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RESEARCH PAPER

Effect of some plant extract on Indian meal moth *Plodia interpunctella* (Hübner) (Lepidoptera: Pyrallidae) on Pistacio fruits in Erbil-Kurdistan Region

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A B S T R A C T:

In this study the Controlling of imature stages of Indian meal moth, *Plodia interpunctella* (Hübner) (Lepidoptera- Pyralidae) By botanical control were investigated in laboratory of Agricultural engineering Science Erbil Governorate, Kurdistan Regionon (2022). The natural insecticides (*Urtica dioica, Ricinus communis, Lactuca seirola* and *Cephalaria setosa*) were used to control the pest during larval instars. Crude plant extracts (*Cephalaria setosa*) with the highest mortality rate (73.94) % against the studied larval instar and crude plant extract *Ricinus communis* with mortality rate 72.27% against the studied larval instars, while in the crude plant extract Urtica diocia was the lowest mortality rate 50.69% against the studied larval stage of *P. interpunctella* (Hübner).

KEY WORDS: Stored product pests, Plodia interpunctella (Hübner), Plant extracts, Imature stages.
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1.INTRODUCTION:

The Indian meal moth, *P. interpunctella* (Hübner), is a cosmopolitan major economic insect pest of stored products (Rees, 2004). The larvae prefer to feed on broken grains especially on milled products such as flour, breakfast foods, stored cereal products, dried vegetables and fruits, processed foods and meals (Veena *et al*., 2005). Generally, the control of this insect pest in storage systems depends on synthetic insecticides organophosphates and pyrethroids) and fumigants (such as methyl bromide or phosphine) (Mbata and Shapiro-Ilana, 2010 and Kim *et al*., 2014). Applications of insecticide had led to resistance in some *P. interpunctella* populations and the accumulation of chemical residues in food, as well as human exposure to pesticides (Attia, 1977; Arthur and Phillips, 2003; Phillips and Throne, (2010). Moreover, methyl bromide, a high toxic product, has been declared an ozone-depleting substance and therefore is being phased out completely (Rajendran and Sriranjini, 2008).

In Argentine the most used insecticides to control *P. interpunctella* are organophosphates (DDVP, pirimiphos-methyl), pyrethroids (lambdacyhalothrin and deltamethrin) and phosphine (Santa Juliana, 2013; Abadia and Bartosik, 2014). The use of plant materials (extracts, essential oils and their components) as traditional protectants of stored products is an old practice used all over the world (Tripathi and Dubey, 2004; Rajendran and Sriranjini, 2008). To reduce the harmful effects of conventional synthetic pesticides, biopesticides based on essential oils appear to be a complementary oralternative method for stored product protection (Tripathi *et al*.,2009) Therefore, the present study was carried out to determine the lethal activity on immature stages of *P. interpunctella.*

2.Materials and Methods

Insect pest breeding:

Colonies of The Indian meal moth, *P. interpunctella* (Hübner) maintained in the

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laboratory without exposure to any insecticide, they were reared in corkbox 60×60 cm, contained pistachio.

Natural Plants Extraction:

In this study Crude plant extracted from four local wild plants were prepared to investigate their effect on larval instars of *P. interpunctella* (Hübner). These experiments were performed under field conditions, the treatment include three replications, each replicate involved (10) larvae.

Collection and Extraction of Plant Materials:

Plants collected from various locations and families table (1), fresh leaves and shoots, shade dried under room temperature and the plant materials were powdered individually by electric blender, (Hitachi, model BL603G, Tokyo, Japan). Each powdered plant material was sieved (40) mesh size sieve to obtain a very fine dust. Twenty grams of each powdered plant material was sequentially mixed with 100 ml tab water for a period of twenty-four hours and then filtered with linen cloth and filter paper, then these crude plants diluted with tab water, (100%) which are used directly, (75%) was made with mixing (75) ml of crude plant extracts and (25) ml of tab water and (50%) was made by mixing (50) ml tab water and (50) ml crude plant extracts. The crudee extracts thus obtained were stored in sterilized amber colored bottles maintained at 4 C^o in a refrigerator till the controlling days. Crudes plants were obtained from four local plant leaves. The toxicity effects of plant extracts obtained from (*Urtica dioica, Ricinus communis, Lactuca seirola* and *Cephalaria setosa*) on the first larval instars of *P. interpunctella*.

Table 1: Scientific names, family names, common names and collecting place of plants which were produced of the crude plant extracts.

No.	ScientificName	Family
1	*Urtica dioica*	Urticaceae
2	*Ricinus communis*	Euphorbiaceae
3	*Lactuca serriola*	Asteraceae
4	*Cephalaria setosa*	Dipsacaceae

Collection of Insects:

Larvae of *P. interpunctella* were collected from the culture. Ten larvae of this insect with fresh *Pistacia vera* seeds were placed into the petri dishes (glass petri dishes nine cm wide × one and a half cm deep, corresponding to 120 ml volume), covered with muslin and fed with the fresh leaf of Pistachio trees then treated with the crude plant extracts (100%, 75% and 50%). The mortalities of the larvae were measured after (three, six, nine, twelve, fifteen, eighteen, and twenty foure) hours (Omer, 2006 and Kesdek, *et al*., 2014).

Mortality Bioassay:

Ten larvae of *P. interpunctell* were introduced to each of the petri dishes, for evaluation of plant larvicidal activity. Three replicates of the treatments and untreated controls were laid out in Randomized Complete Block Design (RCBD). The larval mortality percentage was recorded after (3, 6, 9, 12, 15, 18, 21 and 24) hours , and the mortality percentage ratio has been corrected by using (Abbott, 1925) formula as follows:

$$\%\text{Mortality} = \frac{\text{Number of Died Larvae}}{\text{Total Number of Larvae}} \times 100$$

$$\text{Corrected \% Mortality} = \frac{\%\text{Mortality of Treatment} - \%\text{ Mortality of Control}}{100 - \text{Mortality of Control}} \times 100$$

Statistical Analysis:

The experiment was subjected tofactorial Randomized Complete Block Design. Data were analyzed by using analysis of variance (ANOVA). Mortality was expressed as mean (percentage) ± standard error and compared at (0.5) significant level using the new Duncan's multiple test (Al. Rawi and Khalafullah, 1980).

3. Result and Discussion

The effects of crude plant extracts on mortality of first larval instar of *P. interpunctella*.

In the table (2) show the relation between crude plant extracts, crude plant extract concentration and exposure time that means (ABC) are shown, the lowest mortality rate is (3.33) % after three hours of treatment at concentration of (50) % of *U. dioica* crude plant extracts determined for the first larval instar of *P. interpunctella.* However, the highest mortality rate was (94.67) % after three hours of treatment with *C. setosa* crude plant extract at concentration (100) % has been found against the first larval instar of *P. interpunctella*. Similarly, the lowest mortality rate was (16.67) % recorded after six hours in the (50) % concentration for *U. dioica* crude plant extract. In addition to the highest mortality rate (100) % observed in the (100) % concentration of *C. setosa* crude plant extract after six hours against the first larval instar of *P. interpunctella*. Although the lowest mortality rate was (38.00) % after nine hours of treatment with the (50) % concentration against the first larval instar of *P. interpunctella* was fixed for *U. dioica* crude plant extract. The highest mortality rate was (100) % after nine hours found in the (75 and 100) % concentrations of *C. setosa* crude plant extract. The minimum mortality rate was (51.33) % after twelve hours at concentration of (50) % for *U. dioica* crude plant extract determined for the first larval instar of *P. interpunctella.* However, the highest mortality rate was (100) % after twelve hours of treatment with (75 and 100) % concentrations have been found for *C. setosa* and *Ricinus communis* crud against the first larval instar of *P. interpunctella*. The lowest mortality rate was (64.67) % established after fifteen hours in the (50) % concentration for *U. dioica* crude plant extract. In addition, the highest mortality rate of (100) % was observed in the (50, 75 and 100) % concentrations of *C. setosa* and *L. serriola* crude plant extract after fifteen hours against the first larval instar of *P. interpunctella*. After eighteen hours of treatment the minimum mortality rate was (74.67) % with (50) % concentration for *U. dioica* crude plant extract determined for the first larval instar of *P. interpunctella* and the highest mortality rate was (100) % with (50, 75 and 100) % concentrations for *C. setosa* crude plant extract, (75 and 100) % has been found for *R. communis* crude plant extract and (100) % concentration for *L. seirola*crude plant extract against the first larval instar of *P. interpunctella*. Although after (21) hours of treatment the lowest mortality rate was (78.00) % with (50) % concentration against the first larval instar of *P. interpunctella* which was fixed for *U. dioica* crude plant extract, but the highest mortality rate of (100) % was found in the (50, 75 and 100) % concentrations of *C. setosa* crude plant extract and (75 and 100) % has been found for *R. communis*crude plant extract. At the last time after (24) hours of treatment the lowest mortality rate was (78.00) % with (50) % concentration against the first larval instar of *P. interpunctella* which was fixed for *U. dioica* crude plant extract, the highest mortality rate of (100) % was found in the (50, 75 and 100) % concentrations of *C. setosa* crude plant extract.

In general, the highest mortality rates of the first larval instar of *P. interpunctella* were fixed after all tested periods (three, six, nine, twelve, fifteen, eighteen, twentyone and twentyfour) hours at concentration of (100) % for *C. setosa*crude plant extract. As well as the lowest mortality rates after all tested periods were (three, six, nine, twelve, fifteen, eighteen, twentyone and twentyfour) hours in the (50) % concentration for *U. dioica*crude plant extract. Besides, it was established that there was mortality in all concentrations and times for extracts of four crude plant extracts on the first larval instar of *P. interpunctella* and in comparison, with controls.

The relation between crude plant extracts and crude plant extract concentrations that means (AB), the lowest mortality rate was (50.58) % at concentration of (50) % for *U. dioica* crude plant extract, the highest mortality rate of (99.33) % at concentration of (100) % for *C. setosa*crude plant extract, has been found against first larval instar of *P. interpunctella*, in comparison with controls. The relation between crude plant extracts and tested periods that means (AC), the lowest mortality rate of (7.33) % after three hours for *U. dioica*crude plant extract, and the highest mortality rate was (73.67) % after (24) hours for *R. communis* and *C. setosa*which has been found against first larval instar of *P. interpunctella*. In the relation between crude plant extract

concentrations and tested periods that means (BC), the lowest mortality rate was (48.49) % at concentration of (50) % after three hours, as well as the highest mortality rate was (100) % at concentration of (100) % in the (eighteen, tweny one and twenty four) hours of tested periods, in comparison with controls. The relation between each crude plant extracts that means (A) appeared, in which the lowest mortality rate was (50.69) % for *U. dioica*, as well as the highest mortality rate was (73.94) % for crude plant extracts of *C. setosa*, at the P< 0.05 level (Duncan Test) there was no significant difference between *C. setosa* and *R. communis* and significant difference with other crude plant extracts. The relation between each crude plant extract concentrations that means (B) appeared the lowest mortality rate was (73.69) % at concentration of (50) %, and the highest mortality rate was (91.42) % at concentration of (100) %, which has been found against the first larval instar of *P. interpunctella*, and in comparison, with control. The relation between each tested period that means (C), the lowest mortality rate was (43.98) % after three hours, as well as the first larval mortality rate increased with tested period, rise to (72.52) % after (24) hours.

Zaitoun, (2007) tested that the extracts of *Abrus precatorius, Laurus nobilis, Petroselinum sativum* and *Plantago psyllium*have insecticidal effects against the moth; they killed 100 or 95% of the tested wax moths respectively without adverse effects on worker bees except in the case of *A. precatorius*. and Zlatko, *et al*,. (2007) indicated that the extract of *Achillea millefolium* L. (100%) was ineffective in insecticidal activity, extracts from *Sambucus nigra*L. and *Juglans regia* L. were ineffective in all conducted bioassays. It also agrees with Yelmaz, *et al*., (2013) results, that the susceptibility of *T. wilkinsoni* larvae increase in younger stage.

The effects of crude plant extracts on mortality of first larval instar of *Plodia interpunctella* (Hübner):

Figures (1, 2, 3 and 4) showed the relationship between increasing crude plant extracts concentration produced from (*U. dioica*, *R. communis*, *L. seirola* and *C. setosa*) and mortality number of first larval instar of *P. interpunctella*, showed that with increasing the crude plant extract concentration the mortality number of first larval instar was significantly increased.

Table (2): Effect of Crude Plant extracts with different concentration on First Larval Instar of *P. interpunctella* (Hübner)at Various Exposure Times.

(A) Crude Plant extract	(B) crude plant extract Concentrat	Mean mortality % of first larval instar at different exposure periods (hours) (C)								AB	A
		(3)h	6)h	(9)h	(12)h	(15)h	(18)h	(21)h	(24)h		
Urtica dioica	C.	0.00±0.00(o)	0.00±0.00(o)	8.00±10.00(no)	8.00±10.00(no)	8.00±10.00(no)	8.00±10.00(no)	11.33±8.82(no)	1133±8.82(no)	6.83±5.92(h)	50.69±3.90(c)
	50	3.33±3.33(lno)	16.67±8.82(n)	38.00±10.00(lm)	51.33±12.02(i-l)	64.67±8.82(f-l)	74.67±13.33(c-i)	78.00±15.28(b-g)	78.00±15.28(b-g)	50.58±6.86(g)	
	75	11.33±3.33(n)	38.00±5.77(k-m)	58.00±5.77(g-l)	78.00±5.77(c-i)	84.67±3.33(b-g)	88.00±0.00(a-f)	91.33±3.33(a-d)	93.33±3.33(a-d)	67.83±5.87(f)	
	100	14.67±3.33(mn)	41.33±3.33(j-l)	74.67±3.33(d-i)	94.67±3.33(ab)	94.67±3.33(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	77.50±6.24(e)	
Ricinus communis	C.	2.33±3.33(no)	2.33±3.33(no)	2.33±3.33(no)	2.33±3.33(no)	2.33±3.33(no)	2.33±3.33(no)	2.33±3.33(no)	8.00±5.77(no)	3.04±1.17(hi)	72.27±4.13(a)
	50	81.33±3.33(a-f)	89.00±0.00(a-f)	91.33±3.33(a-d)	91.33±3.33(a-d)	91.33±3.33(a-d)	94.67±3.33(ab)	94.67±3.33(ab)	94.67±3.33(ab)	91.04±1.25(d)	
	75	88.00±5.77(b-h)	91.33±3.33(a-d)	94.67±3.33(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	96.75±1.02(a-c)	
	100	91.33±6.65(a-c)	94.67±3.30(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	98.25±0.90(ab)	
Lactuca seirola	C.	0.00±0.00(o)	0.00±0.00(o)	0.00±0.00(o)	2.33±3.33(no)	2.33±3.33(no)	2.33±3.33(no)	8.00±5.77(no)	8.00±5.77(no)	2.87±1.30(hi)	59.80±3.82(b)
	50	38.00±5.77(k-m)	54.67±6.67(h-l)	61.33±8.82(f-l)	64.67±12.02(f-l)	68.00±11.55(e-k)	68.00±11.55(e-k)	68.00±11.55(e-k)	70.00±11.55(e-k)	61.58±3.62(f)	
	75	51.33±6.67(i-l)	68.00±5.77(e-l)	81.33±3.33(b-h)	84.67±3.33(b-g)	88.00±5.77(a-e)	91.33±6.67(a-c)	91.33±6.67(a-c)	91.33±6.67(a-c)	80.92±3.25(e)	
	100	68.00±5.77(e-l)	91.33±3.33(a-d)	91.33±3.33(a-d)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	93.83±2.15(b-d)	
Cephalaria setosa	C.	0.00±0.00(o)	0.00±0.00(o)	0.00±0.00(o)	0.00±0.00(o)	0.00±0.00(o)	2.33±3.33(no)	2.33±3.33(no)	5.67±6.67(no)	1.29±0.96(i)	73.94±4.28(a)
	50	71.33±3.33(d-j)	89.00±5.77(a-e)	91.33±3.33(a-d)	94.67±3.33(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	93.29±1.97(cd)	
	75	88.00±5.77(a-e)	94.67±3.33(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	97.83±0.96(a-c)	
	100	94.67±3.33(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	99.33±0.40(a)	
AC	*U. dioica*	7.33±2.41(l)	23.00±5.84(k)	44.67±8.20(ij)	58.00±10.52(f-h)	63.00±10.55(e-g)	67.17±11.18(c-f)	70.67±11.07(a-e)	70.67±11.07(a-e)	B	
	R. communis	65.74±11.42(d-g)	68.83±11.84(b-f)	72.17±12.40(a-d)	72.17±12.40(a-d)	72.17±12.40(a-d)	73.00±12.52(a-c)	73.00±12.52(a-c)	73.67±11.70(a)		
	L. seirola	39.33±8.11(j)	53.00±10.55(hi)	58.00±11.15(gh)	62.17±11.51(e-g)	63.83±11.71(d-g)	64.67±11.89(c-f)	66.33±11.14(a-e)	66.33±11.14(a-e)		
	C. setosa	63.35±11.71(e-g)	69.67±12.60(a-e)	71.33±12.81(a-d)	72.17±12.94(a-d)	73.00±13.06(a-c)	73.83±12.64(ab)	73.83±12.64(ab)	73.67±12.27(a)		
BC	C.	0.58±0.83(n)	0.73±0.83(n)	2.33±2.56(mn)	3.17±2.60(l-n)	3.17±2.60(l-n)	4.00±2.61(l-n)	6.50±2.79(lm)	9.00±3.02(l)	3.69±0.84(d)	
	50	48.49±9.61(k)	61.33±9.48(j)	70.50±7.40(ij)	75.50±6.64(g-i)	80.50±5.38(f-h)	83.83±5.43(e-g)	84.67±5.55(d-f)	84.67±.5.55(d-f)	73.69±2.70(c)	
	75	59.67±9.83(j)	73.00±7.12(hi)	83.83±5.14(e-g)	89.67±2.97(c-f)	92.17±2.29(b-e)	93.83±1.93(a-d)	94.67±1.88(a-c)	94.67±1.88 (a-c)	85.19±2.07(b)	
	100	67.17±9.88(ij)	81.33±7.11(e-g)	90.50±3.05(c-e)	97.17±0.83(ab)	97.17±0.83(ab)	100.00±0.00(a)	100.00±0.00(a)	100.00±0.00(a)	91.42±1.84(a)	
C		43.98±5.65(f)	52.56±5.80(e)	56.31±5.70(d)	67.00±5.82(c)	69.00±5.83(bc)	70.73±5.87(a-c)	71.71±5.76(ab)	72.52±5.61(a)		

Values followed by the same letter with in a column are not significantly different at the P < 0.5 level (Dancun test).

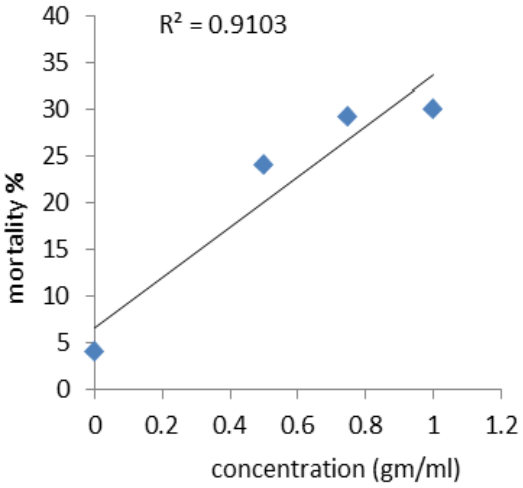

Figure 1: Toxicity line of (*U. dioica*) on the *P, interpunctella* after twelve hours.

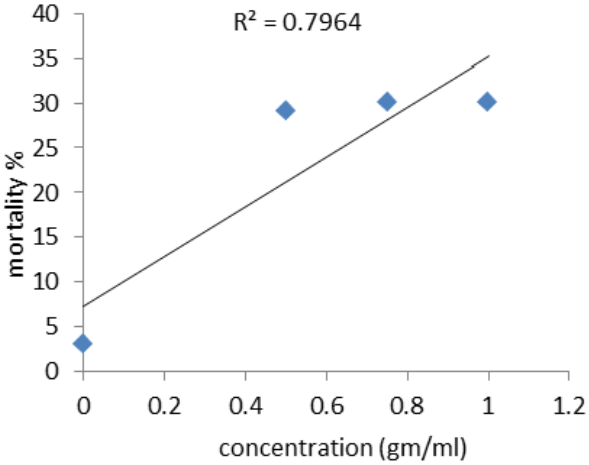

Figure 2: Toxicity line of (*R. communis*) on the *P, interpunctella* after twelve hours.

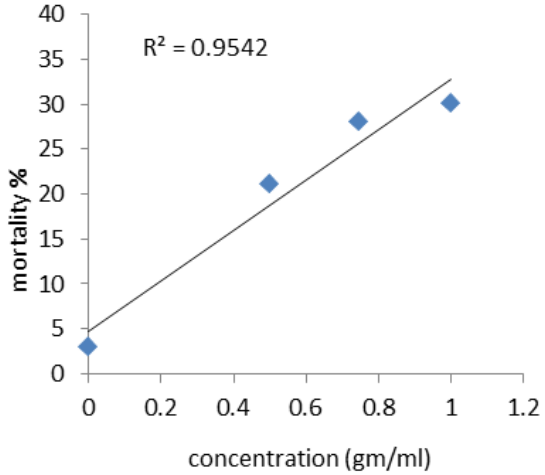

Figure 3: Toxicity line of (*L. seirola*) on the *P. interpunctella* after twelve hours,

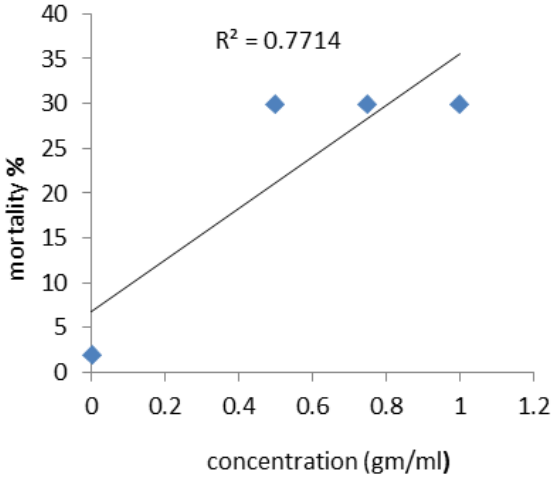

Figure 4: Toxicity line of (*C. setosa*) on the *P, interpunctella* after twelve hours.

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