Population Density, Economic Threshold and Injury Levels of *Tetranychus urticae* and *Petrobia tritici* Infesting Wheat Plants at Sharkia and Beheira Governorates, Egypt

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ABSTRACT

Assessment of the economic damage threshold (ETL) and economic injury level (EIL) of the two tetranychid *Tetranychus urticae* and *Petrobia tritici* infested wheat (Giza 168) were studied during 2016/2017 season at Sharkia and Beheira governorates. Also, the population density of both mite species were estimated. Results cleared that the values of (ETL) were less than (EIL) level. The (ETLs) values of *T. urticae* on wheat plants at Beheira and Sharkia (as x1 &x2 peaks results) ranged 4-4.33 and 4.33-10 individuals /leaf, while the (EIL)values ranged 4.33-5 and 10.33- 13.33 individuals /leaf in the two localities, respectively. In the same trend the ETLs of *P.tritici* on wheat plants at Sharkia and Beheira (as x1 &x2 peaks results) ranged 3.33-4.00 and 3.33 individuals. /leaf, while the EILs ranged 5-5.33 and 3.67-5.33 Individuals / leaf in the two localities, respectively. In addition, the results of population density of the two-mite species showed that, there were two peaks for each species at the two localities. Statistical analysis detected a positive insignificant correlation between the population of the two mite species and average temperature while it was insignificantly negative with average of R.H. %. The relatively high effect as partial regression (E.V. %) for tested climatic factors of 5.18% was recorded for average temperature on *P.tritici* at Sharkia governorate, while the relatively high multiple correlation for the two tested climatic factors together was 17.07% recorded on *P. tritici* at Beheira governorate.

Key words: Economic threshold and injury levels, Population density, *Tetranychus urticae*, *Petrobia tritici*, Wheat.

INTRODUCTION

Wheat is the most important cereal food crop for human and his animals in the world. Recently, the phytophagous mite species have been found infesting its plants in different wheat growing regions causing great damage. The two spotted spider mite, *Tetranychus urticae* Koch and the brown wheat mite, *Petrobia tritici* Kandeel, El-Naggar and Mohamed were recorded as serious mite species on wheat and other Gramineae hosts in many regions, i.e., rice and garlic plants are also infested with *P. latens* (Müller), Wang *et al*., (1994), Kride and Toit (1988), Noorbakhsh (1993), Prinsloo (2001) and Estal, *et al.* (1992). Also, this species harbored some weeds such as, *Convolvulus spium*, Faradji, (1995). In the same trend, Ibraheem *et al*.; (2007) studied the population densities of the two mite species and evaluated the response of three wheat verities to its infestation.

The use of economic thresholds as a basis for pest control decision is considered as a fundamental component of integrated pest management **(Stern, *et al*., 1959).** Proposed the concepts of an economic injury level (EIL) and economic threshold level (ETL) as rational comparison of the economic costs and benefits of pesticides use, EILs detected as the lowest number of pests cause economic damage, where the economic damage is the amount of damage that equal the control cost **(Stern *et al*., 1959)**.

This study aimed to throw lights on assess the economic threshold, injury levels and population density of *Tetranychus urticae* and *Petrobia tritici* infestation as bases for decision making recommendation for the pest control programs in the field.

MATERIALS AND METHODS

1. Assessment of economic damage threshold and economic injury levels:

Two field experiments were carried out during 2016/2017 season in wheat fields at Hehia and Etay El-Barod districts (Sharkeia and Beheira governorates east and west nile delta) to assess the Economic damage threshold and economic injury levels for the two dominant mite specie; the two spotted spider mite, *Tetranychus urticae* and the brown wheat mite, *Petrobia tritici* infest wheat cultivar Giza186, as Marking Plants (natural infestation technique).

Marking plants experiment (Natural infestation technique):

Sample of 40 plants were chosen randomly from 1/2 fadan (2100 m^2) cultivated with wheat (Giza 186 cultivar), from the beginning date of mite infestation and labeled, then left to natural infestation. The mite numbers/labeled plant were counted weekly in the field untill crop harvest. The seeds yield of each plant were collected, counted and weighed in gram per individual from genesis starting plants.

Statistical analysis:

Data were subjected to a certain scheme of statistical analysis, according to Hosny *et al*., (1972), Salem and Zaki (1985) and Ibrahim (1994 & 2001) to calculate economic threshold and economic injury levels using:

Marking plants technique:

The partial regression formula" c-multipliers" which has two independent variables (x1 and x2) were used, where the average number of mites per plant in the two peaks of population activity, the dependent variable (y) represented the yield per plant. The partial regression was used to show the variability in the yield that could be caused by infestation during the whole season. Standard error "SE", "t" values, simple correlation (r) and simple regression "b" were calculated. The slope (b) of straight regression line was carried out to obtain the corrected values for the yield. The linear regression curve was obtained by transforming the (y) into logarithmic value using the following equation:

$$y = e^{-(a+bx)} \text{ (i.e., log. } Y = \pm bx)$$

The chi-square analysis "rx2" was applied, the point at which the wheat at the upper part of the slope start to show a significant drop could be taken as a threshold level.

2. Population fluctuation:

Experiments were carried out at Hehia and Etay El-Barod districts during 2016/2017 season in wheat field cultivate at 20/ 11/ 2016.Weekly samples of 40 wheat leaves were randomly collected early in the morning from wheat fields in the two localities.

All collected samples sent to the laboratory. For mite examination. Temperature and relative humidity were also recorded.

All mite species were identified and the data were subjected to statistical analysis by using Costat Software program of little and Hills, (1975).

RESULTS AND DISCUSSION

1. Assessment of economic threshold and economic injury levels:

The Economic threshold of the two spotted spider mite and the brown wheat mite were studied using marking plants technique, where weekly counts of mites on 40 marked wheat plants were recorded and given in Tables (1:4) and in Figs. (1&2). The mite fluctuation during the growing season showed that, *Tetranychus urticae* passed through 2 effective annual peaks on wheat plants at Beheira and Sharkia Governorates, subjected as X1 & X2 ranged. Statistical analysis indicated that the considered factors (infestation through the two peaks of *T. urticae*) were responsible for 87.79 and 94.12 % of the variability in the yield weight. The reduction in the yield at Sharkia and Beheira was affected by different manners from one peak to another. The infestation of the 26th and 31st of March (x2) showed relatively high effect on yield (b = -1.84 & - 2.86) than in the first peak (x1) at 12th and 3rd March (b = -1.39 & - 2.14) for the two localities respectively. Mathematic determination of the point at which the increase of mite species numbers through the two peaks of infestation (X1&X2) caused a decrease in the weight of yield, chi-square analysis (rx2) was applied. Damage threshold was affected by the two infestation peaks. The mite number of the 1st peak on 12th and 3rd March increased from 4.33 to 10.33 &4 to 4.33 individuals/leaf that decreased yield from 115.05 to 100.18 & 93.68 to 84.51gm. /plant. Also, for the 2nd peak of 26th and 31st March, the mite numbers increased from 10 to 10.33 and from 4.33 to 5.00 individuals/leaf that decreased yield from 115.04 to 100.18 and from 56.56 to 55.46 gm. /plant at Sharkia and Beheira; respectively.

Obtained results agreed with those of Suekane *et al.;* (2012) who recorded that the number of seeds and seed weight were similarly affected by the two-spotted spider mite, where the damage increased by increasing infestation.

In the same trend the ETLs of *P.tritici* on wheat plants in Sharkia and Beheira (as x1 &x2 peaks results), Table (5,6,7 &8) and Figs; (3&4) ranged 3.33-4.00 and 3.33 individuals. /leaf, while the economic injury level ranged 5-5.33 and 3.67-5.33 Individuals / leaf for the two localities, respectively.

Statistical analysis indicated that the considered factors (infestation through the two peaks considered of *P. tritici* population) were responsible for 79.68% and 96.02 % of the variability in the yield weight. The wheat plants yield at Sharkia and Beheira were affected by different manner from one peak to another. The infestation of the 2nd April and 31st March (x2) showed relatively high effect on yield (b = -3.17 & - 4.20) than in the first peak (x1) at 5th and 3rd March (b = - 2.12 & - 2.08) for the two localities respectively.

Mathematic determination of the point at which the increase of mite species numbers through the two peaks of infestation (x1&x2) caused a decrease in the weight of yield, chi-square analysis (rx2) was applied. The results showed that the damage threshold was affected by the two infestation peaks. The mite number during the 1st peak of infestation 5th and 3rd March increased from 3.33 to 5.33 and from 3.33 to 5.33 individuals/leaf that decreased yield from 75.79 to 72.23 and from 62.85 to 60.99 gm. /plant. Also, for the 2nd peaks of 2nd April and 31st March the mite numbers increased from 4.00 to 5.00 and from 3.33 to 3.67 individuals/leaf that decreased yield from 51.08 to 49.8 and from 60.99 to 59.07 gm. /plant at Sharkia and Beheira; respectively.

Table (1): Yield-infestation relationship in 40 marked wheat plants under natural infestation with *Tetranychus urticae* during 2016/2017 season at Sharkia governorate

Plant No.	OYAINPP			1ST peak			2nd peak		
	x1	x2	Grain weight gm/plant	x1	Grain weight gm/plant	*Expected grain weight gm/plant*	x2	Grain weight gm/plant	*Expected grain weight gm/plant*
1	4.33	61	26.0579	4.33	26.0579	74.11	10	26.0579	88.71
2	28	25.33	76.4066	10.33	76.4066	65.74	13.3	76.4066	82.58
3	33.33	45.67	33.4476	11.67	33.4476	63.87	15.3	33.4476	78.90
4	44	25.33	13.1817	12.67	13.1817	62.48	19.3	13.1817	71.54
5	67	40	25.6674	13.67	25.6674	61.08	20.6	25.6674	69.07
6	51	31.33	17.0955	14.33	17.0955	60.16	22	17.0955	66.62
7	40	23.33	18.2034	15	18.2034	59.23	23	18.2034	64.78
8	60	43	10.74	15.67	10.74	58.29	23.3	10.74	64.17
9	33.67	50.67	14.1225	16	14.1225	57.83	25.3	14.1225	60.49
10	30.67	29	51.0848	16.33	51.0848	57.37	25.3	51.0848	60.49
11	13.67	46.33	75.7872	16.67	75.7872	56.90	26	75.7872	59.26
12	42	36	100.1836	19.33	100.1836	53.19	26.6	100.1836	58.03
13	62.67	34.67	57.035	20	57.035	52.25	29	57.035	53.74
14	43.33	60	28.0247	21	28.0247	50.86	31.3	28.0247	49.45
15	67	35.33	40.5846	21.33	40.5846	50.40	32.3	40.5846	47.61
16	20	52.67	36.2297	21.67	36.2297	49.92	33	36.2297	46.38
17	19.33	45	41.0592	22.33	41.0592	49.00	33.3	41.0592	45.77
18	21.33	65.67	9.0075	23	9.0075	48.07	34.6	9.0075	43.30
19	25.33	38	19.9494	23.33	19.9494	47.61	35.3	19.9494	42.09
20	21	54	22.136	24	22.136	46.67	36	22.136	40.85
21	16.67	26	49.7952	25.33	49.7952	44.82	38	49.7952	37.17
22	16.33	44.33	58.2335	28	58.2335	41.09	40	58.2335	33.49
23	15.67	15.33	12.944	30	12.944	38.30	41.6	12.944	30.42
24	35	53.67	16.2384	30.67	16.2384	37.37	42	16.2384	29.81
25	23.33	26.67	53.187	32.33	53.187	35.05	43	53.187	27.97
26	23	22	85.0626	33	85.0626	34.12	43.3	85.0626	27.36
27	32.33	50	68.391	33.33	68.391	33.66	44	68.391	26.13
28	16	20.67	32.2572	33.67	32.2572	33.18	44.3	32.2572	25.52
29	10.33	13.33	115.0437	35	115.0437	31.33	45	115.0437	24.29
30	11.67	10	81.058	40	81.058	24.35	45.6	81.058	23.06
31	30	41.67	11.94	42	11.94	21.56	46.3	11.94	21.84
32	33	33.33	20.1024	43	20.1024	20.17	50	20.1024	15.09
33	12.67	33	23.0355	43.33	23.0355	19.71	50.6	23.0355	13.85
34	14.33	43.33	72.23463	44	72.23463	18.77	52.6	72.23463	10.17
35	63.33	19.33	10.35	51	10.35	9.01	53.6	10.35	8.33
36	21.67	62.67	8.368	60	8.368	2.15	54	8.368	7.72
37	64.33	23	5.6871	62.67	5.6871	4.95	60	5.6871	8.71
38	24	42	29.3525	63.33	29.3525	4.16	61	29.3525	7.07
39	15	32.33	24.373	64.33	24.373	2.96	62.6	24.373	4.96
40	22.33	44	31.9188	67	31.9188	1.76	65.6	31.9188	2.04

Table (2): Yield-infestation relationship in 40 marked wheat plants under natural infestation with *Tetranychus urticae* during 2016/2017 season at Beheira governorate

Plant No.	OYAINPP			1st peak			2nd peak		
	x1	x2	Grain weight gm/plant	x1	Grain weight gm/plant	*Expected grain weight gm/plant*	x2	Grain weight gm/plant	*Expected grain weight gm/plant*
1	26.33	20	69.037	26.33	69.037	70.65	20	69.037	69.60
2	5.33	1.67	5.0094	5.33	5.0094	69.94	1.67	5.0094	68.63
3	6	2	22.8	6	22.8	68.51	2	22.8	66.74
4	10.67	0.67	24.729	10.67	24.729	67.80	0.67	24.729	65.77
5	11.33	4	41.912	11.33	41.912	66.36	4	41.912	64.82
6	17	3.33	39.949	17	39.949	62.78	3.33	39.949	63.88
7	4.33	7.67	29.24	4.33	29.24	57.79	7.67	29.24	62.90
8	13.33	5	26.147	13.33	26.147	56.35	5	26.147	61.02
9	19.67	13.67	7.647	19.67	7.647	54.94	13.67	7.647	59.10
10	13.67	5.33	36.16	13.67	36.16	54.21	5.33	36.16	58.15
11	43.33	24	32.135	43.33	32.135	50.65	24	32.135	56.24
12	17.67	8	65.0685	17.67	65.0685	49.92	8	65.0685	55.29
13	11.67	4.33	17.2296	11.67	17.2296	47.07	4.33	17.2296	54.32
14	4	6	10.7406	4	10.7406	46.36	6	10.7406	53.38
15	15.33	20.67	56.56	15.33	56.56	44.93	20.67	56.56	49.57
16	30	15	34.946	30	34.946	42.78	15	34.946	48.60
17	22	0.33	25.7862	22	25.7862	41.35	0.33	25.7862	47.65
18	7.67	2.33	1.7989	7.67	1.7989	40.64	2.33	1.7989	44.79
19	23.33	18	50.7732	23.33	50.7732	39.93	18	50.7732	41.93
20	24	18.33	59.0715	24	59.0715	38.49	18.33	59.0715	38.12
21	5	1.33	60.9915	5	60.9915	37.06	1.33	60.9915	31.42
22	22.33	16.67	46.3545	22.33	46.3545	36.35	16.67	46.3545	29.54
23	30.33	21	9.7902	30.33	9.7902	32.06	21	9.7902	27.62
24	25	19	33.942	25	33.942	31.36	19	33.942	22.84
25	15	5.67	13.6712	15	13.6712	30.63	5.67	13.6712	21.90
26	23	17.67	58.7485	23	58.7485	29.92	17.67	58.7485	19.98
27	32	21.67	49.5205	32	49.5205	29.21	21.67	49.5205	19.03
28	22.67	17	12.9788	22.67	12.9788	27.78	17	12.9788	18.09
29	20	14.33	19.5435	20	19.5435	25.63	14.33	19.5435	16.17
30	18	9	84.5064	18	84.5064	24.93	9	84.5064	14.25
31	10	2.67	55.467	10	55.467	22.78	2.67	55.467	13.31
32	35	22.33	93.6786	35	93.6786	14.91	22.33	93.6786	11.39
33	25.33	19.67	18.0282	25.33	18.0282	14.21	19.67	18.0282	10.45
34	10.33	10	63.2695	10.33	63.2695	10.63	10	63.2695	8.53
35	40	23.33	11.9402	40	11.9402	7.78	23.33	11.9402	7.59
36	33.33	22	21.9351	33.33	21.9351	4.20	22	21.9351	6.64
37	16	7.33	3.3651	16	3.3651	3.49	7.33	3.3651	5.67
38	19	11.33	2.0882	19	2.0882	3.22	11.33	2.0882	3.78
39	35.33	22.67	62.8465	35.33	62.8465	3.62	22.67	62.8465	2.81
40	42	23.67	43.9488	42	43.9488	5.56	23.67	43.9488	1.86

Table (3): Statistical analysis Simple correlation(r) and Partial regression (b1&b2) for the relationship between *Tetranychus urticae* (Sayed) peaks count and the yield of 40 marked wheat plants (weight of grain) in Sharkia during 2017season

Variables	Simple correlation(r)		Partial regression				Explained variance
	R	p	b	S.E	t	probability	EV%
mite no./ plant (x1)	-0.83	≤ 0.01	-1.39	0.15	-9.29	≤ 0.01	69.47
mite no./ plant (x2)	-0.94	≤ 0.01	-1.84	0.11	-16.52	≤ 0.01	87.79

r = correlation coefficient, b = Partial regression values, x1= 1st peak and x2 = 2nd peak

Table (4) Statistical analysis Simple correlation(r) and Partial regression (b1&b2) for the relationship between *Tetranychus urticae* (Sayed) peaks count and the yield of 40 marked wheat plants (weight of grain) in Beheira during 2017season

Variables	Simple correlation(r)		Partial regression				Explained variance
	R	p	b	S.E	t	probability	EV%
mite no./plant (x1)	-0.95	≤ 0.01	-2.14	0.11	-19.57	≤ 0.01	90.98
mite no./plant (x2)	-0.97	≤ 0.01	-2.86	0.12	-24.66	≤ 0.01	94.12

r = correlation coefficient, b = Partial regression values, x1= 1st peak and x2 = 2nd peak.

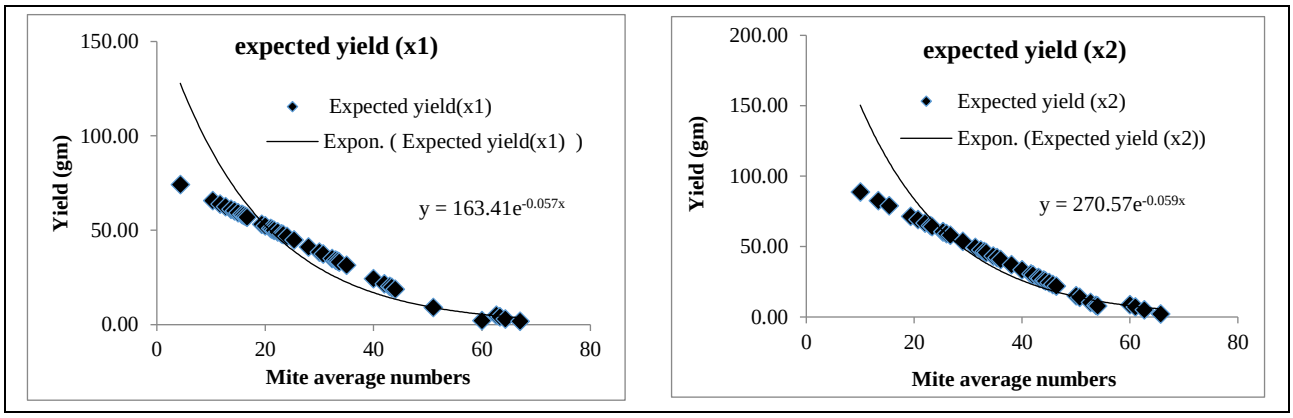

Fig (1): The corrected average change in the wheat plants yield (y) per unit change in *Tetranychus urticae* infestation at the first (x1) and the second (x2) annual peaks at Sharkia Governorate during 2016/2017 season.

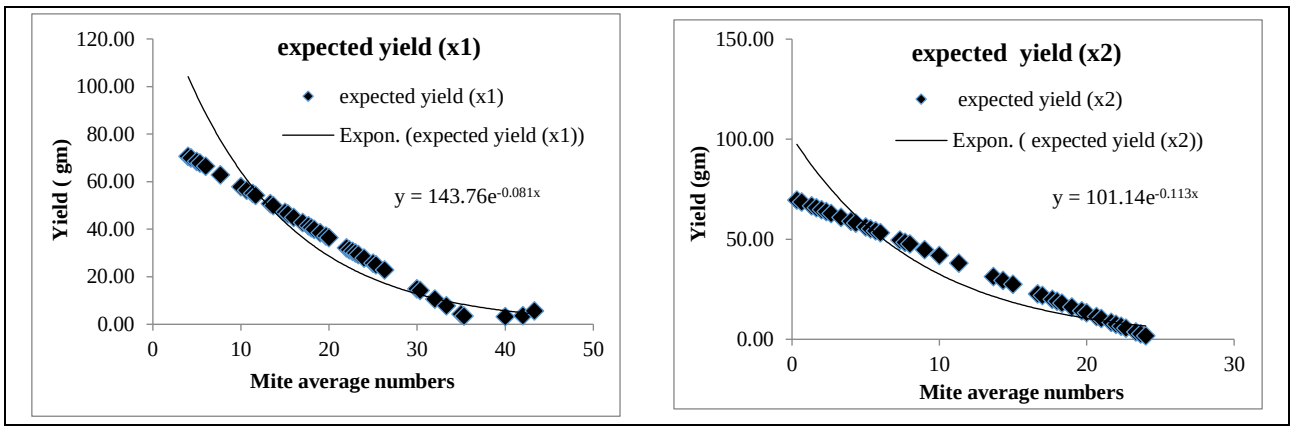

Fig (2): The corrected average change in the wheat plants yield (y)per unit change in *Tetranychus urticae* infestation at the first (x1) and the second (x2) annual peaks at Behira Governorate during 2016/2017 season.

Table (5): Yield-infestation relationship in 40 marked wheat plants under natural infestation with *Petrobia tritici* during 2016/2017 season at Sharkia Governorate

Plant No.	OYAINPP			1ST peak			2nd peak		
	x1	x2	Grain weight gm/plant	x1	Grain weight gm/plant	Expected grain weight gm/plant	x2	Grain weight gm/plant	Expected grain weight gm/plant
1	2.33	3.33	26.0579	2.33	26.0579	70.44	3.33	26.0579	71.86
2	21	2.67	76.4066	21	76.4066	69.04	2.67	76.4066	70.78
3	19	6	33.4476	19	33.4476	68.32	6	33.4476	69.74
4	11.33		13.1817	11.33	13.1817	67.62		13.1817	68.69
5	5.67	2	25.6674	5.67	25.6674	66.92	2	25.6674	67.62
6	9	1	17.0955	9	17.0955	64.79	1	17.0955	66.57
7	14.33	1.67	18.2034	14.33	18.2034	60.55	1.67	18.2034	65.52
8	18	8	10.74	18	10.74	59.83	8	10.74	64.45
9	38	7.33	14.1225	38	14.1225	59.13	7.33	14.1225	63.40
10	22	18.67	51.0848	22	51.0848	56.30	18.67	51.0848	62.36
11	29.33	0.67	75.7872	29.33	75.7872	54.88	0.67	75.7872	61.28
12	19.67	5	100.1836	19.67	100.1836	52.76	5	100.1836	60.23
13	32	8.67	57.035	32	57.035	51.33	8.67	57.035	57.07
14	17	20	28.0247	17	28.0247	50.63	20	28.0247	56.02
15	15	11.33	40.5846	15	40.5846	49.93	11.33	40.5846	54.94
16	21.67	12	36.2297	21.67	36.2297	47.81	12	36.2297	53.90
17	10.33	15.67	41.0592	10.33	41.0592	47.09	15.67	41.0592	49.69
18	8	9.33	9.0075	8	9.0075	46.38	9.33	9.0075	47.56
19	0.67	0.33	19.9494	0.67	19.9494	43.56	0.33	19.9494	45.44
20	1.33	10	22.136	1.33	22.136	42.84	10	22.136	43.35
21	2	3	49.7952	2	49.7952	42.14	3	49.7952	41.23
22	7.33	14.67	58.2335	7.33	58.2335	41.44	14.67	58.2335	37.01
23	47	1.33	12.944	47	12.944	40.01	1.33	12.944	34.89
24	14	16.33	16.2384	14	16.2384	37.89	16.33	16.2384	30.68
25	11.67	12.33	53.187	11.67	53.187	35.77	12.33	53.187	26.43
26	30	4	85.0626	30	85.0626	33.64	4	85.0626	25.39
27	1.67	15	68.391	1.67	68.391	31.52	15	68.391	23.27
28	29	5.67	32.2572	29	32.2572	30.10	5.67	32.2572	21.17
29	13.33	19.33	115.0437	13.33	115.0437	27.27	19.33	115.0437	18.01
30	16	17.33	81.058	16	81.058	25.85	17.33	81.058	15.88
31	35	20.33	11.94	35	11.94	25.15	20.33	11.94	13.76
32	3.33	21	20.1024	3.33	20.1024	24.45	21	20.1024	11.67
33	13.67	22.33	23.0355	13.67	23.0355	10.29	22.33	23.0355	9.55
34	12	21.67	72.23463	12	72.23463	9.59	21.67	72.23463	8.50
35	22.33	23	10.35	22.33	10.35	8.16	23	10.35	6.38
36	6	5.33	8.368	6	8.368	7.46	5.33	8.368	4.26
37	5.33	18	5.6871	5.33	5.6871	3.92	18	5.6871	2.17
38	9.67	23.67	29.3525	9.67	29.3525	1.87	23.67	29.3525	0.05
39	30.33	3.67	24.373	30.33	24.373	3.47	3.67	24.373	1.90
40	10	24	31.9188	10	31.9188	1.37	24	31.9188	1.39

Table (6): Yield-infestation relationship in 40 marked wheat plants under natural infestation with *Petrobia tritici* during 2016/2017 season at Beheira governorate

Plant NO.	OYAINPP			1ST peak			2nd peak		
	x1	x2	Grain weight gm/plant	x1	Grain weight gm/plant	Expected grain weight gm/plant	x2	Grain weight gm/plant	Expected grain weight gm/plant
1	2.33	13	69.037	2.33	69.037	66.51	13	69.037	73.67
2	21.67	2	5.0094	21.67	5.0094	65.14	2	5.0094	70.90
3	11.67	6	22.8	11.67	22.8	64.43	6	22.8	69.47
4	2	8	24.729	2	24.729	63.74	8	24.729	68.08
5	9	1.33	41.912	9	41.912	63.06	1.33	41.912	66.70
6	14.67	10	39.949	14.67	39.949	60.97	10	39.949	65.27
7	18	2.33	29.24	18	29.24	56.81	2.33	29.24	62.49
8	7.67	12.33	26.147	7.67	26.147	56.10	12.33	26.147	61.07
9	22	4	7.647	22	7.647	55.42	4	7.647	59.68
10	29	0.67	36.16	29	36.16	52.65	0.67	36.16	55.48
11	19.33	5	32.135	19.33	32.135	51.94	5	32.135	54.09
12	32.67	17.33	65.0685	32.67	65.0685	51.25	17.33	65.0685	52.66
13	7.33	12.67	17.2296	7.33	17.2296	49.17	12.67	17.2296	51.27
14	17	3.67	10.7406	17	10.7406	47.09	3.67	10.7406	48.46
15	15.67	18.33	56.56	15.67	56.56	46.40	18.33	56.56	45.69
16	10.33	11.67	34.946	10.33	34.946	44.32	11.67	34.946	44.26
17	8	1.67	25.7862	8	25.7862	43.61	1.67	25.7862	42.87
18	0.67	3.33	1.7989	0.67	1.7989	42.92	3.33	1.7989	40.06
19	1.33	10.33	50.7732	1.33	50.7732	40.15	10.33	50.7732	38.67
20	22.67	7.67	59.0715	22.67	59.0715	39.45	7.67	59.0715	35.85
21	47	13.67	60.9915	47	60.9915	37.36	13.67	60.9915	34.47
22	24.67	5.33	46.3545	24.67	46.3545	36.68	5.33	46.3545	33.08
23	30	17.67	9.7902	30	9.7902	35.28	17.67	9.7902	31.65
24	1.67	19	33.942	1.67	33.942	34.60	19	33.942	30.26
25	13.33	14	13.6712	13.33	13.6712	32.51	14	13.6712	27.45
26	16	15.67	58.7485	16	58.7485	30.43	15.67	58.7485	24.67
27	35.33	6.67	49.5205	35.33	49.5205	27.66	6.67	49.5205	23.25
28	3.33	9	12.9788	3.33	12.9788	22.79	9	12.9788	21.86
29	13.67	11	19.5435	13.67	19.5435	22.10	11	19.5435	19.04
30	12	18.67	84.5064	12	84.5064	20.71	18.67	84.5064	17.66
31	25	5.67	55.467	25	55.467	20.02	5.67	55.467	14.84
32	5.33	9.67	93.6786	5.33	93.6786	18.63	9.67	93.6786	12.07
33	23.67	8.67	18.0282	23.67	18.0282	16.54	8.67	18.0282	10.64
34	15	16	63.2695	15	63.2695	15.86	16	63.2695	9.25
35	23	15.33	11.9402	23	11.9402	13.78	15.33	11.9402	6.44
36	6	2.67	21.9351	6	21.9351	7.53	2.67	21.9351	3.66
37	5.67	10.33	3.3651	5.67	3.3651	5.45	10.33	3.3651	2.23
38	26	14.67	2.0882	26	2.0882	5.83	14.67	2.0882	3.17
39	11.33	7.33	62.8465	11.33	62.8465	4.31	7.33	62.8465	1.81
40	10	16.67	43.9488	10	43.9488	6.81	16.67	43.9488	0.87

Table (7): Statistical analysis Simple correlation(r) and Partial regression (b1&b2)for the relationship between *Petrobia tritici* Kandeel, El-Naggar and Mohamed peaks count and the yield of 40 marked wheat plants (weight of grain) Sharkia gov. during 2017season

Variables	Simple correlation(r)		Partial regression				Explained variance
	R	p	b	S.E	t	probability	EV%
Mite no./ plant (x1)	-0.85	≤ 0.01	-2.12	0.21	-10.07	≤ 0.01	72.77
Mite no./ plant (x2)	-0.89	≤ 0.01	-3.17	0.26	-12.21	≤ 0.01	79.68

r = correlation coefficient, b = Partial regression values, x1= 1st peak and x2 = 2nd peak

Table (8): Statistical analysis Simple correlation(r) and Partial regression (b1&b2)for the relationship between *Petrobia tritici* Kandeel, El-Naggar and Mohamed peaks count and the yield of 40 marked wheat plants (weight of grain) Beheira gov. during 2017season

Variables	Simple correlation(r)		Partial regression				Explained variance
	R	p	b	S.E	t	probability	EV%
Mite no./ plant (x1)	-0.93	≤ 0.01	-2.08	0.13	-15.54	≤ 0.01	86.41
Mite no./ plant (x2)	-0.98	≤ 0.01	-4.20	0.14	-30.26	≤ 0.01	96.02

r = correlation coefficient, b = Partial regression values, x1= 1st peak and x2 = 2nd peak

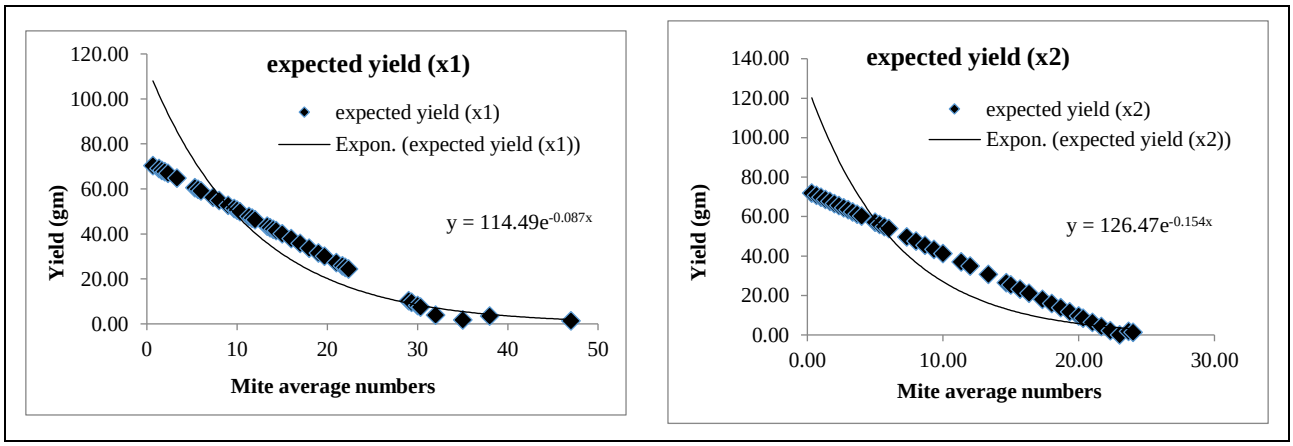

Fig (3): The corrected average change in the wheat plants yield (y)per unit change in *Petrobia tritici* infestation at the first (x1) and the second (x2) annual peaks at Sharkia Governorate during 2016/2017 season.

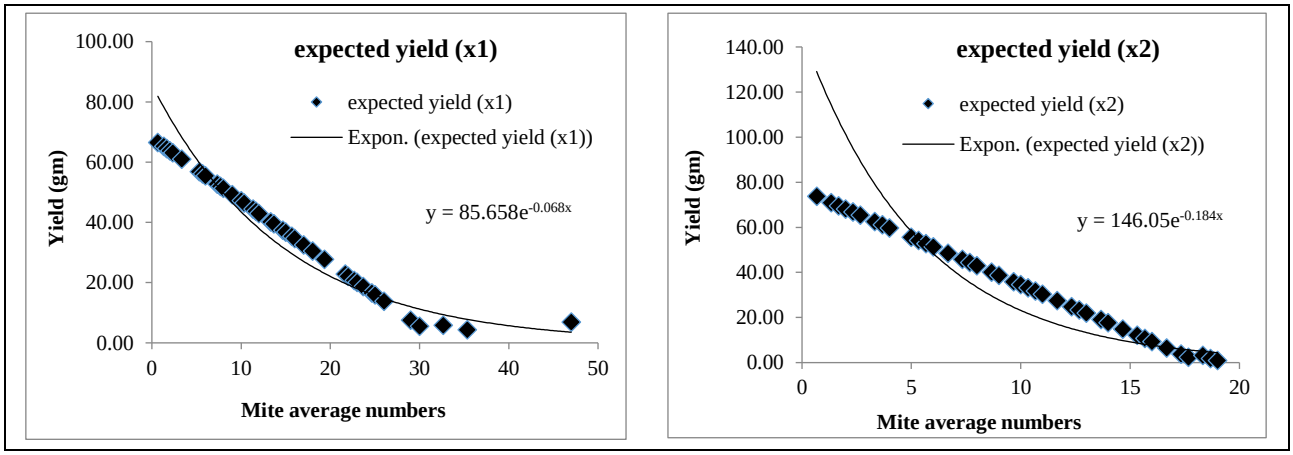

Fig (4): The corrected average change in the wheat plants yield (y) per unit change in *Petrobia tritici* infestation at the first (x1) and the second (x2) annual peaks at Behira Governorate during 2016/2017 season.

1. Population density of *T. urticae* and *P. tritici* infested wheat plants:

Tables (9 and10) showed two peaks for each species at the two localities, and the highest peaks of 37.47 and 20.36 individuals /leaf, were recorded on 26th and 3rd March for *T.urticae* at Sharkia and Beheira respectively; where the highest peaks of 15.88 and 15.53 individuals /leaf, were on 5th and 3rd March for *P.tritici* at the two governorates, respectively.

The results of statistical analysis detected that positive insignificant correlation was observed between the population of the two-mite species and

temperature while it was negative and insignificant with relative humidity. The relatively high effect as partial regression (E.V. %) for tested climatic factors of 5.18% was recorded for temperature on *P.tritici* at Sharkia governorate, while the relatively high multiple correlation for the two tested climatic factors together was 17.07% recorded on *P. tritici* at Beheira governorate.

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