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EFFECT OF TOOTH PICK (*AMMI visnaga* L.) SEED EXTRACTS ON THE RICE WEEVIL *SITOPHILUS oryzae* (COLEOPTERA : CURCULIONIDAE)

[36]

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ABSTRACT

Seeds of the tooth pick plant (*Ammi visnaga* L.) were extracted by organic solvents of different polarities, and tested for their toxic effect on *Sitophilus oryzae* infesting wheat grains. Toxicity of chloroform extract, was the most potent, at both Lc_{50} and Lc_{95} levels (i.e. 3240 and 8730 ppm). Reproductive potential of treated weevil were strongly affected as no progeny were obtained when treated with either Lc_{50} or Lc_{95} with *A. visnaga*. Extracts treatment at Lc_{95} level organic extract gave protection up to 12 weeks for petroleum ether and chloroform, and 9 weeks when acetone was used for extraction. All tested extracts reduced grain germination at the end of 14 weeks storage period. Also, treated wheat grains with tooth pick extracts reduced the weight loss of grains.

Key words: Tooth pick seeds, Rice weevil, Wheat

INTRODUCTION

Cereals crops at harvest and storage are exposed to attack by insects, causing reduction in weight, quality, commercial value and grain viability.

Pesticides have a negative impact on the environment as well as living organisms. The use of natural products from plant origin have proven their efficiency in the control of many insect species, mainly insect of stored products, e.g., **Jilani (1985)**, **Makanjoula (1989)), Mostafa *et al* (1995), Mahgoub and Ahmed (1996), and Ahmed and Kassis (2000)**.

The present work was carried out with the aim of minimizing infection of stored wheat grains by the rice weevil, *Sitophilus oryzae* (Coleoptera, Curculionidae), using extracts of the tooth pick (*Ammi visnaga* L.). *Sitophilus oryzae* (L.), is an insect of economic importance as it is larvae bores into stored grains.

MATERIAL AND METHODS

Test insect

The culture of *Sitophilus oryzae* (L.) was successfully maintained on wheat grains for several generations, at the la-

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boratory under laboratory conditions of 27 ± 1°C and 65 ± 5 R.H .

Preparation of *A. visnaga* seed extract

A weight of 500 gm. of tooth-pick seeds which were obtained from the Department of Plant, Ministry of Agriculture. Dry seeds were cleaned thoroughly by removing any impurities, they were ground to a fine powder by a high speed micromill. The grounded powder was extracted first with petroleum ether (40 – 60) in a flask and left for 48 hr, the extract was then filtered and the solvent was then evaporated under reduced pressure by using a rotary evaporator. The detatted powder was thoroughly dried before being extracted next with chloroform, then acetone solvent as adopted from **Afifi *et al* (1989)**.

Evaluation of extracts toxicity

Toxicity of *A. visnage* as extracted by the three organic solvents determined by adding different concentrations ranging from 2000 up to 10000 ppm to wheat grains.

Twenty five, 1–2 weeks old *S. oryzae* adults, were obtained from the maintained stock culture and placed on the treated wheat grains which were then placed in glass tubes. The tubes were covered with muslin fixed with rubber band and a control was prepared containing untreated grains. After 3, 5, 7 and 14 days, the tubes were investigated and the number of live and dead weevils counted. Accumulated mortality percentages, (Lc_{50} and Lc_{95}) and regression lines slope were determined and corrected by **Abbott's formula (1925)**, and computed mortality percentages conducted after 72 hours exposure according to **Finney, (1952)**.

Effect of tooth pick seed extracts on fecundity and F_1 progeny of *S. oryzae*

Several weight of 10 gm. of wheat grains were prepared and each 10 gm of grains were treated with the determined Lc_{50} or Lc_{95} of each of tooth pick seed as extracted by the three organic solvents. The treated wheat grains were placed in glass tubes (1 x 3 inches), subsequently, five couples of *S. oryzae* 1 – 2 weeks old adult weevils were included in each tube. After two weeks, the tubes were opened and the insects removed, and the number of deposited eggs on the grains were counted according to the method described by **Frankenfeld, (1948) and Howe, (1952)**.

The same previous experiment was repeated, but laid eggs were left undisturbed until hatching. After two weeks the adult weevils were removed and the tubes left for seven weeks, up to progeny emergence and the number of emerged F_1 adult offspring were counted.

All of the forementioned experiments were replicated three times and a control containing untreated wheat included.

Assessment of residual efficiency of tooth pick organic extract

Tubes containing 10 gm. of wheat grains were treated with Lc_{95} concentration of each extract, were divided into several groups and stored.

Three tubes were selected every week and twenty five adults of *S. oryzae* were introduced into there tubes, this process was repeated every week and up to 14 weeks. Mortality counts were carried out

following the third day of introduction weevils. Insect mortality percentages were calculated and corrected according to **Abbott's formula (1925)**. Similarly three replicates of untreated wheat were used as a control for each week.

The effect of tooth pick extract on grain germination

Germination of the wheat grains treated with Lc_{95} of tooth pick extracts, was determined according to the International rules for seed testing (Anonymous 1966) at the initial time and the end of the considered storage period (14 weeks).

Wheat grain weight loss treated with tooth pick extract

Percentage moisture content of wheat grains treated with tooth pick seed organic extracts were determined according to the equation reported by **Khare and Johari (1984)** equation:

$$\text{Weight loss (\%)} = \frac{\text{Initial dry weight} - \text{Final dry weight}}{\text{Initial dry weight}}$$

RESULTS AND DISCUSSION

Effect of tooth pick extracts on *Sitophilus oryzae*

On the basis of the determined mortality aof *S. oryzae* offered wheat grains treated with tooth pick seed extracts the use of chloroform as a solvent was found to be the most toxic against adult weevils, it's Lc_{50} was 3240 ppm, (Tables, 1 and 2). The effect of petroleum ether and acetone tooth pick extracts were relatively similar, as depicted by their Lc_{50}, e.g. 5320 and 5290 ppm, respectively. It is worth mentioning that all extracts caused 100% mortality by the 14 days following treatment.

These results agree with those reported by **Adel M. Abd El-Latif (2004),** which mentioned that *S. granrius* adults are more sensitive to chloroform extracts than acetone and pet-ether.

Effect of tooth pick seed extracts on fecundity and F_1 of *Sitophilus oryzae*

As shown in (Table, 3) tooth pick seed extracts on wheat grains offered to *S. oryzae* reduced the number of eggs laid by this insects. This effect was more pronouced when acetone was used for extraction as only 0.66 eggs were laid, when used at Lc_{50} level. No eggs were laid when Lc_{95} of this extract was tested, (the percentage reduction than the control was 98.52% and 100%, respectively). This effect was followed by chloroform, causing 93.51% and 88.35% reduction in fecundity than the control. As shown (Table, 3) no F_1 progeny emerged from weevils treated with tooth pick seed extracted by the three solvents.

Residual effect

As shown in (Table, 4), the residual effect of tooth pick seed extracts at Lc_{95} level was efficient up to the 9^{th} week when acetone was used for extraction with no significant difference between the other extracts. Meanwhile, it extended to 12 weeks for both, petroleum ether and chloroform extracts. The residual activity of these extracts deteriorated gradually untill it reached 44.67, 57.00 and 31.00%

Table 1. Effect of pick-tooth seeds extracts against *Sitophilus oryzae* adults

Solvents	Concentrations ppm	% Mortality (days)			
		1	3	7	14
Petroleum ether	4000	0.00	22.00 ± 5.49	62.00 ± 2.08	100 ± 0.00
	5000	6.00 ± 1.00	40.00 ± 0.90	74.00 ± 2.00	100 ± 0.00
	6000	20.00 ± 5.20	65.33 ± 3.18	78.00 ± 2.08	100 ± 0.00
	7000	20.00 ± 0.58	78.00 ± 3.64	94.67 ± 1.86	100 ± 0.00
	8000	27.67 ± 3.85	92.00 ± 1.16	100 ± 0.00	100 ± 0.00
Chloroform	2000	4.00 ± 2.31	24.00 ± 3.22	48.33 ± 3.18	100 ± 0.00
	4000	16.67 ± 3.34	61.00 ± 1.73	88.67 ± 1.16	100 ± 0.00
	5000	22.00 ± 0.58	72.00 ± 1.53	94.00 ± 1.53	100 ± 0.00
	6000	28.00 ± 1.53	86.00 ± 2.52	100 ± 0.00	100 ± 0.00
	7000	34.00 ± 2.31	92.00 ± 2.00	100 ± 0.00	100 ± 0.00
Acetone	4000	4.00 ± 1.16	20.00 ± 2.52	60.00 ± 3.06	100 ± 0.00
	5000	4.00 ± 0.00	45.00 ± 2.08	90.00 ± 2.00	100 ± 0.00
	6000	8.00 ± 1.53	80.00 ± 2.52	94.00 ± 2.00	100 ± 0.00
	8000	18.00 ± 0.58	85.00 ± 2.31	100 ± 0.00	100 ± 0.00
	10000	36.00 ± 3.06	95.00 ± 1.00	100 ± 0.00	100 ± 0.00

Table 2. LC_{50} and LC_{95} values and regression line of tooth pick seeds extracts against 1– 2 weeks old of *Sitophilus oryzae* adults

Solvent	Lc_{50} (ppm)	Lc_{95} (ppm)	Slope
Petroleum ether	5320	9060	7.11
Chloroform	3240	8730	3.81
Acetone	5290	9260	6.75

Table 3. Fecundity and F_1 progeny of *Sitophilus oryzae* on wheat grains treated with tooth pick seeds extracts

Solvent	Conc. ppm	Mean no. of eggs/5 pairs	Reduction (%)	Mean no. of (F_1) progeny	Reduction (%)
	Lc_{50} (532)°	4.66 B	88.35	00.0B	100
Petroleum ether	Lc_{95} (906)°	0.33 B	99.18	00.0B	100
	Control	40.0 A	--	17.0A	--
L.S.D. 0.05%	--	11.49	--	2.26	--
	Lc_{50} (324)°	3.33 B	93.51	0.00B	100
Chloroform	Lc_{95} (873)°	1.00B	98.05	0.00B	100
	Control	51.33A	--	18.33A	--
L.S.D. 0.05%	--	2.87	--	2.00	--
	Lc_{50} (529)°	0.66B	98.52	0.00B	100
Acetone	Lc_{95} (926)°	0.00B	100	0.00B	100
	Control	44.67A	--	25.00A	--
L.S.D. 0.05%	--	5.13	--	8.17	--

* Means within a column followed by the same letter are not significantly different at 5%

Table 4. Mortality percentages of *Sitophilus oryzae* adults exposed to grains treated with Lc_{95} of tooth pick seed extracts after several weeks post treatment

Weeks post treatment	Solvents used for extraction		
	Petroleum	Chloroform	Acetone
Initial	98.00A	97.00A	95.00A
1	95.00A	96.00A	96.00A
2	97.00A	97.00A	96.00A
3	94.00A	95.00A	96.00A
4	96.00A	95.00A	95.00A
5	96.00A	96.00A	96.00A
6	96.00A	96.00A	95.00A
7	95.00A	96.00A	95.00A
8	96.00A	95.00A	95.00A
9	96.00A	95.00A	94.00A
10	95.00A	95.00A	89.00B
11	95.00A	95.00A	83.00C
12	90.00B	90.00B	75.00D
13	79.00C	83.00C	60.00E
14	44.00D	57.00D	31.00F
LSD. 0.05%	3.98	3.40	3.37

* Means within a column followed by the same letter are not significantly different at 5%

after 14 weeks for pet-ether, chloroform and acetone, respectively. Significant differences were found between the three extracts starting from the 10^{th} week following treatment.

Effect of tooth pick seed organic extracts on the germination of treated wheat grains

Soon after wheat treatment (initial time) with tooth pick seed petroleum ether extract, germination was not significantly affected (Table, 5). Meanwhile, chloroform and acetone extracts caused a significant reduction in treated wheat germination. At the final investigation (14 weeks), all treatments revealed significant effects on wheat germination. **Shemais and Al Moajel (2000)**, found that wheat grains treated with capparis seed extracts also lost their viability at the end of 14 weeks of storage.

Effect of tooth pick seed extract on weight loss of wheat grains

Treated wheat grains with tooth pick extracts caused a weight loss in grain weight ranging between 71% - 82% than the control when treated at Lc_{50} level. Meanwhile, when treated with $Lc_{95,}$ this loss was between 80 - 87% than the control.

Table 5. Germination of wheat grains treated with tooth pick seed extracts and stored for 14 weeks

Solvent	Concentration ppm	Initial time		14 weeks storage	
		Germination (%)	Reduction %	Germination %	Reduction %
Petroleum ether	9060	94.oAC	3.75	68.0B	26.08
Chloroform	8730	92.0B	5.80	60.0C	34.78
Acetone	9260	86.0C	11.94	58.0C	36.95
Control	--	97.67A	--	92.0A	--
LSD. 0.05%	--	5.13	--	3.95	--

Table 6. Weight loss of the wheat grains treated with tooth pick extracts infestation by *Sitophilus oryzae* adults

Solvents	Concentration ppm	Dry weight loss %	Dry weight reduction %
Petroleum ether	Lc_{50} (532) °	4.35	71
	Lc_{95} (906) °	2.87	80
	Control	15.00	
Chloroform	Lc_{50} (324) °	2.98	80
	Lc_{95} (873) °	2.00	86
	Control	15.00	
Acetone	Lc_{50} (529) °	2.70	82
	Lc_{95} (926) °	1.85	87
	Control	15.00	

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تأثير مستخلصات بذور الخلة ضد حشرة سوسة الارز على حبوب القمح

[36]

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استخلصت بذور الخلة بواسطة عدة مذيبات (الإثير البترولى – الكلوروفورم – الأسيتون) وذلك لاختبار سميتهم ضد سوسة الأرز التى تصيب القمح استخدمت هذه المستخلصات على مستوى التركيز القاتل لـ50% ، 95% ، لكل منها كمعاملة سطحية على الحبوب .

مستخلص الكلوروفورم كان الأكثر كفاءة عند استخدامه فى التركيز القاتل لـ50% ، 95%.

تأثرت الكفاءة التناسلية لسوسة الأرز تأثرا شديد عند استخدام هذين التركيزين القاتل لـ50% ، 95% حيث حدثت حماية كاملة للحبوب حيث لم تخرج خلفة من الحبوب المعاملة بكلتا التركيزين.

معاملة الحبوب بالتركيز القاتل لـ 95% أعطت حماية 12 أسبوعا لكل من مستخلص الكلوروفورم والاثير البترولى و9 أسابيع فى حالة مستخلص الأسيتون .

تـأثرت نسـبة الإنبـات لحبـوب القمـح المعاملـة حيـث انخفضـت عنـد نهايـة فتـرة التخزين .

الحبـوب المعاملـة بـالتركيزين القـاتلين 50% ، 95% بالمستخلصـات أدى الـى انخفاض الفقد فى الوزن مقارنة بالغير معامل .

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