EFFECT OF *CONYZA DIOSCORIDIS* LEAF EXTRACTS ON THREE MAJOR INSECTS OF STORED PRODUCTS IN EGYPT

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Abstract

This work aims to evaluate the toxic and repellent effect of acetone and petroleum ether extracts of the Barnouf plant leaves (*Conzya dioscoridis*) againts three insects of stored products in Egypt, i.e. *Sitophilus oryzae* (L.), *Rhizopertha dominica* (F.) and *Tribolium castaneum* (Herbst).

Results showed that, at the highest concentration (10%) used, average commulative mortalities with the acetone plant extract after 21 days form treatment amounted to 43.3%, 42.5% and 24.4% for the adults of *S.oryzae, R.dominica* and *T.castaneum*, respectively.

The corrsponding values with the petroleum ether extract of the plant were 65.0%, 43.3% and 10.4% for the aforementioned insects, respectively, indicating that *S.oryzae* was the most sensitive one, followed by *R.dominica* and *T.castaneum.*

Repellency values at the highest concentration (10%), during an observation period of 21 days, revealed that acetone extract of the plant was strongly repellent of *S.oryzae-adults*, while was negligible in the case of *R.dominica* and *T.castaneum.* Meanwhile, petroleum ether extract of the plant showed moderate repellent effect with *S.oryzae* and *R.dominica*, while this effect was low for *T.castaneum-adult* at the highest concentration. Susceptibility of the three tested insects to the extract of the plant leaves; *Conza dioscoridis* was found independent of each other.

INTRODUCTION

Insect infestation of stored grains and their products is serious problem throughout the world. Control of these insects by chemical insecticides created other problems to the environment, human health, and non-target organisms. There is no doubt that wide spread of indiscriminate pesticide application have sometimes caused contamination of the environment and some disastrous ecological damage. Moreover, heavy use of conventional pesticides enhances the potential for the development of pesticides resistance.

Also residues of pesticides in stored products could cause a health hazards to ultimate consumers.

Thus, Hileman (1990) reported that awareness has contributed to rise the alternative agriculture, a farming system that aims for adequate productivity, while ensuring food safety and protection of the environment. One approach to the control of pests in alternative agriculture is the use of biodegradable natural plant compounds in place of synthetic insecticides. It was observed that plants produced chemical compounds that may have biological activity against certain pests (Farag et al., 1989). The multiple biological activity of various botanical extracts as repellent, toxic, antifeedant and reproduction inhibitors against insects have been reported by several investigators (Darwish, 1992;Mostafa, 1993; El-Lakwah et al., 1992, 1993 and 1994).

The use of natural products of plant origin is a new trend that preserve the environment from contamination with harmful toxicants. Several studies have suggested the use of plant dusts and extracts (Yadava, 1971; Su et al., 1972; Singh et al., 1978).

The present work aims to evaluate the toxic and repellent properties of the "Barnouf plant", *Conyza dioscoridis* (L.) against some stored product insects, namely; the rice weevil, *Sitophilus oryzae* (L.), the lesser grain borer, *Rhizopertha dominica* (F.) and the red flour beetle, *Tribolium castaneum* (Herbst).

MATERIALS AND METHODS

Insects used: Three stored product insects, namely: the rice weevil, *Sitophilus oryzae* (L.), the lesser grain borer, *Rhizopertha dominica* (F.) and the red flour beetle, *Tribolium castaneum* (Herbst), reared under laboratory conditions at 26±1°C and 60±5% RH. at the Stored Product Pests Laboratory of the Faculty of Agriculture at Moshtohor, were taken for conducting these experiments.

Plant used: Leaves of Barnouf plant, *Conyza dioscoridis* (L.) belonging to the family Compositae, were tested as extracts in acetone and/or in petroleum ether.

Preparation of the plant extract: The leaves of *Conzya dioscoridis* were dried at room temperature for 3 weeks, then ground into fine powder in an electric mill. Two hundred grams of the ground powder were added to each solvent (acetone and/or petroleum ether) in flasks and left for 72 hr. as described by Su (1985) and

Abo El-Ghar and El-Sheikh (1987). The flasks were then shacked for 30 min. in a shaker and filtered. After that, the solvent was evaporated at 50°C under reduced pressure by using a rotary evaporator. The crude gum of the extracts was weighed and redissolved in the solvent to give 10% (w/v) stock solution. Concentrations of 10, 5, 2.5 and 1.25% (w/v) were prepared by diluting the stock solution in each solvent.

Toxicity test: One ml of each prepared concentration was added to ten grams food in jars (wheat kernel in case of *S.oryzae* and *R.dominica* and crushed wheat for *T.castaneum*), kept at 26±1°C and 60±5% RH and left for two hrs to evaporate the solvent. Thirty adult insects (1-2 weeks old) were introduced into the jars. Three replicates were used for each concentration. Jars were covered with muslin cloth fixed with rubber band. Mortalities were recorded after 2, 3, 7, 14 and 21 days from the treatment (and then the insects were excluded). F1progeny was inspected after 75 days from the treatments and percentages of reduction in F1 progeny were calculated according to the following equation.

$$\frac{\text{No. of adults emerged in control - No. of adults emerged in treatment}}{\text{No. of adults emerged in control}} \times 100$$

Repellency of the plant extracts : A modified apparatus after Helen (1989) was used to measure repellency effect of acetone and petroleum ether extracts of the plant. A metallic ring (6cm diameter x 0.5 cm height) was placed in the center of a glass Petri-dish on a filter paper. Five grams of the treated diet were placed inside the ring. Twenty adults were introduced to the food and then the Petri-dish was covered with glass lid and the repellency was recorded after different intervals following treatment. Repellency was recorded after 1, 2, 3, 5, 7, 14 and 21 days based on the number of insects counted inside and outside the ring 24-hours from introducing the insects to the food. At the various intervals new adult insects were used and average repellency during this observation period was calculated and illustrated in Fig. 1.

RESULTS AND DISCUSSION

1. Toxic effect of *C.dioscoridis* extracts against *S.oryzae* adults

It is clearly indicated from Tables 1 and 2 that petroleum ether extract was more effective on *S.oryzae* adults than acetone extract. No mortalities were recorded with acetone extract at all concentrations used after three days from treat-

Table 1. Effect of acetone extract of *Conyza dioscoridis* leaves on adults and F1 progeny of *S.oryzae* (L.).

Conc. %	% Adult accumulative mortalities after indicated periods (days)					No.of emerged adults after 75 days	Reduction in F1 progeny %
	2	3	7	14	21		
10	0.0	0.0	31.7±7.1	40.0±4.7	43.3±0.0	68.3±11.6	19.6
5	1.1±1.9	2.2±1.9	16.7±4.7	40.0±9.5	50.0±4.7	77.0±13.7	9.4
2.5	0.0	0.0	6.7±0.0	30.0±0.0	33.3±0.0	78.7±18.0	7.4
1.25	0.0	0.0	11.1±3.9	22.2±3.8	26.6±3.4	80.3±13.1	5.5
control	0.0	0.0	3.3±0.0	13.3±0.0	13.3±0.0	85.0±5.2	--

Table 2. Effect of petroleum ether extract of *Conyza dioscoridis* leaves on adults and F1 progeny of *S.oryzae* (L.).

Conc. %	% Adult accumulative mortalities after indicated periods (days)					No.of emerged adults after 75 days	Reduction in F1 progeny %
	2	3	7	14	21		
10	14.4±3.8	33.3±6.7	56.7±3.4	64.5±3.9	65.0±3.3	20.0±17.3	78.3
5	3.3±0.0	16.7±9.1	26.7±14.1	33.3±0.0	38.3±7.1	50.3±27.5	45.3
2.5	3.3±4.7	6.7±4.7	18.4±2.3	21.7±3.3	26.7±1.3	56.0±14.7	39.1
1.25	3.3±4.7	8.3±7.1	12.3±1.4	18.7±1.3	23.3±9.7	53.7±11.8	41.6
control	0.0	3.3±0.0	3.3±0.0	3.3±0.0	10.0±0.0	92.0±17.6	--

ment in most concentrations, whereas 33.3±6.7% mortality resulted from using the highest concentration (10%) of petroleum ether extract, and 8.3±7.1% with the lowest concentration (1.25%) as compared with 3.3±0% untreated check. Recorded mortalities after 7 days from treatment ranged from 11.1±3.9 to 31.7±7.1 at all concentrations of acetone extract, while ranged from 12.3±1.4 to 56.7±3.4% in case of petroleum ether extract, compared to 3.3±0% in the control. After 21 days of treatment, mortalities were significantly reduced from 26.7±3.4 and 43.3±0% with acetone extract and were between 23.3±9.7 and 65.3.3% with petroleum ether extract when concentration increased from 1.25 to 10%.

As to the resultant F1 progeny of all treatments, petroleum ether extract had also great influence in reducing emerged progeny. 78.3% reduction in F1 progeny resulted from using the highest concentration (10%) and 41.6% from the lowest concentration (1.25%), while the highest concentration (10%) of acetone extract resulted in 19.6% reduction. Thus, acetone extracts have very weak effect on reducing F1 progeny.

2. Toxic effect of *C.dioscoridis* extracts against *R.dominica* adults

Results concerning the toxic effect of *Conyza dioscoridis* acetone and petroleum ether extract on *R.dominica* adults, are summarized in Tables 3 and 4. The two extracts nearly the same trend of weak effect on the insect even after 21 days after treatment. Mortality percentages didn't exceed 43.3 and 42.5% for petroleum ether and acetone extracts, respectively at the highest concentration (10%). The natural mortality among untreated insects was 8.7% after the same period.

Regarding the activity of the two plant extracts on insect progeny, petroleum ether extract appeared the most effective in reducing F1 progeny than acetone extract. At the highest concentration (10%), reduction in F1 progeny reached 78.9% and 40.9% for petroleum ether and the acetone extract of the plant, respectively. Even at 5% concentration, petroleum ether extract gave 57.8% reduction in F1 progeny compared with 34.3% for acetone extract.

This result may be attributed to the activity of petroleum ether in extraction than acetone .

3. Toxic effect of *C.dioscoridis* extracts against *T.castaneum* adults

The toxic effects of the acetone and petroleum ether extract of *Conyza dioscoridis* leaves against *T.castaneum* are presented in Tables 5 and 6. Results indi-

Table 3. Effect of acetone extract of *Conyza dioscoridis* leaves on adults and F1 progeny of *R.dominica* (F.).

Conc. %	% Adult accumulative mortalities after indicated periods (days)					No.of emerged adults after 75 days	Reduction in F1 progeny %
	2	3	7	14	21		
10	22.±1.9	13.3±12.1	31.1±1.9	37.3±10.7	42.5±10.0	20.7±0.9	40.9
5	2.2±1.9	4.4±5.1	10.0±11.9	18.9±10.2	21.1±5.1	23.0±1.7	34.3
2.5	4.4±7.7	6.7±8.8	6.7±8.8	14.4±8.4	20.0±8.8	28.3±0.6	19.1
1.25	3.3±0.0	4.4±1.9	8.9±6.9	15.5±3.8	17.1±1.9	30.7±0.0	12.3
control	0.0	1.1±1.9	1.1±1.9	8.3±5.1	8.7±5.7	35.0±2.6	--

Table 4. Effect of the petroleum ether extract of *Conyza dioscoridis* leaves on adults and F1 progeny of *R.dominica* (F.).

Conc. %	% Adult accumulative mortalities after indicated periods (days)					No.of emerged adults after 75 days	Reduction in F1 progeny %
	2	3	7	14	21		
10	4.4±3.8	8.9±5.0	28.9±5.1	34.5±10.7	43.3±12.1	8.0±2.7	78.9
5	2.2±3.8	8.9±3.8	21.1±3.8	28.9±5.1	36.7±12.1	16.0±1.7	57.8
2.5	10.0±5.8	12.2±6.9	15.5±3.8	22.2±3.8	30.0±3.3	94.7±1.2	35.0
1.25	2.2±3.8	5.6±5.1	10.0±3.3	10.0±3.8	10.7±3.4	30.3±4.9	20.3
control	2.2±3.8	3.3±3.8	6.6±5.8	8.3±2.8	10.0±0.0	38.0±1.6	--

Table 5. Effect of the acetone extract of *Conyza dioscoridis* leaves on adults and F1 progeny of *T.castaneum* (Herbst.).

Conc. %	% Adult accumulative mortalities after indicated periods (days)					No.of emerged adults after 75 days	Reduction in F1 progeny %
	2	3	7	14	21		
10	1.1±1.9	1.1±1.9	3.3±3.4	12.2±6.9	24.4±5.4	26.0±6.4	44.3
5	0.0	1.1±1.9	2.2±3.8	10.0±5.8	18.2±4.8	26.7±8.9	42.8
2.5	0.0	0.0	0.0	11.1±3.8	12.0±3.3	33.0±8.5	29.3
1.25	0.0	1.1±1.9	2.2±3.8	6.7±3.3	11.3±3.3	40.7±19.1	12.8
control	0.0	2.2±3.8	4.4±1.9	8.6±3.1	7.8±1.9	46.7±9.8	--

Table 6. Effect of petroleum ether extract of *Conyza dioscoridis* leaves on adults and F1 progeny of *T.castaneum* (Herbst.).

Conc. %	% Adult accumulative mortalities after indicated periods (days)					No.of emerged adults after 75 days	Reduction in F1 progeny %
	2	3	7	14	21		
10	22.2±1.9	2.2±1.9	2.2±1.9	3.3±3.4	10.4±1.9	20.0±7.8	50.9
5	1.1±1.9	1.1±1.9	1.1±1.9	1.1±1.9	4.4±1.9	21.7±8.0	46.7
2.5	0.0	0.0	1.1±1.9	2.2±3.8	5.5±1.9	28.3±9.1	30.5
1.25	2.2±1.9	4.4±5.1	7.0±6.7	7.0±6.7	8.0±5.8	31.3±6.1	23.1
control	1.1±1.9	1.1±1.9	2.2±1.9	3.3±3.4	5.5±3.8	40.7±115	--

cated clearly that, even after 21 days from treatment, very low mortalities were recorded at various concentrations used.

Concerning the effect of the two extracts on F1 progeny, the highest concentration (10%) of acetone extract resulted in 44.3% reduction in F1 progeny; the corresponding value for petroleum ether extract was 50.9%.

It is apparent that, the reduction in F1 progeny of *T.castaneum* is much higher than mortality at all tested concentrations. This may be due to the toxic action of the plant extract on the developmental stages of this insect species found outside the grains.

Results revealed that, the adults of *T.castaneum* were the least susceptible species to the extracts of the *Conyza dioscoridis* followed by *R.dominica* and *S.oryzae* adults, which were the most sensitive one.

Indeed, further experiments are needed to investigate the main substance responsible for the effect reported. The toxicity effects of the plant extracts might be due to the fact this plant contains terpenoids, glycosoides or similar substances, which possess antifeedant, repellent activities or lead to moulting disturbance which is often lethal (Champagne et al., 1989). Also, the plant substances could be considered as developmental insecticides and that affect the life cycle (oviposition, hatchability, moulting of larval instars.. etc.) of the insects.

The obtained results are in harmony with the findings of other investigators (Darwish, 1992; Ahmed, 1992; El-Lakwah et al., 1992b, 1993 and 1994).

4. Repellency effects of *C.dioscoridis* extracts on the studied insects

Average repellency values of acetone and petroleum ether extracts of *C.discoridis* for *S.oryzae, R.dominica* and *T.castaneum* adults during an observation period of 21 days at various concentrations are collected in Figure 1.

Acetone extract of the plant was a strong repellent to *S.oryzae* adults, that is true at all concentrations used. It showed the most repellent value (78%) on the mentioned insect at the highest concentration (10%), the corresponding values in case of petroleum ether extract amounted 55% on the same insect. Even at the lowest concentration used (1.25%) it had the highest repellency effect, representing 47%. Meanwhile, it showed very negligible repellent effect on *R.dominica* (17%) and *T.castaneum* (18%) with the highest concentration (10%). Petroleum ether extract showed moderate repellent effect on *R.dominica* (54%) and low effect on

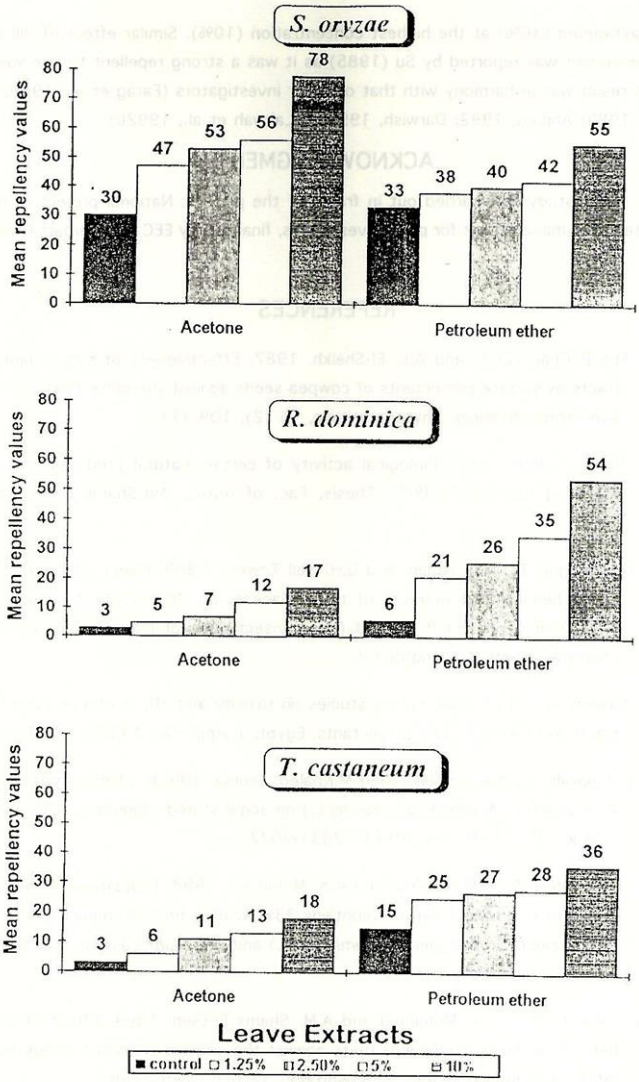

Fig. 1. Average repellency values of acetone and petroleum ether extracts of the adults during 21 days at various concentrations of *Conyza dioscoridis* leaves extracts.

T.castaneum (36%) at the highest concentration (10%). Similar effect of dill acetone extract was reported by Su (1985) as it was a strong repellent to rice weevil. This result was in harmony with that of other investigators (Farag et al., 1989; Helen, 1989; Ahmed, 1992; Darwish, 1992; El-Lakwah et al., 1992b).

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تأثير مستخلصات أوراق نبات البرنوف على بعض حشرات المواد الخزونة

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أجرى هذا البحث بغرض تقييم التأثير السام والطارد لمستخلصات الأسيتون والإيثير البترولى لأوراق نبات البرنوف مع ثلاثة أنواع من حشرات المواد المخزونة وهى سوسة الأرز، ثاقبة الحبوب الصغرى وخنفساء الدقيق الكستنائية.

وقد أظهرت النتائج أن التركيز المرتفع (١٠٪) للمستخلص الأسيتونى للنبات قد أعطى نسب موت مقدارها ٤٣,٣٪ ، ٤٢,٥٪، ٢٤,٤٪ بعد ٢١ يوم من المعاملة وذلك لكل من حشرة سوسة الأرز، ثاقبة الحبوب الصغرى وخنفساء الدقيق الكستنائية على التوالى.

ووجد أن نسب الموت الناتجة من مستخلص الإيثير البترولى للنبات كانت ٦٥٪، ٤٣,٣٪، ١٠,٤٪ للحشرات المذكورة على التوالى.

وأشارت النتائج كذلك أن الحشرات الكاملة لسوسة الأرز كانت أشد حساسية من ثاقبة الحبوب الصغرى وأن خنفساء الدقيق الكستنائية كانت أقل الأنواع حساسية للمستخلصات النباتية المذكورة.

وأوضحت النتائج أن التأثير الطارد لمستخلص النبات الأسيتونى كان عاليا مع أكبر التركيزات المستخدمة وذلك مع حشرة سوسة الأرز، بينما كان هذا التأثير ضعيفا جدا مع كل من ثاقبة الحبوب الصغرى وخنفساء الدقيق الكستنائية.

ووجد أن نسبة الطرد الناتجة مع أعلى تركيز مستخدم لمستخلص الإيثير البترولى للنبات كانت متوسطة لسوسة الأرز وثاقبة الحبوب الصغرى ومنخفضا فى حالة خنفساء الدقيق الكستنائية.