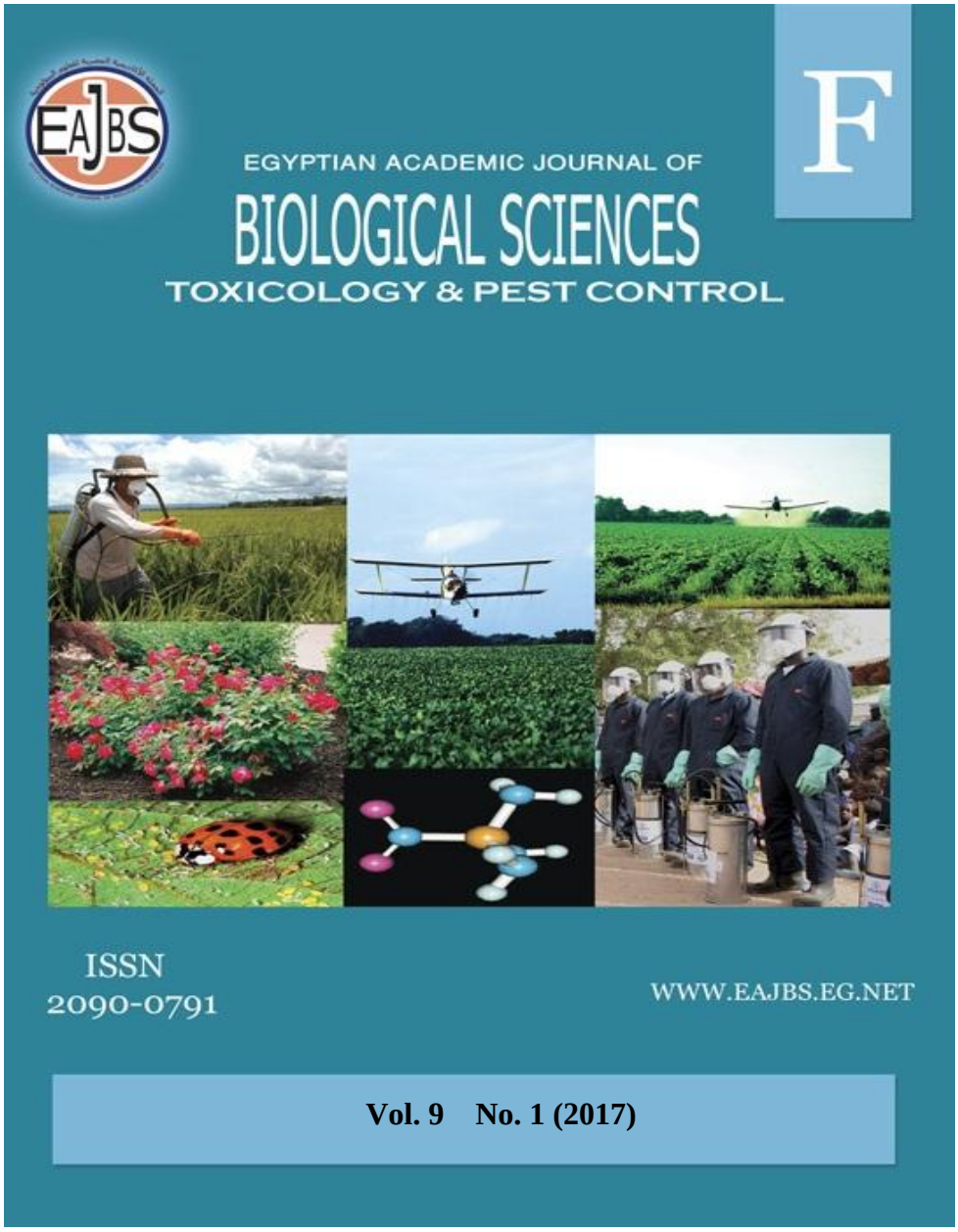

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Evaluation of Rodenticide Bromadiolone and Chlorophacinone in Controlling Rodent Infestation at Al-Wadi Al-Gadeed Governorate in Egypt.

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ABSTRACT

Rodent species was surveyed during the four seasons of 2014 and 2015 years, in four locations (El-Kharga at sherka sabaa (the company seven) area, El-Dakhla at Elrashda and Gharb El-Mawhob villages and El-Farafra at bir sitta (the sixth well) area) at Al-Wadi Al-Gadeed governorate of Egypt which located in the southwestern part of the country, in Egypt's Western Desert, part of the Sahara Desert between the Nile, northern Sudan, and southeastern Libya Which represented about 44% of the area of Egypt. Cultivated area about 108067 feddan. Six rodent species, *Rattus rattus, Rattus norvegicus, Acomys cahirinus, Meriones libycus, Gerbillus gerbillus* and *Gerbillus campestris* were founded. *R. rattus* and *R. norvegicus* were more abundant species in the four seasons (spring, summer, autumn and winter) than other species. Rodent damage assessment to some field crops as wheat, maize, broad beans and tomato in mature stage was carried out. The highest damage was in maize, broad beans and tomato in all studied area and the lowest damage was in wheat in all studies area during 2014 and 2015. On the other hand, the efficacy of bromadiolone and chlorophacinone anticoagulant rodenticides against rodent was tested under field conditions. The field results revealed that, Bromadiolone achieved 86.44% population reduction in maize crop followed by 79.0% for chlorophacinone compound. Also, the population reduction of rodent in broad bean was 87.6% by bromadiolone and 80.59% by chlorophacinone. In case of tomato, bromadiolone gave 87.68% population reduction followed by 81.87% for chlorophacinone compound.

INTRODUCTION

Rodents are considered as one of the most important pest groups in Egypt. It causes great economic losses. It grows through almost any object to obtain food and shelter. Rodents are involved in the transmission and dissemination of many parasites and diseases to man and his domestic animals. Estimation of mean damage by rodents in peanut revealed a complete damage to 0.85% of the plants and partial damage to 3.50% of the plants. Most of the damage occurred between 80 to 120 days after planting Parshad *et al.* (1987). Crop is damaged mainly by the three to four rat species which are considered economically important Pervez *et al*. (2005). Reducing rodent damage in agriculture with using of rodenticides. Because of land reclamation, different wild rodent species disappeared and appeared common species from the old lands.

The present work aims to study

1- Survey of different rodent species in Al-Wadi Al-Gadeed Governorate as a new reclaimed land.
2- Damage assessment of rodent to wheat, maize, broad beans and tomato crops.
3- Efficacy of bromadiolone and chlorophacinone anticoagulant rodenticides against rodent under field condition.

MATERIALS AND METHODS

Experimental area:

This work was conducted in four farms (five Feddans each) at in four location (El-Kharga at sherka sabaa (the company seven) area, El-Dakhla at Elrashda and Gharb El-Mawhob villages and El-Farafra at bir sitta (the sixth well) area) at Al-Wadi Al-Gadeed governorate at Western desert. Studied area in the present work contained hundreds feddans planted with different field crops i.e. wheat, maize, broad bean, clover and some vegetables and fruits i.e. tomato, orange, palm and grape. Also, there are many rural houses, buildings and some cattle and bird farms. There are many wells, irrigation and drainage canals.

Survey and seasonal abundance of rodent species:

Seasonal survey was carried out in the four locations representing different habitats (village houses. cattle farms, bird farms, and citrus orchards). Rodent collections were done over four days in each month, January, April. July and October during 2014 & 2015 seasons. Fifty wire-box traps with spring doors were distributed in five sites. The traps in each habitat were baited with fresh falafel (minced horse bean fried in oil) and tomato slice. In all cases, the traps were baited daily and left from 6.0 P.M. to 7.0 A.M. every morning, traps were checked to collect the caught rats. The trapped rodents were identified. Number of the individuals of each rodent species was recorded for each tested habitat according to Osborn and Helmy (1980).

Assessment of damage caused by rodents to some field crops: -

The damage assessment techniques were done as follows: -

a- Wheat fields:

Two feddans, were randomly chosen. In each field 25 samples were investigated by using quadrate wooden frame (40 X 40 cm) on the diagonal of the field at fixed distance according to its length. The number of damaged and undamaged tillers inside the frame for every signed spot were counted. The percentage of damage was calculated according to Poche *et al*, (1982) by the equation.

$$\text{Damage percentage} = \frac{\text{Number of damaged tillers}}{\text{Total number of investigated tillers}} \times 100$$

b- Maize fields:

Two feddans, were randomly chosen; from which ten samples (each containing 30 maize plants) were randomly chosen and checked to estimate the degree of damage in their ears according to Hamelink (1981). The percentages of damage were calculated using the following equation.

$$\%damage =$$

c- In broad beans and tomato:

Two feddans were randomly chosen to assess damage in every crop. In each field, 10 rows were randomly selected. The number of damage and undamaged pods in 30 successive plants

in each row counted (El-Deeb, 1990). The mean percent damage per crops were calculated according to Kuehenert (1986), using the following equation:

$$\%\ damage = \frac{\text{Total number of damage pods}}{\text{Total number of investigated pods}} \times 100$$

Anticoagulant rodenticides:

Two anticoagulant rodenticides were used in this study, Bromadiolone (super caid) and Chlorophacinone (caid) obtained from KZ pesticides company, Egypt.

6.4) Rodenticide performance under field conditions

The field performance was evaluated for the previous tested compounds under field conditions in El-Kharga district, Al-Wadi Al-Gadeed Governorate during 2015. After harvest crops, an infested area was chosen and divided into plots represent the number of the tested compounds (each of 2 feddans). One plot was left untreated as a check control in each area. The population density of rodents was estimated. Pre and post treatment using food (Crushed Maize) consumption method. Five kg from Crushed Maize were divided and distributed inside 25 clay bait stations (12cm. in diameter and 50 cm. in length) in each plot for 5 successive days. Food consumption was calculated pre and post treatment. The average of food consumption in the last two days was determined. The surplus baiting technique was used for multi dose (Chlorophacinone). The consumed bait was replaced every three days until bait consumption stopped. Regarding the single dose anticoagulant rodenticides (Bromadiolone), pulse baiting technique was used according to Dubock (1982). The efficiency of tested compounds in the present study was tested against rodents to examine their performance under field conditions. The consumed amount of bait was replaced weekly for three times only. The consumed amount of each tested compound was determined. One week after the poison bait was removed; the population reduction of rodents was calculated using the same method mentioned above as the following equation:

Population reducti

RESULTS

Survey of rodent species:

Data in Tables (1&2) at years 2014 and 2015 showed six rodent species were recorded, the first species was, *Rattus rattus*, 41 and 41 individuals in spring, 63 and 70 individuals in summer, 33 and 41 in autumn, 88 and 99 individuals in winter. The second species was, *Rattus norvegicus*, 27 and 33 individuals in spring, 35 and 52 individual in summer, 19 and 31 individuals in autumn & 38 and 46 individuals in winter. The third species was, *Acomys cahirinus*, 6 and 6 individuals in spring, 6 and 3 individuals in summer, 10 and 12 individuals in autumn & 9 and 7 individuals in winter. *Meriones libycus* came in the fourth place with 2 and 5 individuals in spring, 2 and 5 individuals in summer, 3 and 7 individuals in autumn & 1 and 5 individuals in winter, *Gerbillus campestris*, ranked the five with 6 and 6 individuals in spring, 3 and 5 individuals in summer, 3 and 0 in autumn & 4 and 0 in winter. *Gerbillus gerbillus* came in the last with 14 and 15 individuals in spring, 2 and 5 individuals in summer & 0 and 0 individual in autumn & 8 and 0 in winter.

Table 1: Survey of rodent species in different locations of Al-Wadi Al-Gadeed Governorate during 2014.

season	Rodent species / Location	*Rattus rattus*	*Rattus norvegecus*	*Acomys cahirinus*	*Merionus libycus*	*Gerbillus campestris*	*Gerbillus gerbillus*
Spring	Sherka sabaa	17	12	3	1	3	7
	Elrashda	12	7	-	-	3	4
	G. El-Mawhob	7	4	-	-	-	-
	Bir sitta	5	4	3	1	-	3
Total		41	27	6	2	6	14
Summer	Sherka sabaa	29	17	3	1	3	1
	Elrashda	17	15	3	1	-	1
	G. El-Mawhob	4	3	-	-	-	-
	Bir sitta	13	-	-	-	-	-
Total		63	35	6	2	3	2
autumn	Sherka sabaa	13	9	6	2	3	-
	Elrashda	9	5	3	1	-	-
	G. El-Mawhob	5	3	-	-	-	-
	Bir sitta	6	2	1	-	-	-
Total		33	19	10	3	3	0
winter	Sherka sabaa	47	19	4	-	3	7
	Elrashda	33	12	4	-	-	-
	G. El-Mawhob	-	-	-	-	-	-
	Bir sitta	8	7	1	1	1	1
Total		88	38	9	1	4	8
Grand Total		225	119	31	8	16	24

Table 2: Survey of rodent species in different locations of Al-Wadi Al-Gadeed Governorate during 2015.

season	Rodent species / Location	*Rattus rattus*	*Rattus norvegecus*	*Acomys cahirinus*	*Merionus libycus*	*Gerbillus campestris*	*Gerbillus gerbillus*
Spring	Sherka sabaa	19	15	4	1	2	6
	Elrashda	11	9	-	1	4	3
	G. El-Mawhob	5	4	-	1	-	2
	Bir sitta	6	5	2	2	-	4
Total		41	33	6	5	6	15
Summer	Sherka sabaa	34	29	2	1	3	1
	Elrashda	19	16	1	1	2	3
	G. El-Mawhob	6	4	-	1	-	-
	Bir sitta	11	3	-	2	-	1
Total		70	52	3	5	5	5
Autumn	Sherka sabaa	15	13	5	1	-	-
	Elrashda	11	9	3	1	-	-
	G. El-Mawhob	8	4	1	2	-	-
	Bir sitta	7	5	3	3	-	-
Total		41	31	12	7	0	0
Winter	Sherka sabaa	52	27	3	1	-	-
	Elrashda	35	13	2	2	-	-
	G. El-Mawhob	3	1	1	1	-	-
	Bir sitta	9	5	1	1	-	-
Total		99	46	7	5	0	0
Grand Total		251	162	28	22	11	20

The dominant species were *Rattus rattus* and *Rattus norvegicus* in all study areas; El-Kharga, El-Dakhla, Gharb El-Mawhob and El–Farafra districts.

Assessment of rodent damage to some crops:

Data in Table (3) showed the average damage percentages caused by dominant rodent species. Damage in wheat crop was 1.02% in Sherka sabaa, 0.96% in Elrashda, 0.88% in Gharb EL-Mawhob and 0.83% in Bir sitta in season 2014. While in season 2015 the damage

was 0.69%, 1.11%, 0.98% and 0.75% for the same locations, respectively in season 2015. Also, the average damage percentages in maize was 20.7% in Sherka sabaa, 15.56% in Elrashda, 13.59% in Gharb El-Mawhob and 15.1% in Bir sitta in season 2014, but the average damage percentages in maize was 17.37%, 16.23%, 14.44% and 13.89%, respectively in season 2015. In bean the average damage percentages in maize was 15% in Sherka sabaa, 18% in Elrashda, 9% in Gharb EL-Mawhob and 21% in Bir sitta in season 2014, but the average damage percentages in maize was 11.1% in Sherka sabaa, 12% in Elrashda, 6.8% in Gharb El-Mawhob and 27% in Bir sitta in season 2015.

In tomato the average damage percentages in corn was 12.3% in Sherka sabaa, 13.4% in Elrashda, 7.6% in Gharb El-Mawhob and 15.3% in Bir sitta in season 2014, but the average damage percentages in tomato was 10.6% in Sherka sabaa, 10.2% in Elrashda, 5.8% in Gharb EL-Mawhob and 12.4% in Bir sitta in season 2015.

Table 3: Assessment of rodent damage % to wheat, maize, broad bean and tomato in Al-Wadi Al-Gadeed Governorate seasonally in 2014 & 2015.

Crop	Location / years	Sherka sabaa	Elrashda	Gharb El-Mawhob	Bir sitta
wheat	2014	1.02	0.96	0.88	0.83
	2015	0.69	1.11	0.98	0.75
maize	2014	20.7	15.56	13.59	15.1
	2015	17.37	16.23	14.44	13.89
broad bean	2014	15	18	9	21
	2015	11.1	12	6.8	27
tomato	2014	12.3	13.4	7.6	15.31
	2015	10.6	10.2	5.8	12.4

Field studies:

The results in Table (4) noted that the population reduction % of rodents in maize was 86.44 by Bromadiolone and 79.0 by Chlorophacinone. While population reduction % in broad bean was by 87.6 Bromadiolone and by 80.59 Chlorophacinone. But population reduction % in tomato was by 87.68 Bromadiolone and 81.87 by Chlorophacinone.

Table 4: Field performance of Bromadiolone 0.005% and Chlorophacinone 0.005% against rodent in in El-Kharga district at 2015.

crop	Compound	Bait consumption g / feddan			population reduction %
		Pre-treatment	Treatment	Post-treatment	
maize	Bromadiolone	1420	1015	192.5	86.44
	Chlorophacinone	1190	1007.5	250	79.0
broad bean	Bromadiolone	1210	860	150	87.6
	Chlorophacinone	1752	1252	340	80.59
tomato	Bromadiolone	1680	1180	207	87.68
	Chlorophacinone	1340	940	243	81.87

DISCUSSION

Survey of rodent species in the studied area were conducted to know types of rodents. *Rattus rattus* being the dominant species, this may be due to the presence of or attributed to the availability of food and shelter as well as, preferred trees for nesting. On the other hand, this may be due to the interspecific competition between this species and other species. The population of rodent species at the second year was

higher than the first year; this may be due to the changes of the environment in Egypt, by reclamation of the desert and increase in the cover plant in this area, which invariably have a great effect in the distribution of rodent species on abundance in the study area (El-Sherbiny, 1987; Desoky, 2007; Abdel-Gawad, 2010). The difference in species composition of rodents depends on locality, neighboring, habitat type, interspecific compotation and preferred food (Desoky *et al*., 2014). Identification of rodent species in the study area can be used in the development of a future plan in effective strategy for implementation of rodent management programs in newly reclaimed land in Egypt Desoky (2016). The results agree with Hegab *et al.* (2013) who recorded that five species in 2005 & 2006 at three different habitats in El-Ibrahimia district, Sharkia Governorate. Metwaly *et al.* (2009) indicated that seven rodent species at Beheria governorate. Shenbrot *et al.* (2010) recorded that 13-rodent species in five habitats in Negev desert. Abd- El-Kawi (2005) found that Norawy rat was the highest number in house habitats of Assiut governorate. Ahmed (2007) noted that survey of rodent species in three habitats at Menofia government, the dominant species was Norway rat and roof rat. The common and abundant species were 9 species in summer. The damage was due to rodents was determined in some field crops i.e. wheat, corn and tomato as winter crops and, bean as summer crops during the mature stage of these crops. The rat damage to field crops depends upon the cultivated crops, growth stage, the distance of the attacked plant from the border of the field and the rat density. These results agree with El- Deeb *et al.* (2008) who recorded that the damage in some field crops i.e. maize, rice as summer crops and wheat, broad bean as winter crops due to rodent. The damage percentage was high in maize, rice as summer crops and wheat and broad bean as winter crops due to density of rats (Ahmed 2007). The efficacy of the tested compounds differed from one to another according to the type of compound, its chimical structure and concentration. These results agree with Farghal *et al.* (2000) in Qena Governorate studied the toxicity of three anticoagulant i.e. Farobaid, Caid and Supercaid against *A. niloticus* under field conditions, Farobaid gave complete control to *A. niloticus* inhabited tomato field after 20 days of treatment. Supercaid reduced 77.3% of *A. niloticus* population in sugarcane field. Caid gave 59% reduction in *A. niloticus* inhabited sugarcane. Desoky (2013) noted that the control of rodent was using the two compounds supercaid and Zinc phosphide. The rodent activity significantly reduced (90-96%) after five applications of all the rodenticide baits except for zinc phosphide treatment where it reduced to 76.04%. The pattern of rodent activity reduction after bait applications was similar in all cases except for bromethalin. This may be due to delayed mortality, a characteristic of it, or initial extended exploration period Khan (2007). Desoky (2016) recorded that effect of warfarin, diphacinone and chlorophcinone against rodent in Upper Egypt. As general Anticoagulant are very toxic and can usually kill within several days of a single dose more than multi dose.

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ARABIC SUMMERY

تقييم مبيدى بروماديلون وكلوروفاسينون في مكافحة القوارض في محافظة الوادى الجديد بمصر

هانى أحمد عبد العاطى أحمد

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة – مصر.

تم اجراء حصر لأنواع القوارض خلال الأربعة مواسم (الربيع والصيف والخريف والشتاء) عامي ٢٠١٤ و٢٠١٥ في أربعة مواقع (الخارجة بمنطقة شركة سبعة، الداخلة بقريتي الراشدة وغرب الموهوب، الفرافرة بمنطقة بير ستة) بمحافظة الوادى الجديد والتي تقع في الجنوب الغربى لمصر كجزء من الصحراء الغربية ويحدها النيل شرقا والسودان جنوبا وليبيا غربا والتي تمثل حوالى ٤٤% من مساحة مصر٠ المساحة المنزرعة حوالى ١٠٨٠٦٧ فدان. تم حصر ستة أنواع من القوارض (الجرذ المتسلق، الجرذ النرويجى، الفأر الشوكى المصرى، الجرد الليبى، الجربيل الصغير، جربوع شمال افريقيا). الجرذ المتسلق والجرذ النرويجى كانت أكثر الأنواع انتشار في الأربعة مواسم من الأنواع الأخرى. تم اجراء تقدير للخسائر التي تسببها القوارض في بعض المحاصيل مثل القمح والذرة والفول والطماطم وكانت اعلى نسبة خسارة في الذرة والفول والطماطم في كل مناطق الدراسة بينما كان القمح الأقل تضرر وذلك خلال عامي ٢٠١٤ و٢٠١٥. تم اختبار فعالية مبيدى البروماديلون والكلوروفاسينون المضاد للتجلط على القوارض تحت الظروف الحقلية. أظهرت النتائج الحقلية انخفاض في تعداد القوارض في الذرة بنسبة ٨٦,٤٤% بالبروماديلون و٧٩% بالكلوروفاسينون وكانت نسبة خفض التعداد في الفول ٨٧,٦% بالبروماديلون و٨٠,٥٩% بالكلوروفاسينون بينما كانت نسبة خفض في تعداد القوارض في الطماطم ٨٧,٦٨% بالبروماديلون ٨١,٨٧% بالكلوروفاسينون٠