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IMPROVING THE EFFICIENCY OF ZINC PHOSPHIDE BAIT USING POTASSIUM TARTRATE AGAINST RODENTS.

Fatma M. Elgohary and Eman A. Abdelhady
Plant protection research institute, A.R.C Dokki, Giza Egypt

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ABSTRACT: *Laboratory and field trials were conducted to increase the efficiency of zinc phosphide bait against rats using potassium tartrate. Potassium tartrate was tested alone and mixed with zinc phosphide bait using non choice feeding methods against black rats, Rattus rattus. Laboratory results indicated that potassium tartrate at rate 8% when added to 1.5% zinc phosphide bait enhanced the mortality from 60 to 80%. The field performance was in harmony with laboratory results as potassium tartrate enhanced the population reduction of Norwey rat from 28.1 to 70.5% when added potassium tartrate. Also, the consumed amount at bait increase to 27.7g/Fadden comparing with 20g only for zinc phosphide bait alone.*

Key words: *Zinc phosphide - potassium tartrate - Norwey rats -black rats.*

INTRODUCTION

Among different rodent species, black rats and Norway rats is the most harmful rodent species in Egypt, (*El-Deeb, el al.* 2008). Rodent has also been accounted as a serious pest of stored commodities keeping economic importance of this pest in view. Different management strategies including use of fumigant, anticoagulants and cut poisons are more preferred and frequently applied as people are anxious to see kill and get rid of damage caused by them (*Steven*, 2008). But the rodents are very intelligent animals with strong smelling sense, which prevents them from instant ingestion of poisons applied directly. Such behavioral phenomena render the rodents control very tricky, because once shy, the rat prefers to remain hungry than eating an apprehensive food (*Naeem, M. et. al.* 2011). Litrature also reveals the use of cereals in whole-some, cracked form as well as mixed with additives such as vegetable oil, egg shell, egg yolk- minced meat (*Shumake, 1978; Shafi et al.*, 1990, *Brooks et al.*, 1981; *Marsh*, 1988; *Parshad and Jindal, 1991; Pervez et al.*, 2003). A 10% concentration of the scent gland extract was more effective than a 5% concentration in acceptance female Norway rats of poisoned bait (Zn_3P_2). The results suggest efficacy of scent gland in improving the poisoned bait acceptance (*Selvaraj, R. and Archunan, G*; 2002) . Mortality rates have decreased from 87.5 to zero% for quails and stayed fixed at 100% among rats after feeding on 16.6% PT/zinc phosphide bait. (Soliman, *et. al.* 2009).The aim of this study is an attempt to enhance acceptance and mortalities of zinc phosphide bait for roof rats by adding potassium tartrate.

MATERIALS AND METHODS

1- Tested chemicals:

1-1. Potassium Tartrate (PT): ($K_2C_4H_4O_6.2H_2O$). It was pure crystalized supplied from EL- Nasr Com., mixed with crushed maize at 8%.

1.2. Zinc phosphide 80% (Zn_3P_2): It was obtained from EL- Nasr com. It was used as bait where's it was mixed with crushed maize at 1.5%

2- Tested animals:

Twenty five commensal black rats, *Rattus rattus L.*, were trapped from Abou-Rawash, Giza. Animals were transported to laboratory and caged individually in wire cages (50 x 30 x 20 cm), for 2 weeks for acclimatization and Fed on a free diet (bread) and water add libitum. The unhealthy and pregnant rats were excluded. Five animals were used for each treatment and the same number for control.

3- Laboratory Experiments:

No-choice feeding methods were conducted for all treatments.

3-1. Potassium tartrate: Forty grams of mixture of PT with crushed maize at 8% were, daily offered for 3 successive days to each caged rats. The consumed amount of the mixture was daily estimated.

3-2. Zinc phosphide treatment: Zinc phosphide mixed with crushed maize at 1.5% was provided daily for24 h. to each caged rat. Consumption of bait has been recorded. Number of died rats were recorded and observation the survivor rats for 3days.

3-3. Mixture of zinc phosphide bait and potassium tartrate: 8% PT was added to zinc phosphide bait (1.5%). Forty grams of mixture were offered to each rat for 24 h. The individual consumption of each rat was estimated. Animals were observed and mortality was recorded up to 3days of treatment.

4-Field Experiments:

Evaluation of 1.5% zinc phosphide bait alone and mixed with 8% PT was carried out under field conditions of Shebin Alkom district, Menofiya Governorate. An area infested with Norway rats, *Rattus norvegicus* and black rats, *R.rattus* was chosen and divided into distances (each of one Fadden) represents the number of treatments and another one was left without treatment as a check control. The population densities of rats were estimated pre and post- treatment using food consumption method (Rennison, 1977). Twenty seven plastic sacks of crushed maize (each of 20g) for each treatment were distributed in the infested spots beside rat burrows for 72h. The consumed amount of each treatment was recorded pre and post treatment. One week after the poison bait was removed. Population reduction was calculated using the equation of (*Henderson and Tilton* 1955)

$$\% \text{ Mortality} = 1 - \frac{(t2 \times r1)}{t1 \times r2} \times 100$$

Where

t1 = pre-treatment consumption (g) taken from treated field

t2= post-treatment consumption (g) taken from treated field

r1 = pre-treatment consumption (g) taken from untreated field

r2 = post-treatment consumption (g) taken from untreated field

RESULTS AND DISCUSSION

1- Laboratory Experiments:

The effect of 8% PT added to 1.5% zinc phosphide bait on roof rats *Rattus rattus* using non choice test was showed in Table (1). Results indicated that 8% PT increased rat consumption significantly than control, as the consumption was 12.16g in PT bait while it was 7.95g for control. In poison bait the addition of 8%PT bait increased the mortality 1.33 times than 1.5% zinc phosphide bait alone.

Table (1): Effect of 8%potassium tartrate (PT) added to 1.5% zinc Phosphide bait on Black rats *Rattus rattus* in non-choice test.

Treatment	Average daily consumption (g)	Time to death (h)	Mortality (%)
Control	7.95+1.38 a	0	0
potassium tartrate	12.16+ 2.22 b	0	0
zinc phosphide	0.528+0.05a	24	60
PT+ zinc phosphide	0.434+0.22a	48	80

*Average is followed by + SD. P< 0.001

The vertical columns marked with the same letters are not significantly different by SAS (2006).

The percent of mortality increase from 60% for zinc phosphide alone to 80% when added pt. non-significant decrease was observed in the consumption of bait as it was 0.53g for zinc phosphide and 0.43g for the consumption zinc phosphide + pt.

(*Soliman, et. al.* 2009) found that the addition of 16.6% PT to 0.5% zph bait led to an increase in its average consumption and acceptability by roof rats and increase mortalities 100% after 3 days in non- choice test.

In an attempt to develop baiting strategies to increase bait acceptance and efficacy of zinc phosphide-coated baits, sugar-enhanced rolled oat based zinc phosphide bait was evaluated. (*Johnstona, et al.*2005). With pre-baiting, 100 and 60% mortality was achieved for California and Belding's ground squirrels, respectively.

An attempt were carried out by (*Rady, et al.* 2012) to overcome zinc phosphide (Z_nP) bait shyness using otilonium bromide (OB) in form of Spasmomen® drug against the white albino rat, *Rattus norvegicus*, the Nile rat, *Arvicanthis niloticus* and the house mouse, *Mus musculus*. Under laboratory conditions, results showed that Spasmomen® at rate 0.012 and 0.025% when added to each 0.06 and 0.12%ZP bait concentration achieved complete mortality when used for four successive days against the albino rat. On the contrary, the application of ZP bait 0.06 and 0.12% alone gave zero and 20% mortality, respectively. The same trend was noticed with *A. niloticus*. On the other hand, *M musculus* showed more sensitive to the same treatment recording 100% mortality comparing to 20 and 40% mortality using ZP alone with the two concentrations, respectively.

2- Field Experiments:

The efficiency of 1.5% zinc phosphide baits alone and mixed with 8% potassium tartrate was tested against Norway rats, *Rattus norvegicus* and black rats, *Rattus rattus* under field conditions of Shebin Alkom district, Menofiya Governorate. Data in Table (2) show that the combination of zinc phosphide bait +potassium tartrate was the most effective one as it achieved 70.5% rat population reduction while zinc phosphide alone gave 28.1% only. On the other hand, mixing of potassium tartrate enhanced the average consumed amount of zinc phosphide bait from 20 to 27.7g /feddan, respectively. Reviewing the aforementioned results, it is obvious that field performance was in harmony with the laboratory results. (*Khan et. al.* 2012) found that 2% zinc phosphide bait (wax cake and broken rice) achieved 62.7% population reduction of rodent groundnut crop in Pakistan. (*Gabr and Rizk* 2010) enhanced the efficiency of zinc phosphide from 66% to 71.2% population reduction for Norway rats using antispasmodic agent (octialonium bromide) under field's conditions. Also, (*Rady et al,.* 2012) recorded the rats population reduction was increased to 49.53 and 59.60% when used ZP bait 0.06% + Spasmomen® 0.012% compared with 7.09 and 18.13% when used ZP bait 0.06% alone against *A. niloticus* and *M. musculus*, respectively.

Table (2): Effect of 8%potassium tartrate (PT) added to 1.5% zinc phosphide bait against Norway rats, *Rattus norvegicus* and roof rats, *Rattus rattus* under field conditions.

Treatment	bait consumption(g / Feddan)			Population reduction(%)
	Pre-treatment	treatment	Post-treatment	
Zinc phosphide	1390.5	20.0	1000.0	28.1
Zinc phosphide + 8% PT	1485.3	27.7	438.6	70.5

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تحسين كفاءة طعم فوسفيد الزنك باستخدام طرطرات البوتاسيوم ضد القوارض

فاطمه مصطفى متولى ، ايمان عبد الرازق عبد الهادى

معهد بحوث وقايه النباتات – الدقى –– جيزه – جمهورية مصر العربية– مركز البحوث الزراعية

الملخص العربى

أجريت بعض التجارب المعملية والحقلية لدراسة التأثير على كفاءة طعم فوسفيد الزنك باستخدام مادة طرطرات البوتاسيوم ضد الجرذان.

تم اختبار طرطرات البوتاسيوم بمفردها ومخلوطة بطعم فوسفيد الزنك بمعدل ٨% باستخدام طريقة التغذية اللاختيارية ضد الجرذ المتسلق فى المعمل والجرذ النرويجى فى الحقل فى مركز شبين الكوم بمحافظة المنوفية.

أظهرت النتائج المعملية انه عند اضافة مادة طرطرات البوتاسيوم بتركيز ٨% الى طعم فوسفيد الزنك ١.٥% أدت الى رفع نسبة الموت من ٦٠ الى ٨٠% . وقد أظهرت النتائج الحقلية توافقا مع النتائج المعملية حيث ارتفعت نسبة الخفض فى تعداد الجرذان ٢٨.١الى ٧٠.٥% عند اضافة مادة طرطرات البوتاسيوم الى طعم فوسفيد الزنك. بينما زادت الكمية المستهلكة من الطعم الى ٢٧.٧ جرام للفدان مقارنة ب ٢٠جرام فقط فى حالة استخدام فوسفيد الزنك بمفرده.

يتضح من النتائج ان تأثير مادة طرطرات البوتاسيوم ترفع كفاءة طعم فوسفيد الزنك مما يؤدى الى زيادة نسبة الموت فى الجرذان.