increase in the concentration of the Tondexir. The highest mortality rate was 61.66 in concentration 3 compared with the control treatment. For the fifth instar larvae of *E. cautella* the results showed that the highest rate of effect of the agent of the different concentrations of the Tondexir was (42.14%) at the concentration (3 ml/liter), which was significantly superior to the rest of the concentrations, followed by the recommended concentration (2 ml/liter), the results of the statistical analysis indicated



that there were significant differences between second and fifth instars larvae of *E. cautella*. The second larval stage was more sensitive to the Tondexir than the fifth larval stage. The mortality rate for the second larval stage was 100% after 5 days of treatment. The results of the statistical analysis showed significant differences between the treatments. For the effect of the period factor, the average loss rate increased with the number of days as the percentage of loss reached.

Table (1):Effect of time and concentration of the Tondexir pesticide on the mortality of the second larval stage of the *E. cautella*

Time /Days	1	3	5	Average of Concentrations
Con. ml/L				
1	10.00	45.00	100.00	51.66
2	20.00	60.00	100.00	60.00
3	32.50	52.50	100.00	61.66
Control	0.00	0.00	0.00	0.00
Average of time	15.62	39.37	75.00	
L.S.D 5%	Concentrations: 8.7819, Time: 7.6045, Interaction: 15.211			

Table (2): Effect of time and concentration of the Tondexir pesticide on the mortality of the fifth larval stage of the *E. cautella*

Time /Days	1	3	5	7	9	11	14	Average of Concentrations
Con. ml/L								
1	10.00	22.50	30.00	30.00	30.00	30.00	30.00	26.07
2	30.00	32.50	32.50	32.50	32.50	32.50	35.00	32.50
3	32.50	50.00	45.00	45.00	45.00	45.00	45.00	42.14
Control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average of time	18.12	23.12	26.87	26.87	26.87	26.87	27.50	
L.S.D 5%	Concentrations: 6.2992, Time: 8.3331, Interaction: 16.666							

The study's results showed the effectiveness of the pesticide of plant origin, Tondexir, as it had a significant effect on the high mortality rates for different ages of the insect, as this effect increases with increasing the concentration of the pesticide and the period. Piperine [13] found that the alcoholic extract of black pepper seeds achieved a killing rate of 89.5% against adult insects of *Tetranychusturkustani* at a concentration of 1000 ppm.

The effect of pesticides is because they contain volatile oils with high efficacy and compounds with the ability to permeate and spread between the tissues of the body of the insect, like the action of pesticides by touching the surface of the body of the insect, where the chemical compounds penetrate through the thin areas of the insect's body and cause paralysis and thus causing death. Pesticides of plant origin contain toxic substances and alkaline compounds or effective compounds that prevent the occurrence of feeding, which causes the insect to die. Also, pesticides of plant origin affect the nervous and digestive systems by entering the respiratory openings [14].

The botanical pesticides contain hormone-like compounds and thus lead to a defect in the functions of the cells and lead to their death (For death in the fourth larval stage of the red flour beetles *Tribolium castaneum* and Khapra Beetle *Trogoderma granarium* and the percentage of mortality increases with the increasing of concentration.

The effects of Tondexir pesticide on the mortality of the *E. cautella* adults

Table (3) indicates the effect of overlapping treatments of the Tondexir pesticide at different concentrations (1, 2, 3) ml/L, as well as the period on the corrected percentages for the mortality of *E.cautella* adults. The results show that the highest rate of effect of the factor of different concentrations of the Tondexir was the ratio of (27.14%) at the concentration (3ml/liter), which was significantly superior to the rest of the concentrations, followed by the recommended concentration (2ml/liter), if the average effect of the concentration factor reached (18.21%). As for the period effect factor, the 14-day period was significantly superior to the rest of the periods if it gave mortality rates of 45.00 and 37.50% at the recommended concentration (2 ml/liter) and the high concentration of 3 ml/liter), respectively. The control treatment was devoid of any mortality rates.

Table (3): Effect of time and concentrations of the Tondexir on the pesticide on the mortality of the *E. cautella* adults

Time /Days	1	3	5	7	9	11	14	Average of Concentra-tions
Con. ml/L								
1	2.50	2.50	7.50	10.50	15.00	17.50	17.50	10.35
2	0.00	7.50	15.00	17.50	20.00	30.00	37.50	18.21
3	7.50	15.00	15.00	32.50	32.50	42.00	45.00	27.14
Control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average of time	4.37	6.25	8.12	15.12	16.87	22.50	25.00	
L.S.D 5%	Concentrations: 4.7819, Time: 6.3259, Interaction: 12.652							



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