TOXICITY AND JOINT ACTION OF CORIANDER SEED EXTRACT AND MODIFIED MICRO-HABITAT ATMOSPHERE GASES (MAS) AGAINST SOME STORED GRAIN INSECT PESTS

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Abstract

The present study evaluate the bio-effect of coriander seed extract alone and under MAs of microhabitat harvested food in hermetically sealed conditions with low oxygen and high carbon dioxide i.e. 25%, 50% CO_2 and 99.8% nitrogen under 27 ± 2°C and 60 ± 5% RH against adults of *Sitophilus oryzae* (L.), *Rhizopertha dominica* (Fab.) and *Tribolium castaneum* (Hbst.) at in stored grain insects lab., Faculty of Agriculture, Moshtohor, Zagazig University. Results obtained revealed that, the effectiveness depends first on the coriander extract concentration, exposure period and tested insect species. The extract at 1 % w/w was the most effective to *R. dominica* adults hence the adult mortality reached 75.5% after two weeks, while it was 30% and 9.9% for *S. oryzae* and *Tribolium castaneum.* respeitively In respect to 25% CO_2 micro-habitate atmosphere (MA). The adult mortality demonstrated 100% for *T. castaneum* after 3 days of exposure, while it was 56.6 and 87.7% for both *S. oryzae* and *R. dominica*,. respeitivtively Complete mortality was achieved for *R. dominica* and *S. oryzae* survivors after 5 and 7 days, respectively. The modified micro-habitat atmospheric conditions (MA), containing of 50% CO_2 demonstrates complete mortality of the three tested insects species after three days of treatment. Similar results were in respect to the reduction parameter expressed as percentage (%) of the adult emergence (%). The atmospheric micohabitat containing 99.8% N_2 showed complete mortality of *S. oryzae* and *R. dominica* after 5 days exposure period, while it was 88.8% for *T. castaneum*. The joint action of extract with the three modified atmospheres figures were used depends mainly on extract concentration, insect species and type of the modified atmosphere, physical factors prevailed. Results revealed the presence of reliable synergistic effect for *S. oryzae* individuals at 25% CO_2 and 25% extract, on the other hand additive effect was reported for *R. dominica* and *T. castaneum*. At 50% CO_2 and 5% extract, the resultant effect demonstrated additive for the three insect species. The microhabitat components of 99.8% N_2 with 5% of the extract showed reliable additive effect after 3 days from exposure period with the three insect species.

INTRODUCTION

Synthetic pesticides have been used for many years to prevent insect pests from causing significant damage. Problems may occur from continued applications of insecticides. The development of insect resistance, pollution of the environment and hazards from handling toxic compounds have to become a need to develop alternative cheap control measurements were studied. In many areas of the world, locally available materials were widely used as grain protectants against insect infestation (Golob and Webley, 1980). Alternative protectants to synthetic pesticides besides are having less adverse effects on mammals. Hence, pest control strategies for the future need safer alternatives as insecticides of plant origin, that may offer a better solution.

The 2nd future pest control alternative is changing the environmental components as a non-chemical control method which is application of modified atmospheres. Use of modified atmospheres have been used to control insect pests in museums with increasing amount of interest in the last decade (Gilberg, 1991, Daniel *et. al* 1993, Koestler, 1993, Kigawa *et. al* 2001) and against insects of stored grains and their products (Bell *et al.*, 1984, Krishnamurthy *et al.*, 1986, Navarro and Jay, 1987, Halawa, 1998, El-Lakwah and Halawa, 1997, and El-Lakwah *et al.*, 1997).

The combined effect of plant extracts as neem fruits and Datura leaves with modified atmospheres against stored grain insects was recently studied in Egypt by (Darwish, 1997, El-Lakwah *et al.* 2000 b) at various exposure periods and/or extract concentration. MAs of micro- habitat of three insect species infesting stored grains by low oxygen atmospheres combined with coriander seed extract are studied here, with the objectives of preventing and keeping stored grains from insect attack and damage.

MATERIALS AND METHODS

1- Insects Laboratory colonies of the rice weevil, *S. oryzae* (L.), lesser grain borer, *R. dominica* (F.) and the red flour beetle, *T. castaneum* (Herbst) were used for the present study. Rearing procedure was conducted at 27 ± 2°C and 65 ± 5% RH in the stored grain insect's laboratory, Plant Protection Department, Faculty of Agriculture, Moshtohor, Zagazig University. Stock cultures of *S. oryzae* and *R. dominica* were reared on wheat grains, and *T. castaneum* insects were reared on wheat flour. Adults of 7-14 days old of the test insects were used for the trails.

Wheat grains and wheat flour were well sterilized by freezing at −18°C for 2 weeks before application to eliminate as far as possible hidden insect infestations.

2- Plant extract Seeds of the coriander, *Coriander sativum* (L.) was purchased from the local supermarket and ground into a fine powder, then extracted with petroleum ether solvent at 50°C under reduced pressure as described by Su (1989) .

3- Bioassay tests

A- Effect of coriander extract on the tested insects four serial concentrations (1.0, 0.5, 0.25 and 0.125% V/W) were prepared from the stock solution in petroleum ether. The treatments were completed by adding one ml from each concentration to 10 g wheat grains or crushed wheat in jars. Thirty adults of each of the three insect species, 0-2 week old, were introduced into the jars. Three replicates were selected for each concentration. Treated insects were kept at 27 ± 2°C and 65 ± 5%, and mortalities parameter of the adult insects were assessed 2, 3, 5, 7 and 14 days post-treatment. The F1 progeny was counted after 60 days from the start of the experiments and reduction expressed as percentage in adult emergence was calculated and corrected to control figures according to the following equation:

$$\text{Reduction (\%)} = \frac{\text{No. of adults emerged in control} - \text{No. of adults emerged in treatment}}{\text{No. of adults emerged in control}}$$

B- Effect of modified atmospheres (MA) carbon dioxide (CO_2) and nitrogen (N_2) gases were provided as pure gases in pressure steel cylinders. Each cylinder was connected with a pressure regulator. The dilution method was used to achieve the required CO_2 concentration. For the atmosphere of nearly pure nitrogen, the valve of N_2-cylinder was opened for two minutes in order to fill the flask with the nitrogen gas. Following modified atmospheres (MAs) were tested: 25% CO_2: 60% N_2: 15% O_2, 50% CO_2: 40% N_2: 10% O_2 and of 99.8% N_2. Carbon dioxide content was monitored using gas analyzer model 200-600 (Gow-Mac. Instrument Co., USA). Nitrogen content was determined using Oxygen Analyzer 572, Servo-Mex-England. Batches of 30 adults were introduced into wire gauze cages (diameter 14 mm, high 45 mm), filled with about 10 g wheat grains or crushed wheat, and then the cages were covered rubber stoppers. Cages were taken and introduced into Dershel flasks of 0.55 L. Insects in the gas tight flasks were treated for varying exposure periods and at the aforementioned temperature and relative humidity as described above.

After the desired exposure periods, the flasks were aerated and the insects were transferred into Petri dishes for mortality assessments.

C- Effect of coriander seed extract under controlled atmospheres wheat grains/or crushed wheat (10g) were treated with two concentrations only (0.25 and 0.5% w/w) as described above. Thirty insects were introduced into the Dreshel flask, and exposed to the above mentioned modified atmospheres (MAs). Tests were conducted at the previously mentioned conditions at varying conditions of exposure periods. Insect mortality figures were assessed as described above.

D- Calculation of the joint action to evaluate the joint action of both coriander seed extract and the tested modified atmosphere gases, the following equation adopted by Mansour *et al.* (1966) was used:

$$\text{Co-toxicity factor} = \frac{\text{Observed mortality (\%)} - \text{Expected mortality (\%)}}{\text{Expected mortality (\%)}} \times 100$$

This factor was used to classify the results into three categories a positive factor of 20.0 or more means potentiation (Synergistic effect), a negative value of – 20.0 or more means antagonism, and the intermediate values between ± 20.0 and – 20.0 was considered an additive effect.

RESULTS AND DISCUSSION

1- Toxicity of coriander seed extract the bio-effect of PE extract expressed as percentages of adult mortality (%) and adult emergence for the three tested insects were presented in Table 1. For all cases, the adult mortality (%) increased with the increase of both concentration,s and the related exposure period when the species type are considered. *R. dominica* was the most susceptible with a mortality of 75.5% after 2 weeks and the high concentration related CO2 atmosphere and coriander extract provides rapid initial kill of *R. dominica* individuals. While adults of *T. castaneum* demonstrated the least effective mortality figures (9.9%) at the highest concentration. Mortality figures of *S. oryzae* adults were intermediate between *R. dominica* and *T. castaneum.* Percentage of reduction in adult emergence (%) was dose dependant and coincide with those of toxicity which higher mortality (%) gave fewer progeny and so highest values of calculated reduction (%). Inhibition of F1 progeny ranged from 88.9% in *S. oryzae* to 27.7% in *T. castaneum.*

2- Effect of modified atmospheres (MAs) the effect of 3 modified atmosphere gases (25%, 50% of CO_2 and 99.8% N_2) on adult mortality (%) and the corresponding reduction (%) of adult progeny of the three tested insect species are shown in Table 2 . Results in Table 2 showed that 50% CO_2 was the most effective in causing higher adult mortalities (%) of 100.0, 94.4 and 100.0% for *S. oryzae, R. dominica* and *T. castaneum,* respectively after 3 days of exposure. After 5 days complete mortality of *R. dominica* was found. In respect to reduction (%) in adult emergence, the treatment with 50% CO_2 resulted in 83.3%, 87.7% and 76.5% after 2 days while 100%, 93.9 and 100% after 5 days was obtained respectively compared to the control. Treatment with 99.8% N2 caused adult mortalities of 40.0, 92.2 and 67.7%, while caused complete mortalities after 5 days of exposure for *S. oryzae, R. dominica* and 88.8% for *T. castaneum.* Complete reduction of F1 progeny after 5 days Table 2 while it was relatively high after 2 days (36.7, 96.8 and 97%), respectively compared to the control. For the tested insect species, the lower oxygen concentration and the longer exposure period are necessary to produce complete kill. For the species, it has been found that the lethal effect on adults was changing depending of higher CO2 concentrations.

3- Toxic effect of coriander seed extract under modified atmospheres the effectiveness of the extract under the tested modified atmospheres of 25% and 50% CO_2 and 99.8% N2 against *S. oryzae, R. dominca* and *T. castaneum* is given in Table 3. Data clearly showed that the insect species were sensitive to the extract where complete mortality (%) of *S. oryzae* occurred after 2 days with 50% CO_2 + 5% seed extract, and 92.2 and 85.5% after 2 days in *R. dominica* and *T. castaneum* compared to control. Reduction in F1 progeny was completely prevented after 3 days, of all tested species. The 2nd treatment 25% CO_2 + 2.5% extract was less effective but the values of studied characters increased with increase of the exposure period, which 100%, 100% and 68.9% mortalities of *R. dominica, T. castaneum* and *S. oryzae* after 3 days of exposure.

Table 1. Effect of the petroleum ether extract of coriander seed on both adult mortalities (%) and reduction (%) figures in F1 progeny of *S.orzae, R.dominica* and *T.castaneum.*

Insect species	Concentration % (w/w)	% adult mortality after the indicated days					F1 progeny no. after 60 days	Reduction (%) of F1 progeny
		2	3	5	7	14		
S.oryzae	1.0	2.2± 1.1	3.3±0.0	12.2±2.9	15.5±1.1	30.0±1.9	5.0±1.0	88.9
	0.5	0.0	2.2±1.1	3.3±1.9	3.3±1.9	14.4±2.2	9.6±1.5	78.6
	0.25	0.0	0.0	2.2±1.1	2.2±1.1	11.1±1.1	12.6±1.8	72.0
	0.125	0.0	0.0	1.1±1.1	1.1±1.1	5.5±1.1	20±1.1	55.5
	control	0.0	0.0	0.0	2.2±1.1	2.2±1.1	45±6.2	---------
R.dominica	1.0	37.7±8.0	55.5±8.0	62.2±2.9	71.0±4.4	75.5±4.0	10.0±0.3	84.3
	0.5	7.7±2.9	11.1±2.9	9.9±3.3	16.6±3.8	28.8±2.2	17.0±2.6	73.4
	0.25	1.1±1.1	3.3±1.9	4.4±1.1	7.7±1.1	15.5±2.2	30.0±0.4	53.1
	0.125	0.0	0.0	0.0	0.0	8.8±2.2	30.0±2.5	53.1
	control	0.0	0.0	0.0	0.0	0.0	64.0±6.2	---------
T.castaneum	1.0	4.4±1.1	4.4±1.1	5.5±1.1	8.8±1.1	9.9±1.9	35.0±4.0	72.8
	0.5	1.1±1.1	1.1±1.1	3.3±0.0	4.4±1.1	5.5±1.1	34.0±2.3	73.6
	0.25	0.0	0.0	1.1±1.1	2.2±1.1	3.3±0.0	61±1.7	52.7
	0.125	0.0	0.0	0.0	0.0	0.0	93.3±4.2	27.7
	control	0.0	0.0	0.0	0.0	0.0	129±8.4	-------

Table 2. Adult mortality (%) and reduction (%) figures in F1 progeny of *S.oryzae*, *R.dominica* and *T. castaneum* emerged adults affected by modified atmospheres gases.

Insect species	Controlled atmosphere (CA)	% adult mortality and percentage reduction in F1 progeny(in brackets) after the indicated days			
		2	3	5	7
S.oryzae	25% CO_2	25.5±1.1 (45.2)*	56.6±1.9 (61.3)	78.9±2.9 (87.1)	100±0.0 (93.5)
	50% CO_2	98.8+1.1 (83.3)	100±0.0 (96.8)	100.0±0.0 (100.0)	100±0.0 (100.0)
	Control	0.0	0.0	0.0	0.0
	99.8%N_2	23.3±3.8 (36.7)	40.0±3.8 (70.0)	100±0.0 (100.0)	100.0±0.0 (100.0)
	Control	0.0	0.0	0.0	0.0
R.dominica	25% CO_2	61.6±1.1 (55.2)	87.8±1.1 (75.5)	100±0.0 (100.0)	100±0.0 (100.0)
	50% CO_2	67.7+1.1 (87.7)	94.4±1.1 (87.7)	100±0.0 (93.9)	100±0.0 (100.0)
	Control	0.0	0.0	0.0	0.0
	99.8%N_2	87.7±1.1 (96.8)	92.2±1.1 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)
	Control	0.0	0.0	0.0	0.0
T.castaneum	25% CO_2	62.0±1.0 (58.8)	100±0.0 (80.6)	100±0.0 (92.3)	100±0.0 (100.0)
	50% CO_2	77.7±1.1 (76.5)	100±0.0 (94.1)	100±0.0 (100.0)	100±0.0 (100.0)
	Control	0.0	0.0	0.0	0.0
	99.8% N_2	60.0±1.9 (97.0)	67.7±1.1 (97.0)	88.8±1.1 (100.0)	97.8±2.2 (100.0)
	Control	0.0	0.0	0.0	0.0

*Values in brackets are expressed as percentages of reduction in adult emergence.

Reduction of F1 progeny Table 3, (in brackets) resulted from this treatment (25% CO_2, 2.5% extract) showed complete reduction of *R. dominica* after 3 days while values of 85.7 and 100% for *S. oryzae* and *T. castaneum* occurred after 5 days.

The effect of 99.8% N2 plus the two extract concentrations (2.5 and 5.0%) on adult mortality and F1 progeny reduction are presented in Table 3. In general, the N_2 treatment plus additive 5% extract was considered the most effective on mortality and reduction figures of F1 progeny against all tested species after any exposure period. Complete mortality (%) was observed after 3 days for *S. oryzae,* while after 5 days, complete kill i.e. 100% for *R. dominica* and 94.4% in *T. castaneum* was observed.

In respect to effects on progeny reduction (%)Table 3, results showed complete reduction of *S. oryzae* and *T. castaneum* after 3 days exposure, while 92.9% in *R. dominica.* After 7 days, complete kill figure of progeny emerged from *T. castaneum.* The additive joint effect of tested treatments expressed as values of Co-toxicity factor are shown in Tables 4, 5, 6 and 7, respectively. In Table 4 (25% CO_2 + 0.25% extract), the calculated values showed a synergistic effects with *S. oryzae* and synergistic or additive effect with *R. dominica* and *T. castaneum.*

Results obtained in Table 5 (50% CO_2 + 0.5% extract) showed additive toxic bio-effect for all tested cases, while those of 99.8 N2 + 2.5% extract Table 6 varied depending on the selected insect species which demonstrates additive effect obtained when *T. castaneum* was selected and a synergistic effect with other two insects. Data pertaining to 99.8% N2 + 0.5% extract Table, 7 resulted in additive effects with *R. dominica* and *T. castaneum* while varied with *S. oryzae.* The present results agree with the findings of El-Lakwah *et. al* 2000 a, b, Hashem *et al.*1993 and Darwish, 1997. Their results indicate that the adult mortality parameters of the tested stored insects increased when treated with the extracts in the presence modified atmosphere occupied with proper exposure periods. Values of the co-factor toxicity were also increased gradually with the extract concentration and the possible explanation was that active compounds contained in the extract interfere with each other resulting to activation with the tested atmosphere.

Table 3. Adult mortality (%) and reduction (%) figures in F1 progeny (in brackets) of *S.oryzae*, *R.dominica* and *T. castaneum* affected by coriander seed extract under modified atmosphere gases.

Insect species	Controlled atmosphere (CA)	% adult mortality and percentage reduction (%) in F1 progeny after the indicated days			
		2	3	5	7
S.oryzae	25% CO_2+ 0.25% extract	41.1±1.1 (53.6)	68.9±1.1 (75.0)	100±0.0 (85.7)	100±0.0 (100.0)
	50%CO_2+ 0.5% extract	100+0.0 (89.3)	100+0.0 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)
	99.8%N_2+ 0.25% extract	82.2±2.2 (80.7)	88.9+1.1 (100.0)	100.0±0.0 (100.0)	100.0±0.0 (100.0)
	99.8%N_2+0.5% extract	94.4±2.2 (95.2)	100.0±0.0 (100.0)	100.0±0.0 (100.0)	100.0±0.0 (100.0)
R.dominica	25% CO2+ 0.25% extract	82.2±2.9 (76.0)	100±0.0 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)
	50%CO_2+0. 5% extract	92.2+1.1 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)
	99.8%N_2+ 0.25% extract	54.4±2.9 (75.8)	57.7±4.0 (91.3)	81.8±4.0 (98.1)	100.0±0.0 (100.0)
	99.8%N_2+ 0.5% extract	92.2+1.1 (89.4)	94.4±2.2 (92.9)	100.0±0.0 (94.2)	100.0±0.0 (100.0)
T.castaneum	25% CO_2+ 0.25% extract	92.2±1.1 (68.6)	100±0.0 (77.7)	100±0.0 (100.0)	100±0.0 (100.0)
	50%CO_2+ 0.5% extract	85.5+1.1 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)	100±0.0 (100.0)
	99.8%N_2+ 0.25% extract	54.4±2.9 (88.7)	57.7±4.0 (96.2)	82.2±2.2 (100.0)	91.1±2.9 (100.0)
	99.8%N_2+0. 5% extract	56.6±3.3 (96.8)	65.5±2.9 (100.0)	94.4±2.2 (100.0)	100.0±0.0 (100.0)

Table 4. Combined action of 25% CO_2 alone plus 0.25% coriander seed extract against adults of *S.oryzae*, *R.dominica* and *T.castaneum* after various periods of exposure.

Insect species	Exposure period (days)	Adult mortality(%) of the indicated treatments			Co-toxicity factor	Type of Joint action
		25% CO2 alone	0.25 % Seed extract alone	25%CO2 +0.25 % Seed extract		
S.oryzae	2	25.5±1.1	0.0	41.1±1.1	61.2	S
	3	56.6±1.9	0.0	68.9±1.1	21.7	S
	5	78.9±2.9	2.2±1.1	100±0.0	23.3	S
R.dominica	2	61.1±1.1	1.1±1.1	82.2±2.9	32.2	S
	3	94.4±1.1	3.3±1.9	100±0.0	2.4	D
	5	100±0.0	4.4±1.9	100±0.0	0.0	D
T.castanum	2	62.0±1.0	0.0	92.2±1.1	48.7	S
	3	100±0.0	0.0	100±0.0	0.0	D
	5	100±0.0	1.1+1.1	100±0.0	0.0	D

S=synergistic or potentiation effect
D=additive effect

Table 5. Combined action of 50 % CO_2 alone plus 0.5% coriander seed extract against adults of *S.oryzae*, *R.dominica* and *T.castaneum* after various periods of exposure.

Insect species	Exposure period (days)	Adult mortality(%) of the indicated treatments			Co-toxicity factor	Type of Joint action
		50 % CO2 alone	0.5% Seed extract alone	50%CO2 +0.5% Seed extract		
S.oryzae	2	98.8±1.1	0.0	100.0±0.0	1.2	D
	3	100±0.0	2.2±1.1	100.0±0.0	0.0	D
	5	100±0-.0	3.3±1.9	100.0+0.0	0.0	D
R.dominica	2	67.7±1.1	7.7±2.9	92.2±1.1	22.3	S
	3	87.7±1.1	11.1±2.9	100.0±0.0	1.2	D
	5	100±0.0	9.9±3.3	100.0±0.0	0.0	D
T.castanum	2	77.7±1.1	1.1±1.1	85.5±1.1	8.5	D
	3	100±0.0	1.1±1.1	100.0±0.0	0.0	D
	5	100±0.0	3.3±0.0	100.0±0.0	0.0	D

S=synergistic or potentiation effect

Table 6. Combined action of 99.8% N_2 alone and plus 0.25% coriander seed extract against adults of *S.oryzae*, *R.dominica* and *T.castaneum* after various exposure periods (days).

Insect species	Exposure period (days)	Adult mortality (%) of the indicated treatments			Co-toxicity factor	Type of Joint action
		99.8% N2 alone	0.25 % Seed extract alone	99.8%N2 +0.25% Seed extract		
S.oryzae	2	23.3±3.8	0.0	82.2±2.2	252.8	S
	3	40.0±3.8	0.0	88.9±1.1	122.3	S
	5	100.0±0.0	2.2±1.1	100±0.0	0.0	D
R.dominica	2	87.7±1.1	1.1±1.1	54.4±2.9	-38.7	A
	3	92.2±1.1	3.3±1.1	61.1±2.2	-36.0	A
	5	100±0.0	4.4±1.1	81.8±4.0	-18.2	D
T.castanum	2	60.0±1.9	0.0	54.4±2.9	-9.3	D
	3	67.7±1.1	0.0	57.7±4.0	-14.8	D
	5	88.8±1.1	1.1±1.1	82.2±2.2	-8.6	D

S=synergistic or potentiation effect
D=additive effect
A=antagonistic effect

Table 7. Combined action of 99.8% N2 alone and 0.5% coriander seed extract against adults of *S.oryzae*, *R.dominica* and *T.castaneum* after various exposure periods (days).

Insect species	Exposure period (days)	Adult mortality(%) of the indicated treatments			Co-toxicity factor	Type of Joint action
		99.8% N2 alone	0.5% Seed extract alone	99.8%N2 +0.5% Seed extract		
S.oryzae	2	23.3±3.8	0.0	94.4±2.2	305.2	S
	3	40.0±3.8	2.2±1.1	100±0.0	137.0	S
	5	100±0.0	3.3±1.9	100±0.0	0.0	D
R.dominica	2	87.7±1.1	7.7±2.9	92.2±1.1	-3.4	D
	3	92.2±1.1	11.1±2.9	94.4±2.2	-5.6	D
	5	100±0.0	9.9±3.3	100±0.0	0.0	D
T.castanum	2	60±1.9	1.1±1.1	56.6±3.3	-7.4	D
	3	67±1.1	1.1±1.1	65.5±2.9	-4.8	D
	5	88.8±1.1	3.3±0.0	94.4±2.2	2.5	D

S=synergistic or potentiation effect
D=additive effect

Studies are required to explain the mechanisms responsible for the potentiating activity resulted from using plant extracts in combination with the modified atmospheres. It could concluded however that, the effectiveness of the MAs (25% CO_2 or 50% CO_2 or 99.8% N_2) alone or combined with coriander seed extract against adults of *S. oryzae, R. dominica* and *T. castaneum* as well as their subsequent effects on emerged progeny was depended on concentration and time of exposure period along with insect species. Generally, it increased values of representing adult mortality compared to the extract alone against the tested insect species under study was achieved. This method could be considered as a potential alternative method dominated the toxic effect of methyl bromide when used for controlling stored products pests. In general, it appears from analyzing the previous results that the evaluation of respiratory gas exchange during the exposure to modified atmosphere gases may bring about some replacements for the natural conditions of the insect with observed low O2 and high CO2 concentrations.

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فاعلية مستخلص بذور الكسبرة تحت ظروف جوية معدلة ضد بعض حشرات المواد المخزونة

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – مصر

تم دراسة تأثير فاعلية مستخلص بذور الكسبرة منفرداً وتحت ظروف جوية معدلة ، وهى ٢٥% و٥٠% ثانى أكسيد الكربون و ٩٩,٨% نيتروجين فى معمل بحوث حشرات الحبوب والمواد المخزونة بكلية زراعة مشتهر عند حرارة ٢٧ ± ١ْم ورطوبة نسبية ٦٠ ± ٥% ضد حشرات سوسة الأرز وثاقبة الحبوب الصغرى وخنفساء الدقيق الكستنائية.

وقد أظهرت النتائج أن تأثير المستخلص منفرداً اعتمد على تركيز المستخلص ومدة التعريض ، وكان المستخلص أكثر فاعلية بعد أسبوعين ضد ثاقبة الحبوب الصغرى حيث وصلت نسبة الموت ٧٥,٥% مقارنة بسوسة الأرز (٣٠%) وخنفساء الدقيق (٩,٩%) وذلك عند تركيز ١و٠%.

وعند استخدام جو معدل يحتوى على ٢٥% ثانى أكسيد الكربون كانت نسبة الموت ١٠٠% لخنفساء الدقيق بعد ثلاثة أيام ، بينما كانت نسبة الموت لسوسة الأرز وثاقبة الحبوب الصغرى هى ٥٦,٦% و ٨٧,٧% على التوالى وكانت نسبة الموت كاملة بعد ٥ و ٧ أيام من التعريض للحشرتين الأخيرتين على التوالى.

وعند استخدام جو معدل به ٥٠% ثانى أكسيد الكربون وصلت نسب الموت ١٠٠% للحشرات الثلاث بعد ثلاث ايام من المعاملة ، وتم الحصول على نتائج متماثلة فى نسبة إنخفاض ذرية الجيل الأول . وعند الظروف الجوية المعدلة المحتوية على ٩٩,٨% نيتروجين كانت نسبة الموت ١٠٠% لكل من حشرتى سوسة الأرز وثاقبة الحبوب الصغرى بينما كانت ٨٨,٨% فى الحشرات الكاملة لخنافس الدقيق بعد خمسة أيام من المعاملة .

وبالنسبة للتأثير المشترك للمستخلص تحت الظروف الجوية المعدلة فاعتمد على تركيز المستخلص ونوع الحشرة ونوع الجو المحيط المعدل ، ويمكن تلخيص القول بأن التأثير كان Synergistic ضد سوسة الأرز عند ٢٥% ثانى أكسيد الكربون (كجو معدل وتركيز المستخلص كان 0.25% بينما كان مضافاً additive ضد كل من ثاقبة الحبوب الصغرى وخنفساء الدقيق الكستنائية وعند ٥٠% ثانى أكسيد الكربون وتركيز ٥و٠% مستخلص وجد أن التأثير الناتج كان additive ضد الحشرات الثلاث المستخدمة فى البحث وعند معظم فترات التعريض.

وعند ٩٩,٨% نيتروجين والمستخلص بنسبة 0.25% كان التأثير Synergistic ضد سوسة الأرز و additive ضد ثاقبة الحبوب الصغرى وخنفساء الدقيق ، بينما عند ٩٩,٨% نيتروجين والمستخلص بتركيز ٥% كان التأثير الناتج additive بعد خمسة أيام من المعاملة ضد الحشرات الثلاث .