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Preference of some food types and their efficacy as poisoned baits (zinc phosphide) against fruit bat under laboratory conditions

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ABSTRACT

In laboratory, some food of fruits, vegetables and field crops were tested under non- and free choice to determine the food palatability and preference for the Egyptian fruit bat, *Rousettus aegyptiacus*. This is prefatorily to be used as poisoned bait. The obtained results elucidate that generally, under non-choice field crops record, the low palatable was the wheat (the consumption was zero %). While the fruits palatability ranked firstly then vegetables. The average percent of daily consumption of each food group field crops, vegetables and fruits were 10, 30 and 58% respectively. Bats preferred guava, apple, date, tomato and carrot respectively. The toxic effect of compressed date of 5.0, 1, 1.5 and 0.2% zinc phosphide caused mortality ratios of 30, 60, 100 and 100% to each concentration respectively. On the other hand, the bait consumption was reduced with increased concentration.

So, Apple and Guava used as bait with zinc phosphide rodenticide 0.5, 1.0 and 1.5% to enhance the bait consumption and the results showed that the apple bait was more effective against fruit bat compared with guava and compressed date baits. Also, the concentration of 1.0% zinc phosphide with apple caused 100% mortality compared with the same concentration of guava and compressed date where the mortality was 70 and 60% and the average bait consumption was 15.3, 20.4 and 10.9g respectively.

Keywords: food types - poisoned bait (zinc phosphide) - fruit bat.

INTRODUCTION

Bats have the highest number of mammals after rodents (approximately 925 species). Also, among living vertebrates, bats and birds are unique in their ability to fly. In some ways bats, the nocturnal equivalents of birds, have successfully colonized almost every continental region on earth except Antarctica. Generally, bats exhibit a dietary diversity as, fruits, leaves, flowers, nectar, pollen, insects, fish, blood and other vertebrates.

The Egyptian fruit bat, *Rousettus aegyptiacus* (Order: Chiroptera, family: Pteropodidae) is considered an agricultural pest (Kock, 2001). Tomas *et al.* (1984) observed that in most cases the fruit bat caused a great damage on vegetables and fruits. Palaeotropical bats (Pteropodidae) ingest up to 2.5 times their body mass in fruits nightly. On a mass-specific basis, this is about double the amount reported for neotropical fruits bats (Phyllostomidae). Also, the Egyptian fruit bat *Rousettus aegyptiacus* is regarded as a pest for agriculture in Israel and feed mainly on fruits sometimes leaves and pollen are also eaten. Persimmons, loquats, figs and dates fruit constitute 15% of the bats diet (Korine *et al.*, 1998). Other researchers reported that bats feed wide kinds of plant (54 plant species) according to plant availability and quality, season also, need of energy and protein **(**Feldhamer *et al*., 1995; Kunz and Diaz, 1995; Bizerril and Raw, 1998; Luft *et al.*, 2003**)**. Many researchers and farmers

are painstaking to protect the plant farms of vegetables and fruits against attacks of fruit bats. In the nest bat, controlling is made by burning sulphur (30g) with peprik (1g) per m3. Another method used silky net for 7 days (Eissa, 2007*)*. Sometimes poisoned bait was used as date with 3% zinc phosphide bait. This work aims to determine the preference diet from tested vegetable, fruit or field crops to be used as bait with best effectiveness of zinc phosphide concentration against fruit bat *Rousettus aegyptiacus*.

MATERIAL AND METHODS

Bats:

The fruit bats, *Rousettus aegyptiacus*, were trapped from El-Soultan Hassan regions Cairo Governorate by using mist net which set at the sunset in the bat going place. In laboratory, collected bats were weighted and sex determined. Animals were retained individually in wire mash hold cages (90 x 50 x 50 cm). During the acclimation period animals had access to water and guava fruits for 2 weeks.

Chemical and baits:

Technical grade zinc phosphide (94% active ingredient) was obtained from "Kz pesticide company, Egypt" then different baits were prepared. Firstly, poisoned bait of compressed date 0.5, 1, 1.5 and 2g zinc phosphide weighed and mixed with 100g of compressed dates then douched good and balled (each ball 20g). The second type of bait is prepared from the preferred fruits: guava and apple which were tested previously. The fruit were slices (5x2x2cm) and left in laboratory conditions up to have dry surface (3 hours); 0.5, 1 and 1.5g of zinc phosphide mixed with 10g of flour then mixed with fruit slices.

Procedure:

Food Palatability:

Three hundred grams of vegetable types: Tomato, Cucumber, Carrot, Eggplant and Squash; fruit types: guava, Apple, Date palm, Fig and Pear; and field crops: Wheat, Maize, Sorghum, Sunflowers and Sugar cane were used as food in the suspended shape. Groups of five individuals were used to each food type. Animals were daily supplied by water and the remaining food weighted and replaced with the same fresh food for four days. The average food and relative consumption were determined.

Food Preference:

The highest food palatable according to the previous test, Date, Guava, Apple, Tomato and Carrot were used under free- choice. Two hundred grams from each food were presented to five individually caged bats then the consumed amount of food was daily calculated and replaced by fresh for four successive days. The position of suspended food was changed daily to avoid location preference. Acceptance percentages were estimated according to the following formula (Buckle and Smith, 1994):

$$\% \text{ Acceptance} = \frac{\text{Av. consumed of tested food (g)}}{\text{Av. Total consumed (g)}} \text{ X } 100$$

Toxicity Test:

Four groups (of 10 animals) of bats were used per each concentration of compressed date poisoned baits (0.5, 1, 1.5 and 2% zinc phosphide). Five balls of bait (each ball 20 gr) were suspended in cage ceiling by rope. After one day the poisoned

baits were removed and replaced by fresh diet and water. The consumed bait was calculated and dead animals were recorded during three days of treatment.

Another experiment used the preferred fruits, Apple and Guava, as a bait of 0.5, 1 and 1.5% zinc phosphide. Groups of 30 animals each were used. Each group was divided into three sub-groups of 10 animals per each concentration. The poisoned bait slices were suspended in cage for one day, thereafter the poisoned bait was removed and replaced by fresh fruit. The bait consumption and dead animals were recorded during three days of treatment.

RESULTS AND DISCUSSION

Food palatability and preferring:

Under laboratory conditions, types of food were tested to determine the palatability and preferring among different food types of fruit, vegetables and field crops.

Date in table (1) showed that under non-choice among the vegetable types tested, bats consumed a large amount of tomato (average 98.6 g) daily. But, the average consumption was 66.3g of carrot, 36.9g of cucumber and 32.9g of squash.

Table 1: Food Palatability of fruit bat *R. aegyptiacus* to vegetables under non-choice methods.

Vegetable Types	Mean of Body Weight	Average Daily Consumption	Relative consumption
Tomato	100	98.6	1
Cucumber	100	36.9	0.39
Carrot	110	66.3	0.67
Squash	90	32.9	0.33
Egg-plant	115	27.8	0.28

Also, egg-plant recorded the lowest consumption (27.8g). On the other hand, the relative consumption showed that carrot comes in the first palatable (0.67%), then the remaining vegetables which did not reach to the half of tomato consumption: cucumber 0.39%, squash 0.32% and egg-plant 0.28%. Table (2) exhibits the average consumed amount of fruit: 110, 105.3, 95.2, 88 and 85.8 g of Guava, Apple, Fig, Pear and Date, respectively.

Table 2: Food palatability of fruit bat *R. aegyptiacus* to fruits under non-choice methods

Fruit Types	Mean of Body Weight	Average Daily Consumption	Relative consumption
Guava	100	110	1
Apple	105	105.3	0.96
Fig	110	95.2	0.87
Pear	100	88	0.80
Dates	110	85.8	0.78

The relative consumption after guava ranked as follows: Apple 0.96%, Fig. 0.87%, Pear 0.8% and Date 0.78%. The consumption of field crops is reported in table (3): bats consumed 37.7 g of Sun Flower, 17.8 of Sugar cane, 22.2 g of Maize and 12.3 g of Sorghum. While, wheat consumption was zero, the relative consumption showed that wheat was unplatable. Sun Flower and Maize 0.58, were highly platable compared with Sugar Cane 0.47, and Sorghem 0.33, respectively. Regarding to Fig. (1), it is observed that bats preferred fruits more than vegetables and field crops where the average total consumption of different groups were (fruits 484.3g, vegetables 262.6g) but field crops come at last with the consumption of 90g.

Table (3): Food palatability of fruit bat *R. aegyptiacus* to field crops under non-choice methods.

Crop Types	Mean of Body Weight	Average Daily Consumption	Relative consumption
Wheat	120	0.0	0
Maize	115	22.2	0.59
Sorghum	110	12.3	0.33
Sugar Cane	110	17.8	0.74
Sun flower	120	37.7	1

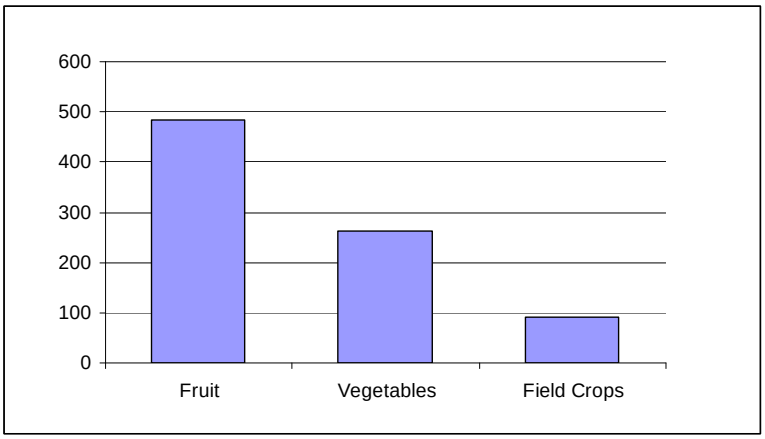

Fig. 1: Food consumption of different food groups by fruit bat *R. aegyptiacus* under non-choice method.

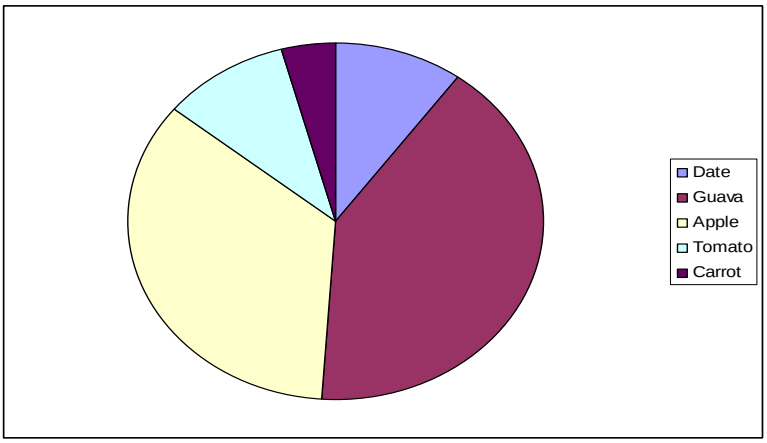

Fig. 2: Food preference of different food types to fruit bat *R. aegyptiacus* under free choice method.

Under free-choice the food preference among the highest palatable food types, date, guava, apple, tomato, and carrot were determined and the obtained data in table (4) revealed that the bats consumed in average 50.4g, 42.7g, 12.3g, 12.3g and 5.9g daily from tested food types respectively. Guava is more pereferred than apple with acceptance of 41.08 and 34.8% then date and tomato each of 10.02% and carrot recorded the minimal acceptance 4.07%.

Generally, most tested field crops were low palatable to bat except sunflower and sugar cane. Bats preferred fruits and consumed large amounts of it compared with vegetables. This may be because fruits contain sugars and proteins which supply bat with energy, (Tomas *et al.*, 1984). Tomas *et al.* (1984) found that male bat consumed a large amount of food compared with female bat. Both sexes preferred fruits more

than vegetables under non- and free-choice methods. The obtained results may explain the bats distribution and population density in plantation areas according to type of plant.

Table 4: Food preference of fruit bat *R. aegyptiacus* to different food types under free choice methods.

Food Types	Mean of Body Weight	Average Daily Consumption	Acceptance %
Date	120	12.3	10.02
Guava	115	50.4	41.08
Apple	120	42.7	34.8
Tomato	130	12.3	10.02
Carrot	115	5.0	4.07

Toxicity of zinc phosphide baits against fruit bat:

Four concentrations of zinc phosphide 0.5, 0.1, 1.5, and 2% were mixed with compressed date caused different mortality percentages in bats. Table (5) showed that concentration of 0.5% killed 30% of treated animals; the mean consumed bait was 11.5 g., while 60% from treated animals died after consuming 10.9 g of poisoned bait of 0.1%. Other concentrations: 1.5% and 2% caused the same mortality percentage (100%); the consumed bait was 7.7 and 7.3g to each concentration respectively. Fig. (3) elucidates that the mortality percentage increased with zinc phosphide concentration increase with reduction of the amount of bait consumption.

Table (5): Toxicity of different concentrations of zinc phosphide compressed date bait against *R. aegyptiacus* under laboratory conditions.

Zinc Phosphide Concentrations	Mean of Body Weight	Consumed Bait	Mortality Percent
0.5%	110	11.5	30
0.1%	120	10.9	60
1.5%	105	7.7	100
2.0%	115	7.3	110

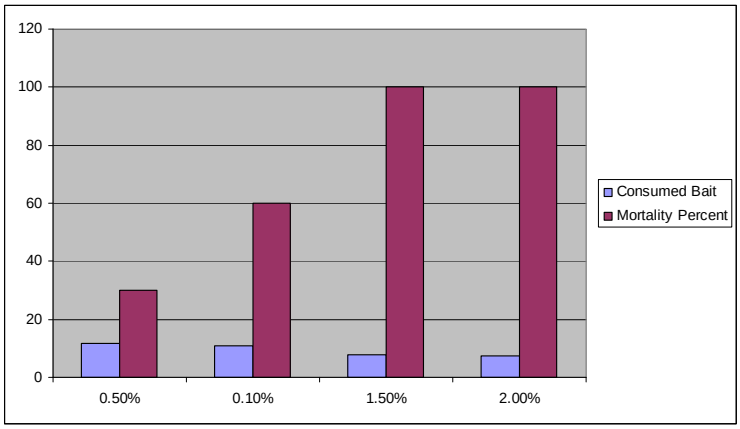

Fig. 3: Toxicity of different concentrations of zinc phosphide compressed date bait against *R. aegyptiacus* under laboratory conditions.

In evasion to enhancing the mortality percentage with low concentration of zinc phosphide by increasing the lethal dose intake of the preferred fruit (Guava and Apple) were used as bait compared with compressed date. Data in table (6) shows that apple baits 0.5, 1 and 1.5% zinc phosphide cause 70, 100 and 100% mortality and the bait consumption were 17.5, 15.3 and 15.5g., while guava bait of the same concentrations cause 40, 70 and 90% mortality of treated animals and the bait intake were 20.4, 20.4 and 18.7 g respectively. Comparison with compressed date poisoned

bait consumption and the mortality percentage increased with using guava or apple compared with compressed date bait. The apple poisoned bait caused highly percentage of bats mortality more than guava bait in spite of reducing the apple bait intake. This observation may be due to guava water content which attributed to loss of phosphine gas from zinc phosphide and reduced the toxic effect. By using the biological methods, Rizk (2000) found that the poisoned bait of zinc phosphide 2.5% lost 20% and 50% of its effectiveness when exposed to 80% R.H for 2 and 7 days, respectively.

Table 6: Effect of preferred food as a poisoned bait zinc phosphide against *R. aegyptiacus* under laboratory conditions.

Zinc Phosphide / Food Types	0.5%		1.0%		1.5%	
	Consu. Bait	Mortality	Consumed	Mortality	Consumed	Mortality
Apple	17.5	70	15.3	100	15.0	100
Guava	20.4	40	20.4	70	18.7	90

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ARABIC SUMMARY

دراسة أفضلية بعض أنواع الغذاء ومدى فاعليتها كطعوم سامة (فوسفيد زنك) ضد خفاش الفاكهة معملياً

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معهد وقاية النباتات –الدقى – الجيزة

يعتبر خفاش الفاكهة من الآفات الحيوانية التي تهاجم المناطق الزراعية مسببة خسائر اقتصادية لذلك تم اختبار الأفضلية الغذائية لبعض أنواع الفاكهة والخضروات ومحاصيل الحقل بالنسبة لخفاش الفاكهة تمهيداً لاستخدامها كطعم سام مع فوسفيد الزنك تحت الظروف المعملية.

ولقد أظهرت النتائج تحت التغذية الإجبارية أن محاصيل الحقل بصفة عامة غير مستساغة لخفاش الفاكهة خصوصاً محصول القمح حيث كانت نسبة الإستهلاك صفر %. بينما كانت الفاكهة هي الأكثر استساغة ثم الخضروات في المرتبة الثانية وكان متوسط نسبة الاستهلاك اليومي لكل مجموعة هي 15%، 58%،30% على الترتيب. كما أن الخفافيش تفضل الجوافة- التفاح- البلح- الطماطم- الجزر على الترتيب تحت التغذية الاختيارية لهذه الأنواع. ولقد سببت التركيزات 0.5%، 1%، 1.5%، 2.0% عند دراسة تأثيرها السام مخلوطة مع بلح العجوة نسبة موت 30، 60، 100، 100% حيث قل معدل الاستهلاك بزيادة التركيز وكان معدل الاستهلاك 10.5، 12.9، 7.7، 7 جم لكل تركيز على الترتيب. وعند دراسة كفاءة طعوم التفاح والجوافة 0.5%، 1.5% و 15% فوسفيد زنك.

أظهرت النتائج أن طعم التفاح كان أكثر فاعلية ضد خفاش الفاكهة مقارنة بالجوافة والبلح العجوة. سجل تركيز 1.5% فوسفيد زنك مع التفاح أفضل نسبة إبادة حيث وصلت نسبة الموت إلى 100% مقارنة بنفس التركيز محمل على الجوافة والبلح العجوة حيث كانت نسبة الموت 70، 60% على الترتيب، كما أن متوسط استهلاك طعوم التفاح مع التركيزات المختبرة أقل من نفس التركيزات محملة على الجوافة.