Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
Impact Factor (RJIF): 5.83
www.entomoljournal.com
JEZS 2025; 13(5): 52-54

Received: 18-06-2025
Accepted: 20-07-2025

Afrah Ibrahim Saleh
Assistant Professor, Department of Field Crops, Faculty of Agriculture, Iraq

Dr. Shaza Ahmed Mahdi
Lecturer, Department of Food Sciences, Faculty of Agriculture, Iraq

Corresponding Author:
Afrah Ibrahim Saleh
Assistant Professor, Department of Field Crops, Faculty of Agriculture, Iraq

Efficacy of Fenugreek (*Trigonella foenum-graecum*) and cumin (*Cuminum cyminum*) seed extracts in controlling the third larval instar of the red rust Flour beetle *Tribolium castaneum*

Afrah Ibrahim Saleh and Shaza Ahmed Mahdi

DOI: https://www.doi.org/10.22271/j.ento.2025.v13.i5a.9606

Abstract
The present study aimed to evaluate the efficacy of alcoholic extracts of fenugreek and cumin seeds against the third larval stage of the red rust flour beetle (*Tribolium castaneum*), one of the most destructive storage pests. Three concentrations (0.75, 1.5, and 3 g/100 ml) were tested, and mortality rates were recorded after 24, 48, and 72 hours of exposure. The results revealed significant effects of both plant extracts, with fenugreek showing higher mortality after 48 hours, while cumin was more effective after 72 hours. Mortality rates increased proportionally with concentration and exposure time. These findings suggest that fenugreek and cumin extracts can serve as promising natural alternatives to chemical insecticides in the management of stored-product pests.

Keywords: Fenugreek, cumin, plant extracts, *Tribolium castaneum*, stored-product pests, botanical insecticides

Introduction
Grains are a staple food commodity due to their direct connection to food security. They are the primary source of energy, carbohydrates, and proteins for human and animal nutrition. During storage, grains are exposed to significant economic losses due to infestation by storage pests, most notably insects such as the rusty red flour beetle (*Tribolium castaneum*), which causes weight loss, food contamination, and a pungent odor resulting from gaseous secretions and volatile substances. Therefore, the search for safe alternatives to chemical pesticides has become crucial. These include the use of plant extracts, which are known for their biological effectiveness and environmental and health safety

Previous Studies
Plant extracts are among the most important biological alternatives to chemical pesticides in controlling stored pests. Several studies have shown that volatile oils and secondary plant compounds have broad anti-insect efficacy.
Hala (1985) [6] indicated that some plant extracts had a clear effect in reducing *Tribolium castaneum* populations when used at different concentrations. Schmutterer (1990) [7] confirmed the effectiveness of neem compounds (Azadirachtin) in inhibiting the growth and development of stored insects. Tripathi *et al*. (2001) [8] demonstrated that essential oils such as clove and camphor oils demonstrated strong efficacy as natural pesticides against stored insects.
Meanwhile, a study by Devi & Devi (2015) [11] showed that local plant extracts produced varying levels of mortality against flour beetle larvae, and that increasing the concentration and exposure duration led to increased efficacy. On the other hand, Isman (2006) [12] demonstrated that plant extracts are relatively safe compared to chemical pesticides and can be part of integrated pest management programs.
These findings support the importance of using plants such as fenugreek and cumin to control stored pests, especially since these plants are locally available and inexpensive, making them a practical option for reducing economic losses.

Materials and working methods
1. Materials used: Fenugreek seeds, cumin seeds, 96% ethanol, distilled water, Tween 20,

Petri dishes, and filter paper.
2. Adult insects were collected from infested flour samples and reared under appropriate laboratory conditions (temperature 28-30°C, relative humidity 70%).
3. The third instar larvae were isolated using a special sieve, and the larvae were stored in transparent plastic containers under the same conditions.
4. An alcoholic extract was prepared by grinding 200 g of seeds and soaking them in 800 ml of 96% ethanol for 48 hours at room temperature. The extract was then filtered and stored in the refrigerator.
5. The extracts were diluted to obtain three concentrations (0.75, 1.5, and 3 g/100 ml) with the addition of Tween 20 to break the surface tension.
6. Third-instar larvae were treated by spraying the extracts into Petri dishes at a rate of six sprays from a distance of 10 cm, with 10 larvae per replicate and three replicates per treatment, in addition to the control treatment.
7. The dishes were incubated at 30°C and 70% humidity, and mortality rates were recorded after 24, 48, and 72 hours.

Results

1. After 24 hours: The cumin extract outperformed, with a 35% kill rate at the highest concentration, compared to 30% for fenugreek.
2. After 48 hours: The fenugreek extract outperformed by 50%, while the cumin extract outperformed by 40%.
3. After 72 hours: The cumin extract recorded a higher kill rate (75%) compared to fenugreek.*(%70)*
4. All concentrations showed an increase in kill rates with increasing concentration and exposure duration, while the control treatment recorded no kill rate *1* .

Table 1: Shows the effect of different concentrations of fenugreek and cumin extracts on mean mortality compared with control

Plant species				Mean mortality
	0.75	1.5	3	
Fenugreek	10	20	30	20B
Cumin	20	30	40	30A
control	0.0	0.0	0.0	0.0C
Mean mortality	15c	25B	35A	

Table 2: Presents the mean mortality of test organisms at different concentrations of fenugreek and cumin extracts compared with the control.

Plant species	Applied concentration (g/100 ml)			Mean mortality
	0.75	1.5	3	
Fenugreek	40	50	60	50A
Cumin	30	40	50	40B
control	0.0	0.0	0.0	0.0C
Mean mortality	35C	45B	55A	

Table 3: Summarizes the mean mortality observed at different concentrations of fenugreek and cumin extracts compared with the control.

Plant species	Applied concentration (g/100 ml)			Mean mortality
	0.75	1.5	3	
Fenugreek	60	70	80	70A
Fenugreek	60	70	80	70A
Cumin	50	60	70	60B
control	0.0	0.0	0.0	0.0C
Mean mortality	55C	65B	75A	

Discussion

The results showed that alcoholic plant extracts of fenugreek and cumin seeds were significantly effective against the third larval instar of the rusty red flour beetle. This is due to the presence of secondary compounds with toxic effects on insects, such as alkaloids, flavonoids, and volatile oils. This is also consistent with previous studies indicating that higher concentrations and longer exposure times lead to increased mortality rates.

Conclusions

1. Alcoholic extracts of fenugreek and cumin demonstrated significant effectiveness in killing rusty red flour beetle larvae.
2. Fenugreek extract outperformed after 48 hours, while cumin extract outperformed after 72 hours.
3. High concentrations (3 g/100 ml) achieved the best results compared to other concentrations.
4. These plants can be considered promising natural alternatives for controlling stored pests, reducing reliance on chemical pesticides.

Recommendations

1. Conduct additional studies on other plants, such as garlic, cloves, neem, and camphor, to determine their effectiveness against stored pests.
2. Test the effect of higher or lower concentrations than those used in this study to determine the optimal concentration.
3. Study the effect of extracts on different insect stages (eggs, nymphs, and adults).
4. The possibility of combining more than one plant extract to determine their synergistic effect.
5. Apply these results in the field to local stored pests to evaluate the effectiveness of plant extracts under practical conditions.

References

1. Al-Azzizi, M. Economic Insects. Cairo: Dar Al-Maaref; c1983.
2. Al-Darakzali, M. Economic Entomology. Baghdad: Ministry of Higher Education and Scientific Research; c1982.
3. Al-Iraqi, M. Warehouse Pests and Methods of Their Control. Baghdad: Dar Al-Kutub; c2007.
4. Al-Jamal, H. Pesticides and Their Effects on the Environment. Cairo: Anglo-Egyptian Library; c2008.
5. Abdul Karim, A. The Role of Plant Extracts in Controlling Warehouse Pests. J Agric Sci. 2012;4(2):33-45.
6. Hala, A. The effect of plant extracts on stored grain insects. J Appl Entomol. 1985;100(3):145-152.
7. Schmutterer, H. Properties and potential of natural pesticides from the neem tree (*Azadirachta indica*). Annu Rev Entomol. 1990;35:271-297.
8. Tripathi AK, Prajapati V, Kumar S. Bioactivities of plant essential oils against storage pests. J Econ Entomol. 2001;94(1):61-66.
9. Rees, D. Insects of Stored Products. CSIRO Publishing; c2004.
10. Shewry, P. Improving the protein content and composition of cereal grain. J Cereal Sci. 2007;46(3):239-250.
11. Devi P, Devi R. Effect of plant extracts against *Tribolium*

castaneum. Int J Adv Res. 2015;3(4):120-126.
12. Isman MB. Botanical insecticides, deterrents, and repellents in modern agriculture and increasingly regulated world. Annu Rev Entomol. 2006;51:45-66.
13. Nerio LS, Olivero-Verbel J, Stashenko E. Repellent activity of essential oils: A review. Bioresour Technol. 2010;101(1):372-378.
14. Pavela, R. History, presence and perspective of using plant extracts as commercial botanical insecticides and farm products for protection against insects - A review. Plant Prot Sci. 2016;52(4):229-241.