

**USAGE OF EGYPTIAN SESBAN (*SESBANIA AEGYPTICA* JYNIT)
SEED EXTRACTS AS PROTECTANTS TO WHEAT GRAINS
AGAINST THE LESSER GRAIN BORER, *RHIZOPERTHA*
DOMINICA F. (BOSTRICHIDAE: COLEPTERA)**

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Abstract

Three extracts of Egyptian sesban (*Sesbania aegyptica* Jynit) seeds were used for protection of wheat grains against *Rhizopertha dominica*, F. adults. The petroleum ether extract was applied to wheat grains at 6, 7, 8, 10 and 12 ml/kg, chloroform extract at 4, 6, 8, 9 and 12 ml/kg, while acetone extract was added at 4, 5, 6, 7 and 8 ml/kg. After three days of exposure, the three extracts at the high concentrations caused high level of mortality and gave complete mortality (100%) after 7 days of exposure. This effect was continued up to two months of storage, then decreased gradually. The LC_{50} , LC_{95} values were (8 & 10), (6.5 & 16) and (6 & 12) ml/kg for petroleum ether, chloroform and acetone extracts, respectively. The LC_{50} values of the three extracts caused high reduction in the number of F_1 progeny, no offspring was produced with LC_{95} values. The reduction in the percentage of germination for the treated grains ranged between (12.5 % - 26 %) in comparison with control. The use of the tested extracts at the LC_{50} , LC_{95} levels reduced the loss in weight of wheat grains after 2 months from the treatment.

INTRODUCTION

The stored grains are usually heavily attacked in storage by several insects of family Bostrichidae. One of the major insect of this family is *Rhizopertha dominica* F. adults cause a great reduction in seed weight, germination and commercial value. The use of plant extracts as protectants of stored grains against insect attack, introduces best control, other than insecticides, because they are effective, safe and lesser of environmental pollution.

The effectiveness of the plant extracts for the control of pests was studied by Su (1985), El-Borlosy *et al.* (1989) and Mahgoub *et al.* (1998) and they found that some plant extracts significantly suppressed reproduction and viability of deposited eggs of some stored grain insects.

The present work aims to evaluate the efficiency and persistence of Sesban (*Sesbania aegyptica*; Jynit) seed extracts on the lesser grain borer, *Rhizopertha dominica*, F.

MATERIALS AND METHODS

Test insect. *Rhizopertha dominica*, (F.) adults provided from laboratory cultures reared at $27 \pm 1^\circ\text{C}$ and 65 ± 5 R. H. were used. All cultures were reared in Egyptian wheat (*Triticum aestivum* L.) variety, Sakha 69. Experiments were carried out with 1-2 weeks old adults.

Test extracts. 500 gms of Egyptian sesban (*Sesbania aegyptica*, Jynit) dry seeds were cleaned thoroughly to remove any impurities, and were ground by a high speed micromill. The detached powder was thoroughly dried before extraction. The resulted powder was successively extracted with different organic solvents (petroleum ether 40 – 60, chloroform and acetone) in flask left for 48 hours and filtered. The solvent was evaporated under reduced pressure by using a rotary evaporator, (Affi *et al.* 1988).

Evaluation of extracts toxicity. Toxicity of each extracts was determined by the application of different extract concentrations, e.g. 6, 7, 8, 10 and 12 ml/kg, 4, 5, 6, 7 and 12 ml/kg and 4, 5, 6, 7 and 8 ml/kg for petroleum ether, chloroform and acetone respectively, and mixed thoroughly with wheat grains. Ten grams of wheat from each treatments placed in glass tube, kept at $26 \pm 1^\circ\text{C}$ and 65 ± 5 R. H.

Batches of 25 adults of the tested insects were introduced into the tubes. Each treatment consisted of three replicates. A similar treatment with untreated wheat was included. Tubes were covered with muslin fixed with rubber band.

Mortality counts were carried out after 1, 3, 5, 7 and 14 days. Percentages of insect mortality were corrected for natural mortality by means of Abbott's formula (1925). Computed mortality percentages after 72 hours exposure were plotted versus the corresponding concentration of log probability paper and the required concentration to produce 50 % and 95 % kill and slopes were determined (Finney, 1952).

Effect of tested extracts on number of progeny. Twenty adults, 1 – 2 weeks old of *Rhizopertha dominica* were placed in glass tube with 10 grams of wheat grains treated with LC_{50} or LC_{95} for each tested extracts.

Two weeks later, the insects were removed. The tubes were kept in an incubator at $26 \pm 1^\circ\text{C}$ and 65 ± 5 R. H. After seven weeks, the total number of emerged F_1 offspring was counted.

The effect of tested extracts on grain germination. Germination tests were carried out according to the international rules for seed testing (Anonymous, 1966) to find out the effect of the tested extracts on the germination of treated wheat grains at the initial time and at the end of storage period. Concentrations used were 10, 16 and 12 ml/kg for petroleum ether, chloroform and acetone extracts, respectively.

Assessment of residual efficiency. Tubes each having 10 gm of wheat grains treated with doubling quantity LC_{95} concentration of each extracts, were divided into several groups. Each group consists of three replicates for each storage period. The tubes were kept under laboratory conditions (26 ± 1 °C and 65 ± 5 R. H.).

Twenty five adults of *Rhizopertha dominica* were introduced into each tube (3 replicates) every week and continued up to 10 weeks. Mortality counts were carried out 72 hours after introducing the insects. Mortality percentages were corrected according to Abbott's formula (Ott, 1925). Similar three replicates of untreated wheat were used as control.

Weight loss. Weight losses in wheat grains untreated and treated with sesban extracts as a result of feeding with *R. dominica* adults were assessed as dry weight losses. To reach this aim, moisture content of untreated wheat grains was determined.

10 gm samples were heated at 105 °C in an electric oven for 18 hours and reweighed. The loss weight as moisture content was calculated as percentage. Seeds from which adults emerged were reweighed, and losses were made.

The frass and all dusts were carefully removed and the moisture content was adjusted. The weight loss (%) was calculated as the following according to Khare and Johari (1984) :

$$\text{Weight loss (\%)} = \frac{\text{Initial dry weight} - \text{Final dry weight}}{\text{Initial dry weight}} \times 100$$

RESULTS AND DISCUSSION

Toxicity of Egyptian sesban seed extracts on *Rhizopertha dominica*.

Data in Table 1 show the effect of Egyptian sesban (*Sesbania aegyptica* Jynit) seeds extracts on the mortality of *Rhizopertha dominica* adults. Adults were highly affected by the high doses of the three extracts after 3 days of exposure (94, 96 and 90 % mortality) were obtained for petroleum ether, chloroform and acetone, respectively. After 5 or 7 days of exposure, the high doses of the three extracts gave complete mortality (100%). With all extracts, complete mortality was obtained after 14 days of exposure, except the lowest doses.

The above results indicate that treating of wheat grains with the three tested extracts of *Sesbania aegyptica*, can be effective against *Rhizopertha dominica* infestation. The concentrations of 12, 12 and 8 ml/kg for petroleum ether, chloroform and acetone extract, respectively, were recommended against *Rhizopertha dominica*. Nadra and Abd El-Baki (2000) reported that *Brassica rapa* extract was very effective

against *Rhizopertha dominica* adults. Table 2 shows that acetone extract on the base of LC_{50} was more effective than chloroform and petroleum ether extracts. The values of slopes show that the adults of *Rhizopertha dominica* were homogenous for the susceptibility to petroleum ether extract than chloroform and acetone extracts.

Effect of sesban seed extracts on F_1 progeny of *Rhizopertha dominica*.

Data in Table 3 indicate that exposing of *Rhizopertha dominica* adults to wheat grains treated with the LC_{50} levels of the tested extracts caused a moderate reduction in the mean number of F_1 progeny/one pair.

Reduction in insect population ranged between 56 and 76 % for chloroform, acetone and petroleum-ether, respectively. No adults were emerged at LC_{95} levels with all the tested extracts compared with mean number of 6.2 insects/1 pair produced with control. These results agree with Taheya and Hammoud (1993) who reported that *N. sataiva* seed powder and extract gave 100 % and 90.16 % reduction, respectively in F_1 progeny of *T. granarium* Everts.

Residual efficiency of sesban seed extracts.

Table 4 shows that acetone extract was the least persistent which gave high mortalities percent (95 %) till the sixth week and reached to (60 %) at the end of storage. Both of petroleum ether and chloroform extracts gave high mortalities percent (94 %) till the eighth week and reached to (70 and 71 %) at the end of storage (10 weeks).

Effect of sesban seed extracts on germination.

The percentage of germination of treated wheat grains at the initial time and at the end of storage are shown in table 5. The viability of grains was affected by all extracts with LC_{95} levels. The highest reduction in the percentage of germination as compared with control was caused by chloroform extract (20.8 %) followed by petroleum ether (16.7 %) then acetone extract (12.5 %). The same trend was observed at the end of storage (26.04, 20.8 and 17.7 % reduction for chloroform, petroleum ether and acetone extract, respectively). These results agree with those obtained by Mahgoub *et al.* (1998).

Effect of sesban seed extracts on weight loss.

Results in Table 6 indicate that treated wheat grains with *Sesbania aegyptica* seed extracts caused a weight loss reduction between 55.56 – 72.16 in wheat grain weight than the control at LC_{50} levels. Meanwhile at LC_{95} levels this loss ranged from 83.68 % to 96.93 % than the control. The highest effect was observed for the acetone extract and the lowest was for petroleum ether extract.

These findings are in harmony with the results reported by Abdel Latif, (2003) who found that the treated cowpea and chickpea seeds with some natural oils reduced the weight loss in the seeds.

Table 1. percent mortality of *Rhizopertha dominica* adults fed on wheat grains treated with sesban extracts.

Extracts	Concentrations ml/kg	% mortality after indicated days				
		1	3	5	7	14
Petroleum- ether	6.0	0.0 ± 0.00	20 ± 2.87	39 ± 2.08	68 ± 5.20	82 ± 0.00
	7.0	0.0 ± 0.00	42 ± 1.53	62 ± 2.08	81 ± 0.00	100 ± 0.00
	8.0	10 ± 2.31	70 ± 5.17	100 ± 0.00	100 ± 0.00	100 ± 0.00
	10.0	12 ± 0.00	84 ± 0.00	100 ± 0.00	100 ± 0.00	100 ± 0.00
	12.0	26 ± 2.31	94 ± 0.00	100 ± 0.00	100 ± 0.00	100 ± 0.00
Chloroform	4.0	0.0 ± 0.00	25 ± 2.89	40 ± 2.33	62 ± 0.00	88 ± 4.62
	6.0	6 ± 0.58	40 ± 5.00	67 ± 3.52	82 ± 3.47	100 ± 0.00
	8.0	12 ± 4.00	50 ± 5.78	100 ± 0.00	100 ± 0.00	100 ± 0.00
	9.0	12 ± 0.00	60 ± 5.78	100 ± 0.00	100 ± 0.00	100 ± 0.00
	12.0	18 ± 1.16	96 ± 0.00	100 ± 0.00	100 ± 0.00	100 ± 0.00
Acetone	4.0	0.0 ± 0.00	25 ± 5.04	53 ± 2.00	78 ± 3.46	84 ± 2.00
	5.0	0.0 ± 0.00	35 ± 2.89	62 ± 0.00	91 ± 1.00	100 ± 0.00
	6.0	6 ± 0.00	52 ± 6.12	79 ± 0.00	100 ± 0.00	100 ± 0.00
	7.0	18 ± 1.53	70 ± 2.52	100 ± 0.00	100 ± 0.00	100 ± 0.00
	8.0	22 ± 4.17	90 ± 4.05	100 ± 0.00	100 ± 0.00	100 ± 0.00

± mean S.E.

Table 2. LC_{50} and LC_{95} and slope values of regression lines for tested extracts against *Rhizopertha dominica* adults (72 hrs after treatment).

Extracts	LC_{50} ml/kg	LC_{95} ml/kg	Slopes
Petroleum- ether	8.00	10.00	7.07
Chloroform	6.50	16.00	4.32
Acetone	6.00	12.00	4.26

Table 3. Progeny of *Rhizopertha dominica* as affected by sesban seed extracts.

Extracts	Concentration ml/kg	Mean no. of F_1 progeny/1 pair	% Reduction
Petroleum- ether	LC_{50} (8.00)	1.33	76
	LC_{95} (10.00)	0.00	100
	Con.	5.7	
Chloroform	LC_{50} (6.5)	3.20	56
	LC_{95} (16.0)	0.00	100
	Con.	7.3	
Acetone	LC_{50} (6.00)	1.67	70.7
	LC_{95} (12.00)	0.00	100
	Con.	5.7	

Table 4. Mortality percentages of *Rhizopertha dominica* adults exposed to wheat grains treated by doubling quantity of LC_{95} of tested extracts after different post treatment periods.

Period after treatment (in weeks)	Mortality percentages of <i>Rhizopertha dominica</i>		
	Petroleum - ether	Chloroform -	Acetone
Initial	98	97	97
1	96	95	96
2	96	96	96
3	95	96	95
4	95	95	94
5	94	95	95
6	95	94	95
7	93	93	93
8	94	94	90
9	80	82	78
10	70	71	60

Table 5. Germination of wheat grains stored for 10 weeks after treatment with *S. aegyptica* seed extracts.

Test extracts	Concentrations ml/kg	Initial time		After 10 weeks	
		Germination %	Reduction %	Germination %	Reduction %
Petroleum- ether	10.00	80	16.7	76	20.8
Chloroform	16.00	76	20.8	71	26.0
Acetone	12.00	84	12.5	79	17.7
Control		96		96	

Table 6. Effect of tested extracts on grains weight loss.

Solvents	Concentrations ml/kg	Dry weight loss %	Dry weight loss reduction %
Petroleum- ether	LC_{50} (8.00)	5.84	67.36
	LC_{95} (10.00)	1.95	89.10
	Con.	17.89	
Chloroform	LC_{50} (6.5)	7.95	55.56
	LC_{95} (16.0)	2.92	83.68
	Con.	17.89	
Acetone	LC_{50} (6.00)	4.98	72.16
	LC_{95} (12.00)	0.55	96.93
	Con.	17.89	

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استخدام بعض مستخلصات مادة السيسبان المصرى كمادة واقية لحبوب القمح ضد حشرة ثاقبة الحبوب الصغرى

سوسن عبد العزيز شemis

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة

— تم استخدام ثلاثة مستخلصات (الايثير البترولى والكوروفورم والاسيتون) لبذور السيسبان المصرى لوقاية حبوب القمح من الاصابة بحشرة ثاقبة الحبوب الصغرى .

— وقد تم استخدام الثلاثة مستخلصات السابقة بتركيزات مختلفة (٦ ، ٧ ، ٨ ، ١٠ ، ١٢ مل/كجم) بالنسبة للايثير البترولى ، (٤ ، ٦ ، ٨ ، ٩ ، ١٢ مل/كجم) بالنسبة للكوروفورم اما بالنسبة لمستخلص الاسيتون فكانت التركيزات (٤ ، ٥ ، ٦ ، ٧ ، ٨ ، مل/كجم) وقد تم خلطها بحبوب القمح .

— بعد فترة تعريض ٣ ايام كان للتركيزات العالية اثر كبير على نسب موت الحشرات ، وقد اعطت الثلاثة مستخلصات بالتركيزات العالية نسب موت كاملة (١٠٠%) بعد ٧ ايام من التعريض . وقد استمر هذا التأثير لمدة شهرين من التخزين ثم بدأ فى الانخفاض التدريجى .

— وقد اظهر كلا من التركيز القاتل لـ٥٠% ، القاتل لـ٩٥% للثلاث مستخلصات اثر كبير على الكفاءة التناسلية للحشرات حدث انخفاض شديد فى عدد الخلفة الناتجة بالنسبة للتركيز القاتل لـ٥٠% وانحصرت الخلفة تماما بالنسبة للتركيز القاتل لـ٩٥% .

— اظهرت النتائج ان المعاملة بالمستخلصات السابقة ادت الى انخفاض نسبة الاصابة فى الحبوب المعاملة عن مثيلاتها الغير معاملة .

— ادى استخدام هذه المستخلصات بكلا التركيزين القاتل لـ٥٠% ، القاتل لـ٩٥% من الحشرات الى خفض الفاقد الوزنى لحبوب القمح بعد شهرين من المعاملة .

— ينصح باستخدام التركيزات ١٢ ، ١٢ ، ٨ مل/كجم لمستخلصات الايثير البترولى والكوروفورم والاسيتون على التوالى ضد حشرة ثاقبة الحبوب الصغرى .