

Evaluation of damage caused by some species of rodents on sugar cane and sugar beet

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Abstract

The damage caused by the Nile grass rat, *Arvicanthis niloticus* (Desmarest) and the white bellied rat, *Rattus rattus frugivorus* (Rafinesque) on sugar cane variety G.T. 54-9 was evaluated in three areas (Al-Hasany ; Al shek wify and Ber El-Nos) at Qena Governorate during 2014 and 2015. The highest infestation was recorded in Ber Elnos area while Al-Hasany showed the lowest infestation during the two seasons. The percentage of infestation in sugar cane was higher in the first season than that in the second. The damage caused by *A. niloticus*, *R. r. frugivorus* and *Rattus rattus alexandrines* (Geoffroy) on sugar beet was high in Assiut district during two cultivation seasons.. The losses in sugar beet weight was due to the damage caused by the three rodent species was (10.7, 10 and 6.7%) and (6.7, 6 and 4%) for the two seasons. The damage was concentrated at the upper part of the root.

Keywords: Rodents damage, sugar cane, sugar beet.

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Introduction

Rodent pests were a major constraint on agricultural production in Egypt and in many countries of the world. They may damage sugar cane *Saccharum officinarum*, and sugar beet *Beta vulgaris*, from the time of planting through harvesting, and cause additional waste by contamination (Bakri-Eman, 2004; Zhang & Zhang, 1999; El-Nashar, 1998; Engeman et al., 1998; Brodie & Webster, 1997; Ali & Farghal, 1995; Ali & Farghal, 1994; Brooks et al., 1989; Abd El-Gawad et al., 1982; Abd El-Gawad, 1974). Rodent attacked sugar cane and sugar beet from the beginning of agriculture until harvest which leads to lower quality juice and the percentage of sucrose and productivity per feddan (feddan = 1.038 acres). As well as the productivity of sugar per feddan in all growing seasons. The annual loss in sugar cane crop caused by *A. niloticus* was estimated by 5-8% in weight. The proportions of rat damaged mill able stalk averaged 23.99% and of dead stalks (due to damage) 7.17% in non-baited fields while in baited fields, rat damaged mill able stalks averaged 13.53 % and of dead stalks 3.85% (Porguez & Barredo, 1978). Rodent damage to sugar cane in Upper Egypt was estimated by 20 to 40 % reduction in yield, and 30 % in final sucrose in the infested stalks of sugar cane (Abazaid, 1990). In North California rodents attacked 27% of all roots of sugar beet fields and caused 9% loss in total production (Salmon et al., 1984). Losses to sugar beet root yield by rats were about (47.33 and 39.33 kg.) and (51.54 and 43.33 kg.) during cultivation seasons (2004 / 05 and 2005 / 06) at Assiut and El-Minia Governorates, respectively (Bakri-Eman & Al-Gendy, 2009). The present study was planned to evaluate the damage caused by rodents on sugar cane

and sugar beet at Assiut and Qena Governorates.

Materials and methods

Studies on rodent survey showed that, *R. r. frugivorus* and *A. niloticus* in EL-Dahasa village, Farshut district at Qena governorate, Egypt while *A. niloticus*, *R. r. frugivorus* and *R. r. alexandrinus* were found in Assiut, Abo-Tig districts, and Bany-Adivillage at Assiut governorate, Egypt. The damage assessment technique was done as follows:

Sugar cane, *Saccharum officinarum* L.:

To determine the damage caused by rodents on sugar cane planted in three areas (Al-Hasany, Al shekwefy and Ber El-Nos) from EL-Dahasa village at Qena Governorate. The variety was, G.T. 54-9. The experiment was laid out in a randomized block design with 3 replications for each variety was 6x7 meter plots (1/100 of feddan) (feddan = 1.038 acres). At the harvest time three random samples (each one 30 stalks) representing each variety were taken from the plant cane. The stalks were carefully examined to determine the percentage of rodent damage. The percentage of damage was calculated using the following equation.

$$\text{Damage \%} = \frac{\text{Number of infested internodes}}{\text{Total number of internodes}} \times 100$$

Sugar beet, *Beta vulgaris* L.:

To determine the damage caused by rodents on sugar beet, *Beta vulgaris* Linn., planted in Assiut, Abo-Tig districts, and Bany-Adi village at Assiut Governorate. The variety was Golorya,

The experiment was laid out in a randomized block design with 3 replications (6x7 meter plots, 1/100 of Feddan). At the harvest time three random samples (each one 30 root) were

taken from the plant beet. The root was carefully examined to determine the percentage of rodent damage. The percentage of damage was calculated using the following equation.

$$\text{Damage \%} = \frac{\text{Number of infested plant}}{\text{Total number of plant}} \times 100$$

$$\text{Reduction \%} = \frac{\text{Examined root weight or examined stalks weight} - \text{infested root weight or infested stalks weight}}{\text{Examined root weight or examined stalks weight}} \times 100$$

Data were analyzed according standard procedures for analysis of variance Duncan's (1955) and (Steel & Torrie, 1980).

Results and Discussion

Sugar cane: The damage caused by rodents in sugar beet and sugar cane crops show in figure (1). Data presented in Table (1) and figure (2) illustrated the rodent damage in variety G.T. 54-9 sugar cane planted at Qena Governorate during two successive years in three areas (Al-Hasany, Al shek wefy and Ber El-Nos). The percentage of rodent damage recorded in Ber El-Nos area was (8.8 and 7.3%) and Al shek wefy was (8.5% and

(7.2%). While the least damage was 7.9 % during and 6.5% in Al-Hasany area during the two seasons. The percentages of weight loss in sugar cane during 1st and 2nd years were (5.29 and 4.64%), (5.57 and 4.91%) and (5.94 and 5.15%) for the areas Al-Hasany, Al shek wefy and Ber El-Nos respectively. There was high significant difference between the damage percentage at Al-Hasany district and other two districts. No significant difference was recorded between Al shek wefy and Ber El-Nos during the first and second year of study. The present results were in agreement of that obtained by (Bakri-Eman & Al-Gendy, 2009; Bakri-Eman, 2004; Ali & Farghal 1995; Asran 1991; Abazaid, 1990; Abd El- Gawad et al., 1982).

Table 1: Damage caused by common rodents in sugar cane crops during two successive years at Qena governorate, Egypt.

Year	Areas	Infested internodes	Sound inter nodes	Damage (%)	Weight/kg.		
					Infested	Non infested	Damage (%)
1 st year	Al-Hasany	45 ^b	525	7.90	3.18 ^a	31.76	5.29
	Al shek	51 ^a	549	8.50	1.89 ^b	32.06	5.57
	Ber El-Nos	52 ^a	536	8.80	2.01 ^b	31.84	5.94
Total		148	1710	25.2	7.08	95.66	16.8
L.S.D.		5.22			3.15		
2 nd year	Al-Hasany	37 ^b	533	6.50	3.16 ^a	31.55	4.64
	Al shek	43 ^a	557	7.20	1.71 ^b	32.92	4.91
	Ber El-Nos	43 ^a	545	7.30	1.73 ^b	31.94	5.15
Total		123	1635	21	6.60	96.41	14.70
L.S.D.		3.01			2.33		

Means in each column followed by the same letters are not significantly different by (P=0.05) according to Duncan's multiple range test.



Figure 1: Damage caused by rodents in sugar beet (a and b) and sugar cane (c and d) crops.

Table 2: Damage caused by Rodents in sugar beet crops during two successive years at Assiut governorate, Egypt.

Year	Areas	Infested roots	Sound roots	Damage (%)	Weight/kg.		
					Infested	Non infested	Damage (%)
1 st year	Abo-Tig	2.00 b	28.00	6.70	2.15 b	44.3	4.63
	Assiut	3.20 a	26.80	10.70	3.87 a	50.97	7.1
	Bany Adi	3.00 a	27.00	10.00	3.44 a	50.71	6.35
Total		8.2	81.8	27.4	9.46	145.98	18.08
L.S.D.		0.87			0.92		
2 nd year	Abo-Tig	1.20 b	28.80	4.00	1.28 b	45.42	2.73
	Assiut	2.00 a	28.00	6.70	2.43 a	52.22	4.45
	Bany Adi	1.80 ab	28.20	6.00	2.03 ab	50.90	3.83
Total		5.0	85.0	16.7	5.74	148.54	11.01
L.S.D.		0.75			0.84		

Means in each column followed by the same letters are not significantly different by (P=0.05) according to Duncan's multiple range test.

Sugar beet: Data in Table (2) and Figure (3) illustrated the rodent damage in variety Golorya sugar beet at Assiut Governorate during two successive years

in three areas (A, B and C). The damage was concentrated at the upper part of the root, where the sucrose was high (Ali & Farghal, 1994). Results proved that the

least rodents damage was recorded in area (A) 6.7 % during 1st year and 4% during 2nd year (Fig. 3). While the highest damage was observed in (B area)

(10.7 and 6.7%) during 1st and 2nd years. The percentage of damage was in (10%) during 1st year and (10%) during 2nd year in area (C).

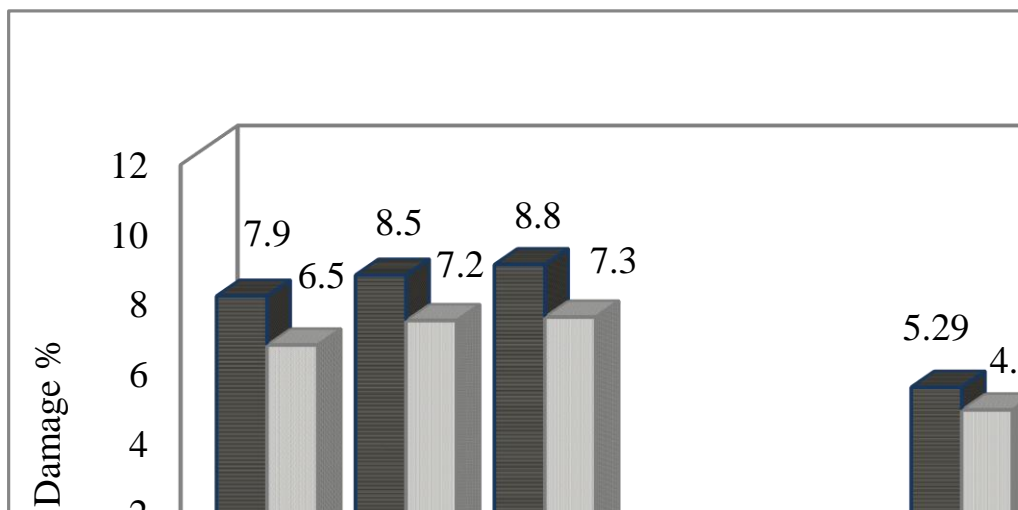


Figure 2: Percentage of damage on sugar cane at Qena governorate, Egypt.

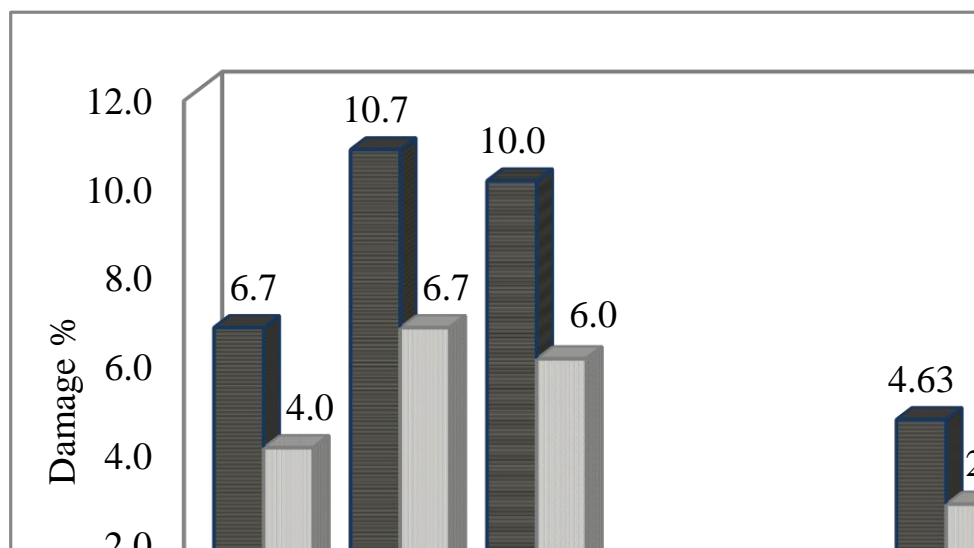


Figure 3: Percentage of damage on sugar beet at Assiut governorate, Egypt.

Also, weight damage percentage during 1st and 2nd years were (4.63 and 2.73%), (7.1 and 4.45%) and (6.35 and 3.83%) for areas A, B and C respectively. There were significant differences on damage caused by rodents in Assiut area, Bany-

Adi areas compared with Abo-Tig area in first year (Fig. 3). No significant difference between Bany-Adi compared with Assiut and Abo-Tig areas in the second year. These results were in harmony with results obtained by

Abazaid (1997) and Hussein and El-Deeb (1999) in sand soil and intercropping sugar beet with some essential crops.

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References

- Abazaid AA, 1990. Efficiency of some common used rodenticides and some alternatives against rodent in Qena Governorate. M.Sc. Thesis, Faculty of Agriculture, Assiut University, Assiut, Egypt, 93 p.
- Abazaid AA, 1997. Ecological and toxicological studies on rodent in Qena Governorate (Upper Egypt). Ph.D. Thesis, Faculty of Agriculture, Assiut University, Assiut, Egypt, 96 p.
- Abdel-Gawad KH, 1974. Ecological and toxicological studies on communal and house hold rodents in Assiut area. M.Sc. Thesis, Faculty of Agriculture, Assiut University, Assiut, Egypt, 91 p.
- Abdel-Gawad KH, Salit AM, Maher AA, 1982. Damage caused by rodents in sugar cane plantations. Assiut Journal of Agricultural Sciences **13**(2): 63–70.
- Ali MK, Farghal AI, 1994. Damage caused by rodents in beet plantation. Assiut Journal of Agricultural Sciences **25**(3): 210–213.
- Ali MK, Farghal AI, 1995. Damage caused by rodents to sugar cane varieties and juice quality in Sohag Governorate. Assiut Journal of Agricultural Sciences **26**(4): 231–237.
- Asran AA, 1991. Chronology of damage appraisal in some field crops caused by the Nile rat *Arvicanthis niloticus* in Minia Governorate. 4th Arab congress of plant protection, Cairo, Egypt, Vol. II: 509–512.
- Bakri-Eman AA, 2004. Ecological and toxicological studies on some rodent species infesting sugar cane crop. M.Sc. Thesis, Faculty of Science (Girls), Al-Azhar University, Cairo, Egypt, 178 p.
- Bakri-Eman AA, AL-Gendy AAR, 2009. Evaluation of damage caused by the Nil grass rat *Arvicanthis niloticus* (Des.), in sugar cane and sugar beet. Minufiya Journal of Agriculture Research **34**(1-2): 269–275.
- Brodie A, Webster K, 1997. Trees for timber and rat control in cane. BSES Bulletin **59**: 14–15.
- Brooks JE, Ahmed E, Hussain I, Khan MH, 1989. The agricultural importance of the wild boar (*Susscrofa* L.) in Pakistan. Vertebrate pest control project, Denver. Wildlife Research center, Denver, Colorado, USA. Tropical Pest Management **35**(3): 278–281.
- Duncan DB, 1955. Multiple ranged multiple F-tests. Biometrics **1**: 1–17.
- El-Nashar MA, 1998. Ecological and toxicological studies on some Egyptian rodents in certain traditional cultivated areas in some Governorates in Egypt. M.Sc. Thesis, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt, 62 p.

- Engeman RM, Tobin ME, Sugihara RT, Fall MW, Jackson WB, 1998. Relationships of rat damage to physical and yield characteristics of Hawaiian sugar cane Vertebrate. *International Biodeterioration & Biodegradation* **42**: 123–127.
- Hussein AHA, El- Deeb MA, 1999. Evaluation of intercropping faba bean, chickpea and lentil with sugar beet in Middle Egypt. *Arab Universities Journal of Agricultural Sciences* **7**(2): 475–482.
- Porquez PHJr, Barredo FC, 1978. Rat damage survey in the Victorias mill district. *Victories Agricultural Research Reports* **16**(21): 44–52.
- Salmon TP, Gorenzel WP, Lickliter RE, 1984. Severity and distribution of rodent damage to sugar beet. *Protection Ecology* **7**(1): 65–72.
- Steel RDD, Torrie JD, 1980. *Principle and procedures of statistics*. Mcgrow-Hill Book, Co., New York, 481Pp.
- Zhang Y, Zhang YX, 1999. Damage characteristics and control methods for the yellow rat. *Chinese Journal of Vector Biology and Control* **10**(2): 137–139.