

**TOXICITY OF CAPPARIS, *CAPPARIS SPINOSA* SEED  
EXTRACTS TO THE LESSER GRAIN BORER, *RHIZOPERTHA  
DOMINICA*, F. (BOSTRYCHIDAE : COLEOPTERA)  
LABORATORY EVALUATION**

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**Abstract**

The toxicity of 3 different extracts from *Capparis spinosa* seeds was tested against the lesser grain borer, *Rhizopertha dominica*, F. adults . The petroleum ether extract was applied to wheat grains at 7, 9, 10, 11, 13 and 14 ml/kg (as surface treatment) , chloroform extract was added at 13, 14, 15, 16 and 18 ml/kg , while acetone extract was used at 11, 12, 13, 14 and 15 ml/kg .

Results indicated that all extracts at the high doses gave complete mortality (100%) after 7 days of exposure. LC<sub>95</sub> level continued to give 90% kill up to 4 weeks for acetone extract, while continued up to 5 and 6 weeks for petroleum ether and chloroform extracts, respectively.

The LC<sub>50</sub> values of the three extracts caused high reduction in the number of F<sub>1</sub> progeny, no offspring was produced with LC<sub>95</sub> level .

The percentage of germination of the treated wheat grains variety Sakha 69 were highly affected by the three extracts of *Capparis spinosa* seeds .

**INTRODUCTION**

The use of plant extracts offers a hope for protection of stored grains from insect attack, because they are effective, safe and more economical than synthetic insecticides, which became a source of environmental pollution. Malik and Mujtaba (1984) found that some plants acts as repellents or antifeedants for stored grain insects .

Other authors , i.e. Hill and Shoonhoven (1981) , El-Boroloso *et al.*, (1989) and Mahgoub *et al.*, (1998) reported that some plant extracts significantly suppressed reproduction and viability of deposited eggs of some stored grain insects .

The present study aims to test the toxicity of three extracts of *Capparis spinosa* seeds to the lesser grain borer , *Rhizopertha dominica*, F.

## MATERIALS AND METHODS

**Materials** : Three hundred grams of Capparis, *Capparis spinosa* seeds were ground in an electric mill into fine powder. The ground powder was successively extracted using organic solvents of high polarity (petroleum ether, chloroform and acetone) and a Soxhlet extractor. The solvents were evaporated from the extracts by heating in a water-bath at 50 °C, then the collected extracts weighed and stored in the refrigerator. The lesser grain borer, *Rhizopertha dominica*, F. adults 1-2 weeks old taken from laboratory cultures were used as experimental insect.

Wheat grains variety Sakha 69 having 9% M.C. were also used.

**Methods** : Different concentrations of each extract (7, 9, 10, 11, 13 and 14 ml/kg for petroleum ether extract; 13, 14, 15, 16 and 18 ml/kg for chloroform extract and 11, 12, 13, 14 and 15 ml/kg for acetone extract) were applied to 10 gms. of wheat grains in glass jars and mixed thoroughly. After the solvent was evaporated, 20 adults of the insect were introduced to each jar covered with muslin and kept in an incubator. Three replicates were used for each concentration, other three replicates of untreated grains were used as a control. Mortality counts were recorded after 1, 3, 7 and 14 days. Percentage of insects mortality were corrected according to Abbott's formula (1925).

The corrected mortality percentages were statistically computed using the method of Finney (1952). Computed mortality percentages were plotted versus the corresponding concentrations on log probability paper and the concentrations that kill 50% and 95% of adults and slopes of the regression lines were determined.

The effect of the tested extracts on reproduction was determined. Samples of wheat grains 5 gms. each were placed in 21 test tubes, which were then divided into 7 groups of 3 tubes each. Six groups were treated with the  $LC_{50}$  and  $LC_{95}$  of the tested extracts; the seventh group was untreated to be used as a control. Five pairs of *R. dominica* adults of the same ages were added to each of the tubes and covered with muslin. After two weeks, insects were removed. The number of the emerged adults progeny was recorded after six weeks. All treatments were kept under controlled conditions of  $27 \pm 1$  °C and  $65 \pm 5$  % R.H.

To assess the persistence of the tested extracts, sets of 20 adults each of *R. dominica* were exposed in tubes to wheat grains treated with  $LC_{95}$  of each extract separately at the intervals of 1, 2, 3, 4, 5, 6, 7 and 8 weeks. Untreated wheat grains

were used for comparison . Three replicates were used for each storage period . In all cases, mortality counts were carried out after 3 days .

To conduct the germination tests , samples of 25 wheat grains treated with the extracts and free of insect infestation, each were placed in a Petri-dish lined with cotton wool and filter paper soaked in water . Germination was recorded 7 days later . Each treatment was replicated 3 times . Another quantities of wheat grains treated with the different extracts were stored for a period of 8 weeks after which germination tests were carried out again .

## RESULTS AND DISCUSSION .

Results in Table 1 show the effect of *Capparis spinosa* seed extracts on the mortality of *Rhizopertha dominica* F., adults .

Adults were slightly affected by all doses of the three extracts after 1 day of exposure , whereas 3 days after exposure petroleum ether and chloroform extracts at the high doses caused higher mortalities than acetone (90, 92, and 82%, respectively) . Comparing between the mortalities obtained at 14 ml/kg within the three tested extracts, it is obvious that petroleum ether was the most effective followed by acetone, meanwhile chloroform was the least effective . Mortalities obtained 1, 3 and 7 days for petroleum ether were 44 , 90 and 100% followed by 34 , 72 and 100% for acetone , meanwhile the corresponding mortalities for chloroform were the least 18 , 52 and 100% . With all extracts, complete mortality (100%) was obtained after 7 days of exposure , especially at the highest concentrations .

These results indicate that wheat grains can be protected against *R. dominica* infestation by using the three tested extracts .

Table 2 shows that petroleum ether extract at the base of LC<sub>50</sub> was more effective than chloroform and acetone extracts .

The values of slopes show that *R. dominica* adults were homogenous for the susceptibility to chloroform than acetone and petroleum ether extracts .

Data in Table 3 indicate that exposing of *R. dominica* adults to wheat grains treated with the LC<sub>50</sub> and LC<sub>95</sub> of the tested extracts caused a great reduction in the mean number of F<sub>1</sub> progeny/5 pairs. At LC<sub>50</sub> this reduction within all extracts was over 94% and reached 100% at LC<sub>95</sub> level. No adults were emerged at LC<sub>95</sub> levels with all the tested extracts compared with mean no. of 64.3 insect/5 pairs produced at control.

Table 1. Effect of *Capparis spinosa* seeds extracts on percent mortality of *Rhizopertha dominica* F. adults exposed to treated wheat grains .

Extract	Concentration ml/kg	% mortality after indicated days			
		1	3	7	14
Petroleum ether	7	6	20	38	62
	9	10	32	42	76
	10	22	60	76	86
	11	20	68	80	100
	13	42	84	100	100
	14	44	90	100	100
Chloroform	13	8	24	90	100
	14	18	52	100	100
	15	26	66	100	100
	16	44	80	100	100
	18	46	92	100	100
Acetone	11	10	24	51	70
	12	20	50	63	85
	13	22	66	72	100
	14	34	72	100	100
	15	40	82	100	100
Control		0.0	0.0	0.0	4

Table 2. LC<sub>50</sub> and LC<sub>95</sub> values and slopes of regression lines for petroleum ether, chloroform and acetone extracts of *Capparis spinosa* seeds against *Rhizopertha dominica* F. adults (72 hrs. after treatment) .

Extracts	Lc <sub>50</sub> ml/kg	Lc <sub>95</sub> ml/kg	Slope
Petroleum ether	9.8	17	7.17
Chloroform	14.0	19	12.5
Acetone	13.3	17	11.71

Table 3. Effect of *Capparis spinosa* seed extracts on  $F_1$  progeny of *Rhizopertha dominica* adults exposed to treated wheat grains.

Tested concentrations	LC <sub>50</sub>		LC <sub>95</sub>	
	Mean no. of $F_1$ progeny/5 pairs	reduction %	Mean no. of $F_1$ progeny/5 pairs	reduction %
Extracts				
Petroleum ether	3.0	95.60	0.0	100
Chloroform	4.3	94.10	0.0	100
Acetone	0.7	98.97	0.0	100
Control	68.0		64.3	

Table 4 shows that chloroform extract was the most persistent, which gave high mortalities (90%) up to six weeks.

Acetone extract was the least persistent which gave high mortalities percent till the fourth week, while petroleum ether extract was highly effective up to five weeks. Chloroform extract was the most persistent, caused high mortality till the sixth week.

Table 4. Corrected mortality of *Rhizopertha dominica* adults exposed for 3 days to wheat grains treated with LC<sub>95</sub> of the tested extracts after different post-treatment periods.

Period after treatment (in weeks)	Petroleum ether extract	Chloroform extract	Acetone extract
	Corrected mortality %	Corrected mortality %	Corrected mortality %
Initial	99	98	100
1	96	96	96
2	98	96	96
3	95	95	94
4	92	95	90
5	90	94	70
6	84	90	60
7	57	72	58
8	35	37	29

Data in Table 5 show that the viability of wheat grains at the initial time was highly affected by all tested extracts at all concentrations especially at the high levels (LC<sub>95</sub>).

Table 5. Percentages of germination and water absorption (after 1, 5 and 24 hrs.) of wheat grains treated with the tested extracts of *Capparis spinosa* seeds.

Extracts	Concentration ml/kg	Initial					After 8 weeks				
		Germination %	Reduction %	Water absorption %			Germination %	Reduction %	Water absorption %		
				1 hr.	5 hrs.	24 hrs.			1 hr.	5 hrs.	24 hrs.
Petroleum Ether	Control	94		23	29	57	92		21	31	56
	9.8 (LC <sub>50</sub> )	66	30	23	29	58	54	41	24	36	60
	17 (LC <sub>95</sub> )	49	48	24	30	56	41	55	23	36	59
Chloroform	Control	94		19	34	54	92		19	35	57
	14 (LC <sub>50</sub> )	65	31	20	33	55	57	38	19	34	58
	19 (LC <sub>95</sub> )	53	44	21	32	55	45	51	19	35	56
Acetone	Control	94		18	32	56	92		18	30	55
	13.3 (LC <sub>50</sub> )	69	77	21	32	56	53	42	21	32	57
	17.0 (LC <sub>95</sub> )	57	39	22	33	61	45	51	21	32	57

The results show that petroleum ether extract at LC<sub>95</sub> has the highest reduction in the percentage of germination as compared with control, followed by chloroform extract and finally acetone extract. The same trend was observed after 8 weeks. Ahmed (1992) proved that extracts of *P. armeniaca* and *S. saponaria* showed obvious adverse effect on germinated cowpea seeds.

The above mentioned results indicate the following :

1. All extracts tested at the dosage of 14 ml/kg gave 100% kill after 7 days of exposure.
2. LC<sub>95</sub> level continued to give 90% kill up to 4 weeks for acetone extract, while continued up to 5 and 6 weeks for petroleum ether and chloroform extracts, respectively.
3. The LC<sub>50</sub> level of the three extracts caused high reduction in the number of F<sub>1</sub> progeny, meanwhile no offspring was produced with LC<sub>95</sub> level.
4. The percentage germination of the treated wheat grains variety Sakha 69 were highly affected by the three extracts of *Capparis spinosa* seeds.

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## سمية مستخلصات بذور الكبر على حشرة ثاقبة الحبوب الصغرى

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تم دراسة تأثير سمية ثلاث مستخلصات مختلفة لبذور الكبر ضد حشرة ثاقبة الحبوب الصغرى. هذه المستخلصات هي : مستخلص الإثير البترولى والكلوروفورم والأسيتون وذلك بالمعاملة السطحية لحبوب القمح بتركيزات مختلفة .

أعطت الثلاث مستخلصات نسبة موت ١٠٠٪ لحشرة ثاقبة الحبوب الصغرى بعد ٧ أيام من التعريض .

إستمر التأثير المميت (٩٠٪) لمدة أربعة أسابيع بالنسبة لمستخلص الأسيتون ، بينما إستمر الى ٥ ، ٦ أسابيع لمستخلصى الإثير البترولى والكلوروفورم على التوالى .

أدى التركيز القاتل لـ ٥٪ (LC<sub>50</sub>) الى خفض ملحوظ فى ذرية الجيل الأول F<sub>1</sub>. بينما أدى التركيز القاتل لـ ٩٥٪ (LC<sub>95</sub>) الى عدم إعطاء ذرية جديدة .

أما التأثير على حيوية حبوب القمح صنف سخا ٦٩ فقد كان واضحا حيث إنخفضت نسبة إنبات الحبوب المعاملة بالتركيزات السابقة .