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SURVEY AND POPULATION DYNAMIC OF PREVAILING PESTS AND NATURAL ENEMIES IN APPLE ORCHARD

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ABSTRACT

Survey of pests and natural enemies was carried out in apple orchards at Kafer El Dawar region, Beherra governorate during two successive years of 1997, 1998. The measured densities of different identified destructive pest species indicated that, the highest population dynamic of phytophagous mites represented 95.6% and 86.8% during both years; including the phytophagous ones *Aculops malus* Zaher and Abou Awad; *Panonychus ulmi* (Koch) and *Tetranychus urticae* (Koch). The highest total numbers was noticed for *A.malus* which amounted 19182 and 9256 individuals/100 twigs during the 1st and 2nd years, respectively, while, the total numbers of each of P.ulmi and T.urticae was more or less lower and comprised 3783 and 324 and 1412 and 1401 individuals/100 twigs during the same years, respectively In comparison, *Eriosoma lanigerum* (Forsted) and *Aphidi pomide* (Geer) were the most abundant insect pests representing 31.01 and 81.59% of total inspected insects-species during the both years respectively. Little numbers of predatory species were identified especially predatory insects.

The calculated correlation values of the revealed climatic conditions and inspected mite species showed different interrelationships, in particular, with minimum temperature followed by maximum temperature which indicated the significant relationship with phytophagous mites and the insignificant relationships with predatory ones.

INTRODUCTION

The apple (Pyrus malus L. Roseceae) is one of the utmost important fruit tress in different parts of the world. In Egypt, the growing economic importance of the apple trees has encouraged the growers to cultivate plenty vast areas, particularly in the new reclaimed lands. But, because the apple trees are usually infested by different animal and insect pests [Zaher et al , (1973), El-Halawany et al., (1989); Ali-Abou-Gazia et al., (1989); Mesbah et al., (1994a) & b and El-Deeb et al., (1998)], a more or less destructive changes in plant growth occur due to the level of going on infestation Also, effects of climatic conditions and natural enemies on the abundance of apple-tree pests have been studied by Hamad et al., (1984 & 1985) and Zakzouk and Farrag (1997& 1998).

The present investigation was undertaken to study the populations dynamic of different found pests and natural enemies associated with apple trees at Kafer El-Dawar region during two successive years of 1997 and 1998. In addition, the numbers of inspected and counted phytophagous and/or predatory mites during both the years of study were statistically analyzed and correlated with the registered data of prevailing climatic conditions.

MATERIALS AND METHODS

Field experiments were done on the apple trees of CV. Anna in an orchard at Kafr El-Dawar region. To estimate the population density of different

inspected animal or insect pests and natural enemies, 10 twigs were sampled from each of 10 randomly selected trees; and collected also at random during the experimental period (Jan 1997 till Dec. 1998). The sampled twigs were put in paper bags, firmly closed and transferred to the laboratory in the same day; and examined for detecting and counting the numbers of found different species, using stereoscopic binocular microscopic.

Moreover the relationships between the three detected phytophagous mites with the included climatic conditions in Table 1 as well as five predatory mites are estimated using correlation coefficient analysis (r-coefficient). Herein, the numbers of phytophagous mites of *A.malus*, *P.lulmi* and *T.urticae* were represented as dependent variables (x_1, x_2 and x_3), respectively, while the independent ones were the climatic factors of max. temperature (y_1), min. temp. (y_2), relative humidity (y_3), rainfall (y_4), wind speed (y_5) and sunny period (y_6).

Table (1): The calculated means of prevailing meteorological physical factors, throughout the subsequent years of study (1997 and 19998)

Date	1997						1998					
	Max. Temp.	Min. Temp.	R.H. %	Amount rain fall mm	Wind speed in/sec	Sun durat-ion	Max. Temp.	Min. Temp.	R.H. %	Amount rain fall mm	Wind speed in/sec	Sun durat-ion
Jan	25.7	8.90	78.50	9.50	2.15	10 25	18.97	8 93	70 93	20.60	3.7	10.5
Feb	18.33	8.30	69.33	6.13	3.63	11 10	18.80	10.50	71 33	15 77	3.7	11.1
March	19.73	10.00	66.67	5.70	3.55	12.67	17 60	9.5	66.33	24 33	3.3	12.13
April	22 10	11 50	63.70	2.49	4.67	11 90	35 60	13.20	67.67	00.20	2.9	12 9
May	27.73	16.00	68.61	0.20	2.97	13.4	26 70	17.33	67.33	00.43	3 1	14 37
June	29 33	21.33	68.67	0.00	3.33	14.17	28.77	21.37	69 00	0.0	3 53	14.17
July	30.33	23.47	68.00	0.00	3.63	13.97	30 27	22.17	70.67	0.0	3.33	13.97
Aug	30.40	23.00	66.00	0.00	3.10	13.30	34.80	25.33	72.67	0.0	3.53	13.3
Sept	31 10	20.20	66.33	0.30	2.60	12.33	31.30	22.12	64.63	0.0	3.00	12.7
Oct	27 97	17.83	68 33	2 4	2 67	11 40	28.13	18.83	65 67	0 0	2 77	11 4
Nov	23 97	12.8	74 67	5 60	3.20	10 60	24.43	13.70	71 00	0.0	2.1	10.6
Dec	20.30	9 67	71.67	14 10	2.37	10 20	20 11	11.10	69.67	8.53	2.73	10 2

RESULTS AND DISCUSSION

I- The 1st year (Jan/Dec 1997):

As shown in Tables 2, 3 and 4 and Fig 1 different species of pests and natural enemies were identified and counted on sampled apple twigs during the different inspection periods. Twelve mite species of phytophagous, predatory and saprophagous ones were recorded and identified Table (2). Data in Table 3 exhibit the calculated percentages of each mite group, which comprised: 95.6, 0.92 and 3.48% of total counted numbers of all inspected mite species, respectively. The phytophagous mites included *A.malus*, *P.ulmi* and *T.urticae* and their initial infestation occurred during March/May. The estimated fluctuations of population density of *A.malus* tended to slow one period of activity, from Jan till Dec, giving a prominent peak of 7863/100 twigs

in September (min. temp. 20.20C° and R.H % 66.33) After which, a gradual decrease was ooserved during the period extending from October up to November and reached a minimum of 13 ones in December. Comparatively, predatory mites were scarcely found on sampled and inspected twigs, and amounted to 0.92% of total detected and counted mite species. These predatory mites implied; *Typhlodromus* spp. *A.gossipi*, *P.pulmifer*, *A.exertus* and *C orinatus* (Table 3). *A.gossipi* was relatively the more detected predatory mite with a total number of 99 individuals/100 twigs and higher activity period (March/June), compared to the other found and inspected predatory mites (Table 3).

Table (2): Survey of animal and insect pests and natural enemies found on apple trees at Kafer El-Dawar region, Beherra Governorate throughout two successive years (1997 and1998)

Pests/natural enemies	Family	Species
Mites	*Eriophydae*	*Acuplos malus* (Zaher and Abou-Awad)
	Tetranychidae	*Panonychus ulmi* (Koch)
	Teranychidaedae	*Tetranychus urticae* (Koch)
	Phyytoseiidae	*Typhlodromus* spp.
	Phytoseiidae	*Amblyseius gossipi* (El-Badry)
	Phytoseiidae	*Phytoseius plumifer*
	Stigmaeidae	*Agistemus exsertus* (Gonzales0
	Cheyletidae	*Cheletogenes ornatus* (C. and F.)
	Oribatidae	*Zygoribat sayedi* (El-Badry and Nassr)
	Tyroglyphidae	*Tyrophagous putriescentiae* (Schrank)
	Tarsonemidae	*Tarsonemus pullidus* (Banks)
	Tydeidae	*Tydeus californicus* (Banks)
Insects	*Thripidae*	*Retithrips syriacus* (Mayet)
	Aphididae	*Eriosoma lanigerum* (Hausm)
	Aphididae	*Aphis pomi* (de Geer)
	Psyllidae	*Psylla pyricola* (Forster)
	Alerodidae	*Siphoninus granati* (Prieser and Hosny)
	Margordidae	*Iceria aegyptiaca* (Donglus)
	Coccidae	*Ceroplastes floridensis* (Comstock)
	Diaspididae	*Aspididiotus hederae* (Vallot)
	Hyonetiidae	*Hyonetiu clerkla* (L)
	Cossidae	*Leuzera pyrina* (L)
	Scolytidae	*Scolytus amygdalivar* aegyptiacus Pic
	Dimorphordae	*Pheenobremia aphidivora*
	Chrysopidae	*Chrysopa vulgaris* (Schn.)
	Arichiposdae	*Arichiposocus nomas* (Curey)
Snails	*Hellicidae*	*Theba pisana*

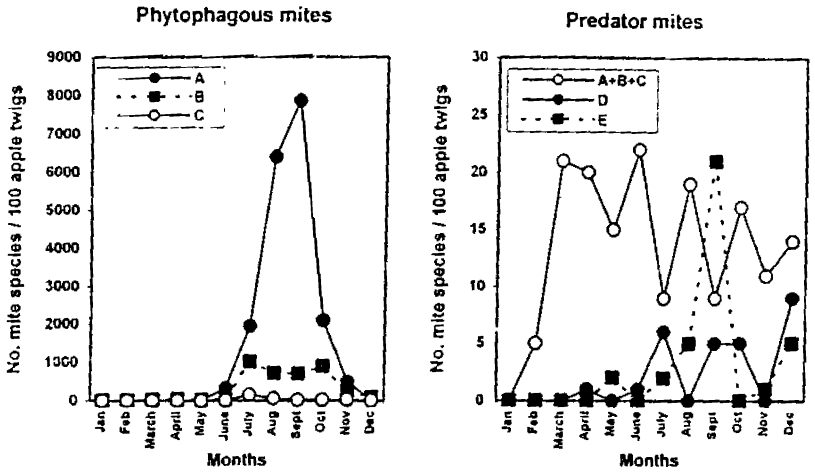

Figure (1) : Numbers, seasonal abundance and their monthly variation of mites (Phytophagous and predators) on 100 apple twigs with collected from apple orchards of Kafr El Dawar, Beheira (1997).

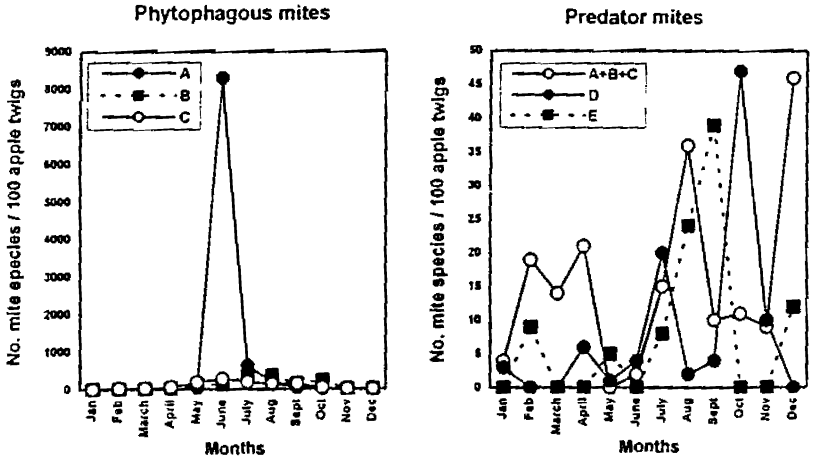

Figure (2) : Numbers, seasonal abundance and their monthly variation of mites (Phytophagous and predators) on 100 apple twigs with collected from apple orchards of Kafr El Dawar, Beheira (1998).

Table (3): Fluctuations of the population densities of inspected mite species on apple trees at Kafer El Dawar region, Beherra, 1997.

Date	No. mite species/100 twigs												Grand total
	Phytophagous*			Predatory**					Saprophagous***				
	A	B	C	A	B	C	D	E	A	B	C	D	
Jan	0	0	0	0	0	0	0	0	2	0	0	0	
Feb	0	0	0	0	5	0	0	0	6	0	0	0	
March	0	22	0	3	16	2	0	0	14	1	7	23	
April	0	37	5	0	19	1	1	0	0	3	0	18	
May	27	23	2	4	7	4	0	2	7	0	0	26	
June	338	49	11	0	15	7	1	0	42	0	3	31	
July	1951	1010	161	1	7	1	6	2	20	2	82	5	
Aug	6398	720	68	0	6	13	0	5	19	0	0	0	
Sept	7863	699	25	0	0	9	5	21	65	0	0	0	
Oct	2101	891	26	15	0	2	5	0	95	13	6	0	
Nov	491	241	22	0	11	0	0	1	110	6	31	17	
Dec	13	91	4	0	13	1	9	5	5	10	33	176	
Total/	**19182**	**3783**	**324**	**23**	**99**	**40**	**27**	**36**	**385**	**35**	**162**	**266**	
Total	**43289**			**225**					**848**				**24362**
%	**95.6**			**0.92**					**3.48**				

*** Phytophagous mites:** A- ***A.malus***, B- ***P.ulmi***, C- ***T.urticae***

**** Predatory mites:** A- ***Typhlodromus*** **spp.** B- ***A.gossipi***, C- ***P.plumifer*** D- ***A.exsertus*** E- ***C.orinatus***

*****Saprophugous mites:** A- ***Z.sayedi***, B- ***T.putriescentiae***, C- ***T.pallidus*** D- ***T.californicus***

Moreover, the found saprophagous mites included *Z.sayedi*, *T.putriescntiae*, *T.pallidus* and *T.californicus*. Amongst, *Z.sayedi* was relatively more occurred, showing a total number of 385 individuals/100 twigs.

The presented results in Table 4 show the different occurred fifteen species of insects and snails on examined apple twigs. The aphids *E.lanigerum* and *A.pomi* were the highest abundant species, showing a percentage of 31.0 of the total inspected and counted numbers of insect species. The noticed initial occurrence began on March and reached the maximum on May (min. temp. 16.0C° and R.H % 68.61) with a peak of 303 individuals/100 twigs.

The monthly observations of fluctuating *L.clerkla* population showed that this Jassid species reached its peak during May and Aug./Sept with 92 and 100/90 individuals respectively. The population of the *Psyllid pyricola* increased rapidly during May/July to reach the highest peak (180 individuals/100 twigs) in July. Thereafter, it sharply decreased until 12 ones in Aug. (Table 4).

The measured fluctuations of the land snail (*T.pisana*) population calibrated during the periods of Jan/April, June/July and Oct./Dec., and ranged between 6 and 21, 6 and 19 and 54 and 58 per 100 twigs, respectively. Little numbers of the predatory *Chrysopid vulgaris* were found and counted with a total number of 18 individuals represented 0.01% during this monthly periods.

Table (4): Fluctuations of the populations densities of inspected insects and snails on apple trees at Kafer El Dawar region, Beherra. 1997

Date	No. insects and snails/100 twigs														Grand total
	Insects								Snails						
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Jan	0	0	0	2	0	0	99	0	0	0	0	3	0	6	
Feb	0	0	0	0	4	0	65	2	3	17	3	3	0	10	
March	0	44	0	7	2	0	16	6	0	2	0	2	0	33	
April	40	142	0	42	2	0	3	10	0	0	5	8	8	21	
May	4	303	25	0	0	0	0	92	6	0	1	0	1	0	
June	6	120	31	21	0	0	0	0	0	0	4	0	3	6	
July	0	0	180	0	0	2	0	0	0	0	0	0	6	19	
Aug	0	0	12	0	0	0	0	100	0	0	3	0	0	0	
Sept	0	180	0	0	17	15	0	90	0	0	0	0	5	0	
Oct	0	48	0	16	8	21	0	24	0	20	2	7	2	54	
Nov	19	0	0	9	58	18	0	0	0	5	0	11	0	11	
Dec	25	0	0	40	15	27	53	0	1	6	0	5	0	58	
Total/	144	737	248	135	106	83	236	324	10	50	18	39	29	218	2377
%	6.1	31.01	10.4	5.7	4.5	3.5	9.9	13.6	0.004	2.1	0.01	1.6	1.2	902	

A- *R.syriacus* B- *E.lanigerum + A.pomi* C- *P.pyricola*
D- *S.granati* E- *I.aegypticaca* F- *C.floridensis*
G- *A.hedera* H- *L.clerkia* I- *Z.pyrina*
J- *S.amygdali var-aegypticus* K- *C.vulugavis* L-*A.nomas*
M- *P.aphidivava* N- *T.pisana*

I- The 2nd year (Jan/Dec 1998)

The presented results in Table 5 and Figure 2, show that the same mite species were identified and counted on sampled apple twigs during the 2nd years of 1998. The phytophagous mites were also the most abundant with a total number of 12069 individuals/100 twigs equal to 86.81%. A higher number of *A.malus* was noticed with a peak of 8301ones in June. After that, dropped sharply until reached the lowest number of 30 individuals/100 twigs in Oct, and completely coincided during Feb./March and Nov./Dec. In comparison initial infestation of *P.ulmi* occurred during Feb./March and reached its peak during July/Aug with number of 359/360 individuals/100 twigs , respectively.

The totals of counted predatory mites comprised 50, 71, 76, 97 and 97 individuals/100 twigs for *P.plumifer*, *A.gossipi*, *Typhlodromus* spp., *A.exsertus* and *C.orinatus*, respectively (Table 5).

In case of saprophagous mites, *Z.sayedi* was the most abundant with a total of 626, followed by *T.californicus* and *T.pallidus* 511, 299 ones respectively. In comparison, *T.putriescentiae* was the lease abundant with a total 6 individuals/100 twigs.

Data in Table 6 elucidate that the aphids *E.lanigerum* and *A.pemi* were the common prevailing special with a total number of 8175 ones represented 81.6%. The max. number of aphids reached 4500 in Aug. (min. tem. 25.33 and R.H % 72.67) followed by 2831 in Sept. (min. tem. 22.12 and R.H % 64.63) while, the other detected insects showed relatively lower counts (Table 6).

Table (5): Fluctuation of the populations densities of inspected mite species on apple trees at Kafer El Dawar region, Beherra, 1998

Date	No. mite species/100 twigs												Grand total
	Phytophagous				Predatory				Saprophagous				
	A	B	C	A	B	C	D	E	A	B	C	D	
Jan	4	0	3	4	0	0	3	0	0	2	0	0	
Feb	0	3	30	5	8	6	0	9	9	0	3	115	
March	0	11	34	8	6	0	0	0	8	1	0	143	
April	19	37	62	0	21	0	6	0	6	1	5	232	
May	39	130	198	0	0	0	1	5	20	0	0	21	
June	8301	129	290	2	0	0	4	0	41	0	150	0	
July	643	359	200	0	5	10	20	8	0	0	58	0	
Aug	170	360	150	28	8	0	2	24	60	0	9	0	
Sept	50	151	161	7	3	0	4	39	351	0	71	0	
Oct	30	241	38	5	5	1	47	0	45	0	0	0	
Nov	0	0	18	0	5	4	10	0	43	0	0	0	
Dec	0	9	17	7	10	29	0	12	43	2	3	0	
Total/	9256	1412	1401	76	71	50	97	97	626	6	299	511	
Total	12069				391				1442				13902
%	86.81				2.81				10.37				

* Phytophagous mites: A- *A.malus*, B- *P.ulmi*, C- *T.urticae*

** *Predatory mites:* A- *Typhlodromus* spp. B- *A.gossipi*, C- *P.plumifer*
D- *A.exsertus* E- *C.orinatus*

*** Saprophugous mites: A- *Z.sayedi*, B- *T.putriescentiae*, C- *T.pallidus*
D- *T.californicus*

Table (6): Fluctuations of the populations densities of inspected insects and snails on apple trees at Kafer El Dawar region, Beherra, 1998

Date	No. insects and snails/100 twigs														Grand total
	Insects												Snails		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Jan	0	0	0	0	0	0	120	0	2	0	0	0	0	15	
Feb	0	0	0	0	0	0	64	0	0	0	0	0	0	40	
March	0	15	0	89	21	0	0	2	0	19	0	0	2	0	
April	0	104	0	46	31	0	0	41	0	0	4	11	0	0	
May	9	128	0	9	9	25	0	40	0	0	0	0	6	0	
June	9	512	5	0	0	37	0	58	0	0	0	0	0	0	
July	5	61	36	0	0	22	0	37	5	0	0	0	5	4	
Aug	0	4500	18	9	5	2	5	0	0	0	9	0	1	6	
Sept	0	2831	16	270	18	0	7	8	2	9	6	0	1	0	
Oct	0	24	47	16	129	2	17	4	0	35	6	0	9	15	
Nov	0	0	0	0	0	20	35	5	0	20	0	0	0	132	
Dec	0	0	0	0	187	0	25	0	0	22	0	21	1	15	
Total/	23	8175	122	439	231	108	273	195	9	105	25	32	25	257	10014
%	0.002	81.6	0.01	4.4	2.3	1.1	2.7	2.0	0.01	1.1	0.002	2.002	0.002	2.6	100

A- *R.syriacus* B- *E.lanigerum* + *A.pomi* C- *P.pyricola*
D- *S.granati* E- *I.aegypticaca* F- *C.floridensis*
G- *A.hedera* H- *L.clerkia* I- *Z.pyrina*
J- *S.amygdali var-aegypticus* K- *C.vulugavis* L-*A.nomas*
M- *P.aphidivava* N- *T.pisana*

Effect of some climatic conditions and predaceous mites on the abundance of occurring phytophagous mites on apple trees:

The calculated correlation coefficient values (r) between the climatic conditions (max. temp, min. temp, R.H, rainfall, wind speed and daily sunny period) and the counted numbers of the inspected phytophagous mites *A.malus*, *P.ulmi* and *T.urticae* on apple trees are presented in Table 7. The significant moderate and strong correlations between min. temp. and each of these three mites had been detected. The values of r-coefficient were 0 473 (at 0.05) level with *A.malus* and 0.568 and 0.621 with *T.urticae* and *P.ulmi*, respectively at the 0.01 level. The insignificant negative correlations were recorded between the climatic factors of relative humidity, rainfall and wind speed and each of three mites. While, significant positive weak correlations were recorded between max. temp. and each of *P.ulmi*, *T.urticae* and *A malus* with r-coefficient value of 0.471, 0.422 and 0.351, respectively. Also, there was significant strong positive correlation between the daily sunny period and *T.urticae* with r-coefficient value of 0.611.

Table (7): Correlation coefficient values between some physical climatic factors and densities of three found phytophagous mites on apple trees at Kafer El Dawar region throughout two successive years (1997 and 1998)

Phytophagous mites	Correlation coefficient (r-coefficient)					
	Max. temp.	Min. temp.	RH (%)	Rainfall	Wind speed	Daily sunny period
A.malus	0 351 ns	0 473*	-0 215 ns	-0 306 ns	-0 251 ns	0 333 ns
P.ulmi	0 471*	0 621**	-0 180 ns	-0 378 ns	-0 049 ns	0 261 ns
T.urticae	0 422*	0 568**	-0 089 ns	-0 355 ns	-0 107 ns	0 611**

NS = Not significant * = Significant at 5% level ** = Significant at 1% level

From these results, it could be revealed that min. daily temp. is more effective on the abundance of three studied phytophagous mites and controlled 47.3, 56 8 and 62 1% of the total variations in *A.malus*, *T.urtica* and *P ulmi* respectively. (Table 7). These results agree with those obtained by Zaher et al. (1973) who stated that apple trees were infested heavily with *P ulmi* in summer Also El. Halaweny, et al (1989) mentioned that high temperature and high relative humidity increased the population of mites El-Deeb et al, (1998) indicated that both mites and insectes occurred in higher number in summer and fall than in winter.

Data in Table 8, also exhibit the results of performed correlation analysis (r-coefficient) between the phytophagous mite species and their predatory ones. The data indicated the insignificant positive or/and negative weak correlations between each of the three detected phytophagous mites and the five predatory ones.

The reduced insignificant r-coefficients values were 0.135, 0 074 and 0 192 for *Typhlodromus* spp. with *A.malus*, *P.ulmi* and *T.urticae*, respectively The same results were noticed between *A.exesrusts* and the three phytophagous mites. In general, all the predatory mites insignificantly affected the three phytophagous mites on apple trees.

Table (8): Correlation matrix between predatory and phytophagous mites on apple trees at Kafer El Dawar region throughout two successive years (1997 and 1998)

Phytophagous mites	Correlation coefficient (r-coefficient)				
	Typhlodromus spp.	A.gossipi	p. plumifer	A. exsertus	C. arinatus
A.malus	0.135 ns	-0.371 ns	0.164 ns	-0.063 ns	0.333 ns
P.ulmi	0.192 ns	-0.266 ns	0.132 ns	0.123 ns	0.261 ns
T.urticae	0.074 ns	-0.332 ns	-0.136 ns	0.070 ns	0.611

NS = Not significant

From the above mentioned results, it could be concluded that apple trees are a good host harbouring many pests, particularly the mite species. Population densities of inspected insect and animal pests and natural enemies varied depending on climatic conditions during investigation period. Correlation analysis among the phytophagous mites with either climatic conditions or predatory mites may help to predict the variation in the numbers of mite species.

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الحصر والتعداد الديناميكى للآفات والأعداء الطبيعية فى بساتين التفاح

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تناولت الدراسة حصر وتقدير كثافة الآفات والإعداء الطبيعية المتواجدة علـــى أشـــجار التفاح لمدة عامين متتاليين فى منطقة كفر الدوار (محافظة البحيرة) كما تناولت دراســـة علاقـــات الإرتباط بين كلا من الظروف المناخية، الأعداء الطبيعية على بعض الأكاروسات النباتية الضارة. ولقد أظهرت النتائج ما يلى:

١- تواجد أنواع مختلفة من الآفات الأكاروسية والحشرية والقواقع بالإضافة إلى الأعداء الطبيعيـــة خلال فترات الفحص والدراسة.

٢- الإنتشار النسبى لأنواع الأكاروسات النباتية الضارة وهى أكاروس صـــدأ التفـــاح وأكـــاروس الحلويات الأحمر، العنكبوت الأحمر العادى حيث بلغ المجموع الكلى لهذه الأفراد خلال عـــامى ١٩٩٧، ١٩٩٩٨ (١٩١٨٢ ، ٩٢٥٦)، (١٤١٢ ، ٣٧٨٣)، (١٤٠١ ، ٣٢٤٦) فـــرد / ١٠٠ فريع على التوالى.

٣- أكثر الآفات الحشرية تواجدا هما نوعـــى المـــن *A.pomi* ، *E.lanigerum* حيـــث كـــان مجموعهما معا يعادل ٣١، ٨١,٦% من المجموع الكلى للحشرات خلال عـــامي ١٩٩٧-١٩٩٨ على التوالى.

٤- تواجد أعداد منخفضة من الأعداء الطبيعية وخاصة الحشرية ــ أسد المن.

٥- الإرتباط الموجب المعنوى بين درجات الحرارة المنخفضة وتعداد الأكاروسات النباتية الضـــارة يلي ذلك تأثير درجات الحرارة المرتفعة.

٦- تأثيرات غير معنوية بين الأنواع الأكاروســـية النباتيـــة الضـــارة والمفترســـات الأكاروســـية الموجودة.