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EFFICIENCY OF CERTAIN CHEMICAL COMPOUNDS AGAINST THE CLIMB RAT *Rattus rattus alexandrine* Under Laboratory Conditions

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ABSTRACT

Laboratory studies were applied to investigate the efficiency of bromadiolone 0.005%, vitamins (A, C and E) and bromadiolone 0.005% with vitamin E; on the both sexes of climb. rat, *Rattus rattus alexandrines*; the obtained results could be summarized in the following points;- The daily bait consumption of males and females of climbing rat, *R. rattus* had no any noticeable differences between the investigated vitamins A, C and E.), Vitamin A and C had no mortality, meanwhile vitamin E at 0.50%, 0.75% and 1.0% caused 20%kill, 28%kill and 8.5%kill for male. Where it was 16%kill, 20%kill and 16.0% kill for female of *R. rattus*, respectively. Vitamin E at 1.0 ratio killed each of male and female of *R. rattus* after 1.8 day and 4.4 day as average, respectively. The tested vitamins (A, C and E) in different mixing bait ratio 0.50%, 0.75% and 1.0%, caused reduction to the body weight of both sexes of climb. rat, *Rattus rattus alexandrines* especially Vitamin E, The daily bait consumption from bromadiolone 0.005% with 1.0% vitamin E of sub lethal doses, LD_{50}, for male and females *R. rattus*, were (8.5gm),. The mortality increased when the rats exposed to bromadilone plus Vitamin E than either of them singly. Also the highest mortality was recorded for bromadilone + Vitamin E 0.75% (gave 30%kill) Mostly, the shortest time to death under the combination condition was recorded by female.

INTRODUCTION

Rodents cause untold economic loss to farmers, food manufacturers and processors as well as causing damage to the structure and buildings fabric. Undoubted by the economic loss due to rodents is enormous particularly in the tropics, but it is impossible to place exact monetary values on the damaged caused. The World Health Organization estimates that about 33 million tons of food are destroyed world-wide each year. More recently it has been estimated that world-wide post harvest loss attributable to rodent and insect depredation is about 20% of its total value. Even on a smaller scale, estimates of the economic loss caused by rodents must be treated with reserve. For instance, $ 900 millions/year was the figure put on rodent depredations in the USA in the 1960's (Clinton, (1969); and in India up to 16% of food is claimed to be lost each year but the figure may be much higher (Bull, (1972) and Krishnamurthy *et al.* 1975).

Chemical pesticides were used to control rodents, therefore they caused environmental pollution. Concentration of pesticide are increasingly magnifies in tissue and other organs along the food chain (Mori *et al.* 1983; Abd El-Gawad and Shams Al-Din, 1990).The majority of anticoagulants chemically belong to coumarin gmoup. Naturally coumarins are present in plants in free as well as conjugated gmoup An investigation into the establishment of biochemical criteria for detection of early manifestations of liver damage revealed that administration of various hepatotoxic compounds including coumarin, to rats brought about a reduction in liver. Thus, the aim

of this work was to investigate the toxicity of bromadiolone 0.005% against Norway rat, *Rattus norvegicus*, and climb. rat, *Rattus rattus*. Besides, the biochemical, teratogenic and biological effects of the above mentioned anticoagulant and vitamins (A, C and E) were studied in the laborator

MATERIALS AND METHODS

Experimental design:

1-Effect of vitamins,(A, C and E) bromadiolone 0.005% and combination Broma diolone 0.005% vitamin E:-

A-1 – The tested Vitamin:-

Three vitamins were investigated through this study; vitamin A (from Kahira pharmaceuticals, chemical industries Co. Cairo Egypt), vitamin C (from chemical industries development (CID) Giza – A.R.E.) and vitamin E (from Kahira pharmaceuticals, chemical industries Co. Cairo Egypt). 0.50%, 0.75% and 1.0% from each of the used vitamins were tested against the experimental animals. These concentrations were added to 100 gm of whole wheat seeds to introduce it to the experimental rats as bait.

A-2- The experimental animals: -

Adults of climbing rats, *Rattus rattus alexandrinus* were obtained from Abo-Rawash district Giza Governorate and Banha district ,Kalubia Governorate . Rats were individually reared acclimatized under laboratory conditions.. The active healthy and similar weight-as possible were chosen and separated into three gmoups. First gmoup were fed on bait with vitamin A. Meanwhile, vitamin C (2^{nd} gmoup) and vitamin E (3^{rd} gmoup) baits were offered to *R. rattus alexandrines ,*respectively.

A- 3-The Procedure:-

The plain food was removed from the animal cages 24 hours before administering the treated seeds (wheat) with the mentioned concentrations of Vitamins A, C and E previously The daily baits consumption was recorded .Also the mortality, time to death and weight fluctuation were recorded daily. Serial different bromadiolone active ingmedient counted as mg/kg body weight were prepared and suspended in distilled water. Ten adult caged individually were used for every dose level and were fastened for about 24 hours before treatment. A poralled control test was conducted using plain distilled water. M0rtallity percentages were recorded up to 28 days after treatment. L D50 values were calculated by using probit transformation, table designed by Weil (1956) and simplified formula given by Horn (1956).

A-4- Tested rodenticides:-

The investigated anticoagulant was bromadiolone 0.005% which prepared by I C I Company. The LD50 values were estimated for both sex of the experimental rats the 1/10 LD50 values were administrated by oral intubations. Plain bait and water were supplied daily. Mortality, time to death and bait consumption was recorded per day. The same steps were followed for 2^{nd}, 3^{rd} and 4^{th} gmoups which exposed to bromadiolone+ vitamine 0.5,% bromadilone+ vitamine0.75 % and bromadiolone+ vitamine0 1.0%.

RESULTS AND DISCUSSION

I-A-Effect of certain ratios of vitamin on climb Rat (*Rattus rattus*)

I- A-1- Bait consumption:-

The tabulated results in Table (1) showed that, the average of the daily bait consumption of the tested ratios of (0.50%, 0.75% and 1.0%) climbing rat *Rattus rattus* was 17.1, 17.7 and 17.3 gm for males, and it was 15.4, 12.8 and 12.1 gm for females., respectively. Meanwhile the consumptions baits of vitamin C at 0.50%, 0.75% and 1.0 by males *R. rattus*, were 17.6, 10.1 and 12.9 gm. and for females were 16.0, 13.7 and 11.6 gm., respectively. For vitamin the average of the daily bait consumption were 10.6,12.2 and 11.5 gm. E 0.50%, 0.75% and 1.0% for males of *R. rattus* whereas, females consumed 11.0, 12.3 and 11.3gm. the gained data proved that the daily bait consumption of males and females of climbing rat, *R. rattus* had no any noticeable differences between the investigated vitamins A, C and E.

I- A-2- Mortality:-

The presented data in Table (1), showed that vitamin A and vitamin C had no mortality for males or females of rat, *R. rattus*, The compiled data in Tables (1), proved that vitamin E at 0.50%, 0.75% and 1.0% caused 20%kill, 28%kill and 8.5%kill in male. For female it was 16%kill, 20%kill and 16.0% kill of *R. rattus*, respectively. Our results agmeed with the obtained results by Dowd and Zheng (1995) who found that vitamin E in the reduced, alpha-tocopherol from shows very modest anticlotting activity. In contrast, vitamin E quinine is a potent anticoagulant. This observation may have significance for the field trials in which vitamin E is observed to exhibit beneficial effects on ischemic heart disease and stroke. Vitamin E quinine is a potent inhibitor of the vitamin K-dependent carboxylase that controls blood clotting. A newly discovered mechanism for the in hibition requires attachments of active site thiol groups of the carboxylase to one or more methyl groups on vitamin E quinine. The results from a series of model reactions support this interpretation of anticlotting activity associated with vitamin E.

I-A-3-Day to death:-

The presented data in Table (1), administrated that average of day to death of climbing rat, *Rattus rattus*, because of in taking vitamin E at 0.50%, 0.75% and 1.0%concentrations, these figures were 5.4, 2.8 and 1.8 day for males, and for females were 2.6, 2.6 and 4.4 day respectively.

I-A-4- Rat body weight fluctuation:-

The presented data in Table (1), showed the body weight fluctuation of climb. rat, *R. rattus* which fed on bait of Retinol (vitamin A)at 0.50%, 0.75% and 1.0 concentrations of male, were -5.2, -2.1and -9.3 gm. For female it was -12.3, -7.6 and -7.8 gm. IN case of Ascorbic acid (vitamin C) at the tested ratios, the body weight fluctuation were -6.3 . -2.1 and-5.0gm. in male of *R. rattus*, meanwhile for female it was -19.6, -3.0and +6.0gm. As well as male of *R. rattus* which fed on bait with Tocopherol (vitamin E) 0.50%, 0.75% and 1.0% had been reduction in its body weight which differed according to the ratios.The reduction in weight of males was, -8.2, -7.3 and -9.2 gm. for 0.50%, 0.75% and 1.0% respectively. For females it was -10.5, -14.1 and -10.0 gm., respectively.

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Generally, the tow vitamins (A, and C) in different mixing bait ratio 0.50%, 0.75% and 1.0%, caused reduction to the body weight of both sexes in climb. rat, *Rattus rattus* after 15 days feeding, xie-Liang Min *et al*., (2005) studied was conducted to investigate the effect of vitamin E (VE), selenium (Se) and quercetin on the expression of zf-9 messenger RNA (mRNA) of hepatic stellate cells during early acute liver injury in rates. .

B-1-Bromadiolone 0.005% and bromadiolone 0.005% with vitamin E –

B-1-Bait consumption:-

The tabulated result in Tables (2) showed that, the average of the daily bait consumption of bromadiolone 0.005% of sublethal doses (LD_{50}) of male *R. rattus*, were (16.7 gm.) . For females there were (18.5 gm). The average of the daily bait consumption of bromadiolone 0.005% with 0.50% vitamin E sub lethal doses (LD_{50}) of males *R. rattus*, were (9.5gm.), and for females, were (10.5 gm.). The daily bait consumption of bromadiolone 0.005% with 0.75% vitamin E of sublethal dose (LD_{50}) in males *R. rattus*, were (7.11 gm.), and for females, were (7.7 gm.). On the other hand average of the daily bait consumption from bromadiolone 0.005% with 1.0% vitamin E of sub lethal doses, LD_{50}, for male and females *R. rattus*, were (8.5gm.),.

B-2-Moratlity:-

The tabulated result in Table (2), showed that, the combination of sub-leathal doses (LD50) of Bromadiolone with different concentrations of Vitamine E (Tocopherol) on the males and females of *Rattus rattus*. The gained results proved that the mortality increased when the rats exposed to bromadiolone plus Vitamine E than either of them singly. Also the highest mortality was recorded for Bromadilone + Vitamine E 0.75% (gave 30%kill), meanwhile, Bromadilone+Vitamine E 0.5% gave 20.1% kill and bromadiolone + vitamine E 1.0% caused 20% kill. For the whole treatment the highest kill percentage observed in Male.

Marsh *et al.,* (1980) found when comparing acute LD_{50} values in laboratory rats that Bromadiolone (LD_{50} = 1.12mg/ kg) appeared to be 165 times more toxic than Warfarin (180mg/ kg). They carried out a comparison of the multiple dose (5 days) LD_{50} values using Sprague-Dawley rats, they found that the toxicity of Bromadiolone was reduced to less than three times gmeater. Similarly tests on laboratory mice indicated that although Bromadiolone is 214 times more toxic than Warfarin according to acute LD_{50} values (1.73 mg/ kg versus 374 mg/ kg), it is only 15 times more toxic than Warfarin based on multiple dose LD_{50} to house mice (5 x 0.15mg/ kg versus 5 x 2.2mg/ kg).

B-3-Day to death:-

The present data in Table (2) administrated that average of day to death of bromadiolone 0.005%, of sub lethal doses (LD_{50}),plus different concentrations of Vitamine E for the tested animals were 8, 7, 5 and 5 days for bromadilon, bromadilone+vitamine E0.5%, 0.75% and 1.0% concentrations respectively. Mostly, the shortest time to death under the combination condition was recorded by female . In general the average time of death because of this combination.

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B-4- Rat body weight fluctuation:-

The tabulated data in Table (2) revealed that the combination between bromadiolone and the used concentrations of vitamin E (Tocopherol) caused noticeable reduction in body weight of both sex of the experimental animal. This reduction in body weight of rat has a positive correlation with the average daily bait consumption .Male has more reduction in its body than female for the whole treatment.

REFERENCES

Abdel-Gawad A.A. and A. Shams Aldine (1990). Pesticide residues in food stuffs in imported food. J. of the Egypt. Soc. of toxicol 5: 49-52.

Bull J.O. (1972). The influence of attractants and repellants on the feeding behavior of *Rattus norvegicus*. Proc. 5th Vert. Pest. Conf. Fresno, Calif. March (7-9):

Clinton J.M. (1969). Rats in urban America Pupl. Hlth Rep., wash. 84 (1): 1-7.

Dowd P. and Z. B. Zheng (1995). On the mechanism of the anticlotting action of vitamin E quinine. Proceeding of the National Academy of sciences of the united states of America. 92 (18): 8171-8175

Horn, H. G.(19560 Simplified (LD50or ED50)calculation. Biommetrics,12: 311-322

Krishnamurthy K.; G. C. Chaturdevi and I. Prakash (1975). Work on rodents and their control in India to prevent losses in foodgmains. Tropical stored Products Information (25): 28.

Marsh R. E.; W. E. Howard and W.B. Jackson (1980). Bromadiolone: a new toxicant for rodent control. Pest Control, 48: 22-26.

Mori Y.; K. Masanori; O. Erculo and O. Toshihiro (1983). Level of PCB and orangochlorine pesticides in human adipose tissue collected in Enime prefecture. Bull. Environment contam. Toxicol. 30: 74-79.

Weil,Hj.(1956)Table for convenient calculation of medium effective dose (LD50 or ED50) and instruction in its use. Biometrics, 8 :249-263.

Xie-liang Min; Ma-lin; chen-xiu Hua; Sun-Jian Qin; (2005). Effect of dietary supplementation of antioxidants on zf-9 mRNA expression in rat hepatic stellate cells during acute liver damage. Acta. Nutrimenta sinica. 27 (1): 5-8.

عبد الموجود عبدالله عسران ، طلعت محمد سليمان قشطة و عبد المقصود عبد المقصود أبو هاشم و مجدى بولس ولسن
معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الجيزة - مصر

أجريت تجارب معملية لتقييم كفاءة البروماديلون 0,005 % ، فيتامين (أ ، سى ، هـ) والبروماديلون 0,005 مع فيتامين هـ على كلا الجنسين للفأر المتسلق.
أوضحت النتائج أنه لا يوجد فروق معنوية فى الأستهلاك بين الذكور والأناث فى فيتامين أ ، سى ، هـ ولم يحدث موت فى المعاملة بفيتامين أ ، سى بينما المعاملة بفيتامين هـ بجرعة 0,5 % ، 0,75 % و 1 % حيث أعطى نسبة موت 20 % ، 28 % ، 8,5 % فى حالة الذكور أما فى حالة الأناث فكانت نسبة الموت 16 % ، 20 % ، 16 % على الترتيب .
كذلك فان خلط الجرعات السابقة بالطعوم أعطت خفض فى وزن الجسم لكلا الجنسين ، خصوصا فيتامين هـ .

قام بتحكيم البحث
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Table (2): Effect 0f sub lethal doses 1/10 (LD50) of Bromadilone and Bromadilone plus different concentration of Tocopherol (Vitamin E) on climb rat *Rattus rattus* under laboratory conditions

Treatment	Sex	LD50 Mlg/kg	Weight		Weight fluctuation	Average daily bait cnsumption	Mortalty%	Time to death		
			Befo.	after				min	max	Ave.
Bromadilone 0.005%	Male	1.42	293.0	282.0	-11.0	16.7	20	6	8	7
	Femal	1.65	274.3	262.3	-12.0	18.5	20	8	10	9
	Aver.	1.54	283.7	272.3	-11.5	17.6	20	7	9	8
Bromadilone +Tocopherol (vit. E 0.5%)	Male	0.74	144.0	135.0	-9.0	9.5	20	6	8	7
	Femal	0.89	110.3	102.0	-8.3	10.5	20.2	6	8	7
	Aver.	0.81	127.2	118.5	-8.7	10.0	20.1	6	8	7
Bromadilone +Tocopherol (vit.E 0.75%	Male	0.69	112.3	99.8	-13.3	7.11	40	6	10	8
	Femal	0.79	117.3	113.0	-4.3	7.7	20	2	2	2
	Aver.	0.74	114.8	106.0	-8.8	7.4	30	4	6	5
Bromadilone +Tocopherol (Vit. E 1.0%	Male	0.74	268.0	259.3	-8.7	6.0	40	8	12	10
	Femal	0.84	219.5	214.0	-5.5	11.0	0.0	0	0.0	0
	Aver.	0.79	243.7	236.6	-7.1	8.5	20	4	5	5
Control	Male		221.0	224	3.3	14.5	0	0	0	0
	Femal		177.3	182.0	4.7	13.7	0	0	0	0
	Ave.		194.2	203.2	4	14.1	0	0	0	0

Table (1): Effect of different concentrations of certain chemical compounds on the climb rat *Rattus rattus* under laboratory conditions

Chemical compound	Concentr.	sex	weight		Weight fluctuation	Av. Of daily bait consumption	Mortality %	Time to death		
			before	after				Min.	Max	Av.
Retinol vitamin A	0.5	Male	232.6	227.6	-5.0	17.1	0	0	0	0
	0.75		200.6	118.5	-2.1	17.7	0	0	0	0
	0.1		185.6	176.3	-9.3	17.3	0	0	0	0
	average		206.3	200.8	-5.5	17.6	0	0	0	0
	0.5	Female	159.1	146.8	-12.3	15.4	0	0	0	0
	0.75		111.6	104	-7.6	12.8	0	0	0	0
	0.1		131.8	124	-7.8	12.1	0	0	0	0
	average		134.1	124.9	-9.2	13.4	0	0	0	0
Ascorbic acid vitamin C	0.5	Male	167.6	161.3	-6.3	17.6	0	0	0	0
	0.75		112.3	110.2	-2.1	10.1	0	0	0	0
	0.1		115.6	110.6	-5.0	12.9	0	0	0	0
	average		131.8	127.3	-4.5	13.5	0	0	0	0
	0.5	Female	146.3	126.7	-19.6	16.0	0	0	0	0
	0.75		141.3	138.3	-3.0	13.7	0	0	0	0
	0.1		100.0	106	+6.0	11.6	0	0	0	0
	average		129.2	123.6	-5.6	12.8	0	0	0	0
Tocopherol vitamin E	0.5	Male	179.9	171.7	-8.2	10.6	20.0	4.8	6	5.4
	0.75		177.7	170.4	-7.3	12.2	28.0	1.2	4.4	2.8
	0.1		199.1	189.9	-9.2	11.5	8.0	1.6	2	1.8
	average		185.6	177.3	-8.2	11.5	18.6	2.5	4.1	3.3
	0.5	Female	169.6	159.1	-10.5	11	16.0	2.0	3.2	2.6
	0.75		199.0	184.9	-14.1	12.3	20.0	1.6	3.6	2.6
	0.1		191.5	180.8	-10.0	11.3	16.0	4	4.8	4.4
	average		186.7	174.9	-11.5	11.3	17.3	2.5	3.7	3.2