OVERCOMING ZINC PHOSPHIDE BAIT SHYNESS PHENOMENON USING SPASMOMEN DRUG (OCTYLONIUM BROMIDE) AS ANTISPASMODIC AGENT TO SOME RODENT SPECIES

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ABSTRACT: ***Bait shyness of zinc phosphide is the major problem in rodent control. The strong pain of gastrointestinal from zinc phosphide leads to prophesy animals to bait dangerous and avoided it. So, spasmomen drug used mixed with zinc phosphide bait as an antispasmodic to prevent this pain which lead to shyness. In non-choice feeding test using sub lethal dose of zinc phosphide bait mixing with spasmomen 0.1% or 0.05%, all animals of Norway rat, Rattus norvegicus (albino strain); Rattus norvegicus (wild strain); Roof rat, Rattus rattus; house mouse, Mus musculus and Meriones shawi accepted zinc phosphide bait again after 10 days. Complete mortality was occurred within 24h approximately for all tested species. While animals, which previously fed on sublethal dose of zinc phosphide, bait alone avoided this bait and the mortality percent were zero except Mus musculus and Meriones shawi showed a relative acceptance and the mortality percent were 20% after 48h to both species. In the field application, animals of Rattus rattus continue in consumed zinc phosphide bait 0.5%+0.1% or 0.05% Spasmomen up to 5 days comparing with the applied area of zinc phosphide bait alone, where the consumption bait was stopped approximately after two days. The population reduction in the two areas treated with 0.5% zinc phosphide bait + 0.1% and 0.05% Spasmomen were (87.5 and 86.7%) comparing with 67.2% in area applied with zinc phosphide bait alone. Generally no observable difference between Spasmomen 0.1% or 0.05% in acceptance or mortality under laboratory and field conditions.***

Key words: *Bait shyness – Zinc phosphide – Spasmomen (Octylonium bromide)*

INTRODUCTION

Zinc phosphide is still the important rodenticide especially after some rodent species appear levels of resistance to anticoagulant rodenticides in the persent time. Zinc phosphide used in rodent control till now because, its effect against rats and mice and Bait shyness considerable the major problem in using zinc phosphide in rodent control programmes through nearly time. Bait shyness phenomenon occur when individuals of rodents fed on poisoned bait and obtained the sub lethal dose of poison then poisoned

symptoms were elicited bait poisoned animals recovered, in the same time recovered animals avoided this bait and transmited this behavior to the remainded animals. Rodent animals identified bait and avoided it by binding between pain resulting from zinc phosphide and bait proprates particularay distingusiheng smell of zinc phosphide bait to some period which different from one species to another, (Chitty and Rzska, 1954; Prakash and Jain, 1971; El-Deeb *et al*; 2001 and Meehan, 1984). Several studies attempt to overcome zinc phosphide bait shyness by used attractant materials (i.e. Vegetable oils, sugar and aromitc compounds) which improve consumption because they mask the taste of rodenticide active ingredient by odeur or they are themselves palatable (Barnett and Spencer, 1953; Abdel Rahman 1991 and Rezk 2000). Another studies lessen bait shyness with changing preferred carrier materals and additives continually to impostor animals, EL-Deeb *et al.* (1991) Beside this studies some testes depend on minimize the concentration of zinc phosphide in bait (Arida 1997). These studies subscribe to minimizing zinc phosphide bait shyness but bait shyness still occur. Spasmomen as antispasmodic drug has an effect on the symptomtic treatment of gastrointestinal spasm or discomfort of the gastrointestinal tract that may be associated with spasm of smooth muscles of the out, Richard and Pamela (2000) and Sweetman (2002). So that, spasmomen mixed with zinc phosphide bait tested against five rodent species under laboratory and evaluated against Roof rat, *Rattus rattus* under field conditions. The present study aim to prevent bait shyness occurrence by add antispasmodic agent (Spasmomen drug) to zinc phosphide bait.

MATERIALS AND METHODS

1. Tested Compounds:

1.1. Zinc phosphide: 94% (Zn_3P_2) is an important rodenticide was obtained from "KZ Pesticide Company, Egypt "It was used as a bait mixing with crushed maize at 0.5% in feeding experiment.

1.2. Spasmomen: (octylonium bromide 40 mg), P-2-(n-octyloxy-benzoyl]-aminobenzoate of N-diethyl-methyl-ammonium-ethyl bromide. It was used in medical treatment as antispamodic agent in spastic states and gastrointestinal tract spasm. It was obtained from Minapharm Co., as tablets each of 40 mg. Tablets were powdered and used at 0.1 and 0.05% mixed with zinc phosphide bait 0.5% to obtained two concentrations of tested compound.

2. Tested Animals:

Four wild rodent species one of them with two strains were examined in the present study, i.e. *Meriones shawi* and *Mus musculus* trapped from Abu-Rawash area, Giza Governorate. *Rattus rattus* and *Rattus norvegicus* trapped

from Beni-Suef Governorate. In addition to white albino rat, *Rattus norvegicus* was obtained from the Egyptian organization for biological and vaccine production. The trapped animals were transported to the laboratory and caged individually provided with the diet and water up to a fortnight. After this time immature animals, pregnant females and unhealthy animals were excluded, then the remainder matured animals weighed and given a reference number for each one and observed up to used. The field experiment was applied in El-Wasta district, Beni-Suef Governorate to evaluate spasmomen against roof rat shyness to zinc phosphide bait. Roof rat, *Rattus rattus* is the most dominant species in agricultural areas.

3. Experiments:

Initiative experiment was conducted to test the spasmomen efficacy on zinc phosphide bait shyness phenomenon on albino rat, *R. norvegicus* then tested against wild rat later.

3.1. Laboratory Experiments:

Three treatments were prepared (1) 100g of zinc phosphide bait 0.5% alone, (2) 100g of zinc phosphide bait 0.5% mixed with 0.1g spasmomen (3) 100g of zinc phosphide bait 0.5% mixed with 0.05g spasmomen. According to zinc phosphide LD_{50} value of albino rat, sub lethal dose (¼ LD_{50}) was determined and calculated form each bait tape. Group of 10 animals to each bait tape were treated. Animals starved for 4 hours before offered the calculated weight baits. After one day baits were removed and replaced with diet and water for 10 days, through it animals were observed. After this period five individually animals selected from each group and treated with 25 g of zinc phosphide bait 0.5% for one day then bait removed and replaced with diet and water. Animals were observed for 72h and the consumed bait (g), percentage of mortality and time to death (h) were recorded.

The same experiment was applied on four wild rat species i.e., *Rattus norvegicus*, *Rattus rattus*, *Mus musculus* and *Meriones shawi.*

3.2. Field Experiments:

Three tapes of zinc phosphide bait were applied against Roof rat, *R. rattus* in El-Wasta district, Beni-Suef Governorate. An infested area which nearby houses and around the plantation lands in the village were chosen, one area to each bait tape. The population density of rats was estimated pre-and post-treatment by food consumption method (Mathys, 1975). Before the begining of the treatment census empty clay containers laid on the infested spots for three days. The pre-treatment census was administrred by distributing 50g wheat on each clay containers for five successive days and weighting daily. The total amount of diet left and compensating the weight loss. The largest daily loss amount of wheat diet was used as an index of the population size.

Tapes of zinc phosphaide bait were distributed in clay containers for 5 days and the consumed bait amount was recorded. After seven days from the removing bait tapes, the same pre- baiting procedure was run as an index of surviving the size of population. The population reduction of rats was calculated as the following Equation:

$$\text{Rat population reduction\%} = \frac{\text{(Pre-treatment census)- (Post-treatment census)}}{\text{(Pre-treatment census)}} \times 100$$

RESULTS AND DISCUSSION

Two concentrations of spasmomen 0.1% and 0.05% were tested to overcoming zinc phosphide bait shyness against four species of rodent and the obtained data showed that

1. Under Laboratory Conditions:

Firstly efficacy of two concentration of spasmomen 0.1% and 0.05% to overcoming zinc phosphide bait shyness were tested against albino rat, *Rattus norvegicus* using non-choice feeding to make sure of this affect. Data in Table (1) showed that zinc phosphide bait 0.5% gave 0.0%, 100% and 100% mortality within average time death of 20 and 24h in the three groups of animals which previously treated by sub lealthl dose of zinc phosphide bait 0.5% (tape one), zinc phosphide 0.5% + 0.1% spasmomem (tape two) and zinc phosphide bait 0.5%+0.05% spasmomen (tape three), respectively. Average of consumed bait were 0.13, 6.3 and 5.93g to each group, respectively. A previous result indicated to the efficacy of spasmomen on bait acceptance and the mortality percent. So, the obtained data of four wild species which exposure previously to bait tapes which feed in zinc phosphide bait 0.5% (after 10 days from expouse) summarized in tables (2:5). In Table (2) the mortality percent of wild rat, *R. norvegicus* reached to 100% in both tape groups received spasmomen and time to death were 20 and 24h for each tape group, respectively comparing with zero percent in tape group which did not received spasmomen. The intak bait were 9.3, 11.4 and 0.0g to each tape groups, respectively. The same results was obtained with *R. rattus* in Table (3), the mortality percent were 0.0%, 100% and 100% within 24h and consumed bait rates were 0.0, 6.6 and 8.5g for each tape group, rspectively. Regarding to data in Tables (4 and 5), results indicated that animals of *Mus musculus* and *Meriones shawi* in tape group one clear relative acceptance to zinc phosphide bait and the consumed bait was 0.25 and 0.86 g. The mortality percent was 20% after 48h to each species, respectively. While all animals of tape group (2) and (3) were acceptabile to zinc phosphide bait and the consumed bait rates were (1.45 and 1.99 to *Mus musculus*) and (3.6 and 3.3g to *Meriones shawi*) for both tape groups, respectively. Also, the mortality percent was 100% through 24h for both spasmomen concentration and for both rat species.

Table (1): Response of Norway rat, *R. norvegicus* (albino strain) which previously fed on sub lethal dose of Zinc phosphide bait tapes to Zinc phosphide bait 0.5%.

Group of bait tapes	Av. Body weight (g)	Av. Consumed bait (g)/rat	%Mortality	Av. Time to death (h)
G. of tape 1	130	0.13	0.0%	-
G. of tape 2	133	6.30	100%	20
G. of tape 3	132.5	5.93	100%	24

Table (2): Response of Norway rat, *R. norvegicus* (wild strain) which previously fed on sub lethal dose of Zinc phosphide bait tapes to Zinc phosphide bait 0.5 %.

Group of bait tapes	A. Body weight (g)	Av. Consumed bait (g)/rat	%Mortality	Av. Time to death (h)
G. of tape 1	130	0.0	0.0%	-
G. of tape 2	133	9.3	100%	20
G. of tape 3	132.5	11.3	100%	24

Table(3): Response of Roof rat, *Rattus rattus* which previously fed on sub lethal dose of Zinc phosphide bait tapes to Zinc phosphide bait 0.5%.

Group of bait tapes	Av. Body weight (g)	Av. Consumed bait (g)/rat	%Mortality	Av. Time to death (h)
G. of tape 1	123	0.0	0.0%	-
G. of tape 2	113	6.6	100%	24
G. of tape 3	130	8.5	100%	24

Table (4): Response 0f *Mus musculus* which previously fed on sub lethal dose of Zinc phosphide bait tapes Zinc phosphide bait 0.5 %.

Group of bait tapes	Av. Body weight (g)	Av. Consumed bait (g)/rat	%Mortality	Av. Time to death (h)
G. of tape 1	11.6	0.25	20%	48
G. of tape 2	13.6	1.45	100%	24
G. of tape 3	14.3	1.9	100%	24

Table (5): Response of *Meriones shawi* which previously fed on sub lethal dose of Zinc phosphide bait tapes in Zinc phosphide bait 0.5%

Group of bait tapes	Av. Body weight (g)	Av. Consumed bait (g) / rat	%Mortality	Av. Time to death (h)
G. of tape 1	64.0	0.25	20%	48
G. of tape 2	13.6	1.45	100%	24
G. of tape 3	14.3	1.9	100%	24

Tape 1 : Zinc phosphide bait 0.5%
Tape 2 : Zinc phosphide bait 0.5%+0.1% Spasmomen
Tape 3 : Zinc phosphide bait 0.5%+0.05 % Spasmomen

2.Under field Conditions:

Under field conditions spasmomen was applied against Roof rat, *Rattus rattus* and the obtained data in Table (6) clear that in the area treated with zinc phosphide bait alone the consumption of bait stopped approximately after three days, the population reduction were (67.2%). While in two areas which treated with zinc phosphide + 0.1% or 0.05% spasmomen, Roof rat, continue in consumption until the end of trials, and the population reduction were 87.5 and 86.7% to each treatment, respectively. Discussion of these results clear the important role of spasmomen (octylnium bromide) in overcoming to zinc phosphide bait shyness whereas all animals of the tested rodent species accepted on zinc phosphide bait after 10 days from exposure to sub leathal dose of zinc phosphide bait mixed with spasmonen. While all animal species which exposure to sub lethal dose of zinc phosphide alone avoided this bait after 10 day of treatment. These results agree with obtained data by (Metwally 2005) who found that adding librax as antistomachache to zinc phosphide bait improved acceptance when compar with zinc phosphide bait alone, and the mortality percent reached to 100% in albino rat, *R. norvegicus*. Our results are in harmony with that obtained by Gabr and Rezk (2010) who found that, Spasmomen 0.05% when added to zinc phosphide bait 0.25and 0.125% achieved 43.5 and 46.3% acceptance and the mortality percent were 75% and 50% comparing with the same baits free from spasmomen (50% and 25%), respectively using free choice feeding to Norway rat, *R. norvegicus*. While the population reduction enhanced from 17.4 and 66.0% to 56.0 and 77.2% to each concentration, respectively.

Table (6): Field evaluation of spasmonen additive to Zinc phosphide bait against roof rat, *R. rattus* at Beni-suef Governorate to overcoming bait shyness.

Bait treatment	Pre-treatment consumed (g)/3 days	Daily consumption of baits					Post treatment consumed (g)/ 3days	% Population reduction
		1 day	2 day	3 day	4 Day	5 day		
0.5 % zinc phosphide bait	320	102	120	4	0	0	105	67.2
0.5 % zinc ph. + 0.1% spasmomen	432	115	203	32	17	12	54	87.5
0.5% zinc ph. + 0.05% spasmomen	610	160	260	64	38	18	81	86.7

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التغلب على ظاهرة النفور من طعم فوسفيد الزنك بإستخدام عقار الاسبازمومين (أوكتيلونيوم بروميد) كمضاد للتقلصات لدى بعض أنواع القوارض

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الملخص العربى

نظراً للقصور فى نتائج أعمال المكافحة بإستخدام طعم فوسفيد الزنك بسبب ظاهرة النفور من الطعم فقد استهدفت هذه الدراسة محاولة التغلب على هذه الظاهرة بإستخدام عقار الاسبازمومين والذى يسكن الألم الناتج عن تناول فوسفيد الزنك دون التأثير على سميته حيث أختبرت أربع أنواع من القوارض (أحد الأنواع له سلالتين) وهى السلالة المعملية للفأر النرويجى والسلالة البرية للفأر النرويجى والفأر المتسلق وفؤيرة المنازل وفأر المريونس حيث غذيت هذه الأنواع على جرعات محسوبة (تحت مميتة) من طعم فوسفيد الزنك فقط ومخلوط بتركيزات ٠,١% ، ٠,٠٥% من الاسبازمومين ولقد لوحظ إن الحيوانات التى غذيت على الطعم مضافاً إليه الاسبازمومين ٠,١%أو ٠,٠٥% بعد ١٠ ايام قد أقبلت على التغذية على طعم فوسفيد الزنك ٠,٥% وكانت نسبة الموت ١٠٠% لكل أنواع الحيوانات مقارنة بالحيوانات التى غذيت مسبقاً على الجرعة تحت المميتة من فوسفيد الزنك فقط حيث لوحظ عدم إقبال أى من الحيوانات على طعم فوسفيد الزنك ٠,٥% بعد ١٠ايام وكانت نسبة الموت صفر% باستثناء فؤيرة المنازل والفأر المريونس الذى أبدى إستجابة نسبية للتغذية على فوسفيد الزنك ٠,٥%. وكانت نسبة الموت ٢٠% لكل منهما. أما التجارب الحقلية والتى أجريت على الفأر المتسلق حول المنازل الريفية فى منطقة الواسطى بمحافظة بنى سويف فإن المناطق المعاملة بفوسفيد الزنك فقط قد توقفت الفئران عن التغذية على الطعم فى اليوم الثانى تقريباً بينما استمرت التغذية حتى اليوم الخامس من التجربة فى المناطق المعاملة بفوسفيد الزنك + الاسبازمومين ٠,١ % أو ٠,٠٥% وكانت نسبة الخفض فى التعداد ٦٧,٢ % و ٨٧,٥ % و ٨٦,٧% لكل معاملة على الترتيب. ومن خلال الإقبال على طعم فوسفيد الزنك معملياً وحقلياً يتضح تأثير إضافة الاسبازمومين فى التغلب على ظاهرة النفور من الطعم.