

Identification of the Major Insect Pests of Peanut (*Arachis hypogaea*) and the Most Effective Integrated Pest Management Strategies

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Abstract

This study was conducted at the College of Agriculture, University of Tikrit, from July 8, 2023, to December 7, 2023, and included a series of field experiments carried out in Al-Rumana District, Al-Anbar Governorate. Microscopic examination revealed the presence of several insect species on the peanut crop, recorded for the first time in Iraq.

The results showed variation in yield weight depending on the type and concentration of pesticide used, with Match at the recommended concentration producing the highest yield of 106.3 kg. Regarding the number of pods, Match at the recommended concentration recorded the highest value of 55 pods per plant. Similarly, for the number of seeds per pod, Match at the recommended concentration gave the highest value of 120.7 seeds per pod. Concerning vegetative and root weight, Match at the recommended concentration again produced the highest weight of 1800 g.

Significant differences were also observed between the pesticides, their concentrations, and the exposure duration. EVESICT at the recommended concentration achieved the highest average mortality of 73.03%, whereas Match at half the recommended concentration resulted in the lowest average mortality of 12.05%. Regarding exposure duration, the 7-day period outperformed the other periods, reaching 62.324% mortality compared to the 1-day treatment, which gave the lowest mortality of 14.167%. Notably, EVESICT at the recommended concentration for 7 days produced the highest mortality of 96.00%, while Match recorded 0.00% mortality after 1 day.

Key words: *Arachis hypogaea*, Colored Traps, Integrated Pest Management (IPm), Insect mortality rate

1. Introduction

The peanut (*Arachis hypogaea* L.), which belongs to the family Fabaceae, is considered one of the most important annual crops worldwide due to its richness in essential nutrients. It contains approximately 20% protein, 40% oil, in addition to a wide range of minerals and vitamins. Furthermore, some nutrients such as protein and thiamine are

present in peanuts in higher amounts compared to any other dry fruits. Peanut oil is also considered stable and nutritious, as it contains the optimal ratio of fatty acids, with 25–35% linoleic acid and 40–50% oleic acid. In terms of production, peanut yield in Iraq reached 5,480 tons in 2023, while production in the Arab world was approximately 35,826

tons, compared to a global production of 5.4 million tons [1.]

The major insect pests include the cowpea aphid (*Aphis craccivora*), thrips (*Frankliniella* spp.), jassids (*Empoasca dolichi*), white grubs (larvae of various beetles), and termites (mainly *Microtermes* sp.). Less frequent but still present are false wireworms and millipedes. Soil pests cause more serious damage than foliage feeders or sucking pests. Nevertheless, aphids are particularly harmful because they act as vectors of groundnut rosette virus. In Asia and Africa, these pests are of major concern, whereas in the United States, the lesser cornstalk borer (*Elasmopalpus lignosellus*) and the southern corn rootworm (*Diabrotica undecimpunctata*) are among the most significant insect pests of peanuts [2.]

Integrated Pest Management (IPM) is a sustainable agricultural approach that combines cultural, biological, mechanical, and chemical methods to control pests within the economic threshold while minimizing environmental and health risks. Its practices include prevention through resistant varieties and crop rotation, biological control, and careful monitoring of infestations before applying selective pesticides. Recent studies have shown that adopting IPM significantly reduces pesticide use while maintaining productivity and enhancing biodiversity [3]. [4.]

2 Materials and Methods

2.1 Preliminary Procedures for the Field Study

2.1.1 Experimental Site

This experiment was conducted in Al-Rummana District, Al-Anbar Governorate, during the autumn season of 2023. The objective of the study was to evaluate certain

safe, modern insecticides, some pheromone traps, and chemical fertilizers to reduce the risk of infestation by certain insect pests, limit their impact on crop damage, and mitigate economic losses.

2.1.2 Land Preparation

The experimental plot was prepared by smoothing and leveling the soil uniformly. The land was divided into 16 ridges, with a spacing of 75 cm between ridges and 30 cm between plants. Surface irrigation using river water was carried out on 07 July 2023.

2.1 Planting and Irrigation

Seeds of field peanut (*Arachis hypogaea*)—a well-known crop in the study area—were sown, with 2–3 seeds placed in each hole. The spacing between planting holes was 30 cm. Diammonium phosphate (DAP, $(\text{NH}_4)_2\text{HPO}_4$) was applied at a rate of 75 kg during land preparation as a single dose on 08 July 2023.

2.2 Morphological Identification of Insects

Infested pods and leaves from the crop were collected from the field, and the insects were isolated and examined. All specimens were found to exhibit distinct external morphological features and belonged to different species. Adult specimens were sent to the Natural History Museum, Department of Insects and Invertebrates, University of Baghdad, where they were identified by museum specialists.

2.3 Treatments Used in the Study

Table (1) The pesticides used in the experiment.

Pesticide Name	Recommended Concentrations ml/L	Pesticide Sub-recommended Concentrations ml/L
Avunt	25/ 6.5	25/3
BINEVIA	1 /12.5	25/6.5
Match	25/10	25/5
EVISECT	25/15	25/7.5
Coragen	25/8.5	25/4.5
Matrine	25/15	25/7.5

2.4 Evaluation of the Effectiveness of Safe Insecticides on the Following Traits:

2.4.1 Total Plant Weight

At the end of the growing season, plants were uprooted, and any residual soil was removed by washing. The entire plant was washed, dried from water droplets, and weighed to determine the total plant weight, using three replications for each treatment. Data were recorded in specifically prepared tables.

2.4.2 Fresh Weight of the Vegetative Parts (g)

After determining the total plant weight, the shoot system was separated from the root system at the crown region. The fresh weight of the vegetative parts was measured, with three replications for each treatment, and data were recorded.

2.4.3 Fresh Weight of the Root System (g)

Following separation from the shoot system, the root system was weighed using three replications for each treatment, and the results were recorded in prepared tables.

2.4.4 Number of Pods (Pods/Plant)

Five plants were randomly selected from each experimental unit, and the average number of pods per plant was calculated.

2.4.5 Number of Seeds per Pod (Seeds/Pod)

Seeds were counted from pods of the five randomly selected plants. The total seed number was divided by the number of pods to obtain the average seeds per pod.

2.4.6 Yield Weight (g)

The total yield weight for each treatment was calculated using three replications, starting from the first harvest until the end of the season

.3

Results and discussion

3.1 Effect of some pesticides at the recommended and sub recommended concentrations and exposure periods on insect mortality

Table (2) shows that there are significant differences between the pesticides used, their concentrations, and the exposure duration. The pesticide EVESICT at the recommended concentration gave the highest average mortality rate of 73.03%, whereas Match at half the recommended concentration gave the lowest average mortality of 12.05%. The superior performance of EVESICT over Match may be attributed to differences in their modes of action and the nature of their active ingredients. EVESICT contains a broad-spectrum active ingredient with higher penetration ability into the insect tissues or nervous system, leading to rapid paralysis and death even with limited exposure. In contrast, Match relies on an Insect Growth Regulator (IGR) that acts slowly and targets specific developmental stages, reducing its immediate effectiveness, particularly at half the recommended concentration, resulting in much lower direct mortality [5.]

Regarding exposure duration, the 7-day treatment outperformed the other periods, achieving 62.324% mortality compared to the 1-day treatment, which gave the lowest mortality of 14.167%. This superiority can be explained by the need for sufficient time for the pesticide to fully exert its effect, especially

if it contains slow-acting components such as Lufenuron, which acts as an IGR and inhibits chitin formation during molting. This type of pesticide does not cause immediate death for all individuals but prevents the completion of the life cycle, leading to a gradual increase in mortality over time. Longer exposure also increases the likelihood of insects contacting pesticide residues, thereby enhancing cumulative control efficiency, particularly in environments where pesticide translocation within or on plant surfaces is crucial for delivering a lethal dose [6.]

Furthermore, the EVESICT treatment at the recommended concentration for 7 days recorded the highest mortality rate of 96.00%, compared to Match, which recorded 0.00% mortality after 1 day. EVESICT contains Emamectin benzoate, which disrupts the insect nervous system by affecting chloride channels linked to GABA and glutamate, causing rapid paralysis and feeding cessation within hours, in addition to Lufenuron, which halts chitin formation and prevents molting completion. This provides a dual mode of action—both rapid and delayed—resulting in high effectiveness even over short periods, reaching peak mortality within a few days. In contrast, Match relies solely on Lufenuron as an IGR, which does not kill insects immediately but prevents life cycle completion during molting, leading to negligible direct mortality over short periods such as 1 day, with effects appearing only after several days or when insects reach sensitive developmental stages [5.]

Table (2) Effect of some pesticides at the recommended and sub-recommended concentrations and exposure periods on insect mortality

Average	Exposure duration (in days)				Treatment	
	After 7 days	After 5 days	After 3 days	After 1 day	Concentration	Pesticide
47.67 BC	66.67 tf	56.67 dj	43.67 fk	21.67 ou	Recommended	BENIVIA
34.917 DE	59.11 ch	44.76 go	19.44 pu	19.44 pu	Half (or half-recommended)	
41.67 CD	72.23 be	58.89 ci	30.00ns	5.55 tu	Recommended	CRAGEN
24.34 EF	50.01 em	30.56 ts	16.67 qu	0.00 u	Half (or half-recommended)	
73.03 A	96.00 a	81.11 ac	73.88 ad	41.11 gp	Recommended	EVESICT
57.78 B	84.44 ab	67.22 bf	53.33di	26.1 ht	Half (or half-recommended)	
27.64 EF	55.00dj	36.11 it	13.88 rs	5.55 tu	Recommended	MATRIXINE
21.59 FG	46.11 fm	28.89 ms	11.11ts	0.00 u	Half (or half-recommended)	
57.64 B	70.56 bc	62.22 bg	62.22 bg	35.55 ir	Recommended	Avunt
32.08 DF	58.89 ci	32.78 ks	21.67 ou	15.00 rs	Half (or half-recommended)	
25.00 EF	50.00 cm	27.78 mo	22.23 ou	0.00 u	Recommended	Match
12.05 G	38.80 iq	5.55tu	5.55 tu	0.00 u	Half (or half-recommended)	
Overall average	62.324A	44.120B	31.111C	14.167D	Average	
37.93	Concentration	For the pesticides	For the periods	For interactions	L.S.D	
		11.461	6.617	22.922		

3.2

Effect of Pesticide Type at Recommended and Half-recommended Concentrations on Yield Weight Against Insect Pests of Field Peanut.

The results shown in Table (3) indicate variation in yield weight depending on the type and concentration of pesticide used. The pesticide Match at the recommended concentration gave the highest value, reaching 106.3 kg, followed by the half-recommended concentrations of Match and Avunt, which

recorded 89.7 and 89.3 kg, respectively. The lowest yield was obtained with BENIVIA at the recommended concentration, amounting to 45.7 kg.

The superior performance of Match may be attributed to its higher efficacy in controlling insect pests and reducing their damage compared to other pesticides used. Its active ingredient possesses a specific and effective mode of action that inhibits insect growth and

spread, thereby lowering pest population density in the field, reducing economic losses,

and consequently increasing crop yield weight [7. [

Table (3) presents the effect of pesticide type at recommended and half-recommended concentrations on yieldweight (kg) against insect pests of field peanut.

No	Treatment	Yield weight (kg)	
		Recommended	Half of the recommended concentration
1	BENIVIA	45.7	68.3
2	CRAGEN	70	68.3
3	EVESICT	75.3	80.7
4	MATRIXINE	86.3	70.3
5	Avunt	78.7	89.3
6	Match	106.3	89.7
7	Control	72	42.3

3.3

Effect of Pesticide Type at Recommended and Half-recommended Concentrations on the Number of Pods Against Insect Pests of Field Peanut (*Arachis hypogaea*)

The results presented in Table (4) show variation in the number of pods depending on the pesticide type and concentration used. The pesticide Match at the recommended concentration produced the highest number of pods, reaching 55 pods/plant, followed by the half-recommended concentration of Match, which recorded 51.3 pods/plant, compared with BENIVIA at the recommended concentration, which gave the lowest number of pods at 30.7 pods/plant.

The variation in pod number among pesticide treatments and concentrations is attributed to differences in their efficacy in controlling the target pests, leading to variation in pest

pressure on the plants. Match at its recommended concentration exhibited greater effectiveness in reducing populations of insect pests causing direct and indirect damage to flowers and pods, thereby enhancing pod set and development compared to BENIVIA, which showed lower efficacy under the experimental conditions. Additionally, pesticide characteristics such as spectrum of activity, degradation rate, and systemic absorption may influence the extent and duration of protection. Researchers have indicated that variations in the effectiveness of insecticides are reflected in yield components, such as pod number, due to differences in controlling insects responsible for flower drop or pod damage [8. [

Table (4) presents the effect of pesticide type at recommended and half-recommended concentrations on the number of pods (pods/plant) against insect pests of field peanut

N0	Treatment	the number of pods (pods/plant)	
		Recommended	Half of the recommended concentration
1	BENIVIA	30.7	37.7
2	CRAGEN	38	37
3	EVESICT	42.7	43.7
4	MATRIXINE	47	37.3
5	Avunt	47.7	50
6	Match	55	51.3
7	Control	42.3	24

3.4

Effect of Pesticide Type at Recommended and Half-recommended Concentrations on the Number of Seeds per Pod Against Insect Pests of Field Peanut (*Arachis hypogaea*)

As shown in Table (5), there is variation in the number of seeds per pod depending on the pesticide type and concentration used. The pesticide Match at the recommended concentration recorded the highest number of seeds, reaching 120.7 seeds/pod, followed by the half-recommended concentration of Match, which recorded 77.7 seeds/pod. In contrast, BENIVIA at the recommended concentration gave the lowest number of seeds per pod at 49.7 seeds/pod.

The differences in seed number per pod among pesticide treatments and concentrations can be attributed to the effectiveness of each

pesticide in reducing pest damage that affects pollination, fertilization, and seed set. Match at its recommended concentration demonstrated higher efficacy in controlling chewing or piercing–sucking insects that cause flower drop or damage to reproductive organs, thereby improving pod set and increasing the number of seeds per pod. Conversely, BENIVIA at the recommended concentration may have been less effective, slower to degrade, or narrower in spectrum, allowing pest activity to persist, which reduced fertilization and seed formation. The differential effectiveness of insecticides in pest management is directly reflected in yield components, such as seeds per pod, by minimizing insect damage that leads to losses in pod set and fertilization [10. [

Table (5) presents the effect of pesticide type at recommended and half-recommended concentrations on the number of seeds per pod (seeds/pod) against insect pests of field peanut

N0	Treatment	the number of seeds per pod (seeds/pod)	
		Recommended	Half of the recommended concentration
1	BENIVIA	49.7	59
2	CRAGEN	63.3	58.3
3	EVESICT	69	82
4	MATRIXINE	64.3	58.3
5	Avunt	74	77.7
6	Match	120.7	78.7
7	Control	72	38.3

3

5Effect of Pesticide Type at Recommended and Half-recommended Concentrations on Vegetative and Root Weight Against Insect Pests of Field Peanut (*Arachis hypogaea*)

Table (6) shows differences in vegetative and root weight depending on the pesticide type and concentration used. The pesticide Match at the recommended concentration recorded the highest weight of 1800 g, followed by the half-recommended concentration of Match, which recorded 1560 g. In comparison, BENIVIA at the recommended concentration produced the lowest weight of 750 g.

These differences in vegetative and root weights among treatments may be attributed to

variations in pesticide efficacy in protecting plants from insect damage during critical growth stages. Match at its recommended concentration provided greater protection for both vegetative and root tissues from pests, allowing the plant to allocate energy toward growth and development rather than compensating for damage or defending against insects. Complete pest protection promotes increased photosynthesis, improved nutrient uptake, and greater overall biomass accumulation (both above- and below-ground). In contrast, the lower efficacy of BENIVIA allowed continued pest feeding, which reduced the plant's ability to achieve normal, integrated growth [11. [

Table (6) presents the effect of pesticide type at recommended and half-recommended concentrations on vegetative and root weight (g) against insect pests of field peanut.

N0	Treatment	vegetative and root weight (g)	
		Recommended	Half of the recommended concentration
1	BENIVIA	750	1016
2	CRAGEN	1600	1316
3	EVESICT	1266	1483
4	MATRIXINE	1316	1316
5	Avunt	1133	1350
6	Match	1800	1560
7	Control	866	733

.4Conclusions

.1

The experiments showed that the corrected mortality of insects increased over time at 1, 3, 5, and 7 days after pesticide application. EVESICT exhibited the highest mortality rate, while Match recorded the lowest insect mortality.

.2 Variation in pesticide type resulted in differences in vegetative weight and yield traits.

.3 Field application of pesticides at recommended concentrations led to a lower incidence of insect infestation in pods

.5Recommendations

.4

Investigate natural enemies of the insect pests attacking the crop for potential use in biological control.

environmental effects, and other relevant factors.

.5 Study each insect species separately to assess its individual impact on the crop,

.6 Consider the use of alternative chemical pesticides that may be more effective in controlling pests during pod formation.

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