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Biological Activity of Some Essential Oils on Fifth Instar Nymphs of *Ommatissus lybicus* (Homoptera: Tropiduchidae)

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Abstract

Dubas bug, *Ommatissus lybicus* (Asche and Wilson) is one of the major sucking pests of date palm. Both nymphs causes severe damage to the leaves by sucking the cell sap . If the damage is severe, it could cause the death of the date palms. The effect of different concentrations of some natural plant essential oils was evaluated on fifth instar nymphs of the insect. The results clearly demonstrated that the tested oils from mint (*Mentha piperata*), Parsley (*Petroselinum sativum*), Clove (*Syzygium aromaticum*), and Eucalyptus (*Eucalyptus globules*) to evaluate their effect on fecundity of fertile female resulted from these exposed instars nymphs and hatching of these egg. The corrected mortality and numbers of eggs laid, hatching, were studied. The corrected mortality and reduction of laid eggs and hatching was the highest in Eucalyptus. Then *M. piperata* followed by *Syzygium aromaticum* and *P. sativum.*

Keywords: *Eucalyptus globules, Mentha piperata , Syzygium aromaticum, Petrosxlinum sativum ,Ommatissus lybicus.*

الفاعلية الحيوية لبعض الزيوت العطرية في حوريات الطور الخامس لحشرة دوباس النخيل *Ommatissus lybicus* (homoptera: Tropiduchidae)

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الخلاصة

حشرة الدوباس *Ommatissus lybicus* (Asche and Wilson) هي واحدة من الآفات الرئيسية التي تصيب نخيل التمر. حيث تمتص كل من الحوريات والبالغات العصارة من سعف وعذوق التمر. الإصابة الشديدة قد تسبب موت أشجار النخيل.لذا تم تقييم تأثير تراكيز مختلفة من بعض الزيوت العطرية النباتية الطبيعية على حوريات الطور الخامس من حشرة الدوباس. أظهرت النتائج بوضوح أن الزيوت التي تم اختبارها من النعناع(*Mentha piperata*) ، البقدونس *(Petroselinum sativum)* ، القرنفل *(Syzygium aromaticum*) ، واليوكالبتوس *(Eucalyptus globules)* لها تاثير على أنتاجية البيض للاناث المخصبة الناتجة من هذا الطور الحوري ومعدل الفقس لهذا البيض. حيث سجلت نسبة الهلاكات المصححة وعدد البيض الذي تضعه ونسبة الفقس. وكانت تاثير زيت اليوكالبتوس على نسبة الهلاكات المصححة وانخفاض البيض الموضوع ونسبة فقسه هي الاعلى يليه النعناع ثم القرنفل واخيرا البقدونس(المعدنوس).

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Introduction

Dubas bug, *Ommatissus lybicus* (Deberg) (Homoptera: Tropiduchidae) the first to describe this insect is Fieb 1875 of the samples collected on the type of palm ornamental *Chamacrops humilis* in Spain and gave him *Ommatissus binotatus* fieb and adopted the same name by some researchers this insect were recorded in Iraq the first time by them in 1922 [1].

And since then it has become one of the major problems in date palms in Iraq [2]. Dubas bug, so called from the honeydew, Arabic, dibis[3]. Dubas bug, or the Old world date bug, or plant–hopper of Middle East has been recorded in several countries in the near East and North Africa. [4-5]. Because of the damage caused by the increasing incidence of Dubas bug and to avoid dependence on chemical control that have a negative impact on human health and the environment, and the development of new technologies that can replace pesticides in the fight against the insect pests while maintaining the natural balance of the environment. Natural products are an excellent alternative to synthetic pesticides as a means to reduce negative impacts on human health and the environment. Among the various kinds of natural substances that have received particular attention as natural agents for insect management are essential oils from aromatic plants. Essential oils are renewable, non-persistent in the environment and relatively safe to natural enemies, non-target organisms and human beings [6]. Essential oils are defined as any volatile oil(s) that have strong aromatic components and that give a distinctive odor, flavor or scent to a plant. These are the by-products of plant metabolism and are commonly referred to as volatile plant secondary metabolites [7]. Because of the intensity of plant-insect interactions, the plants have well-developed defense mechanisms against pests and are excellent sources of new insecticidal substances [8]. This study aimed to evaluate the effects of some essential oils on mortality, the numbers of eggs laid, hatching of fifth instars nymph of *Ommatissus lybicus* (Asche and Wilson). under field condition.

Materials and Methods

Extraction of essential oils from mint (*Mentha piperata*), Parsley (*Petroselinum sativum*), Clove (*Syzygium aromaticum*), and Eucalyptus (*Eucalyptus globules*) was air dried in the shade at room temperature (26- 28°C) for 20 d and stored in darkness until distillation. The essential oils were isolated from dried plant samples by hydro-distillation using a Clevenger apparatus. Conditions of extraction were: 50 g of air-dried sample, 1:10 plant material/water volume ratio, 3 h distillation. The essential oils were collected, dried over anhydrous sodium sulfate and stored at 4°C until use.

To confine the female nymph stages of dubas bug of spring generations 2012 on the date palm leaflet, (Nymphs females have been isolated and identified because the male have two points with orange color at the end of the abdomen from the lower body representing the testes), a locally made cylinder tube (30 cm long and 4 cm radius) made of transparent very thin plastic sheet with fine holes and screened rectangle (15 X 1.5 cm) for ventilation and spraying extract. 30 nymphs in each cylinder were placed, represented three replicates feeding naturally on selected palm leaflets, treated with the different plant oil extract. Nymphal mortality was recorded 24, 48 and 72 hrs after treatments. The dominated conditions were 24.6-33.7℃ and 44-65 % Rh.

The emerged adults from the survived 5th instars nymphs were kept for 200 ±10 days under field conditions to measure their fecundity and egg hatchability. The corrected efficacy percentage was calculated according to Henderson and Tilton formula [9]:

$$\text{Corrected mortality} = \left(1 - \frac{\text{N in Co befor treatment} \times \text{N in T after treatment}}{\text{N in Co after treatment} \times \text{N in T befor treatment}}\right) \times 100$$

N= No. of population
Co= control
T = Treated

In order to detect the fecundity (number of eggs/ treated female), a single male of dubas bug, were selected from stock populations with the help of aspirator and released in a cylinder tube. Dubas bug pairs were kept in the same cage for the whole adult period. To observe the ovipostional periods and egg laying.

Statistical Analysis

Analysis of variance (ANOVA) and Duncan's multiple comparisons were used for this experiment to determine significant treatment differences by SPSS (version 12).

Result and Discussion

The results in Table-1 showed the efficacy and toxicities of the extracting essential oil from *Mentha piperata, Petroselinum sativum, Syzygium aromaticum* and *Eucalyptus globulus* against dubas bug *Ommatissus lybicus.*

Nymph Mortality

Mortality rates of *Ommatissus lybicus* nymphs treated with plant essential oils were varied with both oil type and concentration used. The highest nymphal corrected mortality was recorded by Eucalyptus 69.99% followed by syzygium 63.33% ,mentha 55.55% and Petroselinum 48.88% at the concentration 15%.The mortality increase with increasing concentration Table-1. Soonwera and Sinthusiri [10] Clove oil 1, 5, 10% exhibited highest larvicidal, pupicidal against *Musca domestica* L.compared with Cymbopogon citrates. Sharaby and El-Nojiban [11] Parsley and mint oils exhibited potentiating effect between them and increasing their mortality against The black cutworm, *Agrotis ipsilon* 3rd larval instars. Maciel, *et al.*, [12] observed after 24, 48 and 72h. *E.staigeriana* oil was the most effective on the larvae of the *Lutzomyia longipalpis*, followed by *E.citriodora* and *E. globulus* oils, respectively, *E. Globulus* oil showed 100% effective at 40 mg/ml, while *E. citridora* and E. *Staggering* oils showed this result in lower concentrations. Choi, *et al.*, [13] essential oil of clove, eucalyptus and mint have a significant nymphicidal effect on *Trialeurodes vaporariorum* (Homoptera: Aleyrodidae).

Table 1- show the mean of nymph corrected mortality treated with the four plant oil extract after 72 h. from (30)nymph.

	Mean of nymph corrected mortality after 72 h			
Concentrations %	***M. piperata***	***P. sativum***	***S. aromaticum***	***E. globulus***
2.5	6.66 ab	3.33 b	5.55 b	9.99 a
5	26.66 a	17.75 b	25.55 a	29.99 a
7.5	32.22 a	25.55 b	30.00 ab	34.44 a
10	37.77 b	32.22 b	49.99 a	52.22 a
12.5	47.77 b	42.22 b	57.77 a	58.88 a
15	55.55 b	48.88 c	63.33 ab	69.99 a

Number of Eggs and Egg Hatchability

Adults fecundity was markedly decreased when fifth nymphal instarwere treated with essential oil from *M. piperata, P. sativum, S.aromaticum* and *E. globulus*. *Eucalyptus* and Mint showed the same reduction of the females fecundity 71, 71.33 egg/ female respectively. While Parsley and clove oil 76.66, 74.33 respectively at 15% concentration, compared with control Table-2. While hatched egg was 52.66,53.0,55.0 and 61.0 at 15% con. For Euaclyptus, clove, mint and parsley respectively, compared with 80 approximately in the control treatment Table-3.

Table 2- show the mean Number of eggs laid by females

	Mean Number of eggs per female			
Concentrations %	***M. piperata***	***P. sativum***	***S. aromaticum***	***E. globulus***
2.5	89 a	90 a	92 a	88.66 a
5	85.33 a	85.33 a	85.33 a	86.33 a
7.5	79.33 b	84.66 a	84.66 a	81.33 ab
10	74.33 b	84.33 a	79 ab	79.33 ab
12.5	72 b	78.66 a	77 a	74.66 ab
15	71.33 b	76.66 a	74.33 a	71 b
Control	101.33 a	99 ab	95 b	91 b

Table 3- show the mean number of an egg hatching / female

	The percentage of egg hatching %			
Concentrations %	***M. piperata***	***P. sativum***	***S. aromaticum***	***E. globulus***
2.5	73.66 a	77.33a	68.00b	75.66a
5	71.66ab	75.33a	67.00b	74.66a
7.5	67.66ab	70.66a	64.66ab	66.00b
10	66.00a	68.00a	61.00b	64.33a
12.5	59.33a	65.33a	59.33a	59.66a
15	55.00ab	61.00a	53.00ab	52.66ab
Control	80.66a	84.33a	82.00a	83.66a

AlDhamin [14] indicated that some of the treated 5th instar nymphs of *Ommatissus lybicus* with 20% oil of *Melia azedarach* could develop and emerged into normal adults. However, the females suffered from reduced fecundity and egg hatchability.

Mean fecundity (no. of eggs/female) of *Ommatissus lybicus* in spring (1st generation) 2009 (104.60)**.** 2010 (106.20)[15]. Pathak and Pandey [16] show decline in egg number of *Corcyra cephalonica* when exposed at the larval stage with neem and eucalyptus oil 20-160 µl the adults metamorphosing from larvae exposed to 40, 80 or 160 µl of oils, showed a severe reduction in egg output and egg hatchability as compared to those recorded for untreated individuals (controls) A significant reduction in glycogen, lipid and protein level and an increase in free amino acids was noticed in testes and ovaries of these insects A sharp decline in the glycogen content of ovaries due to combined action of volatiles,presumably, affects the synthesis of glycogen in the oocytes adversely inactivating glycogen synthetase and /or by blocking the passage of raw materials for glycogen synthesis into the oocytes [17-18-19-20].

Pronounced loss in lipid content in the ovaries of adult females subjected to neem and eucalyptus oil volatiles regimen, can presumably be considered as a reflection of serious dislocation in the physiological operations connected with the movement of lipids which under normal circumstances, occur from fat body to ovary via haemolymph for the purpose of vitellogenesis in the reproductive life of a female insect [21-26].

De Franca [27] were studied *Eucalyptus globulus* L. and *E. Citriodora* Hook and other five plants In toxicity tests, grains of *Phaseolus vulgaris* L. were impregnated with oils and infested with adults of *Zabrotes subfasciatus* up to 24 hours old. All tested oils were effective in reducing the viable egg-laying and adult emergence of this pest. Essential oils from plants of the genus *Eucalyptus* reduced the proportion of viable eggs and emerged adults of *Z.subfasciatus* due to its fumigant effect [28]. Kellouche, *et al.*, [29] stated that clove oil and mentha and Eucalyptus oils affected difrent biological parameters of *Callosobruchus maculatus* such as longevity ,fecundity and adult emergence at 10 ,15 µl.

Jacob and Qamar [30] Laboratory experiments were study fifteen different combinations of six essential oils Cedarwood (*Cedrus deodara*), Camphor (*Cinnamomum camphora*), Eucalyptus (*Eucalyptus globulus*), Lemongrass (*Cymbopogon flexuosus*), Peppermint (*Mentha piperita*), and Bitter orange (*Citrus aurantium*) on the 4th instar larvae of *Corcyra cephalonica* via contact application (cedarwood + eucalyptus, cedarwood + peppermint) fecundity inhibitor as evident by appearance of numerous empty spaces within the ovarioles. The distribution and arrangement of oocytes/ova was also found disturbed and disorderly with two or more ova coalescing and fusing to form a lumpy mass within the ovarioles reducing the number of eggs laid by affected females.

Cruz *et al.*,[31] demonstrate that clove oil at 30,50 mg/liter reduced larval survival. oils interfere in the biology and humoral immunity of *Spodoptera frugiperda* and caused a decrease in the amount of eggs of adults emerged from survived third instar larvae .

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