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Rodent Control in pomegranate orchards (*Punica granatum*) in Assiut Governorate, Upper Egypt

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Abstract

Although rodent control using only rodenticides is the primary strategy followed by Egyptian farmers and responsible authorities, it is known that these rodenticides are ineffective in the long term. Moreover, rodents are considered scattered pests of orchard crops worldwide. The use of rodenticides is a practical and effective method for managing rodent infestations and reducing damage. However, little is known about the effectiveness of rodenticides against these pests in orchards, especially pomegranate trees. To fill this knowledge gap, First, the species of rodents found in pomegranate farms must be determined. The effectiveness of three rodenticide baits (i. e., -2% Zinc phosphide "acute toxicity, ",0.005% Brodifacoum, and 0.005% Diphacinone "anticoagulant") in controlling rodents in agricultural orchards was evaluated using this indicator, compared to a single mechanical control method involving the destruction of burrows and nests. "According to the results, the best alternative for rodent control among the evaluated methods grain bait containing 2 % zinc phosphide (Inhibition% = 77.30**) The elevated bait stations successfully provided bait to the target species and are expected to significantly reduce rodenticide access to other non-target animals.

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INTRODUCTION:

Although pomegranates are commercially important crop fruit, they are susceptible to insect attacks that can seriously impact their yield and quality. (Wakhare and Neduncheliyan, 2023). Although pomegranate trees are susciptible to numerous pests, pomegranate fruits have long been known for their benefits human health. **(Kahramanoglu and Usanmaz, 2013)**.

Rodents are among the most significant pests in Egypt. They have caused great economic losses to farmers, and damaged orange and mandarin orchards. **(Dongol *et al.*, 2021)**. The roof rat, (*Rattus rattus*), also known as the citrus rat, fruit rat, black rat, and gray rat, is one of the most troublesome rodent pests. These rats damage fruit crops consume and destroy stored animal and human food stocks, and build their nests in various places, such as attics, soffits, hollow walls, and outside buildings. When they infiltrate buildings, they gnaw on lead and plastic water pipes, chew on wiring (which can start fires), create holes in walls, and cause other structural damage. **(Kern, 2012)**. Controlling roof rats is challenging, and integrated pest management (IPM), is necessary for effective management. IPM tools include inspection, biological control (predators), physical control (trapping and exclusion), and cultural control (prevention and habitat management) as well as chemical control (rodenticides and repellents) if needed **(Kern, 1997)**.

The use of poison baits is the most common technique, due to ease of use, and effectiveness in rodent control. Acute poisons, such as zinc phosphide, have been used successfully to control rat damage: however, problems with acute poisons, such as poison aversion, lengthy pre-bait procedures, and the risks of toxicity to non-target animals, may discourage their continued use. Because of their effectiveness and relatively low risk and, chronic poisons (anticoagulants) are widely used for rodent control. This method has been successful in reducing and managing rodent populations. As a result of the continued ineffective use of poisons, resistance to anticoagulant developed in the United State, Europe, and other countries. **(Jackson, *et al.*, 1988)**. Therefore, to effectively control rodents, the amount of toxicant required and the best method for its use must be determined. Rodenticides are expected to remain the primary tool used to manage and control rodent damage in agriculture **(Buckle, 1999; Wood and Fee, 2003)**. Marketable fruit production depends on effective control of pests that damage pomegranate fruits. Therefore, the objective of this study was to identify effective techniques for controlling rodents and other pests that damage pomegranate fruits.

MATERIALS AND METHODS:

Field trial, sampling method, experimental design and pest inspection:

A rodent control study consumable food baits (carried on wheat baits) was conducted on a 5 feddans pomegranate farm in El-Badary district, Assiut Governorate, from August 22/2022 to September 26/2022. Three rodenticides and a mechanical control method, including burrows and nests destruction, were evaluated for their effectiveness in controlling rodents in pomegranate trees using a food consumer method.

These pesticides are:

Divacinone 0.005%" a first-generation anticoagulant" is used in wheat bait**.** Brodifacoum 0.005% a second-generation anticoagulant," is used in wheat bait.

Zinc phosphide 2% (for acute toxicity) " is use.

Mechanical control (Destruction of burrows and nests):

For one week before and one week after treatment, bait stations containing untreated wheat were distributed.

Subsequently, over a period of three weeks, bait stations were distributed among rodenticide treatments in three replicates. Additionally, three replicates were used for mechanical control throughout the study. Standard analysis of variance methods, as defined by **Steel and Torrie (1980)** and **Duncan (1955)**, were used to examine the data.

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

RESULTS AND DISCUSSION

The information in Figure 1 and Table 1 shows that the results of 2% zinc phosphide bait and other baits used as control methods in the study area varied significantly from one another. In pomegranate orchards, the application of 2% zinc phosphide to whole wheat proved effective in rodent control. It was the first to demenostrate a rodent suppression rate of 77.27%, while the use of raised bait stations also proved successful in providing bait to target animal. In terms of rodent supression, brodifacoum came second at 63.8%, followed by diphacinone at 48.97%. The final treatment, mechanical control, achived a rodent suppression rate of 40.68%.

The use of raised bait stations is expected to significantly limit access to many non-target species that may have previously been sensitive to rodenticides.

The decrease in the number of rats in pomegranate trees may be attributed to the toxic effect of zinc phosphide and brodifacoum. These results are consistent with those of **Baghdadi, (2006)**; **Metwally *et al.*, (2011)**; **Desoky (2013)**; **Baldwin *et al.*, (2014)**; **Kandil and Ahmed (2017)**; and **Ahmed *et al.*, (2019).** These results differ from those of **Maher,** and **Abdel-Gawad (1982)**.

The results showed that the use of acute rodenticides for chemical rodent control is highly harmful, yet it effective with higher rodent populations, unlike anticoagulants used in pomegranate orchards.

The information Figure (2) and Table (1). Indicated that rodents consumed more bait during the first week of treatment than in the following two weeks. This could be due to the fact that some rats in the treated area died after consuming the poison baits provided in the previous weeks.

CONCLUSION:

Pomegranate orchards in El-Badary district, Assiut Governorate, showed significant rodent damage. From planting to harvest, rodents preyed on pomegranate fruits, bark, and braches resulting in elevated zinc phosphide levels in rodent species in the study area. The first week of treatment allawed rodents to consume larger bait compared to subsequent weeks. The effectiveness of integrated pest management (IPM) for rodent control in reducing rodent population density depends on proximity of rodents to the site, food availability, and other factors.

Table (1): Field performance of zinc phosphide, brodifacoum and diphacinone baits and the destruction of burrows and nests in a pomegranate farm in El-Badary Center, Assiut Governorate.

Control methods		Before treatments food Consumption (gm)	food consumption %	Time of treatments						After treatments food consumption (gm)	food consumption %	Efficiency %
				1st week food consumption (gm)	food consumption %	2nd week food consumption (gm)	food consumption %	3rd week food consumption (gm)	food consumption %			
Chemical control	Zn-ph (2%)	350.68	70.14	227.24	45.45	167.36	33.47	102.52	20.50	79.72 e	15.94	77.27**
	Brodifacoum (0.005%)	323.28	64.66	219.04	43.81	174.08	34.82	132.60	26.52	117.04 d	23.41	63.80**
	Diphacinone (0.005%)	264.88	52.98	213.00	42.60	180.20	36.04	161.60	32.32	135.16 c	27.03	48.97*
Mechanical control (Demolishing burrows)		357.80	71.56	304.12	60.82	256.12	51.22	208.44	41.69	212.24 b	42.45	40.68*
Untreated (Control)		297.00	59.40	314.72	62.94	365.36	73.07	405.68	81.14	445.88 a	89.18	--

Means in each column followed by the same letters are not significantly different by (P=0.05) according to **Duncan's** multiple range test

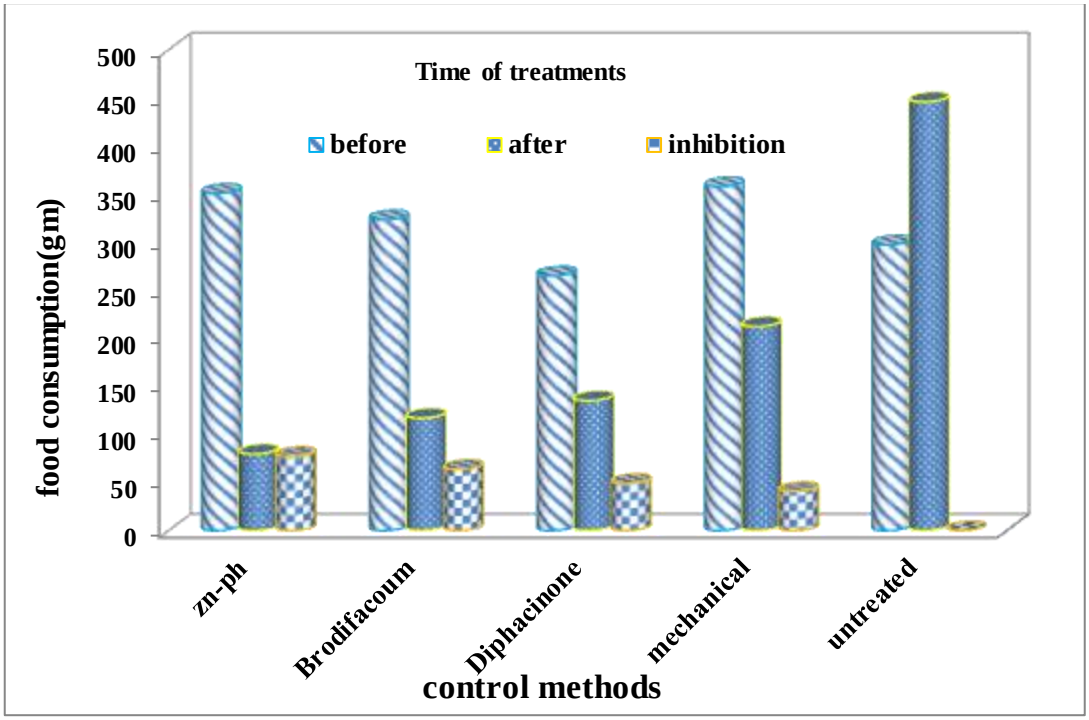

Figure.1 Field performance of zinc phosphide, brodifacoum and diphacinone baits and destruction of burrows and nests in a pomegranate farm in El-Badary Center, Assiut Governorate.

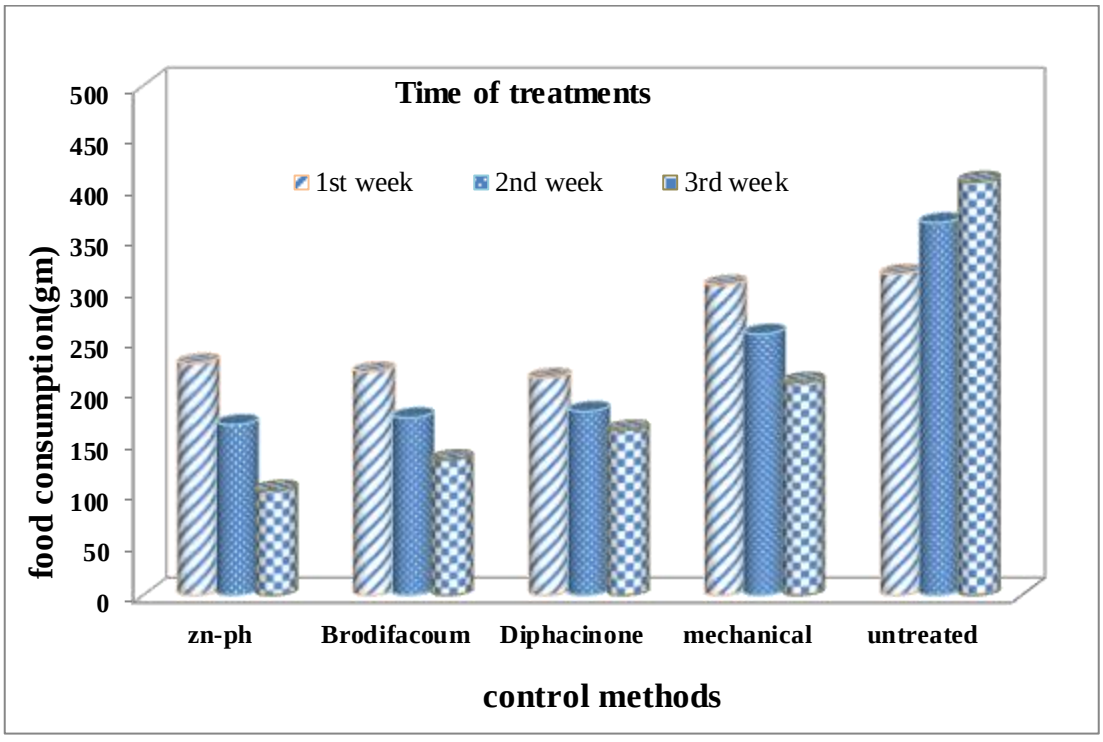

Figure 2: The effect of weekly consumption of baits of different types of rodenticides under field conditions in a pomegranate farm in El-Badary Center, Assiut Governorate.

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