

Results

Table (5) The antigenemia prevalence in the sampled villages

Village	Prevalence %
Arab Al-Ayaydah	2.6
Bijam	0
Kafr Ata Allah	3
Mit Asim	2.6
Kafr Tisfa	2.4
Al - Qulzum	4.4
As - Salmaniyyah	4.1
Nub Taha	3.3
Dijwi	3.2
Namul	4.3
Tirsa	4.1
Abu Al - Ghayt	0
Hallabah	1.2
Al - Baradah	1.3
Tanan	0
Warwarah	1.2
Al - Baqqashin	1.3
As - Salhiyyah	4.6
Tant Al - Jazirah	3.3
Arab Jihaynah & As - Sawalih	2.1
Qaryat 23 July	0
Kafr Ash - Shaykh Marawan	1.4
Kafr Salib	1.1
Kafr Sharaf ad-Din	0
Mit Al - Hofeyin	0
Kafr Ash - Shurafa Al - Qibli	2.1
Kafr Ad - Dayr	3.7
Kafr Ramadah	0.7
Kafr Ash-Shurafa al-Gharbi	1.6
Iz. Kafr Al - Hamam	0
Mit Al - Attar	2.1
Kafr Ilwan	4.2
Iz. Al - Jabal Al - Asfar Farm	0
Kafr Abyan	0.7
Kafr Allym	1.3
Kafr Muways	0
As - Saffayn	0
Barqata	4.3
Kafr Tuhuriyyah	5.9
Kafr Hasan Sad	3.1
Al - Khusus	0.8

Table (5) shows the antigenemia prevalence (prevalence %) for each sampled village

Table (6) The picture of antigenemia prevalence in the sampled villages

prevalence%	Frequency	Percent
0	10	24.39
0.7	2	4.88
0.8	1	2.44
1.1	1	2.44
1.2	2	4.88
1.3	3	7.32
1.4	1	2.44
1.6	1	2.44
2.1	3	7.32
2.4	1	2.44
2.6	2	4.88
3	1	2.44
3.1	1	2.44
3.2	1	2.44
3.3	2	4.88
3.7	1	2.44
4.1	2	4.88
4.2	1	2.44
4.3	2	4.88
4.4	1	2.44
4.6	1	2.44
5.9	1	2.44
Total	41	100

Table (6) describes the antigenemia prevalence in the sampled villages (Prevalence %), the number of villages for each prevalence value (Frequency) and the percent of villages for each prevalence value (Percent)

Table (7) Descriptive Statistics of antigenemia prevalence

	Minimum	Maximum	Mean	Std. Deviation
Prevalence %	0	5.9	2	1.671

Table (7) illustrates that the sampled villages provided a mean prevalence of filariasis infection of 2% with a maximum prevalence of 5.9%

Table (8) the demographic, socio-economic status and activities related to the control of filarial infection

Gender		
	Frequency	Percent
Male	5848	74.36
Female	2016	25.64
Total	7864	100

Education		
	Frequency	Percent
University	1676	21.31
High school	486	6.18
Elementary School	3766	47.89
Literate	1936	24.62
Total	7864	100

Age group		
	Frequency	Percent
16-25	1820	23.14
26-35	3092	39.32
36-45	1531	19.47
46-55	807	10.26
56-65	614	7.81
Total	7864	100

Marital status		
	Frequency	Percent
Single	1434	18.23
Married	6263	79.64
Divorced	62	0.79
Widow	105	1.34
Total	7864	100

Income group		
	Frequency	Percent
<200	3266	41.53
200-500	3039	38.64
500-1000	1052	13.38
1000-2000	345	4.39
<2000	162	2.06
Total	7864	100

Use of net		
	Frequency	Percent
Non User	6261	79.62
User	1603	20.38
Total	7864	100

Presence of signs		
	Frequency	Percent
Absent	7295	92.76
Present	569	7.24
Total	7864	100

Mass treatment Number		
	Frequency	Percent
0	3625	46.1
1	2689	34.2
2	1125	14.3
3	244	3.1
4	181	2.3
5	0	0
Total	7864	100

Previous treatment		
	Frequency	Percent
Never treated	7579	96.37
Treated	285	3.63
Total	7864	100

Table (8) shows that about 80% of the sampled population do not use a mosquito net, about 97% have no signs of filarial infection, about 96% never received treatment for filarial infection, and 46% did not receive MDA. 14% of the sampled population has received MDA two times

Table (9) The correlation between antigenemia prevalence and some of the study variables

		Prevalence%
Gender	Pearson Correlation	0.006
	Sig. (2-tailed)	0.404
	N	7864
Education	Pearson Correlation	0.001
	Sig. (2-tailed)	0.920
	N	7864
Marital status	Pearson Correlation	0.031
	Sig. (2-tailed)	0.000
	N	7864
Use of net	Pearson Correlation	0.008
	Sig. (2-tailed)	0.295
	N	7864
Presence of signs	Pearson Correlation	0.142
	Sig. (2-tailed)	0.000
	N	7864
Mass treatment No	Pearson Correlation	0.359
	Sig. (2-tailed)	0.000
	N	7864
Previous treatment	Pearson Correlation	0.018
	Sig. (2-tailed)	0.017
	N	7864

Table (9) illustrates the correlation between antigenemia prevalence and some demographic, socio-economic variables as well as variables related to filarial control activities, it confirms that these variables are not strongly associated with the prevalence antigenemia as indicated by small Pearson's correlation coefficient.

Table (10) **Tree Sequence as generated by CART analysis**

Tree Number	Terminal Nodes	Cross-Validated Relative Error	Complexity
19**	35	± 0.00346	0.00034
20	34	± 0.00346	0.00056
21	33	± 0.00342	0.00072
22	29	± 0.00342	0.00108
23	26	± 0.00346	0.00395
24	23	± 0.00344	0.00530
25	21	± 0.00343	0.00609
26	20	± 0.00351	0.00706
27	17	± 0.00347	0.00765
28	16	± 0.00349	0.01006
29	14	± 0.00330	0.01236
30	13	± 0.00337	0.01308
31	11	± 0.00353	0.01588
32	10	± 0.00355	0.01962
33	9	± 0.00339	0.02117
34	8	± 0.00291	0.02470
35	6	± 0.00437	0.03254
36	5	± 0.00410	0.05230
37	4	± 0.00005	0.05557
38	1	± 0.00000	0.11112

**** Optimal**

Table (10) shows that tree NO. 19 is the optimal tree provided by automated CART analysis, the choice of optimal tree is an important step that helps to rank the study variables according to their importance

Table (11) The importance score of study variables, as generated by CART analysis

Variable	Score	
DISTANCE TO WATER BODIES	100.00	
ISOTHERMALITY	94.80	
Precipitation_of_wettest_month	92.80	
FEB_TMIN	82.60	
MAY_TMAX	69.34	
SEP_TMIN	69.08	
JAN_TMIN	57.58	
TEMPERATURE_SEASONALITY	54.03	
MAR_TMIN	51.39	
NOV_TMIN	47.04	
MAY_TMIN	46.31	
AUG_TMIN	45.87	
APR_TMIN	45.06	
JAN_TMAX	34.77	
TEMPERATURE_ANNUAL_RANGE	32.11	
JUN_TMIN	31.73	
OCT_TMIN	30.53	
ALTITUDE	26.21	
DEC_TMIN	24.70	
FEB_TMAX	19.56	
JUN_TMAX	18.27	
APR_REL_HUM_	18.14	
FEB_REL_HUM_	18.14	
MAR_REL_HUM_	18.14	
JUN_REL_HUM_	18.14	
JUL_REL_HUM_	18.14	
MAY_REL_HUM_	18.14	
JUL_TMIN	15.49	
AUG_TMAX	14.38	
MEAN_MONTHLY_TEMPERATURE_RANGE	13.94	
MAR_TMAX	13.04	
MEAN_TEMPERATURE_OF_WETTEST_QUAR	10.62	
ANNUAL_MEAN_TEMPERATURE	10.44	
PRECIPITATION_OF_WETTEST_QUARTER	9.93	
ANNUAL_PRECIPITATION	9.93	
PRECIPITATION_OF_COLDEST_QUARTER	9.93	
OCT_TMAX	9.89	
DEC_TMAX	9.25	
JUL_TMAX	8.93	
JAN_PREC	8.16	
APR_TMAX	7.90	
MAR_PREC	7.24	
MAX_TEMPERATURE_OF_WARMEST_MONTH	6.71	
PRECIPITATION_SEASONALITY	5.83	
MEAN_TEMPERATURE_OF_COLDEST_QUAR	4.46	
NOV_TMAX	3.69	

Variable	Score	
MEAN_MONTHLYWIND_2M_M_S	2.13	
MEAN_TEMPERATURE_OF_WARMEST_QUAR	1.54	
MEAN_TEMPERATURE_OF_DRIEST_QUART	1.54	
SEP_TMAX	1.27	
MASS_TREATMENT_NO	0.76	
AGE_GROUP\$	0.26	
PRESENCE_OF_SIGNS	0.20	
PEVIOUS_TREATMENT	0.01	

Table (11) in this table the study variables are ranked by CART analysis according to their importance as predictive to the prevalence antigenemia of filariasis in Kalyobiya governorate

Table (12) The most important predictive variables, as generated by CART analysis

Variable	Importance Score
DISTANCE TO WATER BODIES	100.00
ISOTHERMALITY	94.80
Precipitation of wettest month	92.80
February Minimum Temperature	82.60
MAY Maximum Temperature	69.34
September Minimum Temperature	69.08
January Minimum Temperature	57.58
TEMPERATURE SEASONALITY	54.03
March Minimum Temperature	51.39

Table (12) shows 9 variables, each of them has a predictive effect more than 50% on the prevalence of filariasis in Kalyobiya governorate, as provided by CART analysis

Table (13) Logistic regression model analysis

Dependent Y	Prevalence		
Method	Stepwise		
Enter variable if P<	0.05		
Remove variable if P>	0.1		
Overall Model Fit			
Null model -2 Log Likelihood	0.05862		
Full model -2 Log Likelihood	87.63959		
Chi-square	87.58097		
DF	3		
Significance level	P < 0.0001		
Coefficients and Standard Errors			
Variable	Coefficient	Std.Error	P
Distance_to_water_bodies	-1.0163	0.4110	0.01341
Isothermality	11.4642	4.0219	0.004366
Precipitation_of_wettest_month	1.8491	0.9008	0.04011
Constant	-589.9752		
Odds Ratios and 95% Confidence Intervals			
Variable	Odds Ratio	95% CI	
Distance_to_water_bodies	0.3619	0.1617 to 0.8100	
Isothermality	95247.5225	35.9230 to 252542606.49	
Precipitation_of_wettest_month	6.3541	1.0870 to 37.1419	
Classification table (cut-off value p=0.5)			
Percent of cases correctly classified	93.94 %		
ROC curve analysis			
Area under the ROC curve (AUC)	0.957		
Standard error	0.0504		
95% Confidence interval	0.897 to 0.988		

Table (13) shows that the final logistic regression model contained three geo-climatic significant explanatory variables (Distance to water bodies, Isothermality and Precipitation of wettest month) for the prediction of filariasis prevalence in Kalyobiya governorate, These variables explain 87.6% of the variability in prevalence as indicated by Chi-Square statistic.

Figure (14) The location of digitalized sampled villages on a map of Kalyobiya governorate

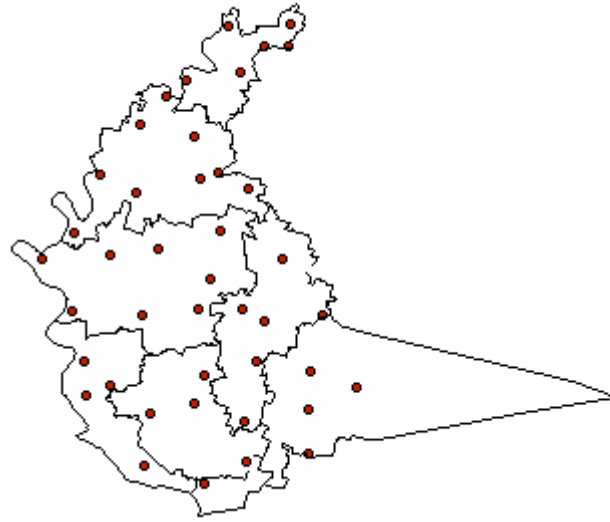


Figure (14) Map of Kalyobiya governorate. SCALE 1:818206
Showing the location of digitalized sampled villages

Figure (15) The semivariogram for the antigenemia prevalence of filariasis in sampled points in Kalyobiya governorate

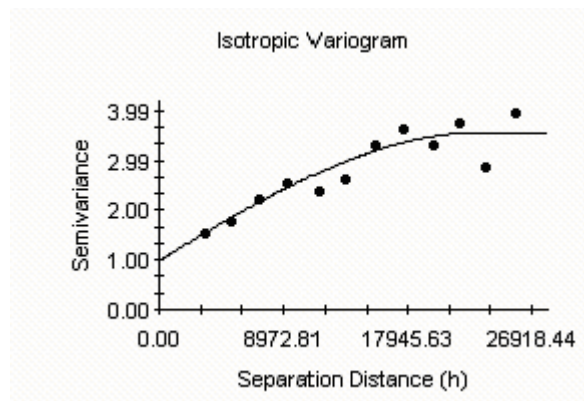


Figure (15) shows the experimental and best-fitting semivariogram obtained from the spherical equation for the prevalence of filariasis in sampled points in Kalyobiya governorate. Solid points represent experimental values $\{\gamma(h)\}$. The bold line indicates the model $(\gamma(h))$ using the spherical equation.

Figure (16) Four anisotropic experimental semivariograms for the antigenemia prevalence of filariasis in sampled points in Kalyobiya governorate

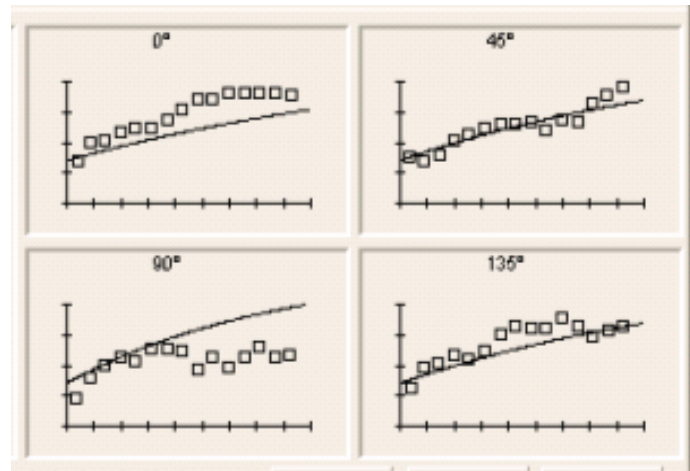


Figure (16) shows four anisotropic experimental semivariograms at 4 different angles (45,90,135), they are nearly identical at the range where the lags meet the variance This suggests that the calculated isotropic semivariogram(fig.15) is justified

Figure (17) The isopleth map of interpolated filariasis antigenemia prevalence based on antigenemia prevalence data in sampled villages

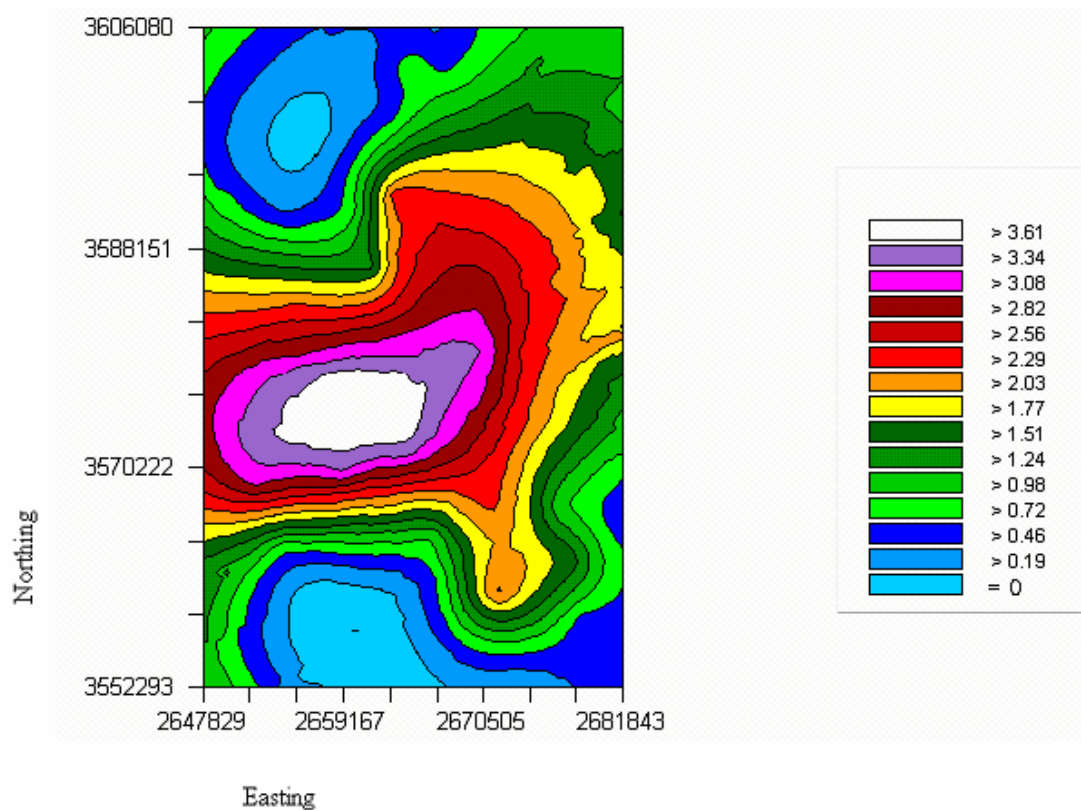


Figure (17) shows the isopleth (continuous) map of interpolated filariasis antigenemia prevalence based on antigenemia prevalence data in sampled villages, the boundaries of the color classes correspond to estimated proportion of prevalence risk in the study area ,the predicted risks are grouped into 15 categories: (= 0 - >3.61%)

Figure (18) Variogram of predicted antigenemia prevalence values using CART analysis

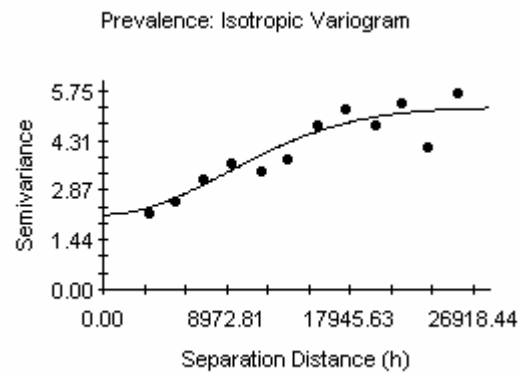


Figure (18) shows the variogram of predicted antigenemia prevalence values using CART analysis; the variogram has a range of 2.3050 km, a nugget of 1.41, and a sill of 5.126. , the spatial autocorrelation among the villages, did not vary considerably than was detected with pure spatial analysis, as compared with (fig.15).

Figure (19) A continuous map of predicted filariasis risk covering a grid of the whole governorate based on CART analysis

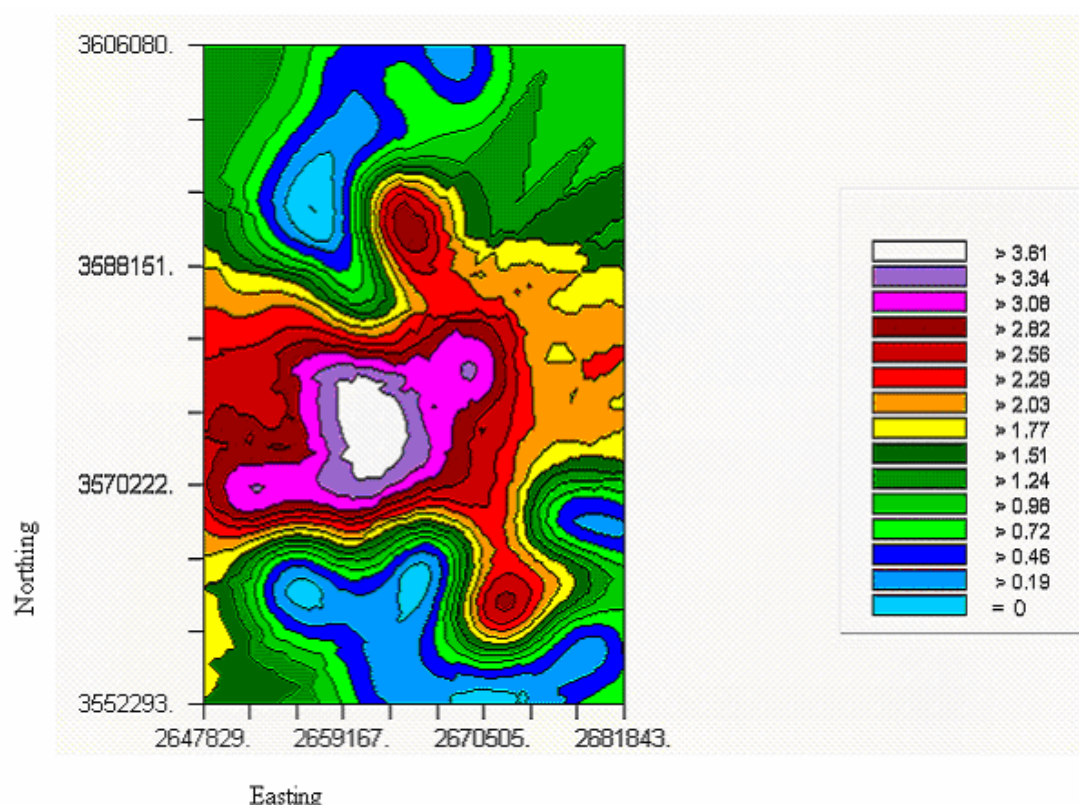


Figure (19) shows a continuous map of predicted filariasis risk covering a grid of the whole governorate based on CART analysis, the boundaries of the color classes correspond to estimated proportion of prevalence risk in the study area ,the predicted risks are grouped into 15 categories: (= 0 - >3.61%)

Figure (20) The Semivariogram of the covariate (distance to water bodies)

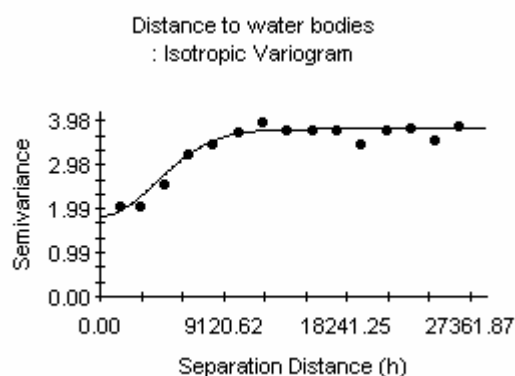


Figure (20) shows the semivariogram of the covariate (distance to water bodies). It has a range of 1.0201 km, a nugget of 1.496, and a sill of 3.791. The variable data are spatially autocorrelated over a distance of 1.0201 km.

Figure (21) The Semivariogram of the covariate (isothermality)

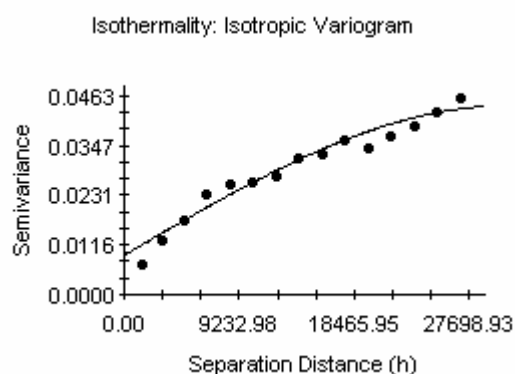


Figure (21) shows the semivariogram of the covariate (isothermality). It has a range of 3.0560 km, a nugget of 0.0092, and a sill of 0.044. The variable data are spatially autocorrelated over the distance of 3.0560 km

Figure (22) The Semivariogram of the covariate (precipitation of wettest month)

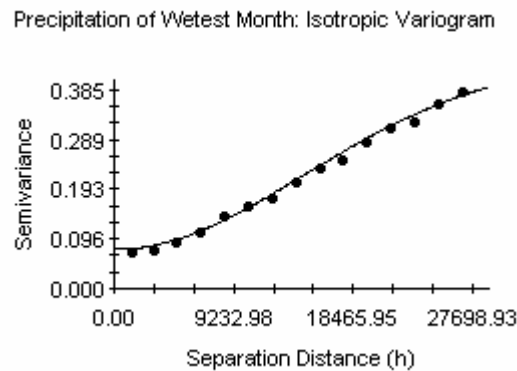


Figure (22) shows the semivariogram of the covariate (precipitation of wettest month). It has a range of 3.5870 km, a nugget of 0.076, and a sill of 0.4430. The variable data are spatially autocorrelated over the distance of 3.5870 km.

Table (14) Comparing the fitted semivariogram of the variables used for co-kriging

Variable	Range	Nugget	Sill	Nugget/ Sill
Prevalence (dependent)	2.311	0.991	3.56	0.27837
Predictions of regression model	2.305	1.41	5.126	0.27507
Distance to water bodies (predictor)	1.020	1.496	3.791	0.39462
Isothermality (predictor)	3.056	0.009	0.044	0.20909
Precipitation of wettest month (predictor)	3.587	0.076	0.443	0.17156

Table (14) compares the fitted semivariogram of the variables used for kriging. The low ratio of nugget to sill values (0.17156 - 0.39462) indicates that a considerable amount of spatial variability in *filariasis prevalence* distribution was accounted for in the Kriging model. The spatial autocorrelation of the variables data was detected maximally at a short distance (range ranging from 1.020 km to 3.587 km).

Figure (23) A continuous map of predicted filariasis risk covering a grid of Kalyobiya governorarte using co-kriging

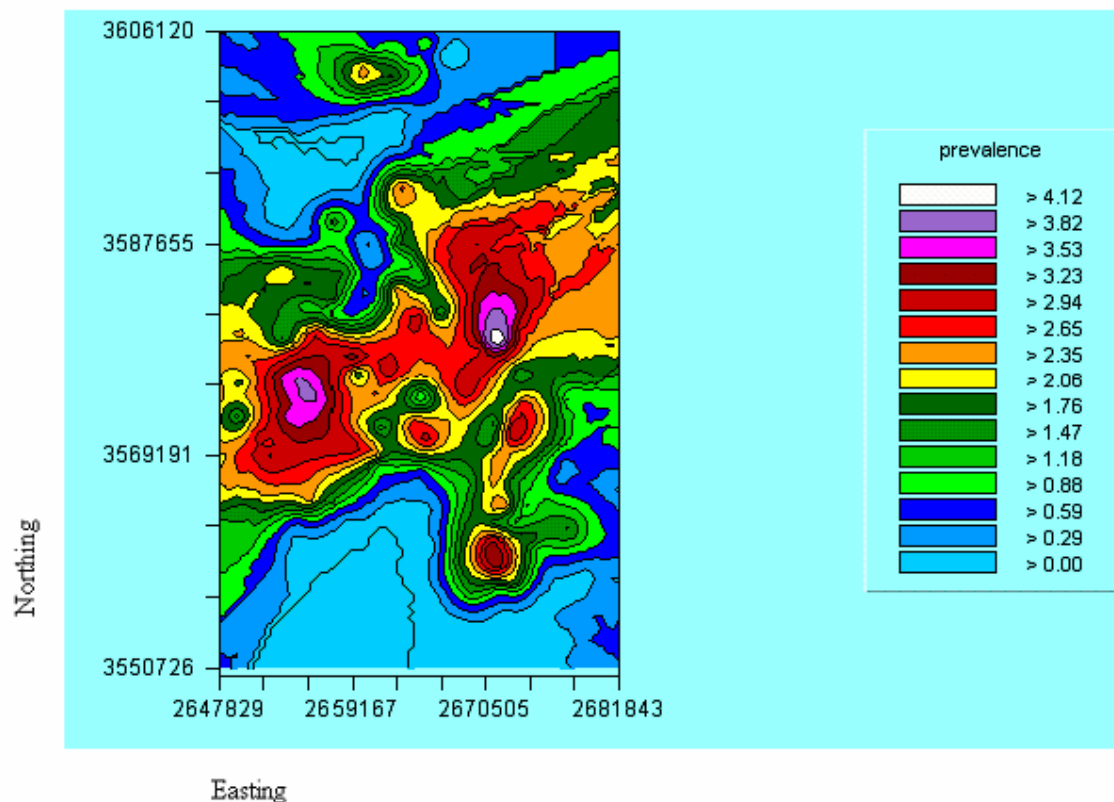


Figure (23) shows a continuous map of predicted filariasis risk covering a grid of Kalyobiya governorarte using co-kriging, the boundaries of the color classes correspond to estimated proportion of prevalence risk in the study area. The predicted risks are grouped into 15 categories: ($> 0 - >4.12\%$). It shows that prevalence values tend to cluster in certain areas with similar prevalence values to form foci for disease spreading.

Figure (24) Cluster analysis

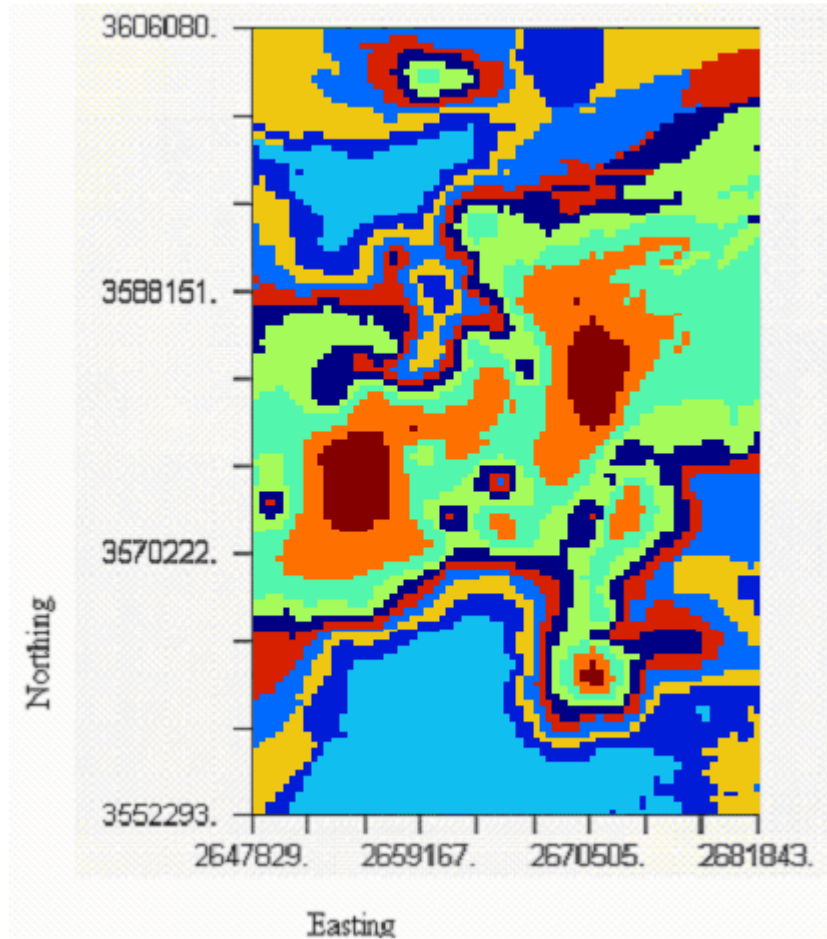


Figure (24) shows the map produced by cluster analysis, major clusters similar colors, can be identified.

Table (15) Cluster analysis

Cluster	ID	Elements	Variance
1	1420	6.21	0.085352
2	1274	6.35	0.023697
3	899	7.24	0.095350
4	1309	7.13	0.061719
5	732	2.12	0.031762
6	1216	3.14	0.063388

Table (15) illustrates that six major clusters can be recognized in the study area, the number of elements correspond to the number of villages and the variance is the sum of all intra-cluster variance, ID is a number generated by geostatistics program to recognize each cluster.

Figure (25) The distribution of digitalized villages points in a grid of Kalyobiya governorate

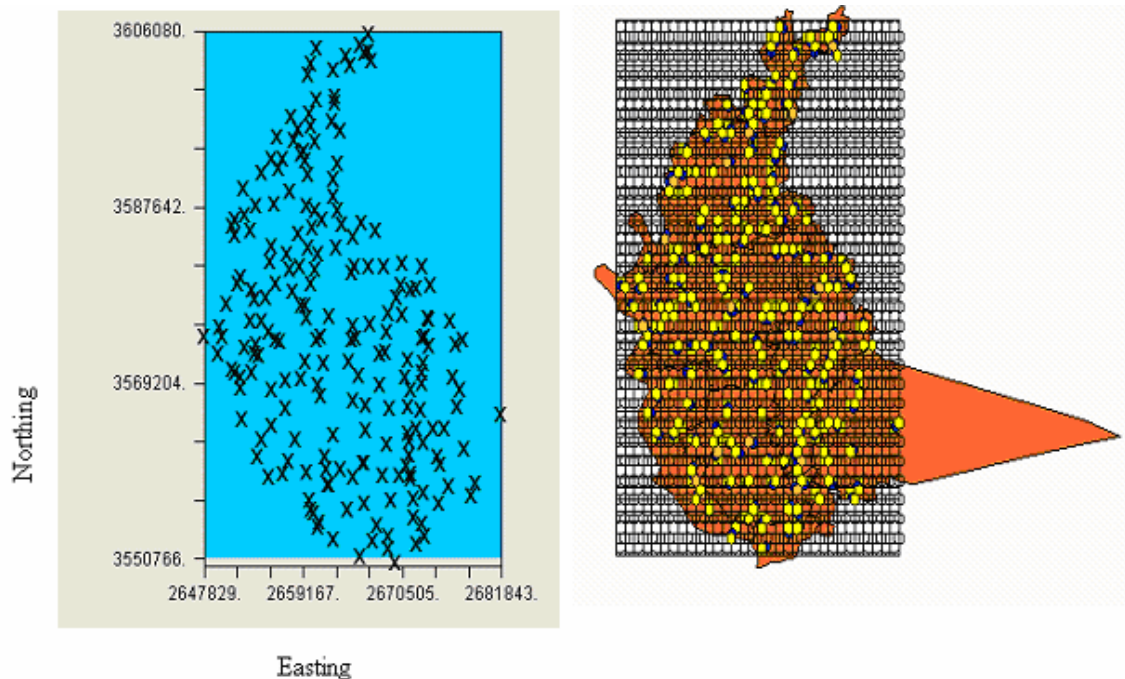


Figure (25) shows the distribution of digitalized villages' points in a grid of Kalyobiya governorate. Each (X) corresponds to the location of a digitalized village on Cartesian coordinates (Northing – Easting).

Table (16) Results of model validation using Moran 's I Statistic test, as generated by spatial analysis GIS software.

Moran 's I Statistic

Null Hypothesis Ho	Densities in adjacent quadrates not significantly different. (i.e. no spatial autocorrelation exists).
Total Quadrats	1380
Morans I Value	0.1909
Standard Deviation	0.0101
Test Probability (p)	0.001
Z score	18.93
Z value for alpha	±1.960
	Reject the Null Hypothesis (Ho).Densities in adjacent quadrates are similar, spatial autocorrelation exists

Table (16) reports the results of Moran's I statistic test of spatial autocorrelation (the Moran's I statistic, Z-score, and the probability level at which the null hypothesis of no significant autocorrelation could be rejected),as generated by spatial analysis GIS software. Moran's I is 0.1909, and Z-score is $18.93 > (Z = 1.96)$, p-value is 0.001.This indicates that the spatial dependence is statistically significant. The positive sign of Moran's I suggests a positive spatial autocorrelation in which similar values of filariasis prevalence tend to be similar to neighboring values.

Table (17) The observed and predicted antigenemia prevalence in 30 villages in Kalyobiya governorate represented by their Cartesian coordinates

X Coordinate	Y Coordinate	Observed Prevalence%	Predicted Prevalence%
2647829	3574399	3.3	3.7
2649447	3572578	0	0.7
2649602	3575362	1.1	1.64
2649990	3574484	3.3	3.6
2651119	3571007	3.74	4.1
2651442	3585073	2.2	2.1
2651763	3579994	2.4	1.9
2652041	3569043	4.4	3.98
2652202	3565725	2.86	2.91
2652308	3589919	0	0.047
2652511	3573327	3.3	2.87
2653209	3585557	3.25	3.33
2654022	3561911	0	0
2655310	3574860	4.21	3.84
2655587	3593112	0	1.2
2656109	3580051	4.4	4.63
2665094	3581789	3.54	2.65
2666268	3604077	0	2.1
2666741	3604296	0	1.4
2667959	3569446	2.2	2.43
2668959	3553483	0	0
2670515	3582195	4.4	3.97
2671193	3564364	3.3	4.1
2671769	3557535	4.62	4.74
2672798	3570686	4.4	3.75
2673097	3553615	0	0
2673702	3579861	2.23	2.24
2675356	3564865	1.87	2.21
2676657	3573643	2.2	1.96
2677576	3562687	2.86	3.1

Table (17) shows the observed and predicted prevalence by kriging, in 30 villages in Kalyobiya governorate represented by their Cartesian coordinates. Table (16) indicates that, the kriged risks are slightly higher than the observed rates.

Figure (26) The predicted filariasis risk produced by simulation, covering a grid of Kalyobiya governorate.

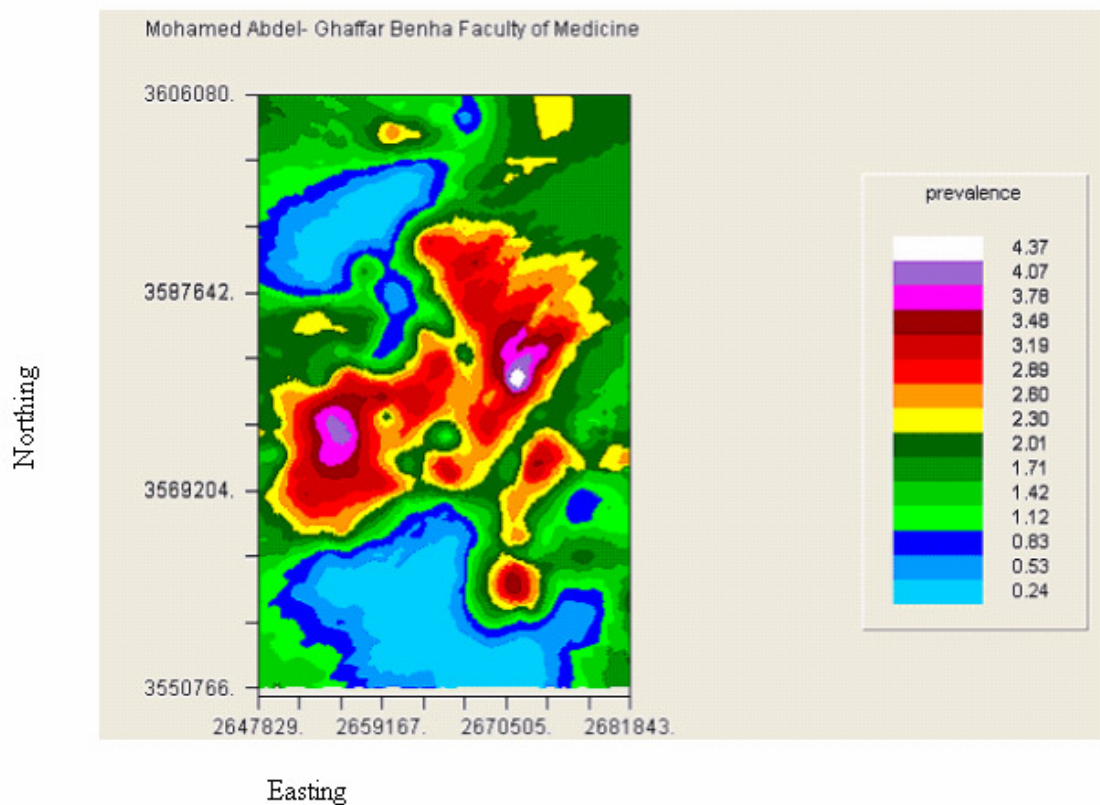


Figure (26) shows the predicted filariasis risk produced by simulation, covering a grid of Kalyobiya governorate. The simulated prevalence risk map shows very comparable spatial trends to the risk map produced by final kriging Fig. (23).

Table (18) The predicted risk values of filariasis antigenemia prevalence for all digitalized villages of Kalyobiya governorate.

Village	LONGITUDE	LATITUDE	Prevalence%
Arab Al - Ulayqat Al - Qibly	31.349	30.274	3.136
Arab al-Ayaydah	31.346	30.209	3.724
Kafr Hamzah	31.329	30.231	2.842
Ajhur As - Sughra	31.139	30.268	4.508
Qaranfil	31.158	30.279	3.214
Shubra Shihab	31.108	30.278	3.687
Izbit al - Qatawi	31.284	30.152	1.176
Bahtim	31.274	30.135	1.176
Bijam	31.243	30.137	2.056
Iz. Ash - Shahid Ahmad J	31.277	30.159	1.675
Musturud	31.285	30.141	1.176
Ash - Shimut	31.209	30.43	3.724
Batamdah	31.281	30.427	4.508
Jizirah Balli	31.295	30.417	4.611
Kafr Ata Allah	31.257	30.443	4.116
Manshaat Banha	31.208	30.469	4.21
Mit Asim	31.176	30.424	3.683
Mujul	31.174	30.391	5.096
Sandanhur	31.192	30.414	4.126
Shiblanjah	31.258	30.471	4.316
Tahlah	31.135	30.403	3.156
Al - Minshah Al - Kubra	31.258	30.576	4.47
Al - Minshah As - Sughra	31.253	30.567	4.416
Kafr Tisfa	31.302	30.567	3.436
Tisfa	31.281	30.566	4.114
As - Sadd	31.247	30.267	2.156
Balas	31.28	30.176	1.176
Kawm Ishfin	31.255	30.179	3.137
Zawiyat An - Najjar	31.292	30.179	4.102
Al - Ahraz	31.306	30.338	4.508
Al - Jaafrah	31.279	30.205	5.096
Al - Murayj	31.316	30.284	5.211
Al - Qashahish	31.288	30.234	4.116
Al - Qulzum	31.311	30.364	5.096
As - Salmaniyyah	31.283	30.197	5.096
Ash - Shubak	31.33	30.306	5.096
Bani Tamim	31.334	30.329	3.136
Kafr As - Suhbi	31.317	30.384	5.096
Kafr Ash - Shubak	31.319	30.292	5.096
Kafr Taha	31.3	30.271	4.508
Nub Taha	31.294	30.257	4.116
Shibin Al - Qanatir	31.323	30.314	1.176
Tuhuriyyah	31.328	30.359	5.39

Village	LONGITUDE	LATITUDE	Prevalence%
Ad - Dayr	31.268	30.336	4.116
Ajhur Al - Kubra	31.147	30.299	4.116
Al - Amar Al - Kubra	31.126	30.341	4.116
Al - Hissah	31.212	30.384	3.136
Arab Al - Haswah	31.286	30.326	5.096
As - Safa	31.146	30.381	4.116
As - Sifaniyyah	31.19	30.38	4.116
As - Siyafa	31.115	30.315	3.136
Barshum Al - Kubra	31.108	30.324	4.508
Barshum As - Sughra	31.11	30.321	4.508
Biltan	31.159	30.38	4.116
Dandana	31.207	30.334	4.116
Dijwi	31.114	30.383	4.116
Imyay	31.138	30.363	5.096
Kafr Al - Haddadin	31.202	30.366	5.096
Kafr Mansur	31.162	30.342	5.096
Kawm Al - Atrun	31.156	30.349	5.39
Manshiyyat Al - Amar	31.138	30.341	4.116
Mit Kinanah	31.259	30.385	5.112
Namul	31.237	30.308	5.096
Qarqashandah	31.164	30.304	4.116
Shubraharis	31.189	30.317	3.136
Sinhirah	31.245	30.294	5.096
Tirsa	31.181	30.303	5.096
Basus	31.209	30.135	1.176
Abu Al - Ghayt	31.183	30.155	1.176
Al - Akhmiyyin	31.169	30.169	1.699
Al - Kharqaniyyah	31.172	30.174	1.176
Balqas	31.28	30.176	4.116
Shalaqan	31.165	30.186	1.176
Hallabah	31.189	30.205	1.357
Sanafir	31.168	30.22	1.176
Qalama	31.206	30.216	1.254
Bahadah	31.142	30.223	1.176
Al - Baradah	31.15	30.233	1.348
As - Sabbah & Kafr Ash - Shah	31.191	30.23	1.176
Al - Munirah	31.118	30.243	1.185
Tanan	31.242	30.244	1.684
Sindibis	31.162	30.25	1.176
Sindiyun	31.205	30.247	1.634
Farsis	31.203	30.401	1.176
Ar - Ramlah	31.157	30.442	4.116
Bigayrah	31.138	30.45	4.116
Bata	31.168	30.462	1.176
Warwarah	31.18	30.49	1.176
Damallu	31.195	30.501	2.142
Jamjarah	31.228	30.499	1.176

Village	LONGITUDE	LATITUDE	Prevalence%
Al - Baqqashin	31.278	30.542	2.183
Az - Zamruniyyah	31.32	30.574	1.176
Khilwat Sinhirah	31.234	30.273	1.176
Al - Hassaniyyah	31.198	30.294	5.096
As - Salhiyyah	31.113	30.306	5.096
Al - Manzalah	31.249	30.338	3.136
Arab Al - Ghudayri	31.291	30.342	4.116
Tant Al - Jazirah	31.083	30.358	4.116
Ikyad Dijwi	31.102	30.363	2.156
Al - Abadlah	31.15	30.361	5.096
Arab As - Saqqarah	31.27	30.199	4.116
Kawm As - Samn	31.284	30.214	5.096
Al - Attarah	31.298	30.236	5.096
Az - Zahawiyyin	31.273	30.259	2.156
Al - Kawm Al - Ahmar	31.267	30.282	3.136
Tahanub	31.296	30.283	2.156
Arab Jihaynah & As - Sawalih	31.359	30.302	3.136
Al - Hasaniyyah	31.304	30.354	3.136
As - Salmaniyyah	31.281	30.193	5.096
Al - Hazzaniyyah	31.287	30.226	1.176
Qaryat 23 July	31.345	30.166	1.176
Al - Maniyyah	31.322	30.179	1.348
Al-Qalaj	31.352	30.177	2.103
Seryaqus	31.317	30.2	1.185
Al - Manayil	31.317	30.233	1.176
Sindiwah	31.307	30.251	2.156
Abu Zabal	31.354	30.261	1.176
Al - Khusus	31.307	30.166	1.547
Kafr Ash - Shaykh Marawan	31.328	30.59	1.176
Kafr Rajab	31.325	30.575	1.176
Kafr Salib	31.326	30.567	1.634
Kafr al - Walja	31.277	30.537	1.384
Isnit	31.246	30.532	1.176
Kafr Sharaf ad-Din	31.225	30.534	1.176
Kafr Radwan	31.23	30.521	1.896
Mit Al - Hofeyin	31.205	30.518	1.176
Kafr Shuman	31.264	30.39	4.116
Kafr ash-Shaykhah Salmah	31.296	30.384	4.116
Kafr Saad Beheiri	31.338	30.376	5.096
Kafr Ash - Shurafa Al - Qibli	31.343	30.359	3.136
Minshat Al - Kiram	31.358	30.324	3.136
Kafr Sulayman Al - Wirr	31.333	30.33	1.176
Kafr Shibin	31.303	30.297	1.274
Kafr Ad - Dayr	31.28	30.309	4.116
Al-Hasafah	31.273	30.309	3.136
Mit Radi	31.207	30.498	1.176
Kafr Al - Arbain	31.232	30.492	2.032

Village	LONGITUDE	LATITUDE	Prevalence%
Kafr Al - Jazzar	31.157	30.48	1.176
Kafr Abu - Dikri	31.153	30.457	2.156
Kafr Bata	31.141	30.455	1.176
Kafr Ash - Shimut	31.225	30.433	1.892
Nay	31.251	30.202	3.136
Kafr Ramadah	31.232	30.216	1.176
Kafr Ash-Shurafa al-Gharbi	31.126	30.223	1.852
Iz. Muh. Hashish	31.22	30.395	2.156
Kafr Tahlah	31.132	30.398	3.136
Kafr Al - Hissah	31.191	30.4	1.176
Kafr Al - Arab	31.226	30.408	1.176
Marsafa	31.247	30.41	5.096
Kafr Farsis	31.216	30.416	1.176
Iz. Kafr Al - Hamam	31.238	30.437	1.176
Mit Al - Attar	31.139	30.441	3.136
Kafr Sandanhur	31.172	30.411	1.176
Iz. Zawyat Bilttan	31.146	30.39	1.176
Kafr Al - Fuqaha	31.128	30.318	4.116
Kafr Ilwan	31.197	30.367	5.096
Kafr Hasan Sad	31.211	30.335	4.116
Kafr Ar - Rijalat	31.095	30.34	1.176
Jazirat Al - Ahrar	31.104	30.355	4.116
Iz. Sirri	31.315	30.208	4.116
Kafr An - Nakhlah	31.14	30.331	5.096
Mansurit Namul	31.245	30.327	1.176
Kafr Al - Hisafah	31.25	30.327	1.176
Kafr Abd As - Sayyid Nawwar	31.298	30.576	1.176
Mit Nama	31.227	30.146	1.634
Manti	31.245	30.147	1.384
Mit Halfa	31.235	30.159	1.176
Kafr Abu Jumah	31.218	30.206	1.176
Kafr As - Sibil	31.19	30.218	1.176
Nawa	31.262	30.228	3.136
Iz. Al - Jabal Al - Asfar Far	31.394	30.231	1.176
Kafr Abyan	31.347	30.247	1.654
Kafr Allym	31.125	30.257	1.176
Kafr Sindiwah	31.313	30.274	3.136
Nazlat Arab Jihaynah	31.367	30.304	1.176
Kafr Tuhuriyyah	31.32	30.358	7.056
Kafr Sa'ad	31.2	30.491	1.176
Nazlat Ar - Rawashdah	31.279	30.387	1.176
Kafr Abid	31.166	30.34	5.096
An-Nassriyah	31.21	30.311	1.176
Iz. Al - Ghariri	31.303	30.223	1.176
Miniyet Shibin	31.326	30.315	4.116
Tall Bani Tamim	31.333	30.33	4.116
Kafr Silim	31.168	30.182	1.176

Village	LONGITUDE	LATITUDE	Prevalence%
Kafr Al-Harth	31.165	30.194	1.176
Kafr Al-Imad	31.136	30.333	5.096
Kafr Abu Zahrah	31.255	30.455	1.176
Kafr Muways	31.232	30.479	1.176
Minyat As - Siba	31.224	30.452	1.185
Nuqbas	31.232	30.447	1.684
As - Saffayn	31.267	30.588	1.135
Mit Ad-Driag	31.257	30.544	1.634
Kafr Izab Ghoneim	31.245	30.522	1.176
Kafr Kordi	31.246	30.507	1.958
Kafr Ash-Shahawi Khattir	31.269	30.521	1.176
Munshahat Abu Diyab	31.268	30.416	1.472
Kafr Ash-Sheikh Ibrahim	31.258	30.429	1.176
JamJara el-Gedida	31.232	30.501	2.045
Kafr Ramada wa at Turjuman	31.233	30.216	1.176
Barqata	31.267	30.483	5.096
Kafr Fanus Masud	31.317	30.583	3.136
Ash - Shuqr	31.276	30.511	4.116

Table (18) shows the predicted risk values of filariasis prevalence for all digitalized villages points in Kalyobiya governorate (202 points). For each village its position is indicated by longitude and latitude and filariasis infection risk is indicated by prevalence percent (prevalence %).

Figure (27) A risk map for filariasis infection in Kalyobiya governorate showing the predicted filariasis risk covering Kalyobiya governorate

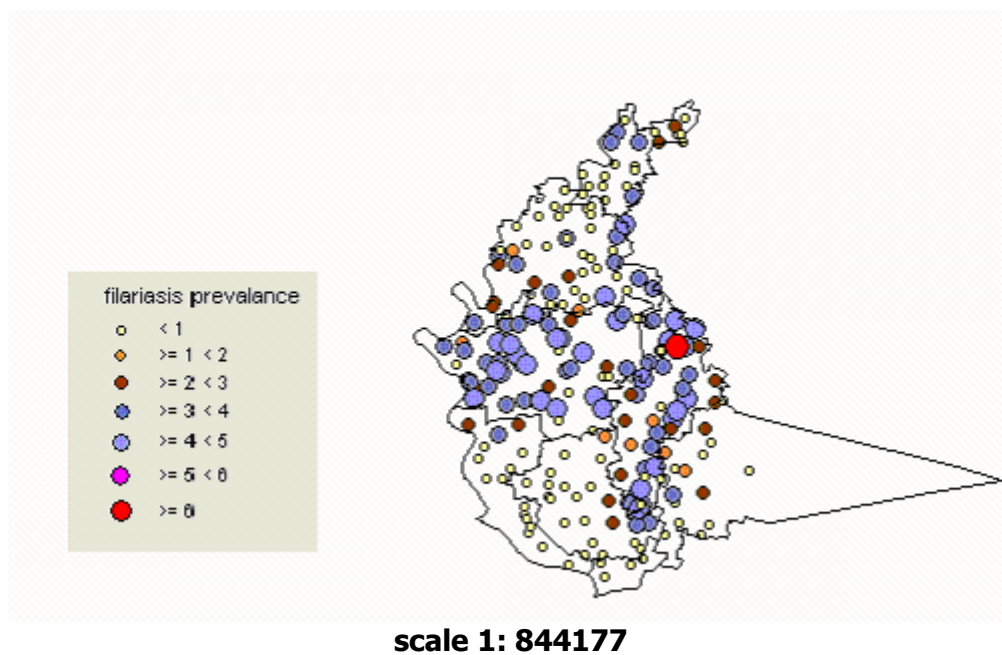


Figure (27) shows the final risk map for filariasis infection in Kalyobiya governorate. It shows the predicted filariasis risk covering the whole governorate. The predicted risks are shown in 7 classes : (>1 - ≥ 6). The map shows that filariasis tend to form foci of disease in certain locations of similar prevalence values.

Table (19) The parameters source used by the study simulation model

LYMFASIM ^a	Coverage			
	60%	70%	80%	90%
Number of MDA rounds needed	10	8	6	5
- had achieved the 0.5% threshold	35/51 (69%)	79/86 (92%)	62/70 (89%)	90/97 (93%)
- had NOT achieved the 0.5% threshold	16/49 (33%)	8/14 (57%)	18/30 (60%)	1/3 (33%)

Table (19) The parameters used by the study simulation model derived from studies applied to Pondicherry region in India based on the impact of the 5 years integrated vector management (IVM) program and MDA.
Source: (Stolk et al; 2006).

Figure (28) The parameters source used by the study simulation model

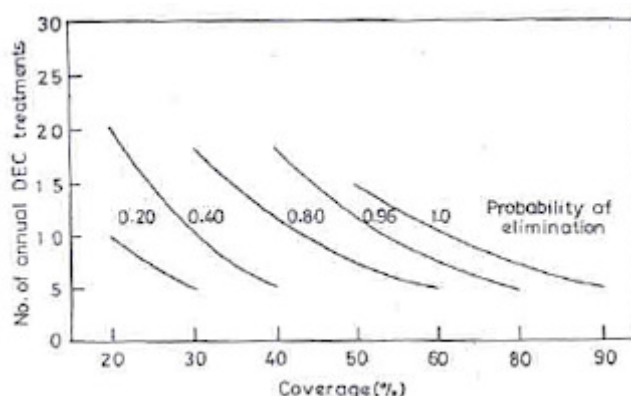


Figure (28) shows the probability of elimination of filariasis infection in relation to coverage and number of annual MDA treatments. The vertical axis indicates the number of annual DEC treatment, the coverage % is shown on the horizontal axis. Source: (Stolk et al; 2006).

Figure (29) The continuous map of simulated filariasis antigenemia prevalence, simulating the administration of mass drug (MDA) for 5 rounds

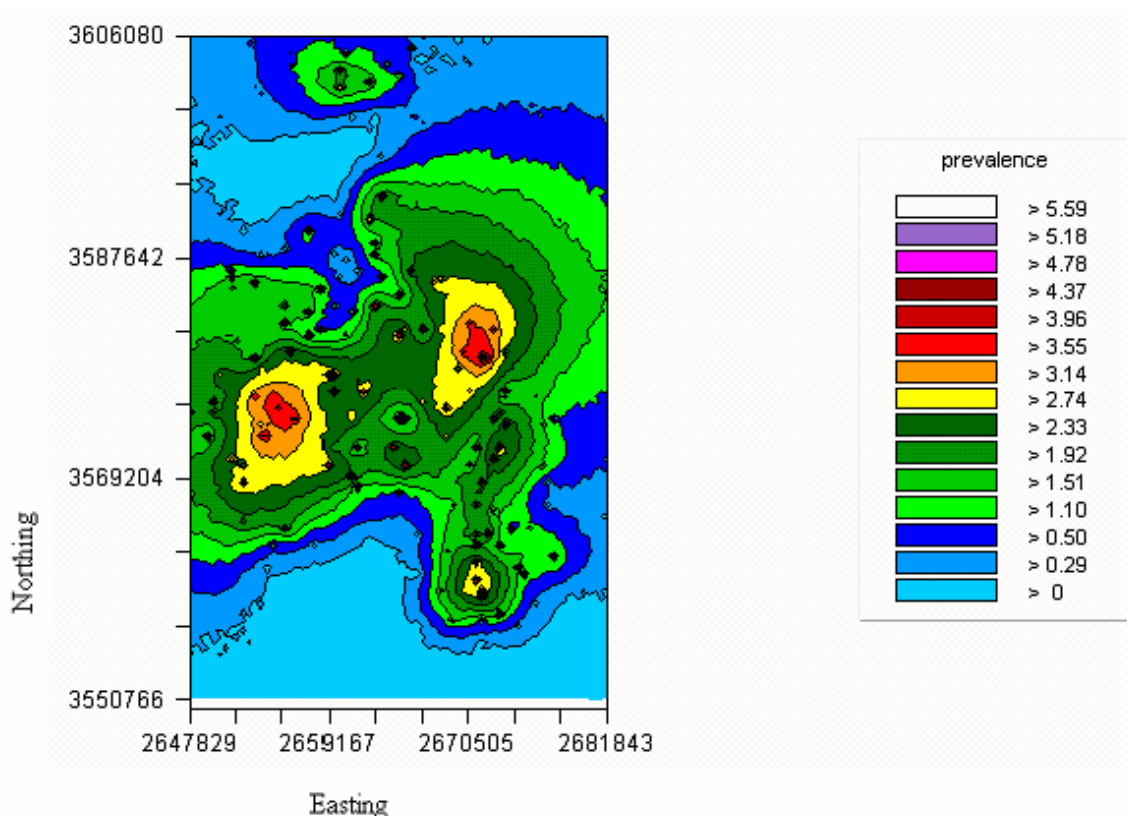


Figure (29) shows a continuous map of filariasis infection as indicated by prevalence %, covering a grid Kalyobiya governorate after simulating the administration of mass drug (MDA) for 5 rounds. Reading the map indicates that most villages of the governorate have a prevalence values between >1.1% and >3.55% and the threshold below 0.5% prevalence to interrupt the transmission cycle could not be reached.

Figure (30) The continuous map of simulated filariasis antigenemia prevalence, simulating the administration of mass drug (MDA) for 14 rounds

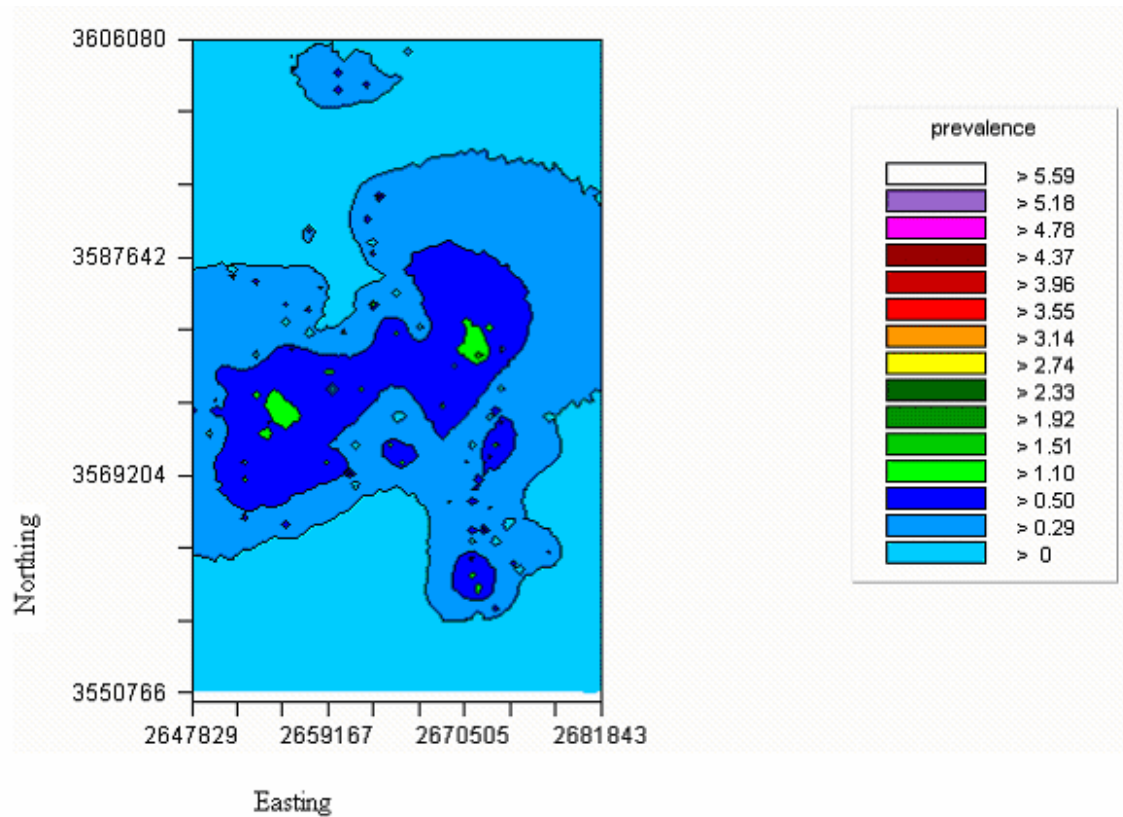


Figure (30) shows a continuous map of filariasis infection as indicated by prevalence %, covering a grid Kalyobiya governorate after simulating the administration of mass drug (MDA) for 14 rounds. Reading the map indicates that some villages of the governorate have a prevalence values between >0.5% and >1.1% and the threshold below 0.5% prevalence to interrupt the transmission cycle could not be reached.

Figure (31) The continuous map of simulated filariasis antigenemia prevalence, simulating the administration of mass drug (MDA) for 17 rounds

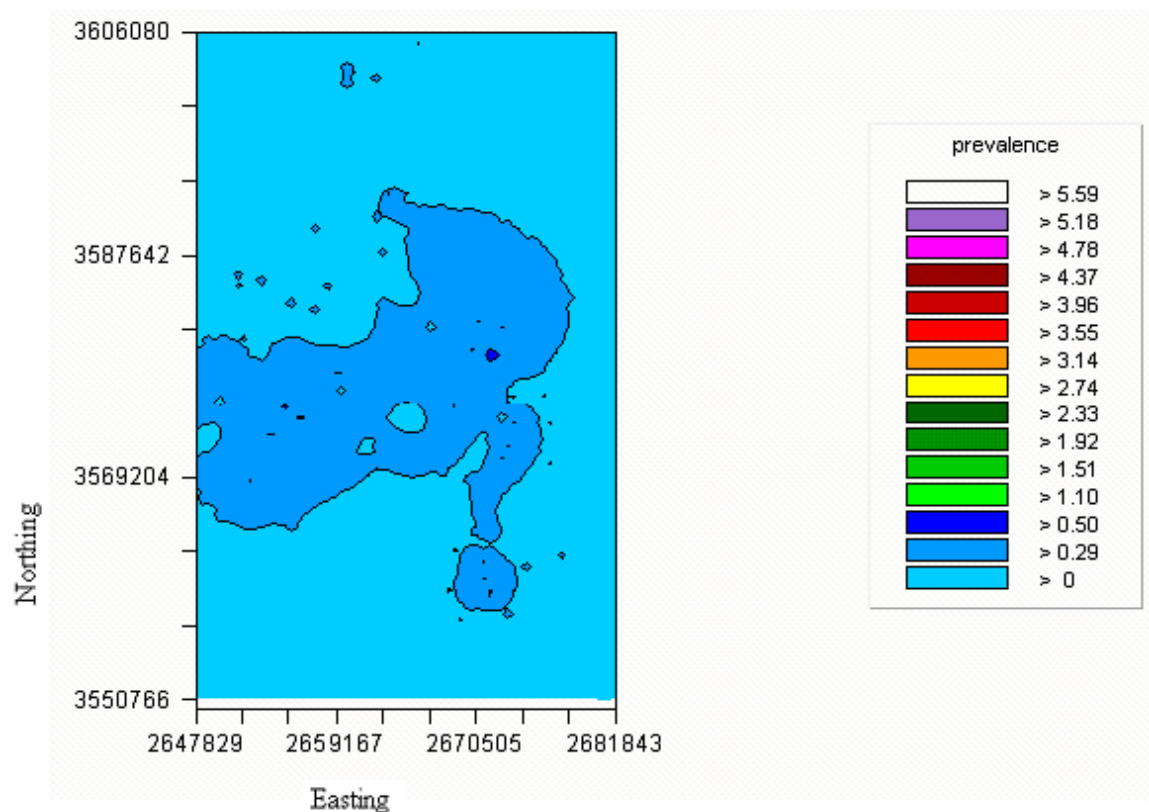


Figure (31) shows a continuous map of filariasis infection as indicated by prevalence %, covering a grid Kalyobiya governorate after simulating the administration of mass drug (MDA) for 17 rounds. Reading the map indicates that all villages of the governorate have a prevalence values less than 0.5% and the threshold below 0.5% prevalence to interrupt the transmission cycle could be reached after 17 rounds of MDA.

Table (20) The simulated filariasis antigenemia prevalence in all digitalized villages of Kalyobiya governorate, simulating the administration of mass drug (MDA) for 21 rounds.

Village	LONGITUDE	LATITUDE	Prevalence%
Arab Al - Ulayqat Al - Qibly	31.349	30.274	0.304
Arab al-Ayaydah	31.346	30.209	0.362
Kafr Hamzah	31.329	30.231	0.276
Ajhur As - Sughra	31.139	30.268	0.438
Qaranfil	31.158	30.279	0.312
Shubra Shihab	31.108	30.278	0.358
Izbit al - Qatawi	31.284	30.152	0.114
Bahtim	31.274	30.135	0.114
Bijam	31.243	30.137	0.200
Iz. Ash - Shahid Ahmad J	31.277	30.159	0.163
Musturud	31.285	30.141	0.114
Ash - Shimut	31.209	30.43	0.362
Batamdah	31.281	30.427	0.438
Jizirah Balli	31.295	30.417	0.448
Kafr Ata Allah	31.257	30.443	0.400
Manshaat Banha	31.208	30.469	0.409
Mit Asim	31.176	30.424	0.358
Mujul	31.174	30.391	0.495
Sandanhur	31.192	30.414	0.401
Shiblanjah	31.258	30.471	0.419
Tahlah	31.135	30.403	0.306
Al - Minshah Al - Kubra	31.258	30.576	0.434
Al - Minshah As - Sughra	31.253	30.567	0.429
Kafr Tisfa	31.302	30.567	0.334
Tisfa	31.281	30.566	0.399
As - Sadd	31.247	30.267	0.209
Balas	31.28	30.176	0.114
Kawm Ishfin	31.255	30.179	0.305
Zawiyat An - Najjar	31.292	30.179	0.398
Al - Ahras	31.306	30.338	0.438
Al - Jaafrah	31.279	30.205	0.495
Al - Murayj	31.316	30.284	0.506
Al - Qashahish	31.288	30.234	0.400
Al - Qulzum	31.311	30.364	0.495
As - Salmaniyyah	31.283	30.197	0.495
Ash - Shubak	31.33	30.306	0.495
Bani Tamim	31.334	30.329	0.304
Kafr As - Suhbi	31.317	30.384	0.495
Kafr Ash - Shubak	31.319	30.292	0.495
Kafr Taha	31.3	30.271	0.438
Nub Taha	31.294	30.257	0.400
Shibin Al - Qanatir	31.323	30.314	0.114
Tuhuriyyah	31.328	30.359	0.523
Ad - Dayr	31.268	30.336	0.400
Ajhur Al - Kubra	31.147	30.299	0.400
Al - Amar Al - Kubra	31.126	30.341	0.400
Al - Hissah	31.212	30.384	0.304

Village	LONGITUDE	LATITUDE	Prevalence%
Arab Al - Haswah	31.286	30.326	0.495
As - Safa	31.146	30.381	0.400
As - Sifaniyyah	31.19	30.38	0.400
As - Siyafa	31.115	30.315	0.304
Barshum Al - Kubra	31.108	30.324	0.438
Barshum As - Sughra	31.11	30.321	0.438
Biltan	31.159	30.38	0.400
Dandana	31.207	30.334	0.400
Dijwi	31.114	30.383	0.400
Imyay	31.138	30.363	0.495
Kafr Al - Haddadin	31.202	30.366	0.495
Kafr Mansur	31.162	30.342	0.495
Kawm Al - Atrun	31.156	30.349	0.523
Manshiyyat Al - Amar	31.138	30.341	0.400
Mit Kinanah	31.259	30.385	0.496
Namul	31.237	30.308	0.495
Qarqashandah	31.164	30.304	0.400
Shubraharis	31.189	30.317	0.304
Sinhirah	31.245	30.294	0.495
Tirsa	31.181	30.303	0.495
Basus	31.209	30.135	0.114
Abu Al - Ghayt	31.183	30.155	0.114
Al - Akhmiyyin	31.169	30.169	0.165
Al - Kharqaniyyah	31.172	30.174	0.114
Balqas	31.28	30.176	0.400
Shalaqan	31.165	30.186	0.114
Hallabah	31.189	30.205	0.132
Sanafir	31.168	30.22	0.114
Qalama	31.206	30.216	0.122
Bahadah	31.142	30.223	0.114
Al - Baradah	31.15	30.233	0.131
As - Sabbah & Kafr Ash - Shah	31.191	30.23	0.114
Al - Munirah	31.118	30.243	0.115
Tanan	31.242	30.244	0.163
Sindibis	31.162	30.25	0.114
Sindiyyun	31.205	30.247	0.159
Farsis	31.203	30.401	0.114
Ar - Ramlah	31.157	30.442	0.400
Biqayrah	31.138	30.45	0.400
Bata	31.168	30.462	0.114
Warwarah	31.18	30.49	0.114
Damallu	31.195	30.501	0.208
Jamjarah	31.228	30.499	0.114
Al - Baqqashin	31.278	30.542	0.212
Az - Zamruniyyah	31.32	30.574	0.114
Khilwat Sinhirah	31.234	30.273	0.114
Al - Hassaniyyah	31.198	30.294	0.495
As - Salhiyyah	31.113	30.306	0.495
Al - Manzalah	31.249	30.338	0.304
Arab Al - Ghudayri	31.291	30.342	0.400
Tant Al - Jazirah	31.083	30.358	0.400
Ikyad Dijwi	31.102	30.363	0.209

Village	LONGITUDE	LATITUDE	Prevalence%
Al - Abadlah	31.15	30.361	0.495
Arab As - Saqqarah	31.27	30.199	0.400
Kawm As - Samn	31.284	30.214	0.495
Al - Attarah	31.298	30.236	0.495
Az - Zahawiyyin	31.273	30.259	0.209
Al - Kawm Al - Ahmar	31.267	30.282	0.304
Tahanub	31.296	30.283	0.209
Arab Jihaynah & As - Sawalih	31.359	30.302	0.304
Al - Hasaniyyah	31.304	30.354	0.304
As - Salmaniyah	31.281	30.193	0.495
Al - Hazzaniyyah	31.287	30.226	0.114
Qaryat 23 July	31.345	30.166	0.114
Al - Maniyyah	31.322	30.179	0.131
Al-Qalaj	31.352	30.177	0.204
Seryaqus	31.317	30.2	0.115
Al - Manayil	31.317	30.233	0.114
Sindiwah	31.307	30.251	0.209
Abu Zabal	31.354	30.261	0.114
Al - Khusus	31.307	30.166	0.150
Kafr Ash - Shaykh Marawan	31.328	30.59	0.114
Kafr Rajab	31.325	30.575	0.114
Kafr Salib	31.326	30.567	0.159
Kafr al - Walja	31.277	30.537	0.134
Isnit	31.246	30.532	0.114
Kafr Sharaf ad-Din	31.225	30.534	0.114
Kafr Radwan	31.23	30.521	0.184
Mit Al - Hofeyin	31.205	30.518	0.114
Kafr Shuman	31.264	30.39	0.400
Kafr ash-Shaykhah Salmah	31.296	30.384	0.400
Kafr Saad Beheiri	31.338	30.376	0.495
Kafr Ash - Shurafa Al - Qibli	31.343	30.359	0.304
Minshat Al - Kiram	31.358	30.324	0.304
Kafr Sulayman Al - Wirr	31.333	30.33	0.114
Kafr Shubin	31.303	30.297	0.124
Kafr Ad - Dayr	31.28	30.309	0.400
Al-Hasafah	31.273	30.309	0.304
Mit Radi	31.207	30.498	0.114
Kafr Al - Arbain	31.232	30.492	0.197
Kafr Al - Jazzar	31.157	30.48	0.114
Kafr Abu - Dikri	31.153	30.457	0.209
Kafr Bata	31.141	30.455	0.114
Kafr Ash - Shimut	31.225	30.433	0.184
Nay	31.251	30.202	0.304
Kafr Ramadah	31.232	30.216	0.114
Kafr Ash-Shurafa al-Gharbi	31.126	30.223	0.180
Iz. Muh. Hashish	31.22	30.395	0.209
Kafr Tahlah	31.132	30.398	0.304
Kafr Al - Hissah	31.191	30.4	0.114
Kafr Al - Arab	31.226	30.408	0.114

Village	LONGITUDE	LATITUDE	Prevalence%
Marsafa	31.247	30.41	0.495
Kafr Farsis	31.216	30.416	0.114
Iz. Kafr Al - Hamam	31.238	30.437	0.114
Mit Al - Attar	31.139	30.441	0.304
Kafr Sandanhur	31.172	30.411	0.114
Iz. Zawyat Bilttan	31.146	30.39	0.114
Kafr Al - Fuqaha	31.128	30.318	0.400
Kafr Ilwan	31.197	30.367	0.495
Kafr Hasan Sad	31.211	30.335	0.400
Kafr Ar - Rijalat	31.095	30.34	0.114
Jazirat Al - Ahrar	31.104	30.355	0.400
Iz. Sirri	31.315	30.208	0.400
Kafr An - Nakhlah	31.14	30.331	0.495
Mansurit Namul	31.245	30.327	0.114
Kafr Al - Hisafah	31.25	30.327	0.114
Kafr Abd As - Sayyid Nawwar	31.298	30.576	0.114
Mit Nama	31.227	30.146	0.159
Manti	31.245	30.147	0.134
Mit Halfa	31.235	30.159	0.114
Kafr Abu Jumah	31.218	30.206	0.114
Kafr As - Sibil	31.19	30.218	0.114
Nawa	31.262	30.228	0.304
Iz. Al - Jabal Al - Asfar Far	31.394	30.231	0.114
Kafr Abyan	31.347	30.247	0.161
Kafr Allym	31.125	30.257	0.114
Kafr Sindiwah	31.313	30.274	0.304
Nazlat Arab Jihaynah	31.367	30.304	0.114
Kafr Tuhuriyyah	31.32	30.358	0.685
Kafr Sa'ad	31.2	30.491	0.114
Nazlat Ar - Rawashdah	31.279	30.387	0.114
Kafr Abid	31.166	30.34	0.495
An-Nassriyah	31.21	30.311	0.114
Iz. Al - Ghariri	31.303	30.223	0.114
Miniyet Shubin	31.326	30.315	0.400
Tall Bani Tamim	31.333	30.33	0.400
Kafr Silim	31.168	30.182	0.114
Kafr Al-Harth	31.165	30.194	0.114
Kafr Al-Imad	31.136	30.333	0.495
Kafr Abu Zahrah	31.255	30.455	0.114
Kafr Muways	31.232	30.479	0.114
Minyat As - Siba	31.224	30.452	0.115
Nuqbas	31.232	30.447	0.163
As - Saffayn	31.267	30.588	0.110
Mit Ad-Driag	31.257	30.544	0.159
Kafr Izab Ghoneim	31.245	30.522	0.114
Kafr Kordi	31.246	30.507	0.190
Kafr Ash-Shahawi Khattir	31.269	30.521	0.114
Munshahat Abu Diyab	31.268	30.416	0.143
Kafr Ash-Sheikh Ibrahim	31.258	30.429	0.114
JamJara el-Gedida	31.232	30.501	0.199
Kafr Ramada wa at Turjuman	31.233	30.216	0.114

Village	LONGITUDE	LATITUDE	Prevalence%
Barqata	31.267	30.483	0.495
Kafr Fanus Masud	31.317	30.583	0.304
Ash - Shuqr	31.276	30.511	0.400

Table (20) shows the simulated atigenemia prevalence (prevalence %) in all digitalized villages of Kalyobiya after 21 rounds of MDA assuming that the climatic conditions favor the spread of filarial infection assuming that the climatic conditions favor the spread of filarial infection. It illustrates that all villages of the governorate have a prevalence values less than 0.5% and the threshold below 0.5% prevalence to interrupt the transmission cycle could be reached after 21 rounds of MDA.