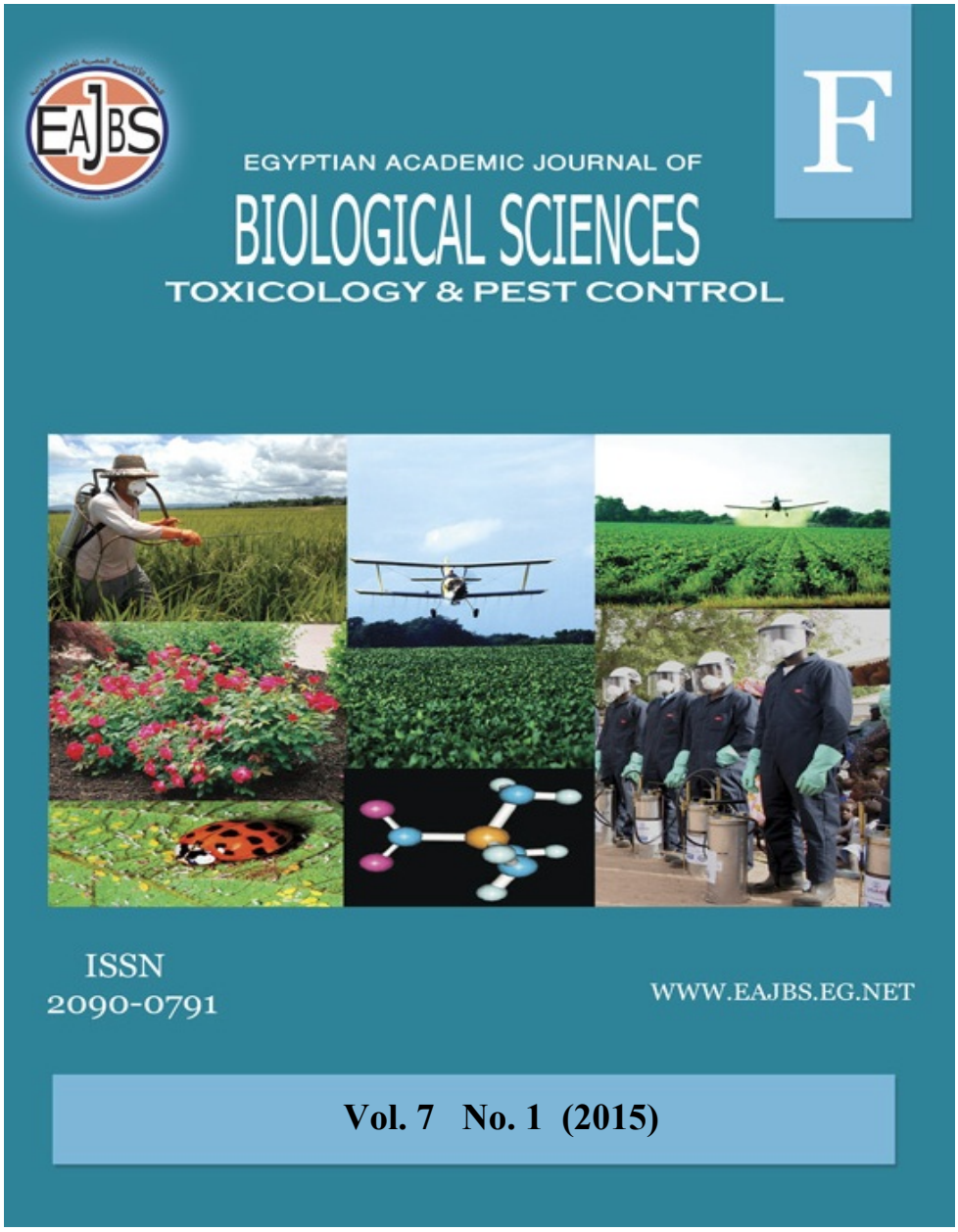

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Evaluation the efficiency of anise oil (*Pimpinella anisum*) for controlling cowpea seed beetle *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae)

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ABSTRACT

The present study was carried out to evaluate the effectiveness and study the impact of anise oil as a natural product against the adults of the cowpea seed beetle, *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) under controlled laboratory conditions.

The study was made at the biology Department, Faculty of Science, Princes Nora University, Al Riyadh, Saudi Arabia, where the effect of four concentrations of anise oil (5, 2.5, 1.25 and 0.12 mg/l) on the adults of this pest was tested. Results were recorded after three and five days of treatment. The Percentage of mortality of adult insects was estimated. Data statistically analyzed and the toxicity lines were illustrated. Data obtained showed that, all the tested concentrations gave satisfactory results against the cowpea weevil under laboratory conditions and the mortality percentage increased with the increase of the oil concentration and the period after treatment.

The percentage of mortality was between 20 and 56.66 % after three days and was between 70 and 83.33 % after five days from treatment at the lower (0.12 mg/l) and higher (5mg/l) concentrations, respectively, and the LC_{50} value was 4.971 mg/l after three days from treatment.

INTRODUCTION

Stored seeds of various grains and legumes constitute the bulk of the world food reserves, a large portion of this reserve being to be damaged during storage due to the infestation of many pests. Insects are one of those pests that cause a significant loss in quantity and quality of the stored seeds. Therefore, it was necessary to find out alternative effective and safe methods instead of chemical pesticides for controlling these pests (Zettler and Cuperus, 1990; Georghiou, 1990 and White, 1995). Extracts and natural oils of higher plants comprise a rich source of novel natural substances that can be used to develop environmental safe methods for insect control. Many investigations have been made to test and evaluate the effectiveness of several natural products of plant origin against the most important warehouse pests.

Of such pests the cowpea seed beetle, *Callosobruchus maculates* (Fab.) which is considered one of the most worldwide insect pests infesting various *Vigna* species in storages causing serious damage and noticeable reduction in the quantity and quality of the crop, may reach 50 – 100% loss within several months from storage (Jood *et al*., 1993; Messina and Rerwick, 1985; El-Sawaf, 1956; Singh, 1978, Seck *et al*., 1991and Tanzubil, 1991). It is also one of the most important pests attacking various legumes in the Kingdom of Saudi Arabia (Mostafa *et al*., 1981).

The effect of several plant extracts as pest control against some stored product pests were studied by many investigators (Afifi *et al.*, 1988 and El Lakwah *et al*, 1992, 1993, 1995 and 2000; Chander and Ahmed, 1987; Su, 1983, 1984, 1985, 1988 and 1989; Ivbijaro, 1983 and 1990; Ivbijaro *et al.*, 1985; Delobel and Malonga, 1987, Zewar, 1978; Chakrabortu and Chose, 1988; Saraswathi and Rao, 1987; Boating and Kusi, 2008; Zettler and Cuperus, 1990; Georghiou, 1990 and White, 1995; Agbakwura *et al*., 1978; Sing *et al*., 1978; Ali *et al*., 1983; Jadhav, 1984; El-Sayed *et al*, 1989; Don- Pedro, 1989; Sarac and Tunc, 1995; Okonkwa and Okoye, 1996; Jaco, 1994; Rajapakse and Van Emden, 1997; Keita *et al.*, 2000; Owsu, 2001; Ajayi and Lale, 2001; Bajya *et al.*, 2007; Boaten and Kusi, 2008; Srinivasan, 2008; Ghosal- Sehapati, 2008; Chubeg, 2008; Raja and William, 2008; Moravei and Abhar, 2008 and Al Bandari F. 2014). The aim of this work is to evaluate the effectiveness of anise oil as natural component against cowpea seed beetle and to contribute to the possibility of using natural oils and plant extracts as alternatives of pesticides in controlling this pest.

MATERIALS AND METHODS

The present study was carried out in the insect laboratory, Biology department, Faculty of Science, Princes Nora University, Riyadh, Kingdom of Saudi Arabia to evaluate the effectiveness of the anise oil, *Pimpinella anisum* for the control Cowpea seed beetle, *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae).

Cowpea seeds (*Vigna unguiculata*) were brought from the local market, purified, washed, dried and maintained in suitable confined jars for at least three weeks to insure free of insect infestation (Adebayo and Gbofade, 1994 and Rajapakze *et al*., 1998). Four concentrations of Anise oil were prepared for the use in the experiment (5, 2.5, 1.25 and 0.12 mg/L).

Sterilization of the seeds was made at 60^{o}C for 20 minutes before the use. Equal quantities of seeds, each of 1 Kg. were held in plastic bags. Oil of the prepared concentrations was added to the bags via a pipette and then the bags were well shaken in order to cover the seeds with the oil. All bags were left away from any source of infestation for 15 days to allow the oil to get inside the seeds.

Treated seeds of equal quantities were put in plastic boxes ca. 6 x 4 cm. then 10 newly emerged adult beetles reared in the laboratory were introduced to each box using fine hair brush. The boxes were covered with punctured plastic cover and were incubated at 25^{o}C and 70% R.H. (Al-Jaberry and Abul Karem, 1987). Three replicates for each treatment were made. Records of adult insect mortalities were made after 3 and 5 days from the treatment. Percentages of adult mortality were calculated and the Lc_{50} was determined. Data are tabulated and presented together with the illustrations of the toxicity lines. Comparisons were made on the basis of

the slops of the LDP (Log. Dose Probit, Finny, 1971).

RESULTS

Four concentrations of anise oil, *Pimpinella anisum* (5, 2.5, 1.25 and 0.12 mg/L) were tested for the control of the adult cowpea seed beetle *Callosobrucus maculatus* (Fab.) under laboratory conditions. The obtained data are recorded, statistically analyzed, tabulated and toxicity lines are illustrated.

From data in Table (1) it could be easily noticed that, after 3 days from the treatment a relatively moderate mortality of the adult beetles was observed at the highest concentration of the anise oil (5 mg/L), and relatively low mortalities were found at the other concentrations of the oil. The mortality increased with the increasing of exposure time, to be very high at all tested concentrations after five days from the treatment.

Results in Table (2) indicated that the mortality percentage after 3 and 5 days from the treatment increased with the increase of the concentration of the orange oil. After 3 days the percentage of mortality was between 56.667 % at the highest concentration (5 mg/l) and 20% at the lowest one (0.12%). After 5 days the percentage increased in all concentrations, reached 83.333% at the highest concentration (5 mg/l), where as it was 70% at the lowest one (Table 3).

Table 1: The effect of anise oil *Pimpinella anisum* on adult *C. maculates* after three and five days from treatment.

Concentration Mg/L	replicates	Total no. insects	After 2 days from treatment		After 4 days from treatment	
			dead	alive	dead	alive
5mg/L	1	10	5	5	9	1
	2	10	6	4	8	2
	3	10	6	4	8	2
2.5mg/L	1	10	5	5	9	1
	2	10	4	6	7	3
	3	10	3	7	8	2
1.25mg/L	1	10	3	7	9	1
	2	10	4	6	6	4
	3	10	2	8	7	3
o.12mg/L	1	10	1	9	7	3
	2	10	2	8	6	4
	3	10	3	7	8	2

Data presented in Tables (2 & 3) and Figs. (1& 2) showed that the value of LC_{50} was 4.471 mg/L and 0.0015 mg/L, and the value of LC_{90} was 798.348 mg/L and 166.648 mg/L after three and five days from the treatment, respectively. The slope was 0.581 and 0.253 after 3 and 5 days from treatment, respectively.

The x^2 counted value was 1.317 after three days from the treatment and was 0.35, after five days from the treatment, whereas the tabulated value was 6 in the two periods.

Table 2: Response of *C. maculatus* adults to the tested anise oil concentrations after three days from treatment

No.	Treated	Concentration	Observed	Linear	Log	Linear
		10	Responded %	Responded %	Conc. 10	Probit
1	30	1.2	20	17.4374	0.079	4.06
2	30	12.5	30	36.3815	1.097	4.652
3	30	25	40	43.1165	1.398	4.827
4	30	50	56.667	50.0581	1.699	5.001

slope	0.581	+/- 0.21
X2	1.317	Tabulated 5

LC	25	50	75	90	95	99
Mg/L	0.343	4.971	71.998	798.358	3368.722	50144.84

Table 3: Response of *C. maculatus* adults to the tested anise oil concentrations after five days from treatment

No.	Treated	Concentration	Observed	Linear	Log	Linear
		10	Responded %	Responded %	Conc. 10	probit
1	30	1.2	70	68.6244	0.079	5.485
2	30	12.5	73.333	77.1314	1.97	5.743
3	30	25	80	79.3710	1.398	5.819
4	30	50	83.333	81.4757	1.699	5.896

Slope	0.253	+/- 0.203
X2	0.35	Tabulated 6

LC	25	50	75	90	95	99
Mg/L	31756E-10	0.0015	0.67	166.648	4524.858	22122E+2

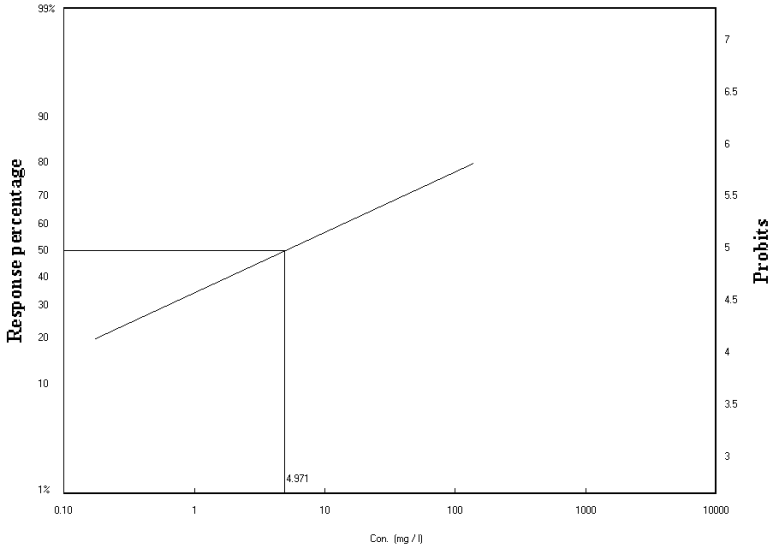

Fig. 1: Probit line showing response of *C. maculatus* adults to the different concentrations of anise oil after three days from the treatment.

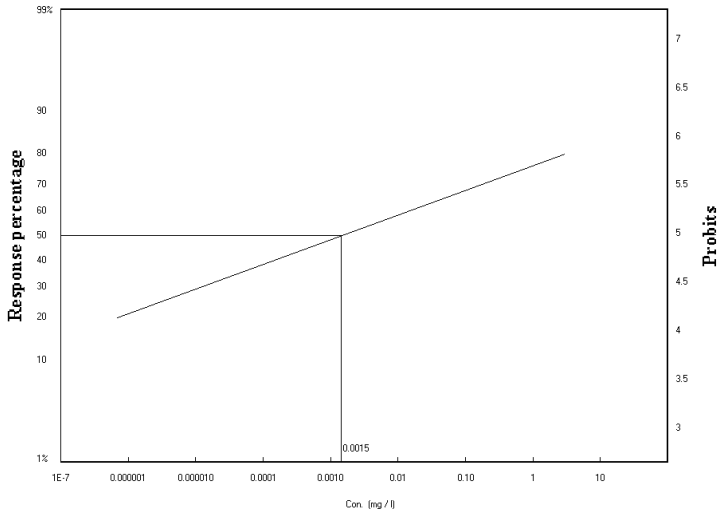

Fig. 2: Probit line showing response of *C. maculatus* adults to the different concentrations of anise oil after five days from the treatment.

A comparison between the two toxicity lines for anise oil and the value of LC_{50} after 3 and 5 days from the treatment is given in Fig. (3).

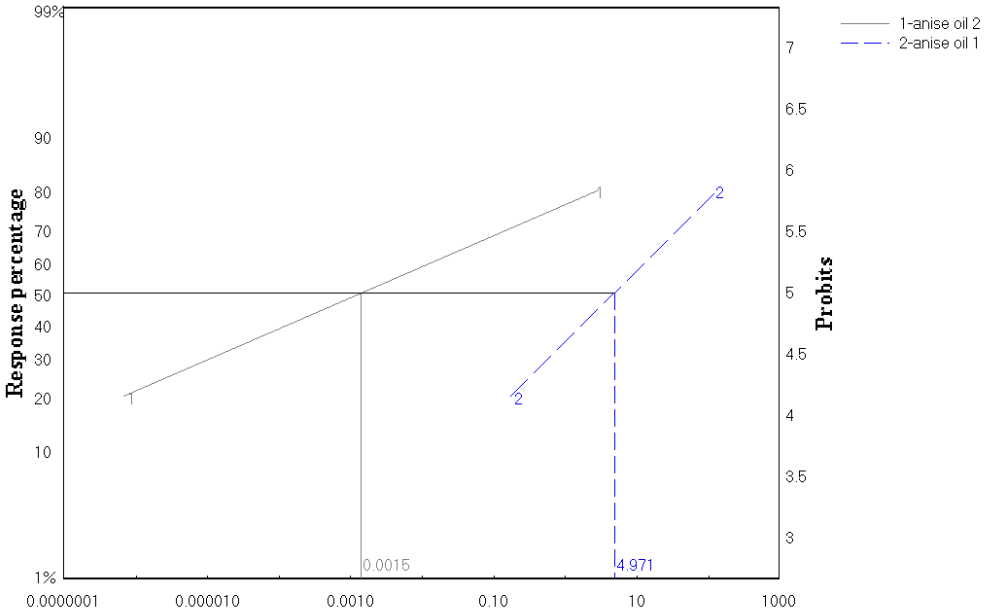

Fig. 3: Probit lines and LC values of orange oil on *C. maculatus* adults after three and five days from the treatment under laboratory conditions.

DISCUSSION

The obtained results and LC_{50} values in the present study showed the susceptibility of the cowpea seed beetle *Callosobruchus maculatus* adults to the tested oil under laboratory conditions.

In general, the current results are found to be in harmony and agree with that obtained by several authors, who achieved similar experiments and tested many natural oils and plant extracts against various pests of stored grains and seeds. Of those who dealt with the control of the cowpea seed weevil: Srinivasan (2008) who studied the efficiency of oils of seven plant spices (*Nigella sativa*, *Anethum graveolens*, *Cuminum cyminum*, *Illicium verum*, *Piper nigrum*, *Muristica fragrans* and *Trachyspermum ammi*) at concentrations of between 5-10 ml/Kg seeds against the cowpea seed beetle. All these oils caused death to the adult insects and the oil of *N. sativa* was the most efficient followed by *A. graveolens* and then *C. cyminum*. Other oils were less effective. Bajya *et al*., (2007) on a study of the effect of the neem oil, castor oil and mustered oil on the adults of the cowpea seed beetle at concentrations of 0.4, 0.8 and 1.2 ml/ 100 gm seeds observed high percentage of mortality after three days and the percentage of mortality increased with the increase of the dose in each case. The most efficient oil was the neem oil which gave 96% mortality after three days from the treatment at concentration of 1.2 ml/ 100 gm seeds, followed by castor oil (84%) at the same concentration. Also, Ali *et al*, (1983) tested a number of plant oils (Neem oil, *Melia azaderach*; Coconut oil, *Cocos nucifera* ; Turnip oil, *Brassica* sp.; Sesame oil, *Sesanum indicum* and Palm oil, *Elaeis guineensis*) on adults of the cowpea seed beetles breading on chickpea plant which were used at concentrations 0.05 and 1ml/100 gm seeds. They found that both neem and coconut oils caused high rates of mortality could reach 100% after three days from the treatment at 1ml/100 gm seeds. The results are also agree with

Zewar (1987) who mentioned that, some plant oils (castor, olive, paraffin and maize) are efficient against adults of cowpea seed beetle *Callosobruchus maculates*. When exposing adult insects to higher concentration (12ml/kg seeds) caused 100% mortality after two days of exposure to the treated grains of castor and paraffin oils, whereas in the case of maize oil caused 90% mortality at the same concentration.

Finally, similar results were reached by Agbakwura *et al*., 1978; Bhaduri and Patil, 1985; Sing *et al*, 1978; Jadhav and Jadhav, 1984; Okonkwo and Okoye, 1996; Jaco, 1994; Keita *et al*., 2000; Su, 1983, 1984, 1985 and 1988; Don-Pedro,1985; Boating and Kusi, 2008 and Rajapakse and Ratnasekera (2008).

It is to be noted that in most studies, high percentages of mortality obtained at higher rates of concentrations and there was a positive relation between the rate of the adult mortality and the concentration of the oil used.

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ARABIC SUMMERY

تقييم فعالية زيت اليانسون *Pimpinella anisum* فى مكافحة حشرة خنفساء اللوبيا *Callosobruchus maculatus* (F.) (رتبة غمدية الاجنحة : فصيلة خنافس البقول)

البندري فهد اليوسف
قسم الأحياء، كلية العلوم، جامعة الأميرة نوره بنت عبدالرحمن
المملكة العربية السعودية

أجريت الدراسة الحالية لتقييم فعالية زيت اليانسون كمستخلص طبيعى فى مكافحة خنفساء بذوراللوبيا Callosobruchus maculatus (F.) تحت الظروف المعملية والتى تعتبر من اهم افات البقوليات المخزونة وخاصة اللوبيا والتى تسبب لها ضررا بالغا يتمثل فى فقد كمية كبيرة من البذور وتؤثر فى جودتها وصلاحيتها للاستهلاك . ولهذه الحشرة انتشارعالمى واسع خاصة فى المناطق الاستوائية والشبه استوائية والمعتدلة.

وقد اجريت هذه الدراسة بقسم الاحياء بكلية العلوم جامعة الاميرة نورا بنت عبد الرحمن بالرياض، المملكة العربية السعودية ، حيث تم اختبار تأثيراربعة تركيزات من زيت اليانسون (٥ ، ٢.٥ ، ١.٢٥ و ٠.١٢ ملجرام / لتر) على هذه الحشرة. اخذت النتائج بعد ثلاثة وخمسة ايام من المعاملة، وقدرت النسبة المئوية لموت الحشرات الكاملة ، وتم تحليل النتائج احصائيا ورسم خطى لوغاريتم السمية.

اظهرت النتائج تاثيرا فعالا لزيت اليانسون فى مكافحة خنفساء بذور اللوبيا تحت الظروف المعملية وان جميع التركيزات المستخدمة كان لها تاثير على نسبة الموت والتى كانت ما بين ٢٠ و ٥٦.٦٦ % بعد ثلاثة ايام من المعاملة ، وكانت ما بين ٧٠ و ٨٣.٣٣ % بعد خمسة ايام من المعاملة للتركيز الادنى والاعلى على التوالى . كما اوضحت النتائج ان قيمة التركيز القاتل ل ٥٠ % من الافراد يساوى ٤.٩٧١ مللجرام / لتر وذلك بعد ثلاثة أيام من المعاملة.