Zoological and Entomological Letters

E-ISSN: 2788-8428
P-ISSN: 2788-8436
ZEL 2025; 5(1): 42-46
www.zoologicaljournal.com
Received: 05-12-2024
Accepted: 05-01-2025

Zahra Khalil Asmail
Department of Biology, College of Education for Woman, Tikrit University, Iraq

Correspondence
Zahra Khalil Asmail
Department of Biology, College of Education for Woman, Tikrit University, Iraq

The effect of some plant extracts on the adults of the southern cowpea beetle *Callosobruchus maculatus* (Fab.)

Zahra Khalil Asmail

DOI: https://www.doi.org/10.22271/letters.2025.v5.i1a.117

Abstract
In this research, the effect of some plant extracts on the adults of the southern cowpea beetle, *Callosobruchus maculatus* (Fab.) was studied, and the toxic effect of alcoholic extracts of the seeds of *Peganum harmala L*., *Citrullus colocynthis* (schrad), and *Datura innoxia* was studied. The insect adults were treated with alcoholic plant extracts and at concentrations (1000, 2000, 4000, 6000, 8000, 10000) ppm / complete by fine spraying and at concentrations (1.25, 2, 5, 10,30,60) ppm / complete and at a temperature of (30 + 1) ° C and relative humidity (70 + 2)% and observe the results after (24- 48) hours of treatment.Treatment with alcoholic extracts showed that the alcoholic colocynth fruit extract was superior to the rest of the extracts, as it achieved two kill rates (83.33 and 91.66%) at the concentration of 10,000 ppm/complete and after 48 and 24 hours of treatment, respectively, and the Lc50 value was equal to 4700 ppm/complete. While the alcoholic caramel seed extract achieved two killing rates (70.83 and 91.66)% at the concentration of 10000 ppm/complete and after 48 and 24 hours of treatment, respectively, and the Lc50 value was equal to 5200 ppm/complete. While the extract of Datura fruits was the least effective on insect adults, as it achieved two kill rates (83.33 and 66.66%) at the concentration of 10,000 ppm/whole and after 48 and 24 hours of treatment, respectively, and the Lc50 value was equal to 6,900 ppm/whole.

Keywords: *Callosobruchus maculatus (Fab.), plant extract, Vigna unguiculata*

Introduction
The southern cowpea beetle, *Callosobruchus maculatus* (Fab.) which belongs to the Bruchidae family of the Coleoptera order, is one of the dangerous insect pests that infect legume seeds in various parts of the world [1]. Legume seeds are of great nutritional importance to humans and animals because they contain important nutrients, including carbohydrates and proteins. This insect is also one of the main insects of leguminous crops in warehouses, as the infestation begins in the field and the insect completes its life cycle and reproduces in the warehouse. The importance of this insect comes due to the feeding and development of its larvae inside the seeds and consuming all their contents, thus increasing the rate of seed damage and reducing its nutritional value and germination rates [2].
Leguminous crops grown in cold or temperate climates are exposed to the insect, which is considered a serious global pest of legumes because it causes serious damage when it feeds directly, in addition to transmitting dangerous bacteria and fungi [3]. The cowpea beetle *C. maculatus* is considered one of the most economical insect pests on stored legume seeds and causes a loss of up to 50% in basic legumes. Its main hosts include the cowpea, *Vigna sneninsis*, the chickpea, *Cicer arietinum*, the mung bean, *Vigna nilotca*, and the pigeonpea, *Pisium sativum*. It has received the attention of researchers around the world [4].

Materials and Methods
Breeding the southern cowpea beetle
The southern cowpea beetle *Callosobruchus maculatus* (Fab.) (Bruchidae:Coleoptera) was obtained from cowpea seeds, especially the infected *Vigna unguiculata* species, which were obtained from the local markets of the city of Tikrit. The insect was then classified in the insect laboratory - Plant Protection Branch / College of Agriculture - Tikrit University. The uninfected cowpea seeds were placed in clean, sterilized glass bottles with a capacity of 800 ml, at a rate of 200 g/bottle, then the adults of the insect newly emerging from the pupal

stage was added to them, and the bottles were covered with a burlap cloth. They were tied with a tight rubber band and placed in the incubator at a temperature of 30±1°C and a relative humidity of 70. ±2% (5). The insect farms were renewed by taking newly emerged insects from the pupal stage and placing them in glass bottles containing cowpea seeds at a rate of 200 grams/bottle for several replicates to conduct experiments on them for the period from April to October / 2023.

plant collection and classification

Coconut, Harmal and Datura plants were collected from the wild areas of the city of Tikrit. Then the plant seeds were cleaned of dust and dirt, washed with distilled water, then dried after placing them on special papers at a laboratory temperature of (20-25) °C after which they were stored in nylon bags until they began to grow Extraction process.

A- Handhel Plant B- Harmal Plant C - Datura plant

Preparation of alcoholic plant extracts

They were prepared based on the method of [6] where the dry plant part was transformed into a fine powder using an electric grinder, then 25 grams of dry powder were placed for each of the Haramel, Handhel and Datura plants As a result of two experiments in the extraction vessel Extraction thamble in the extraction device Soxhlet extractor and using 400 ml of the organic solvent ethanol (Ethanol) with a concentration of 99.9%, the heating continued for between [10, 12] hours until the ethanol came out of the extraction vessel in its natural color, and then the solvent was evaporated. The extract is extracted under low pressure and at a temperature of 40°C using a rotary evaporator to obtain the alcoholic extract in the form of a viscous substance, then collected and stored in sterile dark bottles at a temperature of 5°C until use.

Table 1: Plants used in the study.

Using Part	Family	Scientific Name	Common Name
seeds	Cucurbitaceae	*Citrullus colocynthis*	Handhel
seeds	Solanaceae	*Datura innoxia*	Datura
seeds	Zygophyllaceae	*Peganum harmala*	Harmal, Harmala

represents the weights and percentages of alcoholic plant extracts resulting from the extraction process, and their percentage was calculated using the following law:

$$\text{Percentage of extract} = \frac{\text{Weight of the viscous material obtained}}{\text{Total weight of powder}} \text{X100}$$

Table 2: Weights and percentages of alcoholic plant extracts

Plant used	Weight obtained in grams in ethanol solvent (gm)	Percentage of plant extracts in ethanol solvent
Handhel seeds	12.4	24.8
Datura seeds	4.56	9.12
Harmal, Harmala seeds	7.25	14.5

Preparing concentrations for experimenting with plant extracts

Different concentrations of alcoholic plant extracts were prepared to test their toxicity in adults of the southern cowpea beetle *Callosobruchus maculatus* (Fab.) depending on the amount of sticky substance present in the alcoholic extracts by taking a specific weight of each plant extract in an appropriate volume of alcohol solvent and on a ppm basis (extract / solvent) and the concentrations were prepared (1000, 2000, 4000, 6000, 8000, 10000) ppm/complete.

Toxicity test of alcoholic extracts against adults of the southern cowpea beetle *Callosobruchus maculatus* (Fab.) Whole insects were anesthetized by cooling at zero degrees Celsius for [4-5] minutes, 10 insects were taken into plastic dishes with perforated lids for ventilation using an aspirator. Then the insects in the dishes were treated with alcoholic extracts at concentrations (1000, 2000, 4000). 6000, 8000,

10000) ppm/whole using a micro-spray device (Ultra low volume) with three replicates for each concentration, while placing uninfected cowpea seeds as food for them. As for the control treatment, the insects were treated with solvent only using the micro-spray device at a distance of 10 cm, then after the treated insects were placed in the incubator at a temperature of 30±1 °C and a relative humidity of 70±2%. The results were taken after 24 and 48 hours of treatment, and then the percentage of killing in the treatments in which killing appeared was corrected using the Abbott equation [7].

$$\text{Corrected homicide percentage} = \frac{\text{Percentage of kills in the test- Kill percentage in comparison}}{\text{100- Kill percentage in comparison}} \text{X100}$$

Results

The effect of the ethanolic extract on the adults of the southern cowpea beetle after 24 hours of treatment The results showed that the extract of bitter melon fruits had the highest effect on the insect than the rest of the alcoholic plant extracts, as the highest percentage of killing was 83.33% at a concentration of 10000 ppm/whole and the lowest percentage of killing was 0% at a concentration of 1000 ppm/whole. The value of LC50 was equal to 4700 ppm/full, as shown in Table [4]. The results also showed that the extract of the Harmal plant comes after the extract of the bitter melon plant in terms of its effect on the insect, as the extract showed the highest percentage of killing, which is 70.83% at the concentration 10000. ppm/complete, and the lowest killing rate was 0% at the concentration 1000 ppm/complete, and the LC50 value was equal to 5200 ppm/complete. The Datura plant extract showed the lowest killing rate of 66.66% at the concentration 10000 ppm/whole, and the lowest killing rate was 0% at the concentration of 1000 ppm/whole, and the LC50 value was high at 6900 ppm/whole.

Table 3: Percentage killing of alcoholic extracts 24 hours after treatment with adults

Plant	Ppm in concentration Percentage kill					
	1000	2000	4000	6000	8000	10000
Handhel seeds	0	25.00	37.50	58.33	70.83	83.33
Datura seeds	0	0	33.33	45.83	54.16	66.66
Harmal, Harmala seeds	0	20.83	33.33	54.16	62.50	70.83
Control	20					

According to the results of Table (4) it has been proven that the extract of colocynth seeds and then the seeds of the caramel comes after the extract of the Datura fruits in terms of its effect on the insect.

Table 4: LC50 values of alcoholic extracts after 24 and 48 hours of treatment

Plant	LC50 after 24 hours	LC50 after 48 hours
Handhel seeds	4700	3200
Datura seeds	6900	5000
Harmal, Harmala seeds	5200	4000

The effect of the ethanolic extract on the adults of the southern cowpea beetle after 48 hours of treatment

The results showed that the colocynth fruit extract was superior to other plant extracts in its effect on the insect, as the highest percentage of killing was 91.66% at a concentration of 10,000 ppm/whole, and the lowest percentage of killing was 20.83% at a concentration of 1,000 ppm/whole, as in Table (5). The value of LC50 was equal to 3200 ppm/whole, and the Datura seed extract came after the bitter melon extract in its effect on the insect with a rate of 83.33% at a concentration of 10,000 ppm/whole, and the lowest percentage of killing was 16.66% at a concentration of 1000 ppm. /perfect. The LC50 value of the Datura fruit extract was 5000 ppm/whole. The results also showed that the ethanolic caramel seed extract comes after the ethanolic colocynth seed extract in terms of its effect on the insect, as the highest percentage of killing was 91.66% at the concentration 10000 ppm/whole and the lowest percentage of killing was 16.66% at the concentration 1000 ppm. /Complete. Table (5) and the value of LC50 (4000) ppm/Complete.

Table 5: Percentage killing of alcoholic extracts after 48 hours of treatment with adults.

Percentage kill concentration (ppm)						
Plant	1000	2000	4000	6000	8000	10000
Handhel seeds	20.83	33.33	50.00	75.00	79.16	91.66
Datura seeds	16.66	29.16	45.83	58.33	62.50	83.33
Harmal, Harmala seeds	16.66	33.33	45.83	66.66	70.83	91.66

Discussion

The results of the search for insect adults *C. maculatus* (Fab.). Alcoholic plant extracts contain alcohol extracts that have a high toxicological activity against the insect. The reason may be due to the fact that they are hidden in plants that are dissolved in alcohol, and it may be due to the alcoholic extract containing a mixture of which it has the ability to. It is new in living tissues, similar to known

pesticides, that ethanol has an effectiveness in killing insects at a rate of 20% of the individuals designated for control, and this is what you would expect [8].

The ethanolic extract of bitter melon fruits has a high killing effectiveness against the southern cowpea beetle, as its highest killing rate reached 91.66% at a concentration of 10,000 ppm/whole, and the lowest killing rate was 16.66% at a concentration of 1,000 ppm/whole, and this is consistent with what was found by [9]. as colocynth phenols outperformed the rest of the plants in terms of their effect in reducing (shortening) the duration of the adult stage of the Khabra insect [10]. The reason for this is that the seeds of the bitter melon plant contain resinous substances Resins, alkaloids, pectin, and sapononins, especially the compounds Isovitexin and iso-Orientin isolated from the seeds [11]. which inhibit the action of the enzyme acetylcholinesterase (AChE), which leads to the accumulation of acetylcholine, which ultimately leads to a nervous shock and continuous tremors of the insect, leading to its killing. The results showed that the ethanolic extract of Datura seeds had a good effect against the insect, and this is consistent with [1]. The reason for the effectiveness of Datura seeds against the southern cowpea beetle is that the Datura plant contains tropane alkaloids, the most important of which are hyoscyamine, scopolamine, atropine and daturaine, which is Among the most important of them, their concentration in Datura leaves reaches 0.7%. These alkaloids activate the nerve centers and then suddenly (quickly) inhibit them, which causes a nervous shock and the occurrence of paralysis or a toxic effect. The results also showed that the ethanolic extract of caramel seeds had a good effect on the insect's adults, and this is consistent with With what he stated [12]. The results also showed that the ethanolic extract of caramel seeds had the least effect on the insect, and this is consistent with the results of the study [13]. The results showed that there was an increase in the lethal effect of the plant extracts after 48 hours of treatment, and this is likely due to the factor of the duration of exposure that caused An increase in killing rates. As the duration of exposure to the active agent increases, the killing rates increase. These results are consistent with what was found by [14, 15] that the factor of the duration of exposure to the active ingredient has a greater impact than the quantity or dose used. The results showed that ethanolic colocynth seed extract has a high effect on the southern cowpea beetle, and this is consistent with the findings of [16]. The results showed that the ethanolic extract of the Datura plant had a high effect on C. *maculatus* (Fab.) This is consistent with the study of [17]. The results showed that the ethanolic extract of Datura seeds has a good effect on the insect, and this is consistent with the findings of [17]. The results showed that the ethanolic extract of caramel seeds has a high toxic effect against *C. maculatus* for an hour at the same concentrations, which explains the effect of the duration of exposure to the active agent on the killing rate. The ethanolic extract of the Harmal fruit was less effective than the rest of the extracts, and these results agree with the results of a study [19]. The toxicity of the Harmal plant is due to the Harmal alkaloids, fatty oils, and flavones it contains, which penetrate the cuticle through the flexible areas of it as well as through the respiratory openings. It causes inhibition of some enzymes, including acetylcholinesterase, which leads to continuous tremors, then paralysis and death.

References

1. Al-Ghalibi MAWB. Biological studies on the cowpea beetle (*Callosobruchus maculatus* Fab.) and its control using some plant powders. Master's thesis. College of Education, University of Thi Qar, Iraq; 2006.
2. Bhalla S, Gupta K, Lal B, Kapur ML, Khetarpal RK. Efficiency of various non-chemical methods against pulse beetle, *Callosobruchus maculatus* Fab. ENDURE International Conference 2008: Diversifying Crop Protection, 12-15 October, La Grande-Motte, France, Oral Presentations. 2008. p. 4.
3. Heie O. Why are there so few aphid species in the temperate areas of the Southern Hemisphere? Eur J Entomol. 2013;91:127-133.
4. Ali K, Kenneni G, Ahmed S, Malhotra R, Beniwal S, Makkouk K, *et al*. Food and forage legumes of Ethiopia: Progress and prospects. International Center for Agricultural Research in the Dry Areas (ICARDA); 2006.
5. Elsobky EE, Hassan HH. Optimizing cowpea productivity by sowing date and plant density to mitigate climatic changes. Egypt J Agron. 2021;43:317-331.
6. Riose JL, Recido MC, Villar A. Antimicrobial activity of selected plants employed in the Spanish Mediterranean area. J Ethnopharmacol. 1987;21:139-152.
7. Abbot WS. A method of computing the effectiveness of an insecticide. J Econ Entomol. 1925;18:265-267.
8. Adedire CO, Akinneye JO. Biological activity of tree marigold (*Tithonia diversifolia*) on cowpea seed bruchid, *Callosobruchus maculatus* (Coleoptera: Bruchidae). Ann Appl Biol. 2004;144:185-189.
9. Jirjis SJ, Al-Jubouri ARY. Sublethal effects of crude extracts of some medicinal plants on the hairy grain beetle, Trogoderma granarium (Everts) (Coleoptera: Dermestidae). Iraqi J Agric. 2005;10(1).
10. Abdul-Jabbar HD. Biological effects of some plant extracts (*Eruca sativa*, *Raphanus sativus*, and *Lactuca sativa*) on the life cycle of the cowpea beetle *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae). Master's thesis. College of Education, University of Tikrit, Iraq; 2006.
11. Maatooq GT, El-Sharkawy SH, Afifi MS, Rosazza JPN. C-P-hydroxybenzoyl glycoflavones from *Citrullus colocynthis*. Phytochemistry. 1997;44(1):187-90.
12. Al-Mohammadi NKM. Study on the repellent effect of plant extracts from *Ricinus communis* L. and *Peganum harmala* L. on female mosquitoes *Culex pipiens* molestus (Forskal) (Diptera: Culicidae). Master's thesis. College of Education, University of Anbar, Iraq; 2006.
13. Mohammed OS, Khidr SK. Toxicity study of some plant extracts and chemical pesticides on the cowpea beetle *Callosobruchus maculatus* (Fab.) (Bruchidae: Coleoptera). Rafidain J Agric. 2006;34(2):University of Mosul, College of Agriculture and Forestry.
14. El-Nahal AKM, Schmidt GH, Risha EM. Vapors of Acorus calamus oil: An asphyxiation treatment for stored-product insects. J Stored Prod Res. 1989;25(4):211-216.
15. Al-Tikriti AAJ. Toxic effects of extracts from Melia azedarach and *Cyperus rotundus* L. on the life cycle of the cowpea beetle *Callosobruchus maculatus* (F.).

Master's thesis. College of Education, University of Tikrit, Iraq; 2001.
16. Al-Bakr AAJH. Effect of Melia azedarach on the life cycle of the cowpea beetle *Callosobruchus maculatus* L. Master's thesis. College of Education, University of Mosul, Iraq; 1999.
17. Ivbijara MF. The efficacy of seed oils of Azadirachta indica A. Juss and Piper guineense Schum & Thonn on the control of *Callosobruchus maculatus* F. Insect Sci Appl. 1990;11(2):149-152.
18. Seck D, Iongnay G, Haubruge E, Wathelet J. Biological activity of the shrub Boscia senegalensis (Pers.) Lam. ex Poir (Capparaceae) on stored grain insects. J Chem Ecol. 1993;19(2):377-89.
19. Kéita SM, Vincent C, Schmit JP. Efficacy of oil from *Ocimum basilicum* L. and O. gratissimum L. applied as an insecticidal fumigant and powder to control *Callosobruchus maculatus* (Fab.) (Bruchidae: Coleoptera). J Stored Prod Res. 2001;37:339-349.