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Seasonal distribution of rodent species on citrus farms in Sohag region, Egypt

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Abstract

The purpose of this study is to determine seasonality of rodent species infesting one of the main crops, oranges and mandarin, in three centers of Sohag region: Shandaweel, Tahta and Gerga distributed. The results showed that 3 genera, 1 family and 4 species were recorded in Sohag province, Egypt. Rodent species from different habitats in Sohag province. Among the rodents caught in Sohag, *Rattus rattus frugivorus* (Rafinesque) is the main species (283 and 378 in the first and second years, respectively), followed by *Rattus rattus alexandrinus* (Geoffray) (212 and 278 in the first and second year), this is followed by *Arvicanthis niloticus* (Desm.) (119 in the first and 202 in the second year), and then by *Mus musculus* (Linnaeus). The fewest species (109 in the first year, 117 in the second). On citrus farms, the index is highest in autumn and lowest in winter. Women tend to outnumber men. In two years of study, maturity passes the immaturity stage. The highest density of immature stages was seen in the spring, which may be related to the highest rates of rodent pregnancy that season.

Keywords: rodent, citrus, Sohag, Egypt.

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1. Introduction

White-bellied rat, *R. r. frugivorus* (Linnaeus), gray-bellied rat, *R. r. alexanderinus* (Linnaeus), and Nile rat, *A. niloticus*, and house mouse. The most prevalent invasive rodent in Egyptian citrus crops and citrus farms is *M. musculus* (Abd El Galil, 2019; Ahmed, 2017; Desoky and Baghdadi, 2019; Metwally *et al*., 2011). These rodents are the most destructive pests, who burrow, burrow, and gnaw nests in branches. They hurt fruit and branches directly. Through urine, excrement, and hair, they can have an indirect impact on fruit and twigs. In Egypt, rodents are regarded as one of the worst pests. According to Abdel Gawad and Farghal (1982), it is a significant source of financial loss for farmers (destruction of crops, stored products, poultry, and cattle). Rodents are one of the most significant vertebrate pests in relation to crop production, storage, and human and livestock use (Advani and Mathur, 1982). According to Cuong *et al*. (2002), it is the most significant agricultural mammalian pest in the world. In certain nations around the world, rodent damage results in significant agricultural losses and food shortages (Amusa *et al*., 2005; Fayenuwo *et al*., 2007). Numerous crops suffer harm each year before and after harvest (Meerburg and Kijlstra, 2008).

2. Materials and methods

The rodent survey was carried out between June 2018 and May 2020 in three centers in Sohag governorate: Shandaweel, Tahta and Gerga.

2.1 Site description

Shandaweel farm it is situated in the north of Sohag governorate, Egypt. Approximately 15 km and an area of approximately 100 feddan (), the farm is adjacent to two hundred feddan grown with various field crops, vegetables and fruit trees. They were also adjacent to numerous irrigation and drainage channels; it is bounded across by the Nile, and citrus farms (orange and tangerine) in the center of Tahta center located in the northern Sohag governorate, at a distance of about 30 km. The agricultural area is roughly 14 feddan. The farmhouse is adjacent to two hundred feddan planted with different large crops, vegetables and fruit trees. It was also adjoining numerous irrigation and drainage canals and residential houses. Citrus farms (orange and mandarin) in the center of Gerga located in the south of Sohag governorate at a distance of about 32 km. The area of the farm is about 10 feddan. The farm is adjoining two hundred feddan planted with different field crops, vegetables and fruit trees. It was also adjacent to numerous irrigation and drainage channels and some dwelling houses. By using ordinary wire traps baited with tomato and cucumber and box traps with the standard spring door (25 × 12 × 10 cm), traps were placed at a distance of 10

meters beside rodent runways three times per month at 6 pm and in the morning at 7:00. Morning traps were observed for rodents and graded and tallied, according to Osborn and Helmy (1980). Rodent genus, species, and subspecies were separated from captured rodents, followed by gender and number.

2.2 Population density of rodent species at Sohag governorate

Each rodent species' relative abundance was calculated as follows:

$$Population\ \% = \frac{Number\ of\ rodent\ caught}{Total\ traps/nights} \times 100$$

$$Trap\ index\ \% = \frac{Number\ of\ rodent\ captured}{TTotal\ traps\ distributed} \times 100$$

3. Results and Discussion

The rodent study was conducted for two years from June 2018 to May 2020 in these areas of Sohag governorate all subspecies of *Rattus rattus* (Linn.) as well as the white-bellied rat *R. r. frugivorus* (Rafinesque), the gray-bellied rat *R. r. alexandrinus* (Geoffray), the subspecies Arvicanthis (Desm.) and the species *A. niloticus* (Desm.), Mus subspecies (Linnaeus, 1758) and *M. musculus* species in the orchards of the agricultural center Shandawil, Tahta and Gerga, Sohag province. The results of the study are shown in Tables (1 and 2).

3.1 Sohag governorate

In Sohag governorate, all subspecies of *R. r. frugivorus* (Rafinesque), *R. r. alexandrinus* (Geoffray), *A. niloticus* (Desm.) and M. *musculus* (Linnaeus, 1758) were recorded in the citrus farms (Orange and mandarin) in Shandaweel, Tahta, and Gerga centers (Tables 1 and 2). Among rodent species trapped in Sohag, *R. r. frugivorus* (Rafinesque), was the most dominant species (283 and 378 for the first and second year, respectively) followed by *R. r. alexandrinus* (Geoffray) (212 and 278 for the first and second year, respectively), followed by *A. niloticus* (Desm.) 119 and 202 for the first and second years, respectively then *M. musculus* (Linnaeus). It was the least species (109 and 117 for the first and second year, respectively), the results of the survey were presented in Tables (1 and 2). The density variability of rodent species may be due to competition between different species, which directly influences the existence of rodents. The availability of preferred food and shelter in the three regions led the rats to multiply and increase their numbers, producing higher reproduction rates in the three regions.

Table (1): Rodent species' seasonal distribution in the orange and mandarin farms in Shandaweel, Tahta, and Gerga centers in the Sohag governorate, Egypt (2018–2019).

Site	Season	*R. r. frugivorus*			*R. r. alexandrinus*			*A. niloticus*			*Mus musculus*			Total rodent		
		No. rat	%	Trap index	No. rat	%	Trap index	No. rat	%	Trap index	No. mice	%	Trap index	No. rodent	%	Trap index
Shandaweel Center	Summer	38a	30.9a	0.127a	30a	29.4a	0.100a	12a	26.1b	0.040a	10b	22.7b	0.033b	90a	28.6a	0.300a
	Autumn	35b	28.5a	0.117b	30a	29.4a	0.100a	14a	30.4a	0.047a	15a	34.1a	0.050a	94a	29.8a	0.313a
	Winter	23c	18.7b	0.077d	21b	20.6b	0.070b	8b	17.4c	0.027b	10b	22.7b	0.033b	62c	19.7b	0.206c
	Spring	27c	21.9b	0.090c	21b	20.6b	0.070b	12a	26.1b	0.040a	9b	20.5b	0.030b	69b	21.9b	0.230b
	Total	123A	39.0A	0.102A	102A	32.4A	0.085A	46A	14.6B	0.038A	44A	13.9A	0.037A	315A	100	0.262A
Tahta Center	Summer	23a	26.1a	0.077b	18a	28.1a	0.060a	11a	26.8a	0.037a	13a	34.2a	0.043a	65a	28.1a	0.216a
	Autumn	25a	28.4a	0.083a	20a	31.3a	0.067a	12a	29.3a	0.040a	10b	26.3b	0.033b	67a	29.0a	0.223a
	Winter	19b	21.6b	0.063c	13b	20.3b	0.043b	8a	19.5c	0.027b	7b	18.4c	0.023c	47b	20.3b	0.156c
	Spring	21a	23.9b	0.070b	13b	20.3b	0.043b	10a	24.4b	0.033a	8b	21.1c	0.027c	52b	22.5b	0.173b
	Total	88B	38.1A	0.073B	64B	27.7B	0.053B	41A	17.7A	0.034A	38B	16.5A	0.032A	231B	100	0.192B
Gerga Center	Summer	17b	23.6b	0.056b	10b	21.7b	0.033b	6b	18.8c	0.020b	7a	25.9b	0.023a	40b	22.6a	0.133b
	Autumn	23a	31.9a	0.077a	16a	34.8a	0.053a	10a	31.3a	0.033a	8a	29.6a	0.027a	57a	32.2a	0.190a
	Winter	15b	20.8b	0.050b	10b	21.7b	0.033b	8a	25.0b	0.027a	6a	22.2c	0.020b	39b	22.0a	0.130b
	Spring	17b	23.6b	0.056b	10b	21.7b	0.033b	8a	25.0b	0.027a	6a	22.2c	0.020b	41b	23.2a	0.136b
	Total	72C	40.7A	0.060C	46C	26.0B	0.038C	32B	18.1A	0.027B	27C	15.3A	0.022B	177C	100	0.147C
Shandawil, Tahta and Gerga	Summer	78a	27.6a	0.086b	58b	27.4a	0.064b	29b	24.4b	0.032a	30a	27.5a	0.033a	195b	27.0a	0.216b
	Autumn	83a	29.3a	0.092a	66a	31.1a	0.073a	36a	30.3a	0.040a	33a	30.3a	0.036a	218a	30.2a	0.242a
	Winter	57c	20.1b	0.063d	44c	20.8b	0.048c	24c	20.2c	0.026b	23b	21.1b	0.025b	148d	20.5b	0.164d
	Spring	65b	23.0b	0.072c	44c	20.8b	0.048c	30b	25.2b	0.033a	23b	21.1b	0.025b	162c	22.4b	0.180c
	Total	283A	39.1A	0.078A	212B	29.3B	0.058B	119C	16.5C	0.033C	109C	15.1C	0.030C	723	100	0.200

Means within the same column that are followed by the same little letter do not differ substantially at the 0.05 level of probability. Means in the same row that are preceded by the same capital letter do not differ substantially at the 0.05 level of probability.

These results are supported by those obtained by Soliman *et al*. (2017), Desoky and Baghdadi (2019) in Sohag governorate and Baghdadi (2006) and Abd El-Galil (2019) in Assiut governorate, who found that *R. r. frugivorus* was the most presented species. While results differ from those Ahmed *et al*. (2019) in Sohag governorate, Egypt.

Table (2): Rodent species' seasonal distribution in the orange and mandarin farms in Shandaweel, Tahta, and Gerga centers in the Sohag governorate, Egypt (2019–2020).

Site	Season	*R. r. frugivorus*			*R. r. alexandrinus*			*A. niloticus*			*M. musculus*			Total rodent		
		No. rat	%	Trap index	No. rat	%	Trap index	No. rat	%	Trap index	No. mice	%	Trap index	No. rodent	%	Trap index
Shandaweel Center	Summer	41b	24.6b	0.137c	28b	21.9b	0.093b	20b	23.8b	0.067c	15a	29.4a	0.050a	104b	24.2ab	0.347b
	Autumn	47a	28.1a	0.157a	36a	28.1a	0.120a	23a	27.4a	0.077b	14a	27.5a	0.047a	120a	27.9a	0.400a
	Winter	36b	21.6b	0.120d	28b	21.9b	0.093b	15b	17.9c	0.050d	9b	17.6c	0.030c	88c	20.5b	0.293c
	Spring	43a	25.7a	0.143b	36a	28.1a	0.120a	26a	30.9a	0.087a	13a	25.5b	0.043b	118a	27.4a	0.393a
	Total	167A	38.8A	0.139A	128A	29.8A	0.107A	84A	19.5B	0.070A	51A	11.9B	0.043A	430A	100	0.358A
Tahta Center	Summer	29b	25.7b	0.097b	19b	23.5b	0.063c	16b	24.6b	0.053b	12a	30.0a	0.040a	76b	25.4b	0.253c
	Autumn	34a	30.1a	0.113a	24a	29.6a	0.080a	18a	27.7a	0.060a	9b	22.5c	0.030c	85a	28.4a	0.283a
	Winter	22c	19.5c	0.073c	17bc	20.9c	0.057c	12b	18.5c	0.040c	8b	20.0c	0.027c	59c	19.7c	0.197d
	Spring	28b	24.8b	0.093b	21b	25.9b	0.070b	19a	29.2a	0.063a	11a	27.5b	0.037a	79a	26.4a	0.263b
	Total	113B	37.8A	0.094B	81B	27.1B	0.068B	65B	21.7A	0.054B	40B	13.4A	0.033B	299B	100	0.249B
Gerga Center	Summer	27a	27.6a	0.090b	18b	26.1b	0.060b	15a	28.3a	0.050a	8a	30.8a	0.027a	68b	27.6a	0.227b
	Autumn	29a	29.6a	0.097a	21a	30.4a	0.070a	16a	30.2a	0.053a	8a	30.8a	0.027a	74a	30.1a	0.247a
	Winter	18c	18.4c	0.060d	14c	20.3c	0.047c	10b	18.9b	0.033c	5b	19.2b	0.017b	47d	19.1b	0.157d
	Spring	24b	24.5b	0.080c	16b	23.2b	0.053c	12b	22.6b	0.040b	5b	19.2b	0.017b	57c	23.2b	0.190c
	Total	98C	39.8A	0.082C	69C	28.0B	0.058C	53C	21.5A	0.044C	26C	10.6C	0.022C	246C	100	0.205C
Shandawil, tahta and Gerga	Summer	97b	25.7b	0.108b	65c	23.4b	0.072b	51a	25.2a	0.057b	35a	29.9a	0.039a	248c	23.7b	0.276c
	Autumn	110a	29.1a	0.122a	81a	29.1a	0.090a	57a	28.2a	0.063a	31b	26.5b	0.034b	279b	26.7b	0.310b
	Winter	76c	20.1c	0.084c	59d	21.2c	0.066c	37b	18.3b	0.041c	22c	18.8c	0.024c	194d	18.6c	0.216d
	Spring	95b	25.1b	0.106b	73b	26.3b	0.081b	57a	28.2a	0.053b	29b	24.8b	0.032b	324a	31.0a	0.360a
	Total	378A	36.2A	0.105A	278B	26.6B	0.077B	202C	19.3C	0.056C	117D	11.2D	0.033D	1045	100	0.290

Means within the same column that are followed by the same little letter do not differ substantially at the 0.05 level of probability. Means in the same row that are preceded by the same capital letter do not differ substantially at the 0.05 level of probability.

3.2 Population density of rodent species

A population is a collective group of particular species in a community with distinct characteristics such as population density, sex distribution, age distribution, and pregnancy.

3.3 Seasonal distribution of rodents in the citrus farms (orange and mandarin) in Shandaweel center at Sohag governorate

Data from Table (1) in Sohag show that during the 2018-2019 period, the highest seasonal numbers of rodents on the Shandawil Center farm were recorded in fall (94) and the lowest in winter (62). Peak rat populations were recorded in October (33) and the lowest density was recorded in January (18). This could be due to rats staying in the shelter in January to avoid the cold weather and leaving the shelter in October to carry food. On the other hand, in 2019-2020 (Table 2), the highest seasonal densities were recorded in fall (120) and spring (118), and the lowest in winter (88). The rat population peaked in May (49) and was least dense in January (25). This may be due to their confinement in the shelter to avoid the cold in January and their exit from the shelter to feed in May.

4. Conclusion

1. The location, type of habitat, and preferred food of the rodents all affect the species composition of the group.
2. In spring and summer, when rodent activity is at its peak, the population density of these creatures is higher. Winter and autumn, however, experience the lowest densities.
3. To limit rodent population density, rodent control can be employed efficiently in Integrated Pest Management (IPMA), depending on the geography, the community, and the availability of food.

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