

SURVEY OF COMMENSAL RODENTS AND THEIR FLEAS IN DIFFERENT EGYPTIAN AGROECOSYSTEMS

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Abstract

A preliminary survey of commensal rodent species and their fleas ectoparasites was carried out in some Governorates representing different agrosystems in Egypt. Population density of dominate rodents. Rodent-index (number of rodent/trap) and percentage frequency of males to females of different rodent species were recorded at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates during 2004/2005 seasons. The main species found were the Norway rat, *Rattus norvegicus*, the grey-bellied rat, *Rattus rattus alexandrinus*, the white-bellied rat, *Rattus rattus frugivorus*, the Cairo spiny mouse, *Acomys cahirinus* and the house mouse, *Mus musculus*. Beni-Suef showed the highest existing rodent-index. Also, higher populations were recorded during summer at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates, respectively. Lower populations were recorded during winter at Suez, Menofiya, Giza and Demiata Governorates, respectively. On the other hand, the lowest population at Beni-Suef was recorded during autumn. The Norway rat, *Rattus norvegicus* showed higher frequency at Suez, Giza and Demiata Governorates, respectively. On the other hand, *Rattus rattus alexandrinus* showed the high number at Menofiya Governorate and *Mus musculus* showed the highest species at Beni-Suef Governorate. Data indicated that the frequency of males of *Rattus norvegicus* was higher than females at the five Governorates under studied seasons. The common fleas species attacking rodents at all studied Governorates were: *Xenopsylla cheopis*, *Ctenocephalides felis*, *Leptopsylla segnis* and *Pulex irretance*. The flea index (number of flea/rodent) at Menofiya was the highest, while at Beni-Suef showed the lowest population density. Also, the highest fleas infestation were recorded during summer at Suez, Menofiya, Giza and Demiata Governorates, respectively. While the highest infestation was recorded in spring at Beni-Suef. The frequency of flea species on the five domestic rodent species at the five Governorates indicated that the oriental rat flea, *Xenopsylla cheopis* was the highest. On the other hand, the mouse flea, *Leptopsylla segnis* was the lowest.

INTRODUCTION

Rats and mice are very common pest animals in cities, villages and agricultural fields of almost all Egyptian Governorates (Morsy *et al.* 86, Shoukry *et al.*, 1986). They find their ways into homes and storehouse feeding on almost any human

and/or animal food materials. They also feed on human garbage, manure piles, sewers and other accumulations. They also transmit dangerous disease to human. Baltzard, (1966) showed that most of murine rodents follow man to almost all inhabited areas owing to their ability for survival, multiplication, reproduction and adaptation to varieties of different environmental conditions. Rodent species of Egypt were recorded by Hussein and Pruthi (1955) as related to outbreaks of plague. Population dynamics of rodents were recorded by Abdel-Gawad (1974). Other studies on desert and semi-desert rodents in Egypt were conducted by various authors such as Thomas (1942) and Sctzel (1959). Beside their economic damage and contamination of stored food materials, they play an important role in the transmission as a reservoirs of many human diseases (Minette, 1964, Morsy *et al.* 1981 and Abdon and Samaan, 1962).

The aim of this work is to study the preliminary survey of commensal rodent species and their flea ectoparasites in the cities and villages of some Governorates representing in different agricultural systems.

MATERIALS AND METHODS

1. Experimental location and rodents collection:

The present work was carried out during the two successive years (2004-2005) in five Governorates (Suez, Minufiya, Giza, Damietta and Beni-Suef).

2. Trapping and examination of rodents:

The capture and transport of rodent animals methods described by Riffat *et al.* (1969) and Abdel-Gawad *et al.* (1982) was followed throughout the present investigation. The survey carried during the 4 seasons of 2004/2005 in all 5 Governorates. In every season, 150 wire box traps were used to catch rodents. Traps were pre-cleaned with hot water and soap before for each use, then baited and distributed in selected residential houses at sunset. Traps were placed near runways and other places where there are clear signs of rat activity. Traps were collected next morning and put in separate white bag, to avoid exchange of ectoparasites. During transport care was taken to ensure that the animals not suffer from physical damage. At the laboratory every animal was identified to species and sex. Average Number of rodents per trap was calculated.

The number of rodent species and their associated flea species, in each of the agroecosystem, during the 4 seasons of the year 2004/2005 were subjected to the analysis of variance (ANOVA) tests and the means were compared by L.S.D. test at 0.05 level, using SAS program (SAS Institute, 1988).

3. Detection of flea's parasites of rodents:

In the laboratory, rats and mice were killed with chloroform, then identified and counted. Flea ecto-parasites were collected on a white sheet of paper using a stiff

hard brush. Animals were hanged from the tip of their tail, heads down, to ensure careful collection of all individuals of eco-parasites. Fleas were preserved in 70% alcohol in separate labeled specimen tubes. Identification of rodent species was done according to the key given by Morsy *et al.* (1981). Also, for the identification of arthropod-ecto-parasites, according the key of Soulsby (1978) was followed.

RESULTS AND DISCUSSION

1. Population density of dominant rodent species:

The total number of rates, rodent-index (average number of rodent/trap) and frequency percentage of males to females of different rodent species, from 5 Governorates during 4 seasons of 2004/2005 are shown in Table (1) and Fig. (1). Result showed that the domestic rodent species at all studied Governorate were: the Norway rat, *Rattus norvegicus*, the grey-bellied rat, *Rattus rattus alexandrinus*, the white-bellied rat, *Rattus rattus frugivorus*, the Cairo spiny mouse, *Acomys cahirinus* and the house mouse, *Mus musculus*. Considering the total number of lapped rodent, data indicated contradicting results between the five studied Governorates and between different seasons. Beni-Suef showed the higher frequency of existing rodent-index, i.e 0.44 in comparison with 0.42, 0.42, 0.38 and 0.34 for Suez, Demiata, Giza, and Menofiya Governorates, respectively. Considering the seasonal variation in rodent numbers, data from the same table and figure indicated that the highest rat index were recorded during summer at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates, (0.51, 0.45, 0.50, 0.48 and 0.52), respectively. The lowest rat index was recorded during winter (0.31, 0.25, 0.26 and 0.31) at Suez, Menofiya, Giza and Demiata Governorates, respectively. On the other hand, the lowest population at Beni-Suef was recorded during autumn rat index (0.38). Low temperature, high relative humidity and scarcity of available food during winter season could be among the limiting factors determining the number of trapped rodents. Data from the same table indicted that the Norway rat, *Rattus norvegicus* showed the higher number of rats individuals, i.e. 60.4, 50.7, 57.8% total number of rat trapped at Suez, Giza and Demiata Governorates, respectively. On the other hand, *Rattus rattus alexandrinus* showed the highest species at Menofyia Governorate with 34.6% and *Mus musculus* showed the highest species at Beni-Suef Governorate with 33.7%. Data in the same table indicated that the frequency of males of *Rattus norvegicus* was higher than females at the five Governorates. The percentages of males were 32.72, 10.42, 31.77, 31.93 and 3.23%, while the mean of percentage females were 27.68, 6.83, 18.93, 28.36 and 1.05% at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates, respectively. On the contrary, there were no of males and females from the other species clear differences between the percentages.

Table 1. Frequency distribution (%) of rodent species in the various ecological areas of Egypt during the various season of the year (2004-2005).

Ecological area	Season	No. of collected animal	Roden index	Frequency distribution (%) of rodents														
				<i>Rattus norvegicus</i>			<i>Rattus r. alexandrinus</i>			<i>Rattus r. frugivorus</i>			<i>Acomys cahinnus</i>			<i>Mus musculus</i>		
				T	M	F	T	M	F	T	M	F	T	M	F	T	M	F
Suez	Spring	73.00	0.48	61.64	34.25	27.39	16.44	9.59	6.85	16.44	9.59	6.85	1.37	1.37	0.00	4.11	4.11	0.00
	Summer	76.00	0.51	60.53	31.58	28.95	15.79	7.89	7.90	11.84	5.26	6.58	2.63	0.00	2.63	9.21	7.89	1.32
	Autumn	58.00	0.38	53.45	31.03	22.42	20.69	13.79	6.90	12.06	8.62	3.44	3.44	1.72	1.72	10.34	5.17	5.17
	Winter	47.00	0.31	65.96	34.04	31.95	14.89	8.51	6.38	14.89	8.51	6.38	0.00	0.00	0.00	4.25	4.25	0.00
	Mean	63.50	0.42	60.40	32.73	27.68	16.95	9.95	7.01	13.81	8.00	5.81	1.86	0.77	1.09	6.98	5.36	1.62
Menofiya	Spring	57.00	0.38	12.28	7.02	5.26	36.84	22.81	14.03	26.32	8.78	17.54	3.51	1.75	1.75	21.05	15.79	5.26
	Summer	68.00	0.45	17.65	10.29	7.36	39.71	14.71	25.00	10.29	5.88	4.14	2.94	0.00	2.94	29.41	20.59	8.82
	Autumn	43.00	0.29	25.58	16.28	9.30	34.88	23.26	11.62	11.63	4.65	6.98	9.31	2.34	6.97	18.60	13.95	4.65
	Winter	37.00	0.25	13.51	8.11	5.40	27.03	16.22	10.81	24.32	10.81	13.51	0.00	0.00	0.00	35.14	16.22	18.92
	Mean	51.25	0.34	17.26	10.43	6.83	34.62	19.25	15.37	18.14	7.53	10.54	3.94	1.02	2.92	26.05	16.64	9.41
Giza	Spring	67.00	0.44	56.71	29.85	26.86	13.43	8.96	4.47	11.94	7.46	4.48	10.44	5.97	4.47	7.39	4.49	2.90
	Summer	75.00	0.50	42.66	24.00	18.66	25.33	10.86	14.67	20.00	6.67	13.33	0.00	0.00	0.00	12.00	5.33	6.67
	Autumn	46.00	0.30	52.17	34.78	17.39	23.91	13.05	10.86	13.04	4.35	8.69	6.52	2.17	4.35	4.43	4.34	0.00
	Winter	39.00	0.26	51.28	38.46	12.82	15.38	5.12	10.26	25.64	10.26	15.38	2.56	0.00	2.56	5.12	2.56	2.56
	Mean	56.75	0.38	50.71	31.77	18.93	19.51	9.50	10.07	17.66	7.19	10.47	4.88	2.04	2.85	7.24	4.18	3.03
Demiata	Spring	66.00	0.44	59.09	37.88	21.21	12.12	75.76	45.45	18.18	7.57	10.62	0.00	0.00	0.00	10.60	4.54	6.06
	Summer	72.00	0.48	55.56	20.84	34.72	18.57	13.89	4.16	13.88	8.33	5.55	0.00	0.00	0.00	12.40	5.50	6.90
	Autumn	67.00	0.44	62.68	32.83	29.85	20.90	14.92	5.98	13.44	8.95	4.49	1.49	0.00	1.49	1.49	0.00	1.49
	Winter	47.00	0.31	63.83	36.17	27.66	12.76	4.25	8.51	14.91	8.51	6.40	2.12	2.12	0.00	6.38	4.25	2.13
	Mean	63.00	0.42	60.29	31.93	28.36	16.09	27.21	16.03	15.10	8.34	6.77	0.90	0.53	0.37	7.72	3.57	4.15
Beni-sueif	Spring	68.00	0.45	2.94	0.00	2.94	30.88	13.23	17.65	25.00	8.83	16.17	7.35	4.41	2.94	33.82	11.76	22.06
	Summer	79.00	0.52	3.80	2.53	1.27	34.17	15.18	18.99	18.98	7.59	11.39	3.79	1.26	2.53	39.24	20.25	18.99
	Autumn	57.00	0.38	7.01	7.01	0.00	36.84	19.29	17.55	33.33	15.79	17.54	1.75	0.00	1.75	21.05	10.52	10.53
	Winter	59.00	0.39	3.38	3.38	0.00	23.73	10.17	13.56	22.03	8.48	13.55	10.16	5.08	5.08	40.67	18.64	22.03
	Mean	65.75	0.44	4.28	3.23	1.05	31.41	14.47	16.94	24.84	10.17	14.66	5.76	2.69	3.08	33.70	15.29	18.40
F at 0.05%=			118.62			12.20			72.78			1.68			17.42			
LSD=			7.22			7.46			8.48			4.93			9.14			

T = Total M = Mean F = Frequency

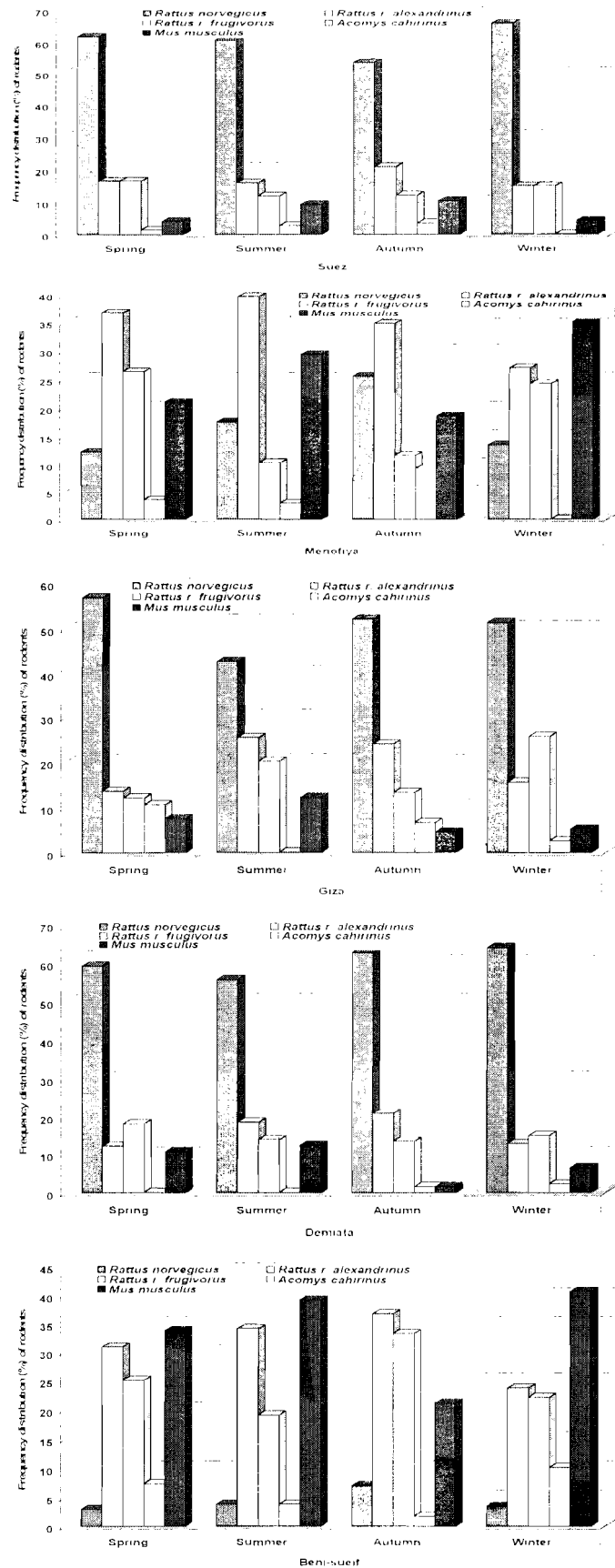


Fig. 1. Frequency distribution (%) of rodent species in the various ecological areas of Egypt during the various season of the year (2004-2005).

Reviewing the obtained results it could be concluded that the domestic rodent species *Rattus norvegicus*, *Rattus rattus*, *Acomys cahirinus* and *Mus musculus* found at five studied Governorates, there marked differences between their population densities. Data indicated that *Rattus norvegicus* showed higher numbers at Suez, Giza, and Demiata Governorates, while *Rattus rattus alexandrinus* showed higher numbers at Menofiya Governorate and *Mus musculus* showed higher number at Beni-Suef Governorate. The highest populations were recorded during summer and the lowest during winter.

Statistical analysis revealed that, there are highly significant difference between the frequency distribution of *Rattus norvegicus*, *Rattus rattus alexandrinus* and *Mus musculus* species at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates ($F = 118.62, 12.20$ and 17.42 & $LSD = 7.22, 7.46$ and 9.14 , respectively). No significant difference between the frequency distribution of *Rattus rattus frugivorus* and *Acomys cahirinus* species at the same Governorates ($F = 72.78$ and 1.58 & $LSD = 8.48$ and 4.93 , respectively).

Theses results are in agreement with that obtained by Mahdi *et al.* (1970) who reported that *Rattus norvegicus* is the most dominant species at Suez area. Salit *et al.* (1982), they reported that the highest and lowest densities of all rodent species were observed during summer and winter, respectively. Allam *et al.* (2002) showed that the common domestic rodents identified at Damietta and Qalybia Governorate were *Rattus rattus alexandrinus*, *Rattus rattus frugivorus* and *Rattus norvegicus*. There also mentioned that was common all the year round except in winter for *R. norvegicus* at Damietta. Shoukry *et al.* (2006) showed that the highest density of rodents was in July and August and the lowest was in January.

The infestation percentages of domestic rodents and flea index of different species of fleas during the successive seasons at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates are tabulated in Table (2) and graphically illustrated in Fig. (2). Results indicated that the common fleas species attacking the rodents at all studied Governorates were: *Xenopsylla cheopis*, *Ctenocephalides felis*, *Leptopsylla segnis* and *Pulex irretance*. The flea index (number of fleas individual/rodent) at Menofiya showed the highest flea index (1.9), while Beni-Suef showed the lowest index (1.2). Also, the results showed that the highest recorded summer infestation percentages were 92, 88, 97% at Suez, Menofiya, Giza and Demiata Governorates, respectively, while the highest recording spring infestations was at Beni-Suef (85%).

The frequency of flea species on the five domestic rodents at the five area of experiment proved that the infestation oriental rat flea, *Xenopsylla cheopis* on the five rodent species was higher than the other flea species. The main flea index of the former species were 1.23, 1.63, 1.52, 1.2 and 1.00 at Suez, Menofiya, Giza, Demiata and Beni-Suef, respectively. Whereas flea index of the cat flea, *Ctenocephalides felis* 0.16, 0.16, 0.16, 0.31 and 0.12 at the same Governorates, respectively.

Table 2. Flea indices of the various rodent species in the various ecological areas of Egypt during the various season of the year (2004-2005).

Ecological area	Season	No. of collected rats	No. infested rats	%Infested rats	No. of flea	Flea index				
						Total	<i>Xenopsylla cheopis</i>	<i>Etenocephalides felis</i>	<i>Leptopsylla segnis</i>	<i>Pulex irritans</i>
Suez	Spring	73	65	89.0	130	1.78	1.63	0.12	0.00	0.03
	Summer	76	70	92.0	76	1.00	0.76	0.21	0.00	0.03
	Autumn	58	45	78.0	77	1.33	1.09	0.19	0.03	0.02
	Winter	47	37	79.0	78	1.66	1.43	0.15	0.02	0.06
Mean		63.50	54.25	84.50	90.25	1.44	1.23	0.17	0.01	0.04
Menofiya	Spring	57	40	70.0	93	1.63	1.59	0.00	0.00	0.04
	Summer	68	60	88.0	86	1.25	1.02	0.11	0.07	0.05
	Autumn	43	30	70.0	91	2.11	1.61	0.41	0.00	0.09
	Winter	37	20	54.0	97	2.62	2.32	0.14	0.02	0.14
Mean		51.25	37.50	70.50	91.75	1.90	1.64	0.17	0.02	0.08
Giza	Spring	67	60	90.0	138	2.05	1.74	0.15	0.00	0.16
	Summer	75	68	91.0	108	1.44	1.15	0.12	0.05	0.12
	Autumn	46	37	80.0	119	2.58	2.35	0.19	0.00	0.04
	Winter	39	31	79.0	44	1.12	0.84	0.18	0.08	0.02
Mean		56.75	49.00	85.00	102.25	1.80	1.52	0.16	0.03	0.09
Demiata	Spring	66	62	94.0	11	1.68	1.56	0.08	0.00	0.04
	Summer	72	70	97.0	131	1.81	1.45	0.15	0.00	0.21
	Autumn	67	58	87.0	87	1.29	1.16	0.13	0.00	0.00
	Winter	47	39	83.0	43	0.91	0.64	0.19	0.06	0.02
Mean		63.00	57.25	90.25	68.00	1.42	1.20	0.14	0.02	0.07
Beni-sueif	Spring	68	58	85.0	83	1.22	0.95	0.18	0.00	0.09
	Summer	79	45	57.0	62	0.78	0.58	0.09	0.00	0.11
	Autumn	57	41	72.0	89	1.56	1.40	0.09	0.00	0.07
	Winter	59	40	68.0	75	1.27	1.08	0.12	0.00	0.07
Mean		65.75	46.00	70.50	77.25	1.21	1.00	0.12	0.00	0.09
F at 0.05%=						1.42	1.13	0.23	0.77	0.54
LSD=						0.73	0.72	0.13	0.04	0.08

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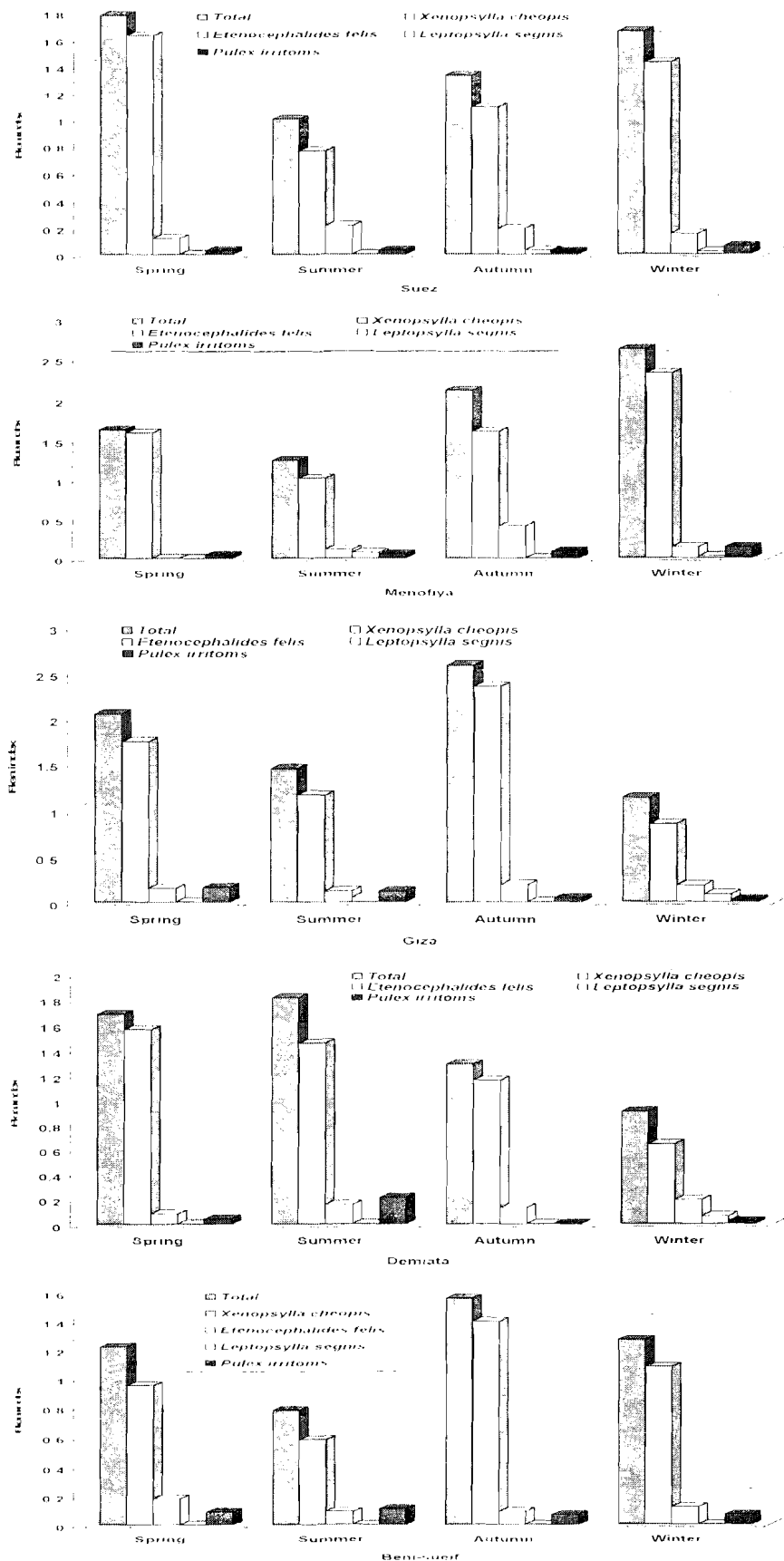


Fig. 2. Flea indices of the various rodent species in the various ecological areas of Egypt during the various season of the year (2004-2005).

On the other hand, flea index of the mouse flea, *Leptopsylla segnis* were the lowest on the five rodent species. The flea index of the former species was 0.01, 0.02, 0.03, 0.01 and 0.00 at the same five Governorates, respectively. While flea indices of the human-flea, *Pulex irritance* were 0.03, 0.08, 0.08, 0.06 and 0.08 at Suez, Menofiya, Giza, Demiata and Beni-Suef, respectively. The recorded flea indices proved that the three flea species, *Ctenocephalides felis*, *Leptopsylla segnis* and *Pulex irritance* are not favourable hosts to the five rodent species in comparison with *Xenopsylla cheopis*.

Statistical analysis revealed no significant difference between the population density of fleas parasites (*Xenopsylla cheopis*, *Ctenocephalides felis*, *Leptopsylla segnis* and *Pulex irritance*) associated with different rodent species (*Rattus norvegicus*, *Rattus rattus*, *Acomys cahirinus* and *Mus musculus*) at Suez, Menofiya, Giza, Demiata and Beni-Suef Governorates areas where $F = 1.13, 0.23, 0.77$ and 0.54 & $LSD = 0.72, 0.13, 0.04$ and 0.08 , respectively.

The density of flea infesting domestic rodents in Egypt was reported by several investigators. Rifaat *et al.* (1969) found that the oriental-rat flea, *Xenopsylla cheopis* was the most predominant species parasitizing commensal and domestic rodents in Egypt. Mahdi *et al.* (1971) reported that spring represents the season of maximum flea parasitism on *Rattus rattus frugivorus* at Fayoum followed by summer, to be farther reduced in autumn and winter. Shoukry *et al.* (1987) found that fleas were the most predominate ectoparasites in Ismilia Governorate. Khaild *et al.* (1992) showed that *Xenopsylla cheopis* the main parasitism species on the rodent hosts over the year, and the total flea index reached the maximum May and it was zero in December and January. The highest number of fleas was on *Rattus norvegicus*. Allam *et al.* (2002) showed that flea infestation varied according to rodent species and to the bioclimatic conditions. The flea index was above one during spring in southern of Nile-Delta and semi-arid areas, in summer in northern Coastal areas and in autumn in southern of Nile-Delta. Shoukry *et al.* (2006) showed that ectoparasites were detected on rodents all year-round in domestic and peri-domestic habitats. In wild habitats ecto-parasites activity was from March to December.

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حصر أكثر أنواع الفئران والبراغيث شيوعاً المرتبطة بها كطفيليات خارجية في بعض محافظات مصر

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تم حصر أكثر أنواع الفئران والبراغيث شيوعاً المرتبطة بها كطفيليات خارجية في بعض محافظات مصر والتي تم إصطيادها من محافظات السويس والمنوفية والجيزة ودمياط وبنى سويف خلال موسم ٢٠٠٤ ، ٢٠٠٥ حيث تم حساب (متوسط أعداد الفئران/مصيدة) كذلك تم حساب النسبة المئوية للذكور والإناث لمختلف الأنواع. حيث أوضحت النتائج أن الفأر *Rattus norvegicus* و *Mus musculus* هي أكثر الأنواع شيوعاً في هذه المحافظات. ووجد أن محافظة بنى سويف بها أكثر الأنواع تواجداً كما وجد أعلى نسبة تعداد للفئران خلال موسم الصيف في محافظات السويس والمنوفية والجيزة ودمياط وبنى سويف على الترتيب، بينما وجدت أقل الأنواع إنتشاراً في الشتاء في محافظات السويس والمنوفية و الجيزة ودمياط على الترتيب. على الجانب الآخر وجد أقل تعداد للفئران تواجداً في الخريف في محافظة بنى سويف. كما وجد أن الفأر *Rattus norvegicus* هو أكثر الأنواع شيوعاً في محافظات السويس والجيزة ودمياط على الترتيب. على الجانب الآخر وجد أن الفأر *Rattus rattus alexandrinus* هو أكثر الأنواع شيوعاً في محافظة المنوفية والفأر *Mus musculus* هو الأكثر إنتشاراً في محافظة بنى سويف. من النتائج إتضح أن نسبة الذكور أعلى بكثير من نسبة الإناث في الفأر النرويجي في مختلف المحافظات. كما أوضحت النتائج أنه تم حصر مجموعة من أنواع البراغيت المرتبطة بأنواع الفئران المختلفة في هذه المحافظات وهي *Xenopsylla cheopis* و *Ctenocephalides felis* و *Leptopsylla segnis* و *Pulex irritance* على الترتيب. حيث تم حساب (متوسط أعداد البراغيت /فأر) وأوضحت النتائج أن أعلى تعداد للبراغيث على الأنواع المختلفة من الفئران تركزت في محافظة المنوفية كما أن أقل تعداد لها في محافظة بنى سويف. كما تم تسجيل أعلى تعداد للبراغيث في أشهر الصيف في محافظات السويس والمنوفية والجيزة ودمياط على الترتيب. بينما أعلى تعداد لها سجل في الربيع في محافظة بنى سويف. من النتائج المتحصل عليها وجد أن النوع *Xenopsylla cheopis* هو الأكثر شيوعاً بأقصى تعداد على الأنواع المختلفة من الفئران بينما سجل النوع *Leptopsylla segnis* كأقل تعداد للبراغيث على أنواع الفئران المسجلة.