J. Agric. Sci. Mansoura Univ., 33(11): 8179 - 8185, 2008

STUDIES ON MECHANICAL AND CHEMICAL CONTROL OF RODENTS AT ASSIUT GOVERNORATE

Metwally, A. M.*;K. H. Abdel-gawad **; A.M. Nashaat * and S. A.Said*****
*** Faculty of Agriculture, Al-Azhar University,Cairo.**
**** Faculty of Agriculture, Asslut University .**
*****Faculty of Agriculture, Al-Azhar University,Assiut branch**

ABESTRACT

Field and laboratory experiments had been carried out to evaluate mechanical control and some treatments against rodent pests at Assiut district. The evaluation of mechanical control measures to reduce rodent population was studied in woodland area. The evaluation of three anticoagulant rodenticides was studied to establish the integrated rodent pest management which has the least impact on ecosystem, in addition to study. The relative susceptibility of different anticoagulant rodenticides (Brodifacoum, Chlorophacinone and Bromadiolone). In general it was observed reduction in rodent numbers after using the ploughing and brushing wood operations. Complete absence in rodent numbers was achieved during the first five months in ploughing and brushing woods operations. Whereas, the number of rodent was increased gradually. Females of *Arvicanthis niloticus*(Desm.) were more tolerant to all rodenticides than males at different poisoned baits and different concentrations . The acceptance of rats to the poisoned bait considerably differed according to the type of baits, the chemical structure of rodenticides and its concentrations. Bromadiolone carried on crushed maize was most acceptance to rats, while Brodifacoum carried on sunflower was the lowest. Brodifacoum carried on wheat was the most effective while the lowest effective was recorded when Chlorophacinone carried on sorghum. Also the effectiveness of rodenticides for mortality time conversed with the rodent wide concentration , Bromadiolone 0.005% more effective than Bromadiolone 0.004%.

INTRODUCTION

The most widely used of rodent control methods are poison baiting because rodenticides are readily available, relatively easy to apply, and can be prove effective and economical control. The use of acute toxicants such as Zinc phosphide was effective in controlling rat damage, but problems associated with the use of acute poisons such as poison aversion, laborious pre-baiting regimes, and toxic hazards to non target animals may present a deterrent to continuing use of these toxicants. Chronic poisons (anticoagulants) have been widely adopted for rodent control because of their relatively low hazard profile and efficacy. This approach was effective in reducing and controlling rodent populations. Resistance to anticoagulants has occurred in Europe, United States, and elsewhere as result of persistent application and inefficient use of toxicants (Jackson et al., 1988). Hence, there is need to determine the required amount of toxicant and the most suitable delivery system to control rodent effectively. The present work was planned to study the following points, Evaluation of mechanical method for rodent control and Evaluation of three anticoagulant rodenticides to *Arvicanthis niloticus* under laboratory conditions.

MATERIALS AND METHODS

1. Evaluation of some mechanical methods for rodent control:

Two highly infested areas with rodents each of about one feddan were chosen. In the first one rodent burrows were destroyed by ploughing and brushing wood operation was done. while the second area was kept as control. The rodent population was estimated in each area using the successive trap 2 days every two weeks during the year of study. The statistical analysis of variance in this study was obtained by using T test.

2. Evaluation of anticoagulant rodenticides against *A. niloticus* under the laboratory conditions:

Rodents were trapped from Al-Azhar University Experimental farm Assiut branch and transferred to the laboratory. Healthy mature males and females from *A. niloticus* about (90-160 g) in weight was chosen for these tests. Animals were singly caged, suitably accommodation in the laboratory for ten days and provided with enough wheat bait and water. The animals were sexed, weighed and individually housed in wire cages. All poisonous baits offered in plastic containers. The quantity of poisoned baits and plain baits were 50 g /container and free water. The poison bait consumed for each animal was recorded in all groups. The animals were weighted before and after the test in all groups. The day of death of each animal was recorded.

Moreover, the time mortality regression lines were drawn on log-probit papers and the medium lethal time (LT_{50}) for each treatment was determined. These lines were fitted using X_2 test and the confidence limits between which LT_{50} might be expected to lie with probability 95% were estimated according to Swaroop *et al* (1966). ; Litchfield and Wilcoxon (1949).

The three anticoagulant rodenticides used:

1. Brodifacoum:

In this experiment twenty eight males and females were selected and divided into four groups each one composed of 7 individuals from both sexes according to the exposure to Brodifacoum 0.005%. The rodenticide was mixed with various bait type as follows: group one with wheat, group two with sunflower, group three with peanut, and group four was dissolved in water.

2. Chlorophacinone:

Twenty eight males and females were divided into four groups according to the type of the carrier of Chlorophacinone 0.005% as follows: group one carried on wheat, group two on sorghum, group three on sunflower and group four on peanut.

3. Bromadiolone:

In this study ten pairs were selected and divided into two groups.These groups were treated with bromadiolone 0.004% and 0.005% mixed with crushed maize.

RESULTS AND DISCUSSION

1- Evaluation of some mechanical control measures in reducing rodent population:

Data in (Table 1) represent the reduction in rodent numbers after using the ploughing and brushing wood operations. Complete absence in rodent numbers was achieved during the first five months in the treated . Then, the number of rodent was increased gradually from May to November. Regarding to the seasons the highest density was observed in Autumn and the lowest in Winter. The use of mechanical control in the present work proved to be more effective in rodent control. In agreement of the present results Abdel-Gawad and Ali (1982) and (Lam, 1990) reported that cultural methods like cropping patterns and timing, habitat manipulation, physical and mechanical control had direct effects on rice field rat population. Also in Egypt (Abazaid, 1997)and El-Eraky et al (2000) recorded that the complete reduction in rodent active burrows was achieved after 10 days of laser-land leveling operation, as compared with 50.6% in Quintox treatment through the same time.

2-Evaluation of anticoagulant rodenticides against A. niloticus under the laboratory conditions:

Laboratory non-choice feeding test was conducted to evaluate the efficacy of Brodifacoum, Chlorophacinone and Bromadiolone anticoagulants carried on different baits against the nile rat, A. niloticus.

Table (1): The efficacy of mechanical control on the infestation of rodents in the woodlands, at Al-Azhar University Exptl. Farm, Assiut (2005).

Month	No. rodents	
	Untreated	Treated
Dec.	10	0
Jan.	7	0
Feb.	5	0
Winter	22	0
Mar.	11	0
Apr.	3	0
May	19	1
Spring	33	1
Jun.	17	2
Jul.	15	2
Aug.	12	3
Summer	44	7
Sep.	9	3
Oct.	5	4
Nov.	12	5
Autumn	26	12
Total	125	20
Mean	10.4	1.7
T value	± 6.12**	

** Highly Significant different between the means at 0.05 and 0.01 level of probability

Tabulated data in (Tables 2 and 3) revealed that when used anticoagulants on the different baits caused complete mortality.

Table (2): Doses and hours to death, reduction in (B. W.) and percent mortality *of A. niloticus* fed on different rodenticides introducing on various carriers.

Rodenticide	Method of application of rodenticide	Sex	Mean of body weight (g)	Mean of amount of poison bait consumption (g)	Mean of amount of active ingredient (mg)	Mean of dose mg/kg (B. W.)	Hours to death		Mean of reduction (B. W.) In (g)	% Mortality
							Range	Mean		
Broadifacoum 0.005%	Dissolving in water	M	148.0	167.80	8.39	56.69	78 – 104	90	4.0	100.0
		F	146.5	211.03	10.55	72.01	162 – 212	192	4.5	100.0
	Carried on wheat	M	137.2	51.20	2.56	18.66	75 – 94	88	3.8	100.0
		F	142.5	62.49	3.13	21.96	98 – 112	105	3.7	100.0
	Carried on peanut	M	141.0	41.52	2.08	14.75	107 – 127	118	4.0	100.0
		F	150.3	51.13	2.56	17.03	120 – 182	152	4.5	100.0
	Carried on sunflower	M	162.3	32.51	1.63	10.04	96 – 122	110	4.0	100.0
		F	175.5	43.70	2.19	12.48	140 – 157	150	4.0	100.0
Chlorophacenon 0.005%	Carried on sorghum	M	163.8	59.10	2.96	18.07	120 – 162	139	3.7	100.0
		F	149.2	66.14	3.31	22.19	168 – 204	191	3.3	100.0
	Carried on wheat	M	181.2	56.53	2.83	15.62	126 – 144	135	3.5	100.0
		F	185.2	73.84	3.69	19.92	163 – 190	176	3.8	100.0
	Carried on peanut	M	140.3	79.90	3.99	28.44	121 – 144	133	5.2	100.0
		F	130.0	86.74	4.34	33.39	162 – 192	173	3.5	100.0
	Carried on sunflower	M	117.5	35.90	1.80	15.32	101 – 141	125	3.5	100.0
		F	125.7	44.54	2.23	17.74	131 – 151	141	3.0	100.0
Bromadiolone 0.005%	Carried on maize	M	164.3	93.41	3.74	22.76	122 – 141	131	4.2	100.0
		F	153.5	105.41	4.22	27.49	156 – 184	168	3.8	100.0
Bromadiolone 0.004%	Carried on maize	M	186.7	99.51	4.98	26.67	96 – 116	108	4.0	100.0
		F	154.5	90.12	4.51	29.19	120 – 143	130	4.3	100.0

Table (3): LT_{50} values, confidence limits and slop of different rodenticides introducing on various carriers against both sexes of *A. niloticus*

Method of application of rodenticide	Sex	Broadifacoum 0.005%				Chlorophacenon 0.005%				Bromadiolone 0.005%				Bromadiolone 0.004%			
		LT_{50} (hours)	Confidence limits		Slop	LT_{50} (hours)	Confidence limits		Slop	LT_{50} (hours)	Confidence limits		Slop	LT_{50} (hours)	Confidence limits		Slop
			Lower	Upper			Lower	Upper			Lower	Upper			Lower	Upper	
Dissolving in water	M	87	81	91	25.45												
	F	184	166	197	16.64												
Carried on wheat	M	85	78	90	23.76	133	128	136	46.76								
	F	103	100	106	45.46	173	165	179	35.63								
Carried on peanut	M	116	110	119	38.49	130	124	135	34.54								
	F	143	123	158	11.48	169	162	175	39.30								
Carried on sunflower	M	107	100	112	25.65	120	106	129	15.93								
	F	148	143	151	47.45	139	134	142	45.84								
Carried on sorghum	M					134	124	142	20.25								
	F					187	174	194	30.03								
Carried on maize	M									105	98	110	25.02	129	124	132	41.10
	F									127	122	132	34.56	164	159	169	50.09

while, a considerable variation was noticed in the palatability of rats to the poisoned baits. Data revealed that high palatability was observed with the Bromadiolone 0.004% and 0.005% carried with crushed maize followed by Chlorophacinone 0.005% carried with peanut, wheat, sorghum, and sunflower, respectively. While, the lowest acceptance was recorded in Brodifacoum 0.005% dissolving in water, carried on wheat, peanut and sunflower, respectively. Average of time required to death differed according to the type of chemicals and bait.

Brodifacoum when carried with wheat gave the most effective (LT_{50} 85&103 h), sunflower (LT_{50} were 107&148 h), peanut (LT_{50} were 166&143 h) for males and females, respectively, followed by Chlorophacinone carried with sunflower (120&139 h), consequently of peanut (130-169 h) followed by wheat (133-173 h) and the last one is sorghum (134-187 h) for males and females, respectively, comparison with Brodifacoum dissolving in water.

In case of Bromadiolone, comparative on two concentration (0.005% & 0.004%). The first concentration 0.005% high effective where (LT_{50} had been given 150-127 h) than the 0.004% concentration (129-164 h) for males and females, respectively. Where as the palatability of rats to the poisoned concentration whereas moderate to both concentrations. All of these rodenticides caused reduction in the body weight of animal tested and this may be due to the bleeding and the variation in the acceptability of poison baits. In general it was observed that females of *A. niloticus* were more tolerant to all rodenticides than males at different poisoned baits and different concentrations ; it may be due to the presence of fats in the body of females more than males. The same results obtained by Rowe *et al.*, (1985) Parshad and Chopra (1986) El-Deeb *et al.*, (1992a) Ibrahim (1995), they stated that all tested anticoagulant rodenticides on dry baits caused complete mortality,

Regarding the acceptance of rats to the poisoned bait considerably differed according to the type of bait and the chemical structure and concentrations of used rodenticides. Bromadiolone carried with crushed maize was most acceptance to rats, while Brodifacoum carried on sunflower was the lowest. On the other hand, the time required to death differed according to the type of rodenticide and bait carrier. Brodifacoum carried on wheat was the most effective while the lowest effective was recorded when Chlorophacinone carried on sorghum. Also, the effectiveness of rodenticides for mortality time was related to the concentration of the rodenticide, Bromadiolone 0.005% was more effective than Bromadiolone 0.004%.. These results were in agreement with Ali (1985) , Arida (1997) , Haque *et al.*, (2001) , Kuar and Parshad (2005) they found, reduction in body weight, severe external and internal hemorrhage associated with subcutaneous and intramuscularly heamatoses.

REFERENCES

Abazaid, A.A. (1997): Ecological and toxicological studies on rodents in Qena governorate (Upper Egypt). Ph. D. Thesis, Fac. Agric., Assiut Univ., pp. 96.

Abdel-Gawad, K.H. and Maher Ali, A. (1982): Ultrasonic waves versus traditional methods for the control of the Nile grass rat, *A. niloticus*. Assiut J. Agric. Sci., 13 (2): 85-88.

Ali, M.K. (1985): Studies on rodents and their ectoparasites in Sohag governorate. M. Sc. Thesis, Fac. Agric. Assiut Univ. pp. 137.

Arida, M.A. (1997): Some ecological and toxicological studies on certain rodents in Egypt. M. Sc. Thesis, Fac. Agric., Al-Azhar Univ., Egypt.

El-Deeb, H.I.; El-Sherbiny, A.H. and Omar, A. (1992a): Laboratory trails of some anticoagulant rodenticides against the black rat, *Rattus rattus* and *Norway rat*, *Rattus norvegicus*. Egypt. J. agric. Res., 70(2): 469-474.

El-Eraky, S.A.; Abdel-Gawad, K.H.; Farghal, A.I. and Abazaid, A.A. (2000): Evaluation of some mechanical control measures to reduce rodent population in Upper Egypt. The 2nd Sci. Conf. of Agric. Sci., Assiut, October. Vol.2 pp 519-522.

Haque, M.E; Ahmmad, K.U.; Islam, S.M.N. (2001): Efficacy of Lanirate (Bromadiolone) on lesser bandicoot rat, *Bandicota bengalensis* (Gray) in the laboratory. Bengladesh Journal of Entomology. 11(1-2): 123-126.

Ibrahim, I.K. (1995): Studies on the toxicity effect of some substances on rodents in Egypt. M. Sc. Thesis, Fac. Agric. Assiut Univ. pp. 153.

Jackson, W.B.; Ashton, A.D. and Delventhal, K. (1988): Overview of anticoagulant usage and resistance. In current advances in vitamin K. Research (J.W. Suttie, ed.) Elsevier New York. PP. 381-388.

Kuar,H. and Parshad, V.R. (2005): Laboratory and field evaluation of three odorant compounds for improving attraction of the lesser bandicoot rat, *Bandicota bengalensis* (Gray) to 0.0375% Comatetralyl bait. International Biodeterioration & Biodegradation. 56: 135-142.

Lam, Y.M. (1990): Cultural control of rice field rats. International rice Res. Inst. Los Banos, Laguna (Phili) IRRI p. 65-72.

Litchfield, J.T. and Wilcoxon, F. (1949): A simplified method of evaluating dose effect experiments. J. Pharmcol. Expt. Therap. 96: 99-113.

Parshad, V.R. and Chopra, G. (1986): The susceptibility of *Rattus rattus rattus* and *Bandicota bengalensis* to a new anticoagulant rodenticide Flocoumafen. J. HYG. Comb., 96(3): 457-478.

Rowe, F.P.; Brafield, A. and Swinney, T. (1985): Pen and field trails of a new-anticoagulant rodenticide Flocoumafen against the house mouse. J. HYG. Comb. 95: 623-627.

Swaroop, S.; Gilory, A.B. and Emura, K. (1966): Susceptibility tests, statistical method in malaria eradication. WHO Monograph series (51) WHO, Geneva: 188-129.

J. Agric. Sci. Mansoura Univ., 33(11), November, 2008

دراسات علي المكافحة الميكانيكية والكيماوية للقوارض فى محافظة أسيوط

عبد الستار محمد متولي* - خليفة حسين عبد الجواد** - نشأت عبد العزيز محمود*** وسعودي عبد الوهاب سيد***
* كلية الزراعة جامعة الأزهر بالقاهرة
** كلية الزراعة جامعة أسيوط
***كلية الزراعة جامعة الأزهر بأسيوط

المكافحة الميكانيكية:

تم تقييم فعالية المكافحة الميكانيكية بمحافظة أسيوط فى خفض تعداد الفئران باستخدام إزالة الحشائش بالحرق والحرث لهدم الجحور مع ترك منطقة بدون حرق أو هدم للمقارنة ولقد أوضحت الدراسة أن المكافحة الميكانيكية كانت ذات فاعلية عالية فى خفض تعداد الفئران والجرذان حيث اختفت الفئران والجرذان تماماً فى الخمسة اشهر الأولى مقارنة بالمنطقة التي لم يحدث بها تلك المعاملة ثم ظهرت وازدادت تدريجيا حتى نهاية العام .

المكافحة الكيماوية :

تم تقييم فعالية ثلاثة من المبيدات المانعة لتجلط الدم محملة على حوامل طعم على فأر الحقل النيلي معملياً .حيث تم دراسة تأثير مبيد البروديفاكوم بتركيز ٠,٠٠٥ % على عدة حوامل للطعم وهى القمح – الفول السودانى – عباد الشمس وكذلك وهو ذائب فى الماء وقد أوضحت الدراسة أن البروديفاكوم المحمل على القمح أعطى أعلى كفاءة من حيث زمن الموت يليه المحمل على عباد الشمس ثم على الفول السودانى وكان الأخير وهو ذائب فى الماء .كذلك تم دراسة الكلوروفاثينون على عدة حوامل وهى القمح – الفول السودانى – عباد الشمس – الذرة الرفيعة القصيرة وكان أعلى كفاءة لمبيد الكلوروفاثينون المحمل على عباد الشمس يليه المحمل على الفول السودانى ثم على القمح ثم على الذرة الرفيعة القصيرة .أما فى حالة بروماديولون فقد تم المقارنة بين تركيزين مختلفين من هذا المركب وهما ٠,٠٠٤ % و ٠,٠٠٥ % حيث أعطى تركيز ٠,٠٠٥ % فعالية أعلى من التركيز الأقل من حيث زمن الموت

وعموماً فقد لوحظ أن إناث فأر الحقل النيلي كانت أكثر تحملا لكل المبيدات. أما من حيث القابلية لحوامل الطعوم فقد سجلت أعلى قابلية في حالة بروماديولون المحمل على الذرة الشامية المجروشة، بينما كانت القابلية الأقل في حالة البروديفاكوم المحمل على عباد الشمس. وأعطى البروديفاكوم المحمل على القمح أعلى فاعلية من حيث زمن الموت بينما سجل الكلوروفاثينون المحمل على الذرة الشامية اقل فعالية مقارنة بغيرة من الحوامل المختلفة .