J. Agric. Sci. Mansoura Univ., 25 (10): 6525 - 6531, 2000.

EFFECT OF *ANABASIS SETIFERA* DIFFERENT EXTRACTS ON THE RICE WEEVIL *Sitophilus oryzae* (L) AND THE COWPEA BEETLE *Challosobruchus chinensis* L.

Mona Magd El-Din

Pest & Plant Protection Department National Research Center, Dokki, Cairo, Egypt

ABSTRACT

Different extract of *Anabasis setifera* were evaluated under lab. conditions for its biological activity against the adult stage of the rice weevil, *Sitophilus oryzae (L.)* (Fam: Curculionidae) and cowpea beettle, *Challosobruchus chinensis* L. (Fam: Bruchidae). The ethanolic extract of *A.setifera* was toxic ($\geq$50 % mortality) to both insect species then applied topically at $\geq$ 30 ug/insect to *S.oryzae* and $\geq$ 40 ug /insect to *C.chinensis* . When applied to wheat, the ethanolic extract was repellent to *S.oryzae* and *C.chinensis*. Application of the ethanolic extract to wheat at concentrations of 63 – 500 p.p.m. reduced the hatchabilty of eggs to 79 – 42.0 respectively in case of *C.chinensis*. On the values were 70% 42 – 59% in case of *S.oryzae* . Volatile essences from *Anabasis setifera* used at 0.5 ml/petri dish killed weevils in 3days and completely suppressed population build – up.

Keywords: Biological, phytochemical, *Anabasis setifera* , *Sitophilus oryzae* and *Challosobruchus chinensis*.

INTRODUCTION

The use of chemical insecticides for controlling the major pests in Egypt during the past 25years has created important problems such as the environmental pollution and pest resistance. Therefore, it has become necessity to look for safe insecticidal . Intensive work has been carried out to develop insect feeding deterrents or botanical insecticides known to occur naturally in many plants grown as weeds or crops. *(Regnault Rogel&Hamraoui 1995)* and *El-Baroty & Abdel- Lattif (1997).* In store *Callosobruchus chinensis* and *Sitophilus oryzae* are considered important pests and cause serious damage of pulse seeds (*El-Shazly, 1993)*.

In Egypt and in other parts of the world coleopterus insects, *C.chinensis* and *S.oryzae* cause serious yield losses to important cash stored product. The widespread use of chemical insecticides to control these pests has disastrous effects on human and animal health and the whole environment.

Family Chenopodiaceae is a large family comprising about 1500 species belonging to about 100 genera ; namely, *Anabasis , Haloxylon , Chenopodium , Beta, Atriplex , Spinacia, Anthrocnemum* and *Salicornia.* Certain species of *Anabasis* and *Haloxylon* were considered as plant source of insecticides. *Anabasis setifera* was reported to have different biological activities. *Al-Sofany (1994)* demonstrated the presence of alkaloids, flavonoids, saponins , coumarins, volatile oil, unsaturated sterols and tannins in *A. setifera* (Moq.) growing in Egypt. The same author isolated anabasine from the same plant.

The present studies aim to evaluate some of plant extract technologies, production and application as feasible safe and harmles bioinsecticidal as safe controlling ulternative of chemical insecticides in controlling pests infeasting stored products.

MATERIALS AND METHODS

Insects:-

Callosobruchus chinensis were reared in glass jars (1.5L) on cowpea seeds for several generations under constant conditions (30 $\pm$ 2^{o}C and 60 $\pm$ 10% RH.). The cultures of *Sitophilus oryzae* was maintained separately in cylindrical glass jars (2 Kg volume) under laboratory conditions. (Temperature 28$\pm$2^{o}C and r.h. 70$\pm$5%). For bioassay testes. Filter paper impregnation method (FPIM) was used according to *Morallo Rejesus et al. (1990)*. The filter papers have been impregnated with the prepared ethanolic extract and put in Petri dishes (9 cm dia. diameter) and were allowed to dry under room temp. Batches of one hundred unsexed adults of each species were introduced to the treated filter papers. Four replicates were conducted for each concentration. Mortality was recorded daily after exposure and corrected by using abbott formua (Abbott, 1925). In addition , some biological aspects of both insects were investigated for 15 days.

To study the effect of ethanolic extract on the number of laid eggs, seeds were dipped in each tested concentration (500, 250, 125, and 63 p.p.m.), then two newly hatched pairs of insects (0 – 24hrs. old) were added. The number of laid eggs /female was recorded after all insects had died. Hatchability and immature stages duration were determined in the four replicates.

Behavioural studies:

The extraction the different solvents were bioassayed for their activity using an arena as that described by *Wigglesworth (1941)*. The apparatus used was an alternative chamber consisting of a Petri-dish , 14 cm dia. and 2.1cm. deep which was divided into four equal compartments by a median glass partition embedded in wax. A circular wire ringe of the same diameter of the Petri-dish with a fully stretched bolting silk rested over the dish. The arena was enclosed by the lid of another Petri-dish, 14 cm. in diameter and 2 cm. deep with a small central hole covered with a vaselinised covere slip. A glass rod , 2mm.in diameter embedded in wax was fastened across the root of the arena to minimize the area of contact between the air on each side. The extract was placed as drops (1% petroleum ether solution) on shreds of filter paper in the compartment . The apparatus was set up and left for about half an hour. The highly mobile adults of *S.oryzae* and *C.chinensis* were then introduced by slightly shifting the cover slip of the upper dish and the number of individuals that settled into each quarter of the arena was recovered every one minutes. Individuals that setted in the middle , none of the arena were not considered the apparatus was rotated 180^{o} half way throughout the experiment to eliminate any possible bias to one particular side. These

experiments were conducted in a constant temperature dark room at 27 ± 2°C using a very faint illumination to detect the trait of the adult of *S.oryzae* and *C.chinensis* Each experimental period was 2hours using 25 adults for each test.

Bioactivity study:

Preparation of ethanolic extract:

500g of each of the aerial parts including stems, leaves, flowers and fruits of *Anabasis setifera* (Moq.) (fam:Anabasmine; C_{10} H_{19} N_3)were collected from limestone wadis Cairo – Suez Road , defated then perolated with ethanol (70%) till exhaustion . Ethanol was removed under vacuum (45°C). Each one gram of dry extract of *A.setifera* is equivalent to 6.63g air- dried powder.

RESULTS AND DISCUSSION

Effect of *A.setifera* plant extracts on the behaviour of the testesd insect*:*

The results obtained in Tables (1 and 2) clear that ethanol extract of *A.setifera* was the most attractive to mobile adults of *S.oryzae* than other extracts. The mean number of mobile adults attracted to each extract were 15.47, 9.33, 6.13 and 3.07 for ethanol, chloroform, petroleum ether and ethyl acetate extracts, respectively. In case of *C.chinensis* the corresponding values were, 18.13, 9.53, 5.13 and 3.13.

Table (1) : Number of responded adults of *S.oryzae*

No. of Experiment	No. of highly mobile adult				
	Control	Ethyl acetate	Petrolium ether	Chloroform	Ethanol
1.	**0**	**4**	**6**	**15**	**24**
2.	1	4	10	10	22
3.	1	5	7	14	19
4.	2	5	8	13	20
5.	1	3	7	12	20
6.	0	3	7	10	14
7.	0	4	11	10	14
8.	2	4	6	8	16
9.	1	3	6	8	17
10.	1	1	5	7	18
11.	1	2	5	7	8
12.	3	1	4	9	9
13.	1	3	4	6	9
14.	0	3	3	6	10
15.	1	1	3	5	12
Meant ± S.E Group.	1.0 ± 0.21 a	3.07 ± 0.33 a	6.13 ± 0.58 a	9.33 ± 0.76 b	15.47 ± 1.27 c
Range	(0 - 2)	(1 - 5)	(3 - 11)	(5 - 14)	(8 - 22)

d.f (4.70)
F 56.055**
l.S.D 5% = 0.65 L.S.D 1% = 1.20
C.V = 42.02 %

Table (2) : Number of responded adults of *c.chinensis*

No. of Experiment	No. of highly mobil adult				
	Control	Ethyl acetate	Petroleum ether	Chloroform	Ethanol
1	0	5	10	15	20
2	0	5	9	14	25
3	1	4	9	9	24
4	2	4	8	9	23
5	1	3	7	11	24
6	0	3	6	11	20
7	1	2	4	10	19
8	2	1	4	10	17
9	0	1	5	8	16
10	1	3	5	8	18
11	0	4	3	7	20
12	1	5	3	7	20
13	1	3	2	10	10
14	1	2	1	8	8
15	0	2	1	6	8
Total	11	47	77	143	272
(Total)^2	121	2209	5929	19600	73984
Meant ± S.E Group.	0.733 ± 0.18 a	3.133 ± 0.34 a	5.133 ± 0.74 a	9.533 ± 0. 62 b	18.133 ± 1.39c
Range	(0 - 2)	(1 - 5)	(1 - 10)	(7 - 15)	(8 - 24)

d.f **(4.70)**
F **56.055****
I.S.D **5% = 0.68** **L.S.D** **1% = 1.26**
C.V = **42.309 %**

The order of efficiency of the tested plant extracts of *A.setifera* can be descendingly arranged according to their attractiveness as follows, ethyl alcohol (23.73+2.56 adults). Chloroform extract (15.0 + 1.22 adults), petrolium ether extract , (8.93 ± 0.70 adults) followed by ethyl acetate extract (1.87 ± 0.35 adult).

From Tables (1,2) ethanol extracts on *S.oryzae* and *C.chinensis* were more attractive to the mobile adult of *S.oryzae* . The mean number of adults attracted adults to each extract were 15.47 and 8.13 for ethanol extract followed by chloroform extract. Data obtained in Table (2) clearly indicate that there were significant differences between treatment means and least significant differences, the coefficient of variation: 42.024% . On the other hand there were significant differences between treatment means, and least significant differences : 2.255 and the coefficient of variation : 42.309% (Table 2). Such observations were found by *Ivbijaro, (1983)* and *Ivbijaro* and *Agbaje, (1986.*

Effect of A.setifera ethanol extract on the egg stage :

Data presented in (Table 3), showed that C.chinensis females laid a higher number of eggs on untreated seeds than those on treated ones. This effect was more obvious which the concentrations of 500 and 250 p.p.m. while at 63 p.p.m., slight but not significant differences between number of laid eggs on treated and untreated seeds were noticed. Using a concentration of 63 ppm. Rate of hatched eggs was higher on untreated seeds (nearly 75%

in all tested concentrations) while hatchability percentage was 74.22% on treated seeds.

The developmental period was completed nearly one month without later differences between reared insects on treated or untreated seeds, regardless of concentration levels.

Although the mode of action of these substances is not well understood, till now it is generally believed that it prove the death of insect eggs or adult by contact (*Schoonhoven, 1978*), or through antiffeedant or repellent activity. (*Don-Pedrol 1985, Alford et al. 1987* and *El-Baroty* and *Abdel-Latif, (1997)*.

The toxicity of ethanolic extract of *A.setifera* against *C.chinensis* and *S.oryzae* adults:

Data in (Table 4) indicated that (500 p.p.m.) concentration gave 50%, 60%, 77 and 85% mortality for *S.oryzae* adults at 6, 8, 10 and 14 days after treatment, while it reached 95% after 14 days in comparison 4% in untreated insects . On the other hand the concentration level 250 p.p.m and (125 p.p.m) produced 40, 55, 70 and 83% and 35, 44, 56 and 60% mortality after 6, 8, 10 and 24 days of treatment, respectively. It was found a great difference between treatment and control. The obtained results indicated that, *C. chinensis* and *S. oryzae* were sensetive at all the tested concentration levels. These concentration gave 90% , 82%, 72 % and 59% and 95, 85, 70 and 60% after 15 days. Mortality percentages were, 50, 60, 77 and 85% of *S. oryzae* adults using a concentration of 500 p.p.m. at 6, 12, 18 and 24 days after treatment, respectively,. The corresponding values at 250 and 125 ppm, respectively were 40,55, 70 and 83% and 35, 44,59 and 60%

On the bases of these results one might concluded that the ethanolic extract of *A.setifera* could be used to reduce *S. oryzae* and *C.chinsis* infestation. Generally it might be possible to use *A.setifera* to reduce infestation of *S.oryzae* and *C. chinensis*. *A.setifera* ethanolic extract were more toxic for both species than other extracts.

Su (1984 and 1990) determined the biological activity of the pericarp of prickly ash, *Zanthoxum alatum* L. against adults of *Callosobruchus maculatus* (Fab.), *Sitophilus oryzae*, *Lasioderma serricorne* and *Tribolium confusum* in USA. The pericarp, applied to wheat grain, at 0.5, 1.0 and 2.0% by weight, showed significant repellency to *S.oryzae*. The acetone extract showed no oral toxicity to *S.oryzae* adults and *C.maculatus* larvae when applied as a commodity surface treatment. This extract also showed very little contact toxicity to *C.maculatus* and *T.confusum* adults, but showed some toxicity to *S.oryzae* and *L.serricorne* adults at 50 µg/ insect. When applied to paper at 340/µg/cm2, the extract had an average repellency of 52% + against *T.confusum* for 2 months. Also, *Ahmed (1985)* found that petrolium ether extract from seeds of *Argemone mexicana* L. was the most toxic one to *Rhizopertha dominca*, *Sitophilus oryzae* and *Tribolium confusum* . Lc 50 's of this axtract were 0.032, 0.123 and 0.192 µg/cm2 for the previously mentioned insects, respectively.

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دراسات بيولوجية وفيتو كيميائية على نبات الأناباسيس ستيفيرا ضد سوسة الأرز وخنفساء اللوبيا

منى مجـد الديـن

قسم وقاية النبات والأفات المركز القومى للبحوث ، الدقى ، مصر

تمت دراسة التأثيرات البيولوجية للخلاصة الكحولية (70%) لنبات الأناباسيس ستيفيرا على الطور الكامل لكل من سوسة الأرز (Fam: Curculionidae) وخنفساء اللوبيـــا (Fam: Bruchidae). تمت دراسة الجرعة المميتة لخمسين بالمائة من الحشرات ووجد أن الخلاصة الكحولية (70%) كانت ذات تأثير سام لكلا النوعين من الحشرات المعاملة بها.

وكانت اكثر من50 % فى حالة سوسة الأرز واكثر من 40% فى حالة خنفساء اللوبيا . وعندما أضيف المستخلص الكحولى (70%) لنبات الاناباسيس على القمح بتركيزات تبدأ من 500 جزء فى المليون وتتدرج إلى أن تصل إلى تركيز 63 جزء فى المليون كان للنبات تأثير طارد - كما أن المستخلص الكحولى قلل من نسبة البيض الفاقس من42 % فى حالة التركيزات العالية إلى 79% فى حالة التركيز المنخفض فى حالة معاملة خنفساء اللوبيا ومن وجهة أخرى فى حالة معاملة سوسة الأرز بأن نسبة الفقس كانت 72% فى حالة تركيز 500 جزء فى المليون نقصت إلى 59% فى حالة تركيز 63 جزء فى المليون. المواد المتطايرة من نبات الاناباسيس ستيفيرا عند استخدامها بتركيز 5 مليلتر لكل طبق بترى يعمل على قتل الخنافس فى 3 أيام.