RESULTS

1. Sand fly species composition and seasonal abundance

A two-year study was designed to investigate sand fly species composition and seasonal abundance in two villages in the Nile Delta. Sand fly collections started from September 2003 to August 2005. A total of 14176 sand flies were collected from the two villages using sticky paper traps. All flies collected were identified as *Phlebotomus papatasi*.

1.1. Sand fly abundance in Kafr Tahla - Qalyubiya Governorate

1.1.1. Outdoor collections of sand flies

A total of 4232 males and 1999 females were collected using sticky paper traps. Data presented in **Table 2** show that *P. papatasi* activity started in April and ended in December during the two-year study period. No sand flies were collected during the months of January, February and March. Data in **Figs. 8** & **9** indicated that sand flies collected from Kafr Tahla had a bimodal peak of activity for the two years. The first peak was observed in September and the second was observed in June. For the two peaks, the monthly mean temperature was 28 °C and 25 °C; RH% was 61% and 59% and wind speed was 1.3 kn (kilo node) and 0.55 kn respectively. *Phlebotomus papatasi* densities were high during June and September where it ranged between 4.55 to 10.60 fly/ trap. Fly densities declined during August and this was followed by another

peak in September. Very low densities of sand flies were observed during December 2003 and December 2004, where the densities reached 1.03 and 0.58 fly/ trap respectively.

Table 2: Monthly abundance of the sand fly *Phlebotomus papatasi* in Kafr Tahla village in relation to recorded weather conditions.

Month	Density (No. sand flies / trap)		Mean values		
	Outdoors	Indoors	Temperature	Relative humidity	Wind speed
Sep-03	10.60	26.25	28	61	1.3
Oct-03	8.90	19.42	23.5	69.5	1.2
Nov-03	2.41	4.33	20.5	72	1.8
Dec-03	1.03	0.33	17	64	1.3
Jan-04	0.00	0.00	13.5	69	1.4
Feb-04	0.00	0.00	12	67	1.2
Mar-04	0.05	0.00	16	66	0.9
Apr-04	1.03	0.92	18.5	55	1
May-04	5.21	21.67	23.5	48	1.4
Jun-04	7.46	19.42	25.5	59.5	1
Jul-04	4.76	20.58	29	63	0.45
Aug-04	3.09	13.08	29	66	0.45
Sep-04	5.10	23.50	28	67	1.2
Oct-04	4.51	43.58	27.5	64.5	0.72
Nov-04	1.91	12.17	24.5	68.5	1.1
Dec-04	0.58	0.00	17	62.5	1.7
Jan-05	0.00	0.00	15.5	69	1.2
Feb-05	0.00	0.00	14.5	60.5	1.1
Mar-05	0.00	0.00	15.5	60	1
Apr-05	0.09	0.33	15	66	0.7
May-05	1.20	6.58	21	56	0.6
Jun-05	4.55	22.58	25	59	0.55
Jul-05	5.24	16.92	27	57.5	0.6
Aug-05	5.88	28.00	30	64	0.55

Fig. (8)

Fig.9.....montly abundance and weather page. 4

The relation between *P. papatasi* densities and prevailed weather conditions namely temperature, relative humidity percentage and wind speed was assessed using correlation and multiple regression analysis. *Phlebotomus papatasi* densities outdoors were positively correlated with temperature (r^2 = 0.6197) while no correlation was found between *P. papatasi* densities and relative humidity percentage and wind speed (r^2 = 0.0261 and 0.0168) respectively (**Fig. 10**). Multiple regression analysis revealed that the model was significant (Adjusted r^2 = 0.634; df = 3,20; F = 14.287; *P* = 0.005). According to the developed model, only temperature could be used as a predictor variable for *P. papatasi* densities (β = 0.901; *P* = 0.0001) (**Table 3**).

Table 3: Multiple linear regression model associating prevailed weather conditions with monthly densities of *Phlebotomus papatasi* in Kafr Tahla village.

Predictor Variable	Beta	Significance (P)
Temperature	0.901	0.0005
Relative Humidity	- 0.078	0.552
Wind Speed	0.293	0.053

1.1.2. Indoor collections of sand flies

A total of 1786 males and 1570 females sand flies were collected indoors from Kafr Tahla using sticky paper traps. Monthly densities of *P. papatasi* collected indoors were given in **Table 2**. *Phlebotomus papatasi* activity started in April and ended in November and no flies could be found from December to March. Data presented in **Fig. 8** indicated that sand flies collected from Kafr Tahla had a bimodal peak of activity during the two years. The first peak was observed in September-October and the second was observed during May-June. In the two peaks, the monthly mean temperature was 25.5 °C and 27.5 °C; RH% was 59.5% and 64.5% and wind speed was 1 kn and 0.72 kn respectively. The density of *P. papatasi* during the two peaks ranged between 19.42 in June 2003 to 43.58 fly/ trap in October 2004. Fly densities were similar during the months of May 2004 to July 2004 while it sharply declined during August and then started to increase during September 2004. Very low densities of *P. papatasi* were observed during December 2003 and November 2004, where the densities reached 0.33 and 12.17 fly/ trap respectively.

The sex ratio of *P. papatasi* collected indoors and outdoors from Kafr Tahla village using sticky paper traps is given in **Table 4.** According to the number of sand flies collected, the mean sex ratio (Male: total) outdoors was (0.70 ± 0.10) which was significantly higher than the mean sex ratio indoors (0.56 ± 0.10) ($F=12.52$, $df=3,64$, $P<0.01$). Chi square test of goodness of fit revealed that the sex ratio outdoors is significantly male biased ($X^2=16.0$, df=1,

P=0.0001) whereas the sex ratio did not differ significantly from expected 1: 1 ratio indoors (X^2=1.44, df=1, *P*=0.23).

Table 4: Sex ratio (male: total) of *Phlebotomus papatasi* collected using sticky paper traps from Kafr Tahla village

Month	Outdoors				Indoors			
	No. collected sandflies			Sex ratio ♂♂/total	No. collected sandflies			Sex ratio ♂♂/total
	Total	♀♀	♂♂		Total	♀♀	♂♂	
09/03	583	166	417	0.72	315	177	138	0.44
10/03	525	110	415	0.79	233	118	115	0.49
11/03	140	54	86	0.61	52	26	26	0.50
12/03	71	29	42	0.59	4	2	2	0.50
01/04	0	0	0	-----	0	0	0	-----
02/04	0	0	0	-----	0	0	0	-----
03/04	3	0	3	1.0	0	0	0	-----
04/04	61	18	43	0.70	11	3	8	0.73
05/04	500	165	335	0.67	260	132	128	0.49
06/04	739	244	495	0.67	233	78	155	0.67
07/04	466	155	311	0.67	247	124	123	0.50
08/04	303	99	204	0.67	157	68	89	0.57
09/04	481	158	323	0.67	282	112	170	0.60
10/04	442	178	264	0.60	523	273	250	0.48
11/04	189	68	121	0.64	146	80	66	0.45
12/04	55	17	38	0.69	0	0	0	-----
01/05	0	0	0	-----	0	0	0	-----
02/05	0	0	0	-----	0	0	0	-----
03/05	0	0	0	-----	0	0	0	-----
04/05	9	1	8	0.89	4	1	3	0.75
05/05	118	33	85	0.72	79	26	53	0.67
06/05	450	135	315	0.70	271	117	154	0.57
07/05	514	174	340	0.66	203	87	116	0.57
08/05	582	195	387	0.66	336	146	190	0.57
Total	6231	1999	4232		3356	1570	1786	
Mean ± SD				0.70 ± 0.10				0.56 ± 0.10

1.2. Sand fly abundance in El-Quantara El-Beida - Kafr El-Sheikh Governorate

1.2.1. Outdoor collections of sand flies

A total of 2192 males and 1090 females were collected using sticky paper traps. Data presented in **Table 5** and illustrated in **Figs. 11** & **12** show that *P. papatasi* activity started in April and ended in January. No sand flies were collected during months of February and March. *Phlebotomus papatasi* collected outdoors from El-Quantara El-Beida showed no distinct peak during summer time where flies were abundant. Fly densities ranged between 3.20 fly/ trap in June 2004 to 2.86 fly/ trap in October 2004 when the monthly mean temperature was 24 °C and 27 °C; RH% was 74% and 89% and wind speed was 0.6 kn and 0.4 kn respectively. Highest sand fly densities were recorded in September 2003 where densities of flies reached 5.47 fly/ trap and the monthly mean temperature was 27 °C; RH% was 75% and wind speed was 1.7 kn. Very low densities were observed during December 2003 and January 2004, where it reached 0.43 and 0.14 fly/ trap respectively.

Table 5: Monthly abundance of the sand fly *Phlebotomus papatasi* in El-Quantara El-Beida village in relation to recorded weather conditions.

Month	Density (No. sand flies / trap)		Mean values		
	Outdoors	Indoors	Temperature	Relative humidity	Wind speed
Sep-03	5.47	15.83	27	75.0	1.7
Oct-03	3.58	6.33	23.5	71.0	0.8
Nov-03	1.02	1.67	21.5	67.5	0.55
Dec-03	0.43	0.00	15.5	77.0	1.2
Jan-04	0.00	0.00	13	74.0	1.85
Feb-04	0.00	0.00	13	73.5	2.55
Mar-04	0.00	0.00	15.5	60.5	1.1
Apr-04	0.05	0.00	17.5	61.0	2
May-04	3.01	3.42	20	70.0	1.3
Jun-04	3.20	11.50	24	74.0	0.6
Jul-04	2.53	5.50	25.5	85.5	0.7
Aug-04	2.13	5.33	27	86.0	0.85
Sep-04	2.48	10.00	26	79.5	1.1
Oct-04	2.86	7.67	27	89.0	0.4
Nov-04	0.99	2.42	26	88.5	1.3
Dec-04	0.37	0.00	18	77.5	1.8
Jan-05	0.14	0.00	14	81.5	1.4
Feb-05	0.00	0.00	14.5	80.5	0.6
Mar-05	0.03	0.00	15.5	74.5	0.7
Apr-05	0.06	0.00	15.5	79.0	0.9
May-05	0.65	3.33	20	74.5	0.5
Jun-05	2.31	11.58	23	77.5	0.55
Jul-05	2.74	11.42	25	75.0	0.6
Aug-05	3.52	12.92	28.5	72.0	0.45

Fig.11…….monthly abundance page. 11

Fig.12…….monthly abundance and weather page. 12

The relation between *P. papatasi* density and prevailed weather conditions namely temperature, relative humidity percentage and wind speed was assessed using correlation and multiple regression analysis. Sand fly densities outdoors were positively correlated with temperature (r^2 = 0.6695) while no correlation was found between sand fly densities and relative humidity percentage and wind speed (r^2 = 0.00997 and 0.00597 respectively) (**Fig. 13**). Multiple regression analysis revealed that the regression model was significant (Adjusted r^2 = 0.645; df = 3,20; F = 14.932; *P* = 0.005). According to the developed model, only temperature could be used as a predictor variable for *P. papatasi* densities (β = 0.882; *P* = 0.0001) (**Table 6**).

Table 6: Multiple linear regression model associating prevailed weather conditions with monthly densities of *Phlebotomus papatasi* in El-Quantara El-Beida village.

Predictor Variable	**Beta**	**Significance (*P*)**
Temperature	0.882	0.0005
Relative Humidity	- 0.266	0.053
Wind Speed	0.032	0.833

Fig. 13 relation density and weather page. 14

1.2.2. Indoor collections of sand flies

A total of 767 males and 540 females of *P. papatasi* were collected indoors from El-Quantara El-Beida using sticky paper traps. Monthly densities of *P. papatasi* collected indoors were given in **Table 5**. Sand fly activity started in May and ended in November and no flies could be found from December to April. Data presented in **Fig. 11** indicated that *P. papatasi* collected from El-Quantara El-Beida had a bimodal peak of activity during the two years. The first peak was observed in June and the second was observed in September, where the monthly mean temperature was 24 °C and 26 °C; RH% was 74% and 79.5% and wind speed was 0.6 kn and 1.1 kn respectively. The density of flies during the two peaks ranged between 11.50 fly/ trap in June 2004 to 10.00 fly/ trap in September 2004. Fly densities were similar during the months of July and August 2004 (5.50 & 5.33 fly/ trap respectively). Fly densities sharply declined during the months of October 2004 to May 2005 and then started to rise during June 2005.

The sex ratio of *P. papatasi* collected indoors and outdoors from El-Quantara El-Beida village using sticky paper traps is given in **Table 7.** According to the number of sand flies collected, the mean sex ratio (Male: total) outdoors was (0.72 ± 0.11) which is significantly higher than the mean sex ratio indoors (0.58 ± 0.06) (F=12.52, df=3,64, $P<0.01$). Chi square test of goodness of fit revealed that the sex ratio outdoors is significantly male biased (X^2=19.36, df=1, P=0.0001) whereas the sex ratio did not differ significantly from expected 1: 1 ratio indoors (X^2=2.56, df=1,

P=0.11). It is worthmentioning that sand fly densities were higher indoors than outdoors during the study period in both villages.

Table 7: Sex ratio (male: total) of *Phlebotomus papatasi* collected using sticky paper traps from El-Quantara El-Beida village

Month	Outdoors				Indoors			
	No. collected sand flies			Sex ratio ♂♂/total	No. collected sand flies			Sex ratio ♂♂/total
	Total	♀♀	♂♂		Total	♀♀	♂♂	
09/03	323	125	198	0.61	190	83	107	0.56
10/03	211	66	145	0.69	76	38	38	0.50
11/03	61	22	39	0.64	20	8	12	0.60
12/03	24	6	18	0.75	0	0	0	-----
01/04	0	0	0	-----	0	0	0	-----
02/04	0	0	0	-----	0	0	0	-----
03/04	0	0	0	-----	0	0	0	-----
04/04	3	0	3	1.0	0	0	0	-----
05/04	312	103	209	0.67	41	18	23	0.56
06/04	295	106	189	0.64	138	45	93	0.67
07/04	243	84	159	0.65	66	24	42	0.64
08/04	207	72	135	0.65	64	31	33	0.52
09/04	248	87	161	0.65	120	41	79	0.66
10/04	280	84	196	0.70	92	46	46	0.50
11/04	99	31	68	0.69	29	14	15	0.52
12/04	36	11	25	0.69	0	0	0	-----
01/05	14	4	10	0.71	0	0	0	-----
02/05	0	0	0	-----	0	0	0	-----
03/05	3	0	3	1.0	0	0	0	-----
04/05	4	1	3	0.75	0	0	0	-----
05/05	64	17	47	0.73	40	16	24	0.60
06/05	229	71	158	0.69	139	58	81	0.58
07/05	274	89	185	0.68	137	58	79	0.58
08/05	352	111	241	0.68	155	60	95	0.61
Total	3282	1090	2192		1307	540	767	
Mean ± SD				0.72 ± 0.11				0.58 ± 0.06

2. Density of sand fly *Phlebotomus papatasi* collected by sticky paper traps at animal pens and rodent burrows

This experiment was designed to study the relation between sand fly densities and their animal hosts, which could help understand their hosts preference. Monthly collections of flies were done using sticky paper traps set near animal pens and rodent burrows.

2. 1. Kafr Tahla village

Data given in **Table 8** showed that highest *P. papatasi* densities were found at animal pens (1.083 ± 1.14), while lowest densities were at rodent burrows (0.247 ± 0.24). Statistical analysis of the data using t-test reveal that differences between the *P. papatasi* densities collected from animal pens and rodent burrows were statistically significant (t = 3.44; *P* = 0.002).

2. 2. El-Quantara El-Beida village

Data given in **Table 8** showed that highest *P. papatasi* densities were found at animal pens (1.125 ± 1.13), while lowest densities were at rodent burrows (0.089 ± 0.08). Statistical analysis of the data using t-test reveal that differences between the *P. papatasi* densities collected from animal pens and rodent burrows were statistically significant (t = 4.47; *P* = 0.000).

Table 8: Density of *Phlebotomus papatasi* collected using sticky paper traps from animal pens and rodent burrows in Kafr Tahla and El-Quantara El-Beida.

Village	Hosts	Traps No.	Mean ± SD
Kafr Tahla	Animal pens	1216	1.083 ± 1.14
	Rodent burrows	256	0.247 ± 0.24
El-Quantara El-Beida	Animal pens	1216	1.125 ± 1.13
	Rodent burrows	256	0.089 ± 0.08

3. The effect of sticky paper traps placement on the number of sand flies collected

This experiment was designed to test whether differences in the heights above ground level where sticky traps were held might influence the numbers of sand flies collected. The number of flies collected at several heights above ground level can help identify their hosts. This experiment was carried out in Kafr Tahla village during a ten months period starting from July 2004 to November 2004 and from April 2005 to August 2005.

Data given in **Table 9** and graphically illustrated in **Fig. 14** show that *P. papatasi* flies were more abundant at 4.0 m above the ground where the mean number of flies collected reached 42.5 ± 17.74. Whereas, the mean number of flies collected at 0.15 and 2.0 m above the ground level were more or less the same (36.9 ± 16.18 and 34.5 ± 14.42 respectively). Statistical analysis of the data using

one way analysis of variance (ANOVA) reveal that the number of flies collected at different heights above the ground level did not significantly differ (F = 0.644; df = 2,27; P = 0.533).

Table 9: Mean number of *Phlebotomus papatasi* collected at different heights above the ground level using sticky paper traps at Kafr Tahla village.

Heights (m)	Total	Means ± SD	Maximum	Minimum
0.15	369	36.9 ± 16.18	63	10
2.0	345	34.5 ± 14.42	53	11
4.0	425	42.5 ± 17.74	69	13

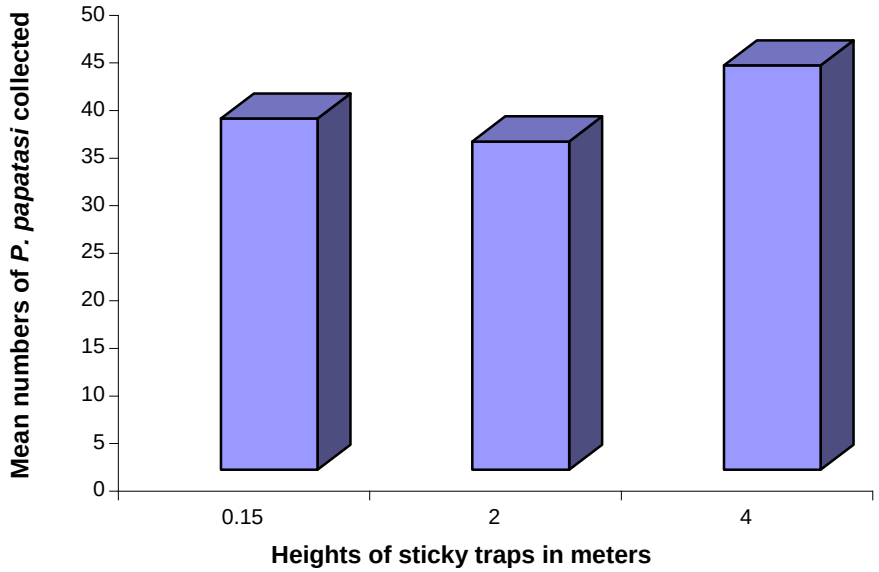

Fig. 14: Mean number of *Phlebotomus papatasi* collected at different heights above the ground level using sticky paper traps at Kafr Tahla village.

4. The effect of lunar cycle and its phases on sand fly abundance

4.1. Kafr Tahla village

The effect of the lunar cycle on the abundance of sand flies in Kafr Tahla village was investigated. Sand flies were collected outdoors using sticky paper traps for 96 nights during Crescent, Full moon, 3/4 moon and New moon. Data given in **Table 10** and graphically illustrated in **Fig. 15** showed that the mean number of flies collected during the Full moon was 111.50 ± 75.23. The maximum number of flies collected during the Full moon was 229 flies and they were found during the month of September 2003. The minimum number of flies collected during the Full moon was 7 flies and they were found in January 2005.

The mean number of flies collected during the Crescent and 3/4 moon were similar (83.77 ± 72.59 and 81.10 ± 55.58 respectively) **(Table 10** and **Fig. 11).** The maximum numbers of flies collected during the Crescent and 3/4 moon were 259 and 160 flies respectively, whereas the minimum numbers of flies collected were 5 and 3 flies respectively.

Data given in **Table 10** and graphically illustrated in **Fig. 15** showed that mean number of flies collected during the New moon was 59.55 ± 49.16. The maximum number of flies collected during the New moon was 153 flies and they were found during the month of June 2004, while the minimum number of flies collected during

the New moon was one fly and it was found during the month of January 2005.

Although activity of sand flies reached maximum during the Full moon, statistical analysis of the data using Kruskal-Wallis test revealed that the lunar cycle had no direct influence on *P. papatasi* abundance in Kafr Tahla (X^2 = 6.140; df = 3; P = 0.105).

Additionally, Spearman correlation was used to investigate the relation between sand fly activity and the fraction illumination during the different lunar phases. Data given in **Fig. 16** showed that the mean number of flies collected was strongly positively correlated with fraction illumination (r^2 = 0.758).

4.2. El-Quantara El-Beida village

The effect of the lunar cycle on the abundance of sand flies in El-Quantara El-Beida village was also investigated. Sand flies were collected outdoors using sticky paper traps for 96 nights during Crescent, Full moon, 3/4 moon and New moon. Data given in **Table 10** and graphically illustrated in **Fig. 15** showed that mean number of flies collected during the Full moon was 59.17 ± 37.14, with a maximum of 103 flies collected during August 2005 and a minimum of 4 flies collected during January 2005.

The mean number of flies collected during the Crescent and 3/4 moon ranged between 41.64 ± 27.94 and 49.66 ± 33.61

respectively **(Table 10** and **Fig. 15)**. The maximum number of flies collected during the Crescent and 3/4 moon were 91 and 100 flies respectively, whereas the minimum numbers of flies collected were 3 for both the Crescent and 3/4 moon.

Data given in **Table 10** and graphically illustrated in **Fig. 15** showed that mean number of flies collected during the New moon was 37.44 ± 25.52. The maximum number of flies collected during the New moon was 80 flies and they were found during the month of September 2003, while the minimum number of flies collected during the New moon was 3 flies and they were found during the month of April 2004.

Although activity of sand flies reached maximum during the Full moon, statistical analysis of the data using Kruskal-Wallis test revealed that the lunar cycle did not significantly affect the abundance of sand flies in El-Quantara El-Beida (X^2 = 4.917; df = 3; P = 0.178).

Additionally, Spearman correlation was used to investigate the relation between sand fly activity and the fraction illumination during the different lunar phases. Data given in **Fig. 16** show that the mean number of flies collected was strongly positively correlated with fraction illumination (r^2 = 0.942).

Table 10: Mean numbers of *Phlebotomus papatasi* collected during different lunar phases using sticky paper traps in Kafr Tahla and El-Quantara El-Beida villages form September 2003 to August 2005.

Village	Moon phases	Total No. sand flies collected	Mean ± SD	Max.	Min.
Kafr Tahla	Crescent	1503	83.77 ± 72.59	259	5
	Full moon	2000	111.50 ± 75.23	229	7
	3/4 moon	1538	81.10 ± 55.58	160	3
	New moon	1190	59.55 ± 49.16	153	1
El-Quantara El-Beida	Crescent	708	41.64 ± 27.94	91	3
	Full moon	1006	59.17 ± 37.14	103	4
	3/4 moon	894	49.66 ± 33.61	100	3
	New moon	674	37.44 ± 25.52	80	3

Fig. 15 lunar and mean number 23

Fig. 16 correlation and mean number 24

5. Species composition and relative abundance of rodent species

This experiment was carried out to study the species composition of rodents in Kafr Tahla and El-Quantara El-Beida villages, owing to their role as reservoir hosts in the leishmaniasis transmission cycle. Results of species composition were tabulated in **Table 11** and illustrated in **Fig. 17**. Four species of rodents were collected from Kafr Tahla and El- Quantara El-Beida villages. The taxonomic classification indicated the presence of *Rattus norvegicus, R. rattus alexandrinus, R. rattus frugivorous* and *Mus musculus.* During the period from September 2003 to August 2005, a total 100 and 121 rodents were collected from Kafr Tahla and El-Quantara El-Beida villages respectively. Rodent species density (rodent/ trap) in Kafr Tahla were arranged in a descending order as *Rattus norvegicus* (2.63), *R. rattus alexandrinus* (2.06), *R. rattus frugivorous* (1.06) and *Mus musculus* (0.50). Similarly, rodent species density (rodent/ trap) in El-Quantara El-Beida were arranged in a descending order as *Rattus norvegicus* (2.69), *R. rattus alexandrinus* (2.25), *R. rattus frugivorous* (2.00) and *Mus musculus* (0.63).

5.1. Kafr Tahla village

The highest density of rodents were recorded in June (0.50), September (0.44) 2004 and August (0.50) 2005 **(Table 12)**. *Rattus norvegicus* recorded the highest density (0.25) during June 2004 and August 2005, *R. rattus alexandrinus* (0.19) during September 2004 and June 2005, *R. rattus frugivorous* (0.13) during September 2004 and June 2005 and *Mus musculus* (0.13) during May 2004.

5.2. El-Quantara El- Beida village

The highest density of rodents were recorded in May (0.56), August (0.63) 2004 and June (0.56) 2005 **(Table 13)**. *Rattus norvegicus* recorded the highest density (0.31) during August 2004 and (0.25) during June 2005, *R. rattus alexandrinus* (0.19) during May, July and September 2004, *R. rattus frugivorous* (0.19) during June 2004-2005 and *Mus musculus* (0.13) during May 2004.

Table 11: Density of rodent species collected from Kafr Tahla and El-Quantara El-Beida during the study period.

Rodent species	Density (No. rodent/ trap) %	
	Kafr Tahla	El-Qunatra El-Beida
Rattus norvegicus	2.63 (42 %)	2.69 (36 %)
R. rattus alexandrinus	2.06 (33 %)	2.25 (30 %)
R. rattus frugivorous	1.06 (17 %)	2.00 (26 %)
Mus musculus	0.50 (8 %)	0.63 (8 %)

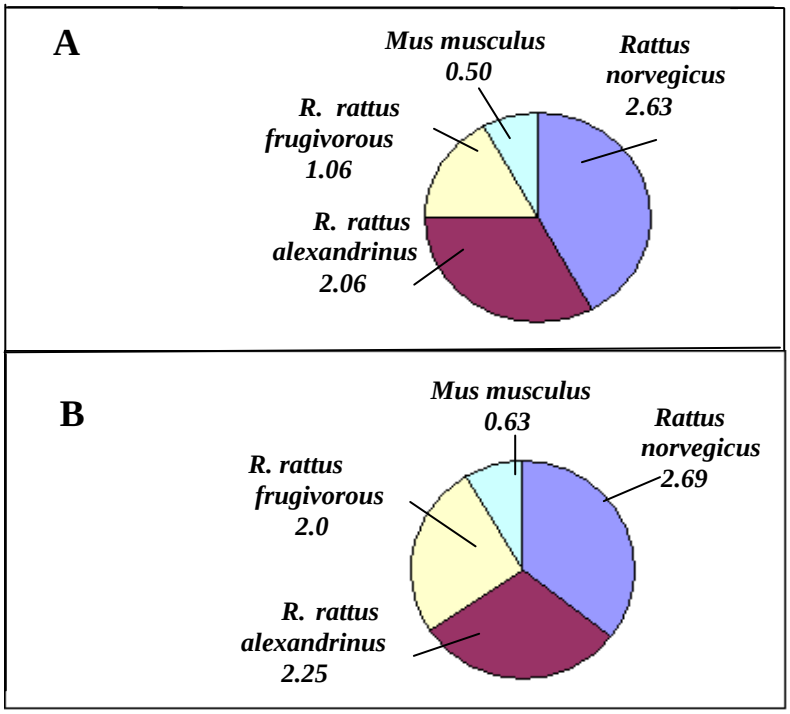

Fig. 17: Species composition of rodents collected in (A) Kafr Tahla and (B) El-Quntara El-Beida villages.

Table 12: Species composition and monthly abundance of rodent species in Kafr Tahla, from September 2003 to August 2005.

Month	Total Rodent /trap	*Rattus norvegicus*	*R. rattus alexandrinus*	*R. rattus frugivorous*	*Mus musculus*
Sep-03	0.38	0.19	0.13	0.06	0.00
Oct-03	0.38	0.13	0.13	0.06	0.06
Nov-03	0.25	0.13	0.13	0.00	0.00
Dec-03	0.19	0.06	0.06	0.06	0.00
Jan-04	0.13	0.06	0.06	0.00	0.00
Feb-04	0.00	0.00	0.00	0.00	0.00
Mar-04	0.06	0.00	0.06	0.00	0.00
Apr-04	0.19	0.13	0.06	0.00	0.00
May-04	0.38	0.13	0.06	0.06	0.13
Jun-04	0.50	0.25	0.13	0.06	0.06
Jul-04	0.38	0.19	0.13	0.06	0.00
Aug-04	0.38	0.13	0.13	0.06	0.06
Sep-04	0.44	0.13	0.19	0.13	0.06
Oct-04	0.31	0.13	0.13	0.00	0.06
Nov-04	0.25	0.13	0.06	0.06	0.00
Dec-04	0.13	0.06	0.00	0.06	0.00
Jan-05	0.06	0.00	0.00	0.06	0.00
Feb-05	0.00	0.00	0.00	0.00	0.00
Mar-05	0.06	0.00	0.06	0.00	0.00
Apr-05	0.13	0.13	0.00	0.00	0.00
May-05	0.25	0.13	0.06	0.00	0.06
Jun-05	0.38	0.6	0.19	0.13	0.00
Jul-05	0.38	0.13	0.13	0.13	0.00
Aug-05	0.50	0.25	0.13	0.06	0.06

Table 13: Species composition and monthly abundance of rodent species collected in El-Qanatra El-Beida, from September 2003 to August 2005.

Month	Total Rodent / trap	*Rattus norvegicus*	*R. rattus alexandrinus*	*R. rattus frugivorous*	*Mus musculus*
Sep-03	0.44	0.19	0.13	0.13	0.00
Oct-03	0.44	0.13	0.13	0.06	0.13
Nov-03	0.31	0.13	0.06	0.06	0.06
Dec-03	0.19	0.06	0.06	0.06	0.00
Jan-04	0.00	0.00	0.00	0.00	0.00
Feb-04	0.00	0.00	0.00	0.00	0.00
Mar-04	0.13	0.00	0.06	0.06	0.00
Apr-04	0.25	0.06	0.06	0.06	0.06
May-04	0.56	0.19	0.19	0.06	0.13
Jun-04	0.50	0.19	0.13	0.19	0.00
Jul-04	0.44	0.13	0.19	0.13	0.00
Aug-04	0.63	0.31	0.13	0.13	0.06
Sep-04	0.56	0.19	0.19	0.13	0.06
Oct-04	0.38	0.13	0.13	0.13	0.00
Nov-04	0.31	0.06	0.13	0.13	0.00
Dec-04	0.25	0.06	0.13	0.06	0.00
Jan-05	0.00	0.00	0.00	0.00	0.00
Feb-05	0.00	0.00	0.00	0.00	0.00
Mar-05	0.13	0.06	0.06	0.00	0.00
Apr-05	0.19	0.06	0.00	0.13	0.00
May-05	0.38	0.13	0.13	0.06	0.06
Jun-05	0.56	0.25	0.13	0.19	0.00
Jul-05	0.44	0.19	0.13	0.13	0.00
Aug-05	0.50	0.19	0.13	0.13	0.06