

## **EFFECT OF RODENTICIDE (DIFETHIALONE) ON ROOF RAT, *Rattus rattus* AND NORWAY RATE *Rattus norvegicus* IN LABORATORY**

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### **ABSTRACT**

In this study, Difethialone 0.0025 % in diet within 3 days non-choice feeding test caused complete mortality for *R. norvegicus* and *R. rattus* indicating that they were susceptible to Difethialone. The bait consumption and corresponding active ingredient intake was more in *R. rattus* than *R. norvegicus*. The mean intake values for *R. rattus* being 3.1 and 2.64 mg/kg group A and 2.6 and 2.65 mg/kg group B for males and females, respectively and for *R. norvegicus* 1.93 and 2.29 mg/kg at group A and 2.14 and 2.09 mg/kg group B for males and females, respectively. Within one day non-choice feeding test the obtained results showed that it caused mortality ranged between 60–70 % for *R. norvegicus* and 50–60 % for *R. rattus* for both sexes. The higher intake values of active ingredient for died rats recorded to the males of *R. rattus* group A (1.45 mg/kg) while males of *R. norvegicus* group A recorded the lower value (0.77 mg/kg). The higher mean death time was recorded to the males of *R. norvegicus* group B (8.5 days), the lower value was recorded for females of *R. rattus* group B that the more of feeding days test, Difethialone within 2 days non-choice feeding test caused mortality between 70-80 % for both species at two regions. The higher values were recorded for male of *R. rattus* group A (2.25 mg/kg), while the lower values were recorded for female of *R. norvegicus* group B (1.39 mg/kg). The mean values of time to death showed that male of *R. rattus* recorded the higher values (6.16 days), while females of *R. norvegicus* showed the lower value group A (4.75 days).

### **INTRODUCTION**

Rodents are the most destructive vertebrate animals on the earth. The gnaw through almost any object in their path to obtain food and shelter. The damage from rodents causes loss every where, furthermore, rodents are involved in transmission of more than 20 disease organisms. Egypt suffered from rodent problems in agricultural areas at the beginning of the 1980s. Change in cropping patterns and deficiency in rodent control information might have increased these problems. Some of the most important rodents in Egypt are the Nile rate, *Arvicanthis niloticus*; Roof rate, *Rattus rattus*, Norway rate, *Rattus norvegicus*; House mouse, *Mus musculus* and the Egyptian spiny mouse, *Acomys cahirinus*; in addition to desert rodent species such as *Meriones* sp., *Gerbillus* sp., *Jaculus* sp., which are involved as pests in Egyptian environment. With the beginning of the rodents' problem in Egypt, many anticoagulant rodenticides have been used in addition of using zinc phosphide which is the famous acute poison rodenticide that has been used for several decades to control all species of rats and mice. In Egypt, the anticoagulant rodenticide has been used on large scale to control rodents. The continued misuse of the anticoagulant rodenticides dipilopeda sort of tolerance or resistance in some rodent species in several countries. With first

anticoagulants generation, the Norway rats developed resistance in Denmark (Lund, 1964), in England and Wales (Drummond and Bentley, 1967) and in North Carolina (Jackson *et al.*, 1971). Difethialone is the first representative of a new anticoagulant chemical family called hydroxy-4 benzothiopyranones (Lechevin and Poch, 1988). Difethialone being of French origin (Lipha SA), the pharmacological and toxicological properties were reported by Lechevin (1986), as well as the activity of the compound in commensal rodents (Lechevin 1987b) and on several field species (Lechevin 1987a). Difethialone was introduced as a second generation anticoagulant in 1986 for that resistant to first-generation anticoagulant. With the second anticoagulant generation, the Norway rats developed difenacum, resistant in England and Denmark (Brooks and Rowe, 1987), roof rats developed difenacum resistant to in France and England and house mouse developed resistance in Denmark, Sweden, United Kingdome and Canada. Difethialone formula was whole grain cereals and husked oat grain baits containing 0.0025 % active substance

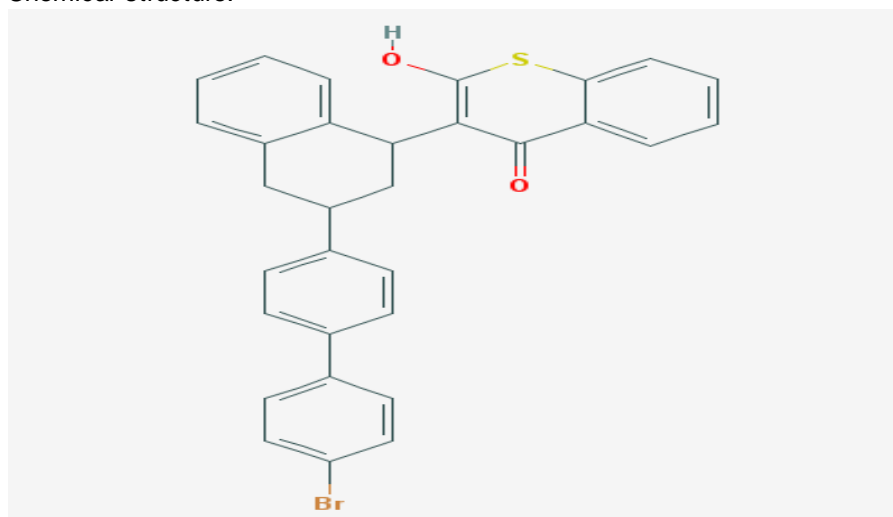
## MATERIALS AND METHODS

### Chemical:

Rodenticide Difethialone

Chemical name: hydroxy-4 benzothiopyranones

Chemical structure:



Rodent species were examined in the present work; the white *Rattus norvegicus* and *Rattus rattus* were trapped from group A and group B ; which free from any rodenticide applications. The trapped animals were carefully transported as possible to the laboratory where provided with suitable accommodation for about 3 weeks before being tested. During that they were individually cages 25 x 35 x 15 cm high with wire floors supported on a tray and given a daily supply of water and standard laboratory diet. The

method described by Rifaat *et al.*, (1969) for capturing and transporting of rodents was followed. The study covered the years 2012 and 2013. The standard wire box traps were deodorized by cleaning with hot water and soap before use. Traps were baited, distributed in sunset. Collected next morning and transported to laboratory. Rats were kept for two weeks before being tested, during this period they were caged individually and were given water and normal diet. Two days before testing, the rats' weight and sex were determined. Immature ones (less than 150 gm for *R. rattus* and 100 gm for *R. norvegicus*). Pregnant females and unhealthy rates were excluded (W. H. O., 1982) rodent strain (*R. norvegicus* and *R. rattus*) from group A and group B were carried under laboratory conditions. Difethialone 0.0025 % anticoagulant rodenticide in bait was used over 1.2 and 3.0 days non-choice feeding test. The amount of anticoagulant bait eaten was recorded daily and food pots were replenished each day with fresh poison bait. After the completion of feeding rats were fed on normal laboratory diet. Day of death was recorded.

## RESULTS AND DISCUSSION

From the obtained data in Table (1), the weight of *R. norvegicus* and *R. rattus* in both group A and group B were differed for both male and females in each region. The weight of *R. norvegicus* was 240 and 230 g, respectively, but *R. rattus* weighted 166.9 and 155.0 gm, respectively in group A. In group B, the recorded weight was 238 and 229 gm for *R. norvegicus* and 167.3 and 165.7 gm for *R. rattus*, respectively. In this study, the 0.0025 % Difethialone was recorded on some Egyptian areas. Data in Tables (1, 2 and 3). Within one day non-choice feeding test data in Table (1) showed that it caused mortality ranged between 60 – 70 % for *R. norvegicus* and 50 – 60 % for *R. rattus* for both sexes group A and group B. The higher intake values of active ingredient for died rats recorded to the males of *R. rattus* group A (1.45 mg/kg) while males of *R. norvegicus* group A recorded the lower value (0.77 mg/kg). On the other hand, the higher mean death time to in this respect was recorded to the males of *R. norvegicus* group B (8.5 days), while the lower value was recorded for females of *R. rattus* group B that the more of feeding days test, the time to death decreased.

In Table (2) dose Difethialone 0.0025 % within 2 days non-choice feeding test caused mortality 70-80 % for both species group A and group B. The mean intake values of active ingredient were more in *R. rattus* than *R. norvegicus*. The higher intake values of died animals was recorded for male of *R. rattus* group A (2.25 mg/kg), while the lower values was recorded for the female of *R. norvegicus* group B (1.39 mg/kg). On the other hand, the mean values of time to death in this respect showed that male of *R. rattus* group A recorded the higher values (6.16 days), while females of *R. norvegicus* group A recorded the lower value (4.75 days).

In the present study, Difethialone 0.0025 % in diet within 3 days non-choice feeding test Table (3) caused complete mortality for both sexes of *R. norvegicus* and *R. rattus* group A and group B, indicating that they were

susceptible to Difethialone 0.0025 %. The bait consumption and corresponding active ingredient intake was more in *R. rattus* than *R. norvegicus*. The mean intake values for *R. rattus* being 3.10 and 2.64 mg/kg group A and 2.63 and 2.65 mg/kg group B for males and females, respectively and for *R. norvegicus* 1.93 and 2.29 mg/kg group A and 2.14 and 2.09 mg/kg group B for males and females, respectively. The death time was taken as a parameter for anticoagulant efficacy on treated rats. Males of *R. norvegicus* group A recorded the higher mean values (6.6 days), while males of *R. rattus* group A recorded the lowest mean value (5.7 days).

The obtained results agreed to Saxena and Sahni (2008) who reported that Difethialone 0.0025 % against *Tatera indica*, *Merrioncis hurrianae*, *Bundicata bengalesi* and *R. rattus* in the Muhama and Sanganer Villages of Jaipur City, India was very effective in controlling the increasing rodent population in field crops with efficacy of 92.13 %. Vipin chaudhury and Tripathis (2006) indicated that Difethialone 0.0025 % was an effective single-dose anticoagulant rodenticide for managing rodents *Tatera indica*, *R. cutchicus* and *Merrioncs hurrianae*. Sampled from Rajasthan, India Tanikaw *et al.*, (2006) reported that when Difethialone 0.0025 % was given to the warfarine-resistance *R. Rattus* (Japan) all rates tested died within 4 days after eating a.i. 10 mg/kg. On the other hand, when Difethialone 0.0025 % was given to the warfarine susceptible roof rats. All rats were killed after eating a .i. 1.7 mg/kg in average for 24 hours exposure. In Egyptian many investigators studies the susceptibility and resistance of first and second generation anticoagulant rodenticides (El-Bahrawy and Morsy, 1990), Mikhail *et al.*, (2007) showed that complete mortality was showed for *R. norvegicus* and *R. rattus* within standard feeding period (6- days) after treatment with bromadiolone, difencoum and coumatetraly trapped from Qaluobia Governorate indicated to be susceptible to the three anticoagulant rodenticides. Zidan *et al.*, (1997) indicated that *R. rattus* and *R. norvegicus* trapped from Qaluobia were susceptible to warfarine and flocaumafen. El-Deeb *et al.*, (1999) studied the susceptibility level of warfarine to different population of *R. rattus* from 4 districts at Beni-Suief Governorate. They showed that the animals trapped from Beba Center, showed a noticeable tolerance to warfarine, while that trapped from Beni-Suief district, exhibited more susceptible. Marshall (1992) evaluated The experimental rodenticide difethialone was evaluated against free ranging indoor/outdoor populations of Norway rats and house mice under a variety of conditions where natural food sources were abundant Rodenticide formulations are considered effective in the field when they demonstrate a minimum 70% reduction in activity when measured by two independent methods, and by capture of no more than 1 target rodent per 10 traps set. Abdel-Hamid and Mikhail (2010) found that complete mortality was obtained for *R. norvegicus* and *R. rattus* within standard non-choice feeding test for (4 days) when using bromadiolone anticoagulant rodenticide.

**Table (1): Criteria for *Rattus norvegicus* and *R. rattus* feeding one day on 0.0025 % Difethialone**

Area		Mean of body weight g.		Dose consumed (mg/kg)		Death day		% Mortality
		Males	females	Males	females	Males	females	
Group A	<i>R. norvegicus</i>	340	267.2	0.92	0.32	8.5	7.0	70
	<i>R. rattus</i>	157	142	1.45	0.77	8.6	6.69	60
Group B	<i>R. norvegicus</i>	273	202	0.82	0.77	8.6	7.1	60
	<i>R. rattus</i>	147	164	1.07	1.11	8.5	6.4	50

**Table (2): Criteria for *Rattus norvegicus* and *R. rattus* feeding for 2-days on 0.0025 % Difethialone**

Area		Mean of body weight g.		Dose consumed (mg/kg)		Death day		% Mortality
		Males	females	Males	females	Males	females	
Group A	<i>R. norvegicus</i>	309	218	2.19	1.89	4.77	5.9	80
	<i>R. rattus</i>	166.0	160	2.25	1.96	6.16	4.75	80
Group B	<i>R. norvegicus</i>	260	255	1.87	1.39	5.3	5.1	80
	<i>R. rattus</i>	199	175	1.69	2.13	5.2	5.36	80

**Table (3): *Rattus norvegicus* and *R. rattus* fed for 3- days on 0.0025 % Difethialone**

Mean of body weight g.		Area		Dose consumed (mg/kg)		Death day		Mortality %
Males	Females			Males	Females	Males	Females	
240.0	230.0	Group A	<i>R. norvegicus</i>	19.3	2.29	6.6	5.7	100
166.9	155.0		<i>R. rattus</i>	3.1	2.64	5.7	6.4	100
238.00	229	Group B	<i>R. norvegicus</i>	2.14	2.09	6.1	6.0	100
167.3	165.7		<i>R. rattus</i>	2.63	2.65	6.0	6.0	100

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## تأثير مبيد الفئران Difethialone على الفأر *Rattus rattus* والفأر النرويجي *Rattus norvegicus* معمليا.

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - دقى - جيزة - مصر

اجريت هذه الدراسة لدراسة تأثير مبيد الفئران % 0.0025 Difethialone على كلا من الفئران *Rattus rattus* و *R. norvaegicus* حيث ادى استخدام المبيد بجرعات ١.٩ و ٣.١ مللى جرام / كيلو جرام على كلا من *R. rattus* و *R. norvegicus* وذلك للفئران المجموعة أ (محافظة القاهرة) وبالجرعات ٢.١٤ و ٢.٦٣ مللى جرام / كيلو جرام للفئران المجموعة ب (محافظة الجيزة) الى اعطاء نسبة موت فى الفئران مقدارها ١٠٠ % بعد ثلاث ايام من المعاملة وذلك للافراد الذكور من الفئران اما الفئران الاناث فقد حدث لها نفس نسبة الموت ولكن عند استخدام الجرعات ٢.٢٩ و ٢.٦٤ مللى جرام / كيلو جرام للفئران المجموعة أ و ٢.٠٩ و ٢.٦٣ مج / كيلو جرام للفئران المجموعة ب وذلك بالنسبة للافراد الاناث. من ناحية اخرى قلت نسبة الابدادة او الموت فى افراد الفئران محققة نسبة مقدارها ٧٠ و ٦٠ و ٦٠ و ٥٠ % عند استخدام الجرعات ٠.٩٢ و ١.٤٥ مللى جرام / كيلو جرام للمجموعة أ لكلا الفئران على الترتيب ، و ٠.٨٢ و ١.٠٧ مج / كيلو جرام للفئران المجموعة ب على الترتيب وذلك بالنسبة للافراد الذكور اما الاناث فقد استخدمت الجرعات ٠.٣٢ و ٠.٧٧ مللى جرام / كيلو جرام فى القاهرة و ٠.٧٧ و ١.١١ مج / كيلو جرام للافراد التى تم جمعها من محافظة الجيزة لكى تعطى نفس نسبة الابدادة. ايضا اتضح من النتائج المتحصل عليها ان نسبة الموت وصلت الى ٨٠ % بعد يومين من المعاملة لكلا من الذكور والاناث عند استخدام مبيد % 0.0025 Difethialone بجرعات ٢.١٩ و ٢.٢٥ مللى جرام / كيلو جرام للذكور فى المجموعة أ و ١.٨٧ و ١.٦٩ مللى جرام / كيلو جرام لنفس ذكور الفئران المجموعة ب وكانت نفس نسبة الابدادة موجودة للافراد الاناث ولكن عند استخدام الجرعات ١.٨٩ و ١.٩٦ مج / كيلو جرام للفئران المجموعة أ و ٥.٣ و ٥.٢ مللى جرام / كيلو جرام للفئران المجموعة ب.