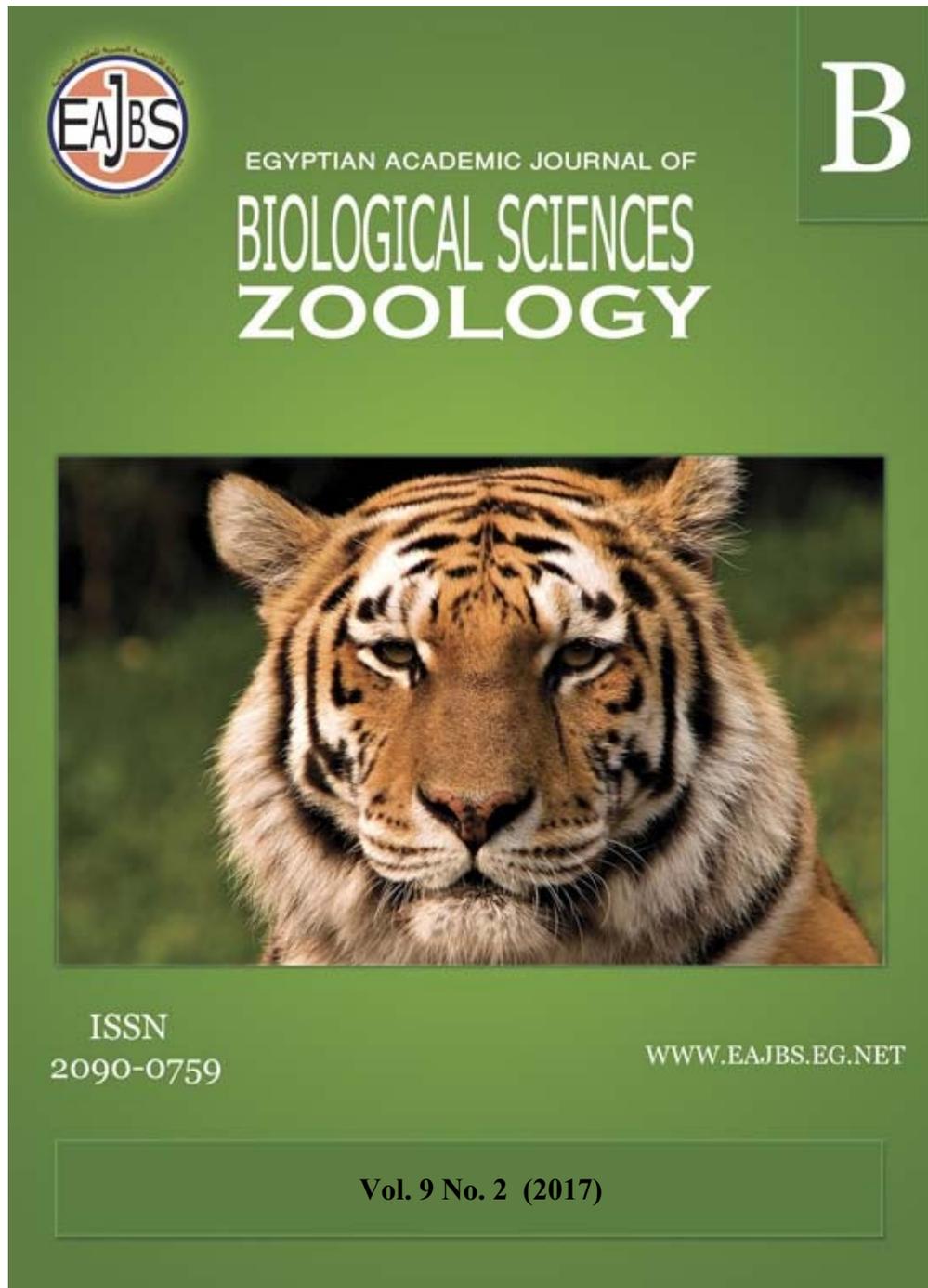


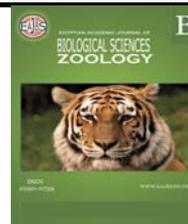
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Rat Damage Assessment and Evaluation of some Methods of Control for *Rattus rattus* on Date Palm and Orange Trees in New Reclaimed Land.

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ABSTRACT

Rodent damage assayed in date palm and orange trees in different locations at El- Wady El- Gadid Governorate (El-Kharga, El-Dakhla, Gharb El-Mawhob and El-Farafra) as new reclaimed lands. In addition, two control methods were studied i.e. chemical control (zinc phosphide and diphacinone anticoagulant bait) and mechanical control (Aluminum sheet rolled around the trees, clean around the trees by rake, the weeds around the trees were removed, demolition of rat burrows by axe and muslin covered the date). Results showed the damage percentages were 37.06 % in El- Kharga, 45.63 % in El-Dakhla, 0.57% in Gharb El-Mawhob and 4.75% in El- Farafra for date palm. While the damage percentages in sweet orange were 28.16% in El-Kharga, 44.08% in El-Dakhla, 4.78% in Gharb El-Mawhob and 9.14% in El-Farafra. In case of bitter oranges damage percentage were 18.61, 28.28, 4.12 and 4.15 % in El-Kharga, El-Dakhla, Gharb El-Mawhob and El-Farafra, respectively. The results of chemical control showed that diphacinone bait was more effective than zinc phosphide. Whereas, zinc phosphide gave 72.43%, while diphacinone achieved 89.26 % population reduction of rats in date palm. Concerning orange trees, it was 69.30 and 86.79 % population reduction of rats.

Regarding the mechanical methods, the damage percent in date palm declined to zero percentage after using aluminum sheets around palm stem, clean around the palm, remove the weeds and demolition of rat burrows in date palm. While, in case of using the muslin cover, percentage the damage not decreased in date palm. The average damage percentage after using the chemical and mechanical control on date palm in El- Dakhla were 1.39, 1.80 and 0.00 % by zinc phosphide, diphacinone and aluminum sheets, respectively. In conclusion, mechanical control of rats on palm was better than the chemical methods to protect the environment from the impact of rodenticides especially in new reclaimed land.

INTRODUCTION

New Valley Governorate rarely used rodenticides so pesticides used to reduce the high incidence of rodents followed by traditional mechanical methods neglected by farmers, which led heavy loss of crops and trees.

Rodenticides are likely to remain the center management tool for controlling rodent damage in agriculture (Buckle, 1999 and Wood and Fee, 2003).

Dates are important commodities and non-traditional crops that can be used for both local consumption and export. This is due to the dates characterized by their

containment of many foodstuffs, vitamins and mineral salts. The dates are the first economic crop in the New Valley so it is necessary to control pests harmful to palms.

Orange occupies the first place in terms of area between citrus types 209575 followed by mandarin and lemon salty which succeeded of planting in sandy lands moreover, newly reclaimed lands (Directorate of Liberation - New Valley), which demonstrates the possibility of spreading.

Rodents considered as one the most important pest in Egypt. That caused great economic loss to farmers (damage the growing crops, stored products, poultry and animals farm), (Abdel-Gawad and Farghal, 1982).

Rat damage to certain crops and density of *Arvicanthis niloticus* in Fayoum Governorate (Asran, *et al.*, 1991). Khan *et al.*, (2009) recorded that control of rodent damage to groundnuts in the postwar plateau region of Pakistan with zinc phosphide. (Metwally, *et al.*, 2011) recorded that use of some mechanical and chemical control methods to control rodent species in some field crops and date palm trees in experimental farm of Al- Azhar University in Assuit. Desoky, (2013) reported that zinc phosphide as chemical control and handing destroy of burrow, deep irrigation and traps as mechanical control to control *Arvicanthis niloticus* in Sohag Governorate. The present work aims to:

- Rodent damage assessment on date palm and orange trees.
- Comparison between zinc phosphide (acute poison) and diphacinone (anticoagulant) compounds against *Rattus rattus*.
- Use of aluminum sheet and muslin cover to control rodents as mechanical control.

MATERIALS AND METHODS

Experimental area and fruit crops:

Five Faddans were chosen from different locations at El-Wady El-Gadid Governorate (El-Kharga, El-Dakhla, Gharb El-Mawhob and El-Farafra) as new reclaimed lands.

The fruit crops were date palm *Phoenix dactylifera* and orange trees *citrus singesis* (sweet orange and bitter orange).

Assessment of damage in date palm and orange trees:

Twenty palms clusters take from each Fadden. Clean around the palms before the beginning of season and before maturity. The date infected with rat and other pests harvested from the trees, prepared and weighed every 3 days. The percentage of damage recorded using the following equation:

$$\text{Damage \% of date} = \frac{\text{Weight of infested clusters}}{\text{Total weight of clusters}} \times 100$$

Regarding the damage in orange fruit trees, fifty random trees are taken from each Fadden. In addition, the percentage of damage recorded using the following equation:

$$\text{Damage \% of orange trees} = \frac{\text{Weight of infested fruit}}{\text{Total weight of fruit crops}} \times 100$$

Pesticides:

a- Zinc phosphide: acute poison zinc phosphide (94% active ingredient), 1.2 conc. obtained from Kafr El- Zayat (K.Z.) Pesticides Co. Egypt.

b- Diphacinone: 0.005% anticoagulant, readymade bait was obtained from New Tarmed International Co.

Population reduction:

The population density of black rat, *Rattus rattus* (the dominant species) was estimated pre and post treatment using food consumption method (crushed maize). The area infested with *Rattus rattus* was about five Fadden. The population density of rodent was estimated pre and post treatment according to Dubock (1984). Two kg of zinc phosphide and five kg of diphacinone divided into plastic sacks (each of 20g for zinc phosphide and 200g for diphacinone and distributed as zigzag shape in each location. Zinc phosphide left for three days without increased. Diphacinone increased through three days until stop consumption. The population reduction percentage calculated as following equation.

$$\text{Population reduction \%} = \frac{\text{Pre treatment consumption (g)} - \text{Post treatment consumption (g)}}{\text{Pre treatment consumption (g)}} \times 100$$

Mechanical control:

- Clean around the trees by rake and weeds removed.
- Demolition of rat burrows by axe.
- Aluminum sheet rolled around the trees at hight half meter from bottom palm (the thickness about 86 microns, the length is one meter and the width is depending on the ocean of the Palm.
- Muslin covers around the clusters of date as a bag.

RESULTS AND DISCUSSION**Rodent damage assessment to date palm and orange trees:**

Data in Table (1): showed the damage in date palm and orange trees caused by *R. rattus* in different location of El- Wady El- Gadid Governorate (El-Kharga, El-Dakhla, Gharb El-Mwhoob and El-Farfra). Results showed that the average damage percentage caused by *Rattus rattus* on date palm were very high in EL-Dakhla, the percentage was 37.06%. While it was high in El- Kharga, the percentage was 45.63. However, it were very low in Garb El- Mawhob, the percentage damage was 0.57. In El-Farfra region, the damage percentage was low compared with the damage percentage in two regions of El- Kharga and El-Dakhla. From the previous results, the highest damage percentage was in El- Dakhla. The lowest damage percentage was in Garb El-mwhob in date palm.

Regarding the damages in sweet oranges was high in case of El-Dakhla 44.08% and 28.61 % for El- Kharga and it was 18.61, and 28.26 %in bitter oranges, respectively.

The lowest damages in sweet oranges in Garb El- Mawhob and El-Farfra region were 4.78 and 4.14 and in bitter oranges was 4.12 and 4.15, respectively.

Rodent damage date palm may be due to neglect of the farmer, non clean around the trees and not demolition of rat burrows. These results agree with Asran, *et al.*, 1985 and Ahmed 2007 the damage in crops was due to density of rats.

Table 1: The average damage percentages caused by *Rattus rattus* on date palm, sweet orange and bitter orange.

Damage %	Location	El-Kharga	El-Dakhla	Gharb El-Mawhob	El-Farafra
	Trees				
	Date palm	37.06	45.63	0.57	4.75
	Sweet orange	28.16	44.08	4.78	9.14
	Bitter orange	18.61	28.26	4.12	4.15

Chemical control:

Data in Table (2) showed that the efficiency of zinc phosphide bait against *R. rattus* achieved 72.43% population reduction of rats and the consumed amount of bait was reduce from 1780g to 785g in date palm. While the population redaction of rats in orange trees was 69.30 % in orange trees and the consumed amount of bait decreased from 1490 to 720g.

Table 2: Field performance of zinc phosphide and diphacinone baits against *Rattus rattus* on date palm and orange tree farms.

Compounds	Treatment	Bait consumption			
	Tree	Pre treatment	Treatment	Post treatment	Population redaction %
zinc phosphide	Date palm	1760	785	670	72.43
	Oranges	1490	720	660	69.3
Diphacinone	Date palm	1620	1310	195	89.26
	Oranges	1380	980	210	86.79

Diphcinone anticoagulant bait caused 89.26 % rat population reduction with decline consumed from 1620 to 195 in date palm. While it caused 86.79 % with decrease amount consumed from 1380 to 980g in orange trees.

From the previous results, diphacinone anticoagulant bait was more effective than zinc phosphide bait against rats, whereas it caused high population reduction with high consumed in the date palm and orange trees. Also, gave good results as an acute poison.

Population reduction of rats in date palm and orange trees was declined may be due to toxic effect of zinc phosphid and diphcinone bait. Rodent controlled in cane field by some rodenticides as zinc phosphide, brodifacoum, coumatetralyl and bromethalin (Khan, 2007) who found that decrease in population reduction of rats by using some rodenticied compoude . The reduction of rodents was due to using two compounds, bromadilone and zinc phosphide (Desoky, 2013). The effect of warfarin, diphacnone and chlorophcinone are very effective against rodent in Upper Egypt (Desoky, 2016). The reduction of rodent in all crops due to toxic effect of bromadiolone and chlorophacinone (Ahmed, 2017).

Mechanical control:

Data in Table (3): showed that the damage percent in date palm declined to zero percentage after aluminum rolled sheets around palm stem, clean around the palm by rake, remove the weeds and demolition of rat burrows.

The aluminum sheet prevented the rat damage on date palm. These results attributed to the rats are unable to climb and reach fruits because of its soft texture. These results agree with Metwally, *et al.* (2011) who recorded that the using aluminum sheet was the best method to control rodent in Upper Egypt comparison with the rodenticides. Some other methods as clean around the palm, remove the weeds and demolition of rat burrows were very simple method but it was very important to keeping on the crops.

Table 3: Field performance of aluminum sheet, clean around the trees; remove the weeds, demolition of rat burrows and demolition of rat burrows on *Rattus rattus* on date palm in El- Dakhla.

Mechanical methods	Average percentage (%) of damages	
	Pre treatment	Post treatment
Aluminum sheet	45.63	0.00
Clean around the trees		0.00
Remove the weeds		0.00
Demolition of rat burrows		0.00
Muslin covered		45.63

Muslin cover was giving negative effect on date to reduce the damages.

This result is may be due to low effect of cover and the rats cut it.

Average damage percentage after using the chemical and mechanical control on date palm in El- Dakhla:

Table (4) showed the comparison between the average damage percentage after using the chemical and mechanical control for black rat, *Rattus rattus* on date palm in El- Dakhla. The damage percent in date palm after used of zinc phosphid was 1.39 and it was 1.8 after used of diphacinone. While it was reached to zero % after used aluminum sheet.

Table 4: The average damage percentage date palm after using the chemical and mechanical control against *Rattus rattus* in El-Dakhla.

Treatment	Date palm damages%
Zinc phosphide	1.39
Diphacinone	1.80
Aluminum sheets	0.00

So, from the previous results, the mechanical method with using aluminum sheet was the most effective method to control the rat in rat in date palm whereas it caused high reduction percentage for rat comparing with rodenticides (zinc phosphid and diphacinone). Also, it was safe to environmental from the impact of rodenticides specially in reclaimed land. El-Eraky *et al.*, (2000) found that mechanical control by laser land operation has given great success. This method reduced rodent active in burrows after 10 days. Abdel- Gawad (2001) use four mechanical control-to-control rodents was laser land leveling, deep irrigation, destroying burrows and traps in maize field.

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ARABIC SUMMERY

تقدير خسائر القوارض و تقييم عدة طرق لمكافحة الفأر المتسلق على نخيل البلح و اشجار البرتقال في الاراضى المستصلحة حديثا

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية- الدقى – الجيزة- مصر

تم تقدير الخسائر التى تسببها الجرذان في أشجار النخيل والبرتقال في مناطق مختلفة من محافظة الوادي الجديد (الخارجة، الداخلة، غرب الموهوب ، الفرافرة) كأراضي مستصلحة حديثا. كما تم استخدام طريقتان من طرق مكافحة هما: المكافحة الكيميائية باستخدام طعوم فوسفيد الزنك و الداى فاسينون المضاد لتجلط الدم و المكافحة الميكانيكية باستخدام الواح الألمنيوم حول سيقان الأشجار مع التنظيف حول النخيل بشوكة الحشائش و نزع العراجين الميتة و هدم جحور الفئران بالفأس وتغطية البلح بالشاش. وقد أظهرت النتائج أن نسبة الخسائر في نخيل البلح كانت ٣٧.٠٦٪ في الخارجة، و ٤٥.٦٣٪ في الداخلة، و ٥٧٪ في غرب الموهوب، و ٤٧.٥٪ في الفرافرة. في حين بلغت نسبة الخسائر في البرتقال الحلوى ٢٨.١٦٪ في الخارجة، ٤٤.٠٨٪ في الداخلة، ٤٧.٨٪ في غرب الموهوب و ٩.١٤٪ في الفرافرة. ولكن في البرتقال البلدى ١٨.٦١، ٢٨.٢٨، ٤.١٢ و ٤.١٥٪ في الخارجة، الداخلة، غرب الموهوب والفرافرة، على التوالي. اثبتت النتائج أن طعم الداى فاسينون كان أكثر فعالية من فوسفيد الزنك لمكافحة الفئران، حيث أعطى فوسفيد الزنك ٧٢.٤٣٪، و أعطى الداى فاسينون ٨٩.٢٦٪ خفض فى تعداد الجرذان في نخيل البلح. بينما أعطي كلا منهما ٦٩.٣٠٪ و ٨٦.٧٩٪ خفض فى تعداد الجرذان في أشجار البرتقال.

قد اظهرت الطرق الميكانيكية، انخفاض فى نسبة الضرر في نخيل التمر إلى الصفر٪ بعد وضع الواح الألمنيوم حول سيقان النخيل مع التنظيف حول النخيل، وإزالة الأعشاب الضارة وهدم جحور الفئران في نخيل التمر. و في حالة استخدام غطاء الشاش لم ينخفض الضرر في النخيل. بلغ متوسط نسبة الضرر بعد استخدام الطرق الكيميائية والميكانيكية في نخيل البلح في الداخلة ١.٣٩ و ١.٨٠ و ٠.٠٠٪ من فوسفيد الزنك والديفازينون وألواح الألومنيوم على التوالي. نستنتج مما سبق ان استخدام الواح الالومنيوم فى مكافحة القوارض فى نخيل البلح افضل من استخدام مبيدات القوارض علاوة على حماية البيئة من التأثير الضار للمبيدات خاصة فى الاراضى المستصلحة حديثا.