



Study of the efficacy of Lambdacyhalothrin 10% wp and the Fruits extracts of *Datura innoxia* plant in the fourth larval instar and adults of sand fly *Phlebotomus papatasi* (Diptera: Psychodidae)

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Abstract

The results of the present study, which aimed to demonstrate the efficacy of Lambdacyhalothrin 10% and alcoholic extracts of *Datura innoxia* fruits in the control of fourth larval instar and adults of the *phlebotomus papatasi*, indicated that the highest mortality percentage of the larval instar was 100% in concentration 3 μL / ml, and the lowest mortality percentage of 33.3% at the lowest concentration of 0.05 μL / ml. The results of adult treatment were the highest mortality percentage of 93.33% at the concentration of 3 μL / ml and the lowest mortality percentage were 20% at concentration of 0.05 μL / ml after 24 Hour of treatment.

The results of the treatment of the fourth larval instar with the *Datura innoxia* fruits extracts showed that the highest mortality percentage was 100% for the concentration of 2000 ppm and the lowest of 13.3% at 75 ppm. The highest mortality percentage of adults insects was 100% when treated with the most effective concentrations (1600, 2000ppm). Thus, the results are shown to be affected by the control method used and the interaction of the insect larval instar to this method. In the end, there was a convergence of the effect of the insecticide and extract in the larval instar and adults insect.

1. Introduction

Sand fly *Phlebotomus papatasi* insects that live as parasites on plant juices, males and females, in addition to absorbing the human and animal blood by females to production and fertilize the eggs, It belongs to order diptera which has a wide medical importance for the ancient world (Asia Africa and Europe) and the modern (Americas), and includes the sand flies subfamily three main genera *Phlebotomus*, *Sergentomyia*, *Chinius* include vectors of Visceral and Cutaneous Leishmaniasis in the ancient world, genera *Brumptomyia*, *Lutzomyia*, *Warileya* which include species that transmit the Leishmaniasis in the modern world [1,2,3,4].

It also plays an important role in the transmission of Carrion's disease and sand fly fever, in addition to causing excessive sensitivity and fever in people exposed to its piercing, and has been recorded in the United States of America The two types of the genus *Lutzomyia* have ability to transferring seven species of the animal protozoa (single-cell) parasites, which

causes reptilian malaria [5,6], sand fly it's ancient insects back appearance of the era of the Cretaceous minimum, and the word Vasd literal translation of the name The Latin race, composed of the Greek root (Phlebo), means venom and (tom) means "incision", mean incision the vein or phlebotomy, the first returns described researcher Phlibobonani published in Rome in 1691 AD, then described scopoli typical type which is *Phlebotomus papatasi* in 1786 AD, either historical records indicate that the medical significance was known before then, in the year 1764 AD published the Spanish doctor Cosma pino book on folk information on transmission of leishmaniasis and bartonellosis disease in the mountains of the Andes in Peru and noted that local residents believe that diseases result from the bite of a small insect called (Uta), It's a sand fly, and The name Papatasi is attributed to the Italian phrase "Papatanchi", which means the silent seafarer because the sand fly does

not hear its buzzing when flying other than the mosquitoes [7,8].

Although the insect was recorded early by Wenyon in 1911, most of the earlier studies were on aspects of propagation, seasonal and geographic distribution, classification was limited to two studies of insect life [9,10,11] And the insect control study was not focused by many researchers, While it represent one of the most important factors of control, and prevent the increasing of insect numbers, including the carriers of the pathogen can reduce the spreading of Leishmaniasis and other degenerative diseases, this insect, it represents an effective factor in the transmission of the disease between animal resource and the final host, a man, the present study aimed to test the effectiveness of the insecticide



Picture (1) a- Aspirator trap .



b-Light trap

2 – 2. Insect rearing

The insect was rearing in the laboratory of insects and parasites by through the custody and feeding of the female on the source of diabetes and blood meal (laboratory mouse) in the cage of custody and nutrition, then transferred to the eggs laying and immature stages breeding cage, prepared by method [13] As shown in Fig. (2-a) and transferred to the incubator at 27 ± 1 °C and relative humidity 75-80%.



a



b



c

Picture (2) a. Transferring and breeding insect Pot. b. Larval diet inside the breeding pot. c. Larval instar inside the breeding pot.

2-3. Preparation of the alcoholic extract.

The alcoholic extract of *Datura innoxia* fruits was prepared according to [16,17] method using ethanol. After obtaining the extraction solution, it was placed in the Petri dishes to dry in an electric oven at a temperature not exceeding 40 °C. After dryness and the appearance of a relatively dense, The resulting extract, collected from the dishes shown in Picture (3), placed in dark glass containers to avoid light and heat effects and kept in the refrigerator at 5 °C until using.



Picture (3) Preparation of the alcoholic extract.

2–4. Sensitivity Test of the fourth larval instar to the toxicity of the insecticide and alcoholic fruits extract

The concentrations of the insecticide (0.05, 0.1, 0.5, 1.0, 2.0, 3.0) µL /ml, as well as concentrations of alcoholic extract were (75, 150, 300, 600, 1200, 1600, 2000)ppm prepared according to the methods [18,19] to control the larval instar by pollution the larval food

in the concentrations under study for the insecticide and extract each separately and after saturation and dryness added 1-2 gm according to the concentration to the control pot within size 125 ml as shown in the picture (4) which containing 5 larvae with three replicates , while control treatment used non-treated food and placed in the incubator at $27 \pm 1^\circ \text{C}$ and relative humidity 75-80%, recorded the results after 24 hours of treatment.



picture (4) Control pot.

2-5. Sensitivity test of adults to insecticide and alcoholic fruits extract

After preparation of insecticide and alcoholic extract concentrations, the method [20] was applied in the treatment of adults by immersing the NO.1 filter paper in the insecticide and extract concentrations prepared each separately within five replicates per concentration, after the saturation was dried in the laboratory and enveloped the inner face of the 125 ml

plastic control pots, And then placed five insects inside and closed them with tulle cloth. As for the control treatment, the filter paper was saturated with ethanol alcohol, then the control pots were placed in the incubator at $27 \pm 1^\circ \text{C}$ and relative humidity 75-80%, and recorded the results after 24 hours of treatment .

3. Results and discussion

3-1. Effect of the insecticide in the fourth larval instar of the *P. papatasi*

The results of the treatment were read after 24 hours and showed that the insecticide achieved the highest mortality percentage 100% of larval instar at $3.0 \mu\text{L} / \text{ml}$ concentration and the lowest mortality percentage was 33.3% at $0.05 \mu\text{L} / \text{ml}$ concentration, shown in Table (1) that indicate the sensitivity of larval instar and affected by the insecticide concentrations, as the increasing in the killing percentage was proportional to the concentration increase, indicating the lack of type *P. papatasi* for any resistance to the used insecticide, so the sensitivity of the larval instar to the insecticide was clear, Figure (1) explaining the results of the treatment.

Table (1) Mortality percentages of fourth larval instar treated with Lambdacyhalothrin after 24 hours of control

Concentration $\mu\text{L} / \text{ml}$	0.05	0.1	0.5	1.0	2.0	3.0	Control
Mortality percentage%	33.3 F	46.6 E	60.0D	80.0 C	93.3 B	100.0 A	0.00 G

* Variable letters horizontally mean that there are significant differences within the probability level of $P \leq 0.05$ (Duncan's test)

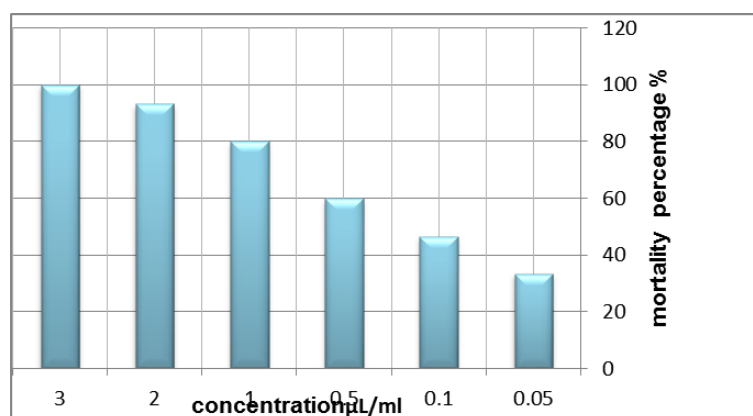


Figure (1) Mortality percentage of the fourth larval instar the Lambdacyhalothrin insecticide after 24 hours of control

Interpretation of the sensitivity to insecticide concentrations either because of the lack or non-use of such insecticide or some of the insecticides belong to its group in the areas where the samples were collected and rearing in the laboratory, or the use of insecticides to control this insect and other insects of the diptera especially medical and other insects was according to the guidance of the company Producing the insecticide without increasing the concentration or

frequency of using during a one season , mean regular and non-random using of the insecticide, the permeability of the insecticide to the larval instar body was through two methods, feeding on the pollution food and the other by contact Larval crawling with the food, which is characterized within wall of his flex thin body containing matchstick hairs intensively, as these factors collectively represent cofactors for the entry into force of sufficient

proportion of the insecticide into larvae instar body and to kill it.

The results of this study were consistent with the results of a study [21] conducted in Kenya to demonstrate the efficacy of two pyrethrin forms, which were powder Moskil in three concentrations (0.2, 0.5, 1.0) mg /ml and liquid pylarvex form of 0.5% against the fourth larval instar of *P. duboscqi* species with the insecticide, the treatment by powder form showed that the highest mortality percentage was 81.7% at the 1.0 mg / ml concentration, while the treatment by liquid form at 0.5% concentration, showed that the first larval instar was more sensitive than the rest instars which achieved 74.2%, this explain the extent to which the results of this study match the results of present study.

Table (2) The mortality percentages of fourth larval instar treated with the alcoholic extract of Datura fruits after 24 hours of control.

Concentration ppm	75	150	300	600	1200	1600	2000	control
Mortality percentage %	13.3 G	26.6 F	40.0 E	66.6 D	86.6 C	93.3 B	100.0 A	0.0 H

* Variable letters horizontally mean that there are significant differences within the probability level of $P \leq 0.05$ (Duncan's test)

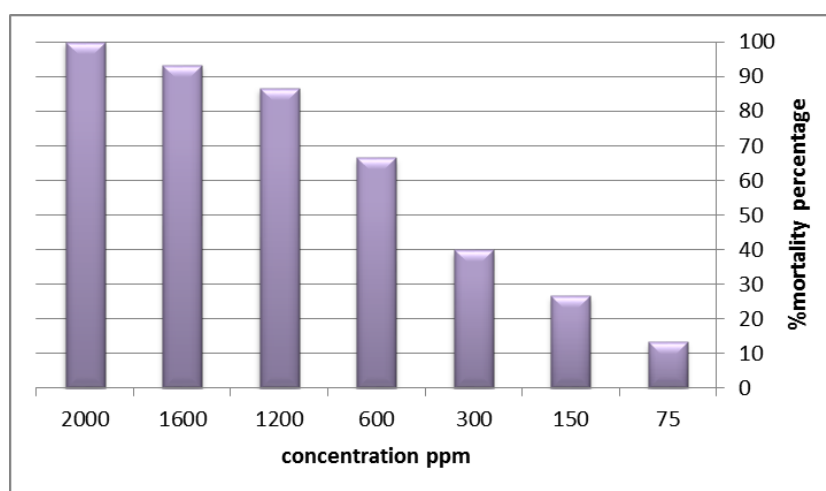


Figure (2) The mortality percentages of larval instar treated with the alcoholic extract of Datura fruits after 24 hours of control

Note the results of the statistical analysis of the mortality percentage resulting from the treatment of the larval instar with the concentrations of the alcoholic extract, There were significant differences between the concentrations. They achieved different mortality percentages for all concentrations. In general, the relationship between extract concentration and mortality percentage was positive, This difference in the effectiveness of the extract against the fourth larval instar of *P. papatasi* back to what is characterized the extract of the datura fruits from the deadly effect of It contains of toxic compounds for insects Especially when used in contact with the spray, as well as the effectiveness of the remaining effect through the treated surfaces, in addition to the absence of aromatic smell may reduce the preference for the larvae of food.

3-2. Effect of alcoholic extract in the fourth larval instar.

The results of the table (2) showed that the extract of the fruits of Datura achieved the highest mortality percentage 100% when treated with concentration 2000 ppm and the lowest mortality percentage was 13.3% at the lowest concentration using in present study which was 75 ppm, Figure (2) shows the effectiveness of the extract in the larval instar. If the mortality percentages achieved by the extract are compared with the insecticide, the efficacy of the extract is shown as a good insecticide, in addition to its rapid degradation in the environment and non-pollution in it, and hasn't resistance by the insect with its various stages.

The present results were consistent with the results of a study [22] in Brazil, which tested the toxicity of *Derris amazonica* extract against *L. longipalpis* sand flies, the concentrations 150, 200, 250 mg / ml were used achieved the highest mortality percentage 100% with 250mg /ml concentration after 72 hours of treatment.

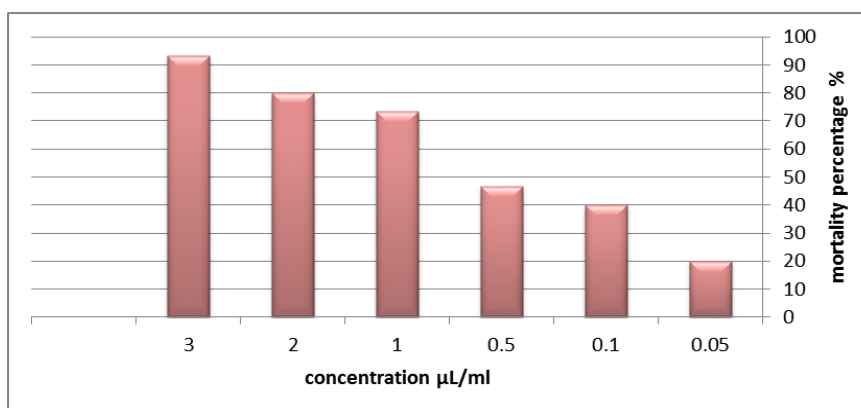
3-3. Effect of Lambdacyhalothrin insecticide in adults of *P. papatasi* sand fly.

By observation the results of adults treated with Lambdacyhalothrin concentrations (0.05, 0.1, 0.5, 1.0, 2.0, 3.0) μL / ml, showed the highest mortality percentage was 93.33% when using the 3.0 μL / ml concentration, and the lowest mortality percentage was 20% at 0.05 μL / ml concentration, The results of the statistical analysis showed significant differences among the mortality percentages of the adults treated with different concentrations of the insecticide .

Table (3) The mortality percentages of adults treated with the Lambdacyhalothrin after 24 hours of control

Concentration $\mu\text{L} / \text{ml}$	0.05	0.1	0.5	1.0	2.0	3.0	Control
Mortality percentage %	20.00 F	40.00 E	46.66 D	73.33 C	80.00 B	93.33 A	0.00 G

* Variable letters horizontally mean that there are significant differences within the probability level of $P \leq 0.05$ (Duncan's test)

**Figure (3) The mortality percentages of adults treated with the Lambdacyhalothrin after 24 hours of control**

The results show the importance of using Lambdacyhalothrin insecticide in the control all instars of the *P. papatasi* sand fly, when based on comparing the results of the treatment of the larval instar with the treatment of adults, then can be used in the various sites where the insect lives, including human dwellings and animals, because its remaining effect and rapid decomposition within the mammalian body, while the decomposition period in the insect body it length and be deadly, so the insecticide can be used at a concentration rate ranging from (0.05 - 3.0) $\mu\text{L} / \text{ml}$ to control the immature instars and adults in the same environment in which the insect reproducing, This reduces the probability of future breeding when control any instar without another, which may be reflected in the number of times required control and therefore the material cost, in addition to the possibility of acquiring insect resistant to insecticide, figure (3) shows the mortality percentages of the insects treated with the insecticide, and Confirmed study [20] which conducted in Sudan to test the sensitivity of *P. papatasi* sand flies collection from three areas to four insecticides included propoxur, malathion, DDT and finally permethrin which were consistent with the results of the present study which showed that the insects did not have any resistance to the malathion in two areas, and possessing resistance in the third area of Surogia Village.

3-4. Effect of alcoholic extract in the adult of *P. papatasi* sand fly

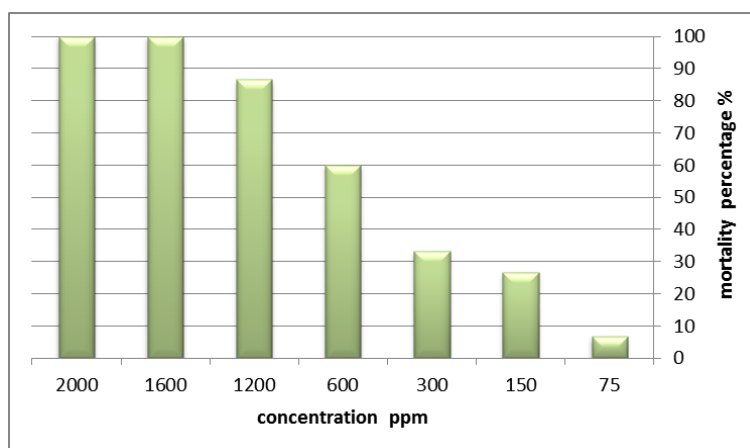
After treatment of adults with alcoholic extracts and taking the results shown in Table (4) after 24 hours of treatment with extract concentrations, the highest

mortality percentage achieved by the extract was 100% for the concentrations 1600, 2000 ppm, respectively. The results of the statistical analysis showed there wasn't significant difference between 1600, 2000 ppm concentrations. The concentration 150 and 300 ppm also achieved relatively close mortality percentages, so that there were no significant differences between them according to the statistical analysis as shown in Figure (4). The fruits extract of datura was clear effectiveness in the insect, that explained by the fact that the datura extract contains several effective compounds, including alkaloids, especially alkaloid scopolamine, hyosine and hyoscyamine (atropine), Atropine is the basis alkaloids Which affects in the nerve endings of nerve cells by inhibiting the acetyl choline esterase, which is responsible for stopping nerve orders after the disappearance of external stimuli.[23] These alkaloids are relatively stable (relatively slow decomposition) and have a similar fatty texture, have been studied, and this has increased the effect of their survival in the control sites and their penetration into the body of the insect through the respiratory spiracles, Sensory hairs and body wall are relatively palpable. Studies that confirm the results of present study was [24] using in which the extracts of several plants, including the extract of *C. citratus* within two form, essential oils extract at the 1% concentration and the other form was crude extract 3% concentration to show their effect in the *Anopheles spp* mosquitoes, which showed that the essential oil extract of the lemon grass gave the repellent effectiveness of the insect was 92.63 %, while the crude extract achieved 50.12 % repellent ratio for adults.

Table (4) The mortality percentages of adults treated with the alcoholic fruits extract of *Datura* after 24 hours of control

concentration ppm	75	150	300	600	1200	1600	2000	Control
Mortality percentage %	6.66 E	26.66 D	33.33D	60.00 C	86.66B	100.00A	100.00 A	0.00 F

* Variable letters horizontally mean that there are significant differences within the probability level of $P \leq 0.05$ (Duncan's test)

**Figure (4) The mortality percentages of adults treated with the alcoholic extract after 24 hours of control**

The results of present study support the results of study[25], which used *allium sativum* oil at a 1% concentration to show his repellent effect and anti-

feeding, which has a repellent effect rate 97% and an anti-feeding effect rate was 100%.

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دراسة فاعلية ميبيد لمبداسيهاالوثرين 10% wp *Lambdacyhalothrin* والمستخلص الكحولي لثمار نبات الداتورة *Datura innoxia* في الطور اليرقي الرابع وكاملات ذبابة الرمل *Phlebotomus papatasi* (Diptera : Psychodidae)

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الملخص

أوضحت نتائج الدراسة الحالية والتي هدفت الى بيان مدى فاعلية كلاً من ميبيد للمبداسيهاالوثرين 10% *Lambdacyhalothrin* والمستخلص الكحولي لثمار نبات الداتورة *Datura innoxia* في مكافحة الطور اليرقي الرابع والكاملات لذبابة الرمل *Phlebotomus papatasi* ان اعلى نسبة قتل للطور اليرقي المعامل بالمبيد كانت 100% عند التركيز 3 mL / mL ، و اقل نسبة قتل وبالباغة 33.3 % عند اقل تركيز مستخدم وهو 0.05 mL / ml ، اما نتائج معاملة الكاملات فكانت اعلى نسبة قتل 93.33% عند التركيز 3 mL / ml و اقلها عند التركيز 0.05 mL/ml وبالباغة 20% بعد مرور 24 ساعة من المعاملة.

كذلك بينت نتائج معاملة الطور اليرقي الرابع بالمستخلص الكحولي لثمار الداتورة *Datura innoxia* أن أعلى نسبة قتل له كانت 100% للتركيز 2000 ppm، و اقلها 13.3% عند تركيز 75 ppm في حين كانت اعلى نسبة قتل للكاملات 100% عند معاملتها بالتركيز الاكثر فعالية في كاملات الحشرة إذ حقق اعلى نسبة قتل وبالباغة 100% للتركيزين (1600، 2000) ppm، وبالتالي توضح النتائج تأثرها بطريقة المكافحة المستخدمة ومدى تفاعل طوري الحشرة لهذه الطريقة وبالنهاية كان هناك تقارب في تأثير المبيد والمستخلص في الطور اليرقي وكاملات الحشرة .

الكلمات المفتاحية: ذبابة الرمل، مستخلص الداتورة ، ميبيد للمبداسيهاالوثرين.