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Population Dynamics of the Egyption Citrus Black Scale Insect *Chrysomphalus aonidum* l. on Citrus Trees in Qalubia Governorate

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Abstract

This work was carried out to investigate the population dynamics of black scale insect *Chrysomphalus aonidum* L. on leaves and fruits of Navel and Balady orange at Tukh and Qalub districts in Qalubia governorate during two successive years from September 2015 to August 2017. The obtained data show that, the highest numbers of *C. aonidum* were recorded in October with total numbers 185 & 195 adult on Navel and Balady orange at average temperature 23.7 C° and relative humidity 74.4% in the first year and 196 & 213 insect in the second year when average temperature and relative humidity were 23.1 C° and 75.9% , respectively. Meanwhile , the highest number of *Ch. aonidum* at Qalub district was recorded in October with total number 160 and 169 adult on Navel and Balady orange at average temperature 25.8 C° and relative humidity 60.1% in the first year while , in the second year , the total numbers of *C. aonidum* were 174 & 192 adult on Navel and Balady orange at average temperature 25.4 C° and relative humidity 62.4%. Also, data revealed that the population of black scale insect, *Ch.aonidium* on Navel and Balady orange trees was positively significant with average of temperture and nonsignificantly negatively with relative hummidity .

Keywords: - *Citrus; Chrysomphalus aonidum, Population.*

Introduction

Egypt is one of the largest producer of citrus crop and considered the largest exporter of orange in the world **(FAO, 2016).** A wide range of pests attack citrus trees, which affect tree health, productivity, fruit and flower's oil quality. One group of these insects is the scale insects (armored scale) (Hemiptera: Diaspididae). Ninety-four species of scale insects have been recorded in Egypt on different plants **(Mohammad and Ghabbour, 2008).** Citrus trees were recorded to be infested by nine species of scale insects with different degrees of importance and distribution **(Ghabbour and Mohammad, 1996).**

Black scale insect, *Chrysomphalus aonidum* L. is the most important one which known to attack branches, twigs, leaves and fruits. This insect among sucking piercing group which depend on sucking plant sap. This mechanism disturbs the plant physiology and results in weaken the tree, which become subject to secondary infestation by other insects. In addition, the black scale insect, *Ch. aonidum* is a dangerous pest on citrus trees which causing dropping leaves and twigs and fruit stunt **(Cilliers, 1971 and Schweig & Grunberg, 2015) .** Understanding the relation between ecological aspects and population dynamics of an insect and its generation's occurrence around the year are important steps in integrated pest management of this insect **(Habib *et al.*, 1971; Rosen, 1974 ; Abul-Nasr *et al.*, 1975; Gravena and Fornasieri 1979; Kamel *et al.*, 2003; Soto *et al.*, 2008; Mala and Sunanda 2014 and Asmaa *et al.*, 2017)**. Therefore, the present work was conducted to study the population dynamics of black scale insect on two citrus verities at Tukh and Qalub districts in Qalubia governorate,Egypt.

Materials and Methods

The population dynamics of black scale insect, *Chrysomphalus aonidum* attacking two citrus varieties (Navel orange & Balady orange), were studied during two successive years, from September, 2015 to August, 2017. The farms infested by citrus red mite *Panonychus citri* and its predacious mites and black scale insect were chosen at Tukh & Qalub districts (Qalubia province). These farms were cultivated with two citrus varieties, Navel orange & Balady orang (trees fifteen years old) and kept free from any chemical applications during this study. Each variety was represented by 80 trees, which divided into four replicates (20 trees each). Monthly samples were taken randomly from each variety. The samples were put in paper bags and directly transferred to the laboratory at the same day. The sample was composed of 25 leaves and five fruits. The upper and lower surface of leaves and fruits were inspected. The adults of black scale insect were counted. The monthly average temperature (ºC) and relative humidity (R.H. %) in Tukh & Qalub districts were obtained from metrological department of central laboratory of condition at Dokki, Giza, Egypt. Spearman's rank correlation coefficient was done among the weather factors and *Ch. aonidum* .

Results

Population dynamics of adults of black scale insect, *Ch. aonidum* were studied on leaves and fruits of two citrus varities (Navel and Balady

orange) at Tukh and Qalub districts in Qalubia governorate:-

1-Population dynamics of *Ch. aonidum* at Tukh district on navel and balady orange .

Data in Tables (1 & 2 and) fig.1 show that, the population of *Ch. aonidum* have been affected by weather factors (temperature degrees & relative humidity) . as following:

A- On Navel orange

The population of black scale insect, was significantly positively correlated with average temperature and nonsignificant negatively correlated with relative humidity ; therefore it has one annual peak on each leaves and fruit during two successive years , whereas, the individual numbers were 82 & 103 adult during October on fruits and leaves, respectively, in the first year at average temperature 23.7 ˚C and relative humidity 74.4% and 89.0 & 107 adult during october in the second year at average temp. 23.1°c & 75.9 R.H %.

The population of black scale insect on fruits of Navel orange was started with high numbers in September and increased in October (82 adult) and disappeared from November to March and finally turned to appears again in April 2016 and gradually increased from April to August. The numbers of adults of *Ch. aonidum* were : 73.0; 82.0; 0; 0; 0; 0; 0; 29.0; 44.0; 51.0; 56.0 and 67.0 adult at temperature degrees: 27.8; 23.7; 18.7; 13.6; 13; 17; 19; 24; 26.5; 30; 29.5 and 30 C° and relative humidity: 64.7; 74.4; 83.4; 85.3; 79.9; 79.7; 72.9; 64.2; 58.1; 65.6; 71 and 73.4% in September; October; November; December; January; February; March; April; May; June; July and August , respectively in the first year. Same trend of population was occurred in the second year whereas the peak of insect was recorded in October (89 insect) at temperature 23.1 °C and relative humidity 75.9%. The population was began with high numbers in September and increased in October then disappeared from November to March. The population turned to appears again in April 2017 and gradually increased from May to August. The numbers of adult stage of *Ch. aonidum* were: 81; 89; 0; 0; 0; 0; 0; 37; 51; 62; 65 and 79 adult at temperature degrees 25.8; 23.1; 17.8; 12.6; 12.5; 12.1; 16.2; 24.5; 26.5; 29; 29.5 and 29.5 C° and relative humidity 69.8; 75.9; 77.8; 77.1; 79; 82.7; 74.5; 71.3; 59.6; 61.6; 72.5 and 73.6 % in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

In addition, the population of adults of black scale insect, has one annual peak on leaves in October with 103 insect at 23.7 °C and relative humidity 74.4 %. The population of *Ch. aonidum* was began with high numbers in September 2015 and reached to its peak in October and decreased in November and gradually increased in December and January2016 then decreased again in February. The population gradually increased during March and April but turned to decreased in May. Finally the population gradually increased from June to August , the numbers of insect were: 92.0; 103; 83.0; 88.0; 98.0; 56.0; 71.0; 79.0; 75.0; 83.0; 92.0 and 97.0 adult at temperature degrees: 27.8; 23.7; 18.7; 13.6; 13; 17; 19; 24; 26.5; 30; 29.5 and 30 C˚ and relative humidity: 64.7; 74.4; 83.4; 85.3; 79.9; 79.7; 72.9; 64.2; 58.1; 65.6; 71 and 73.4% in September; October; November; December; January; February; March; April; May; June; July and August , respectively in the first year. In the second year, the population was started also with high numbers in September 2016 and increased in October (annual peak, 107 adult) and decreased in November then gradually increased from December to recording the highest numbers in January 2017. Finally, the population decreased in February and gradually increased in March and April then decreased in May and increased in June and decreased in July then increased in August. The numbers of adult stage of *Ch. aonidum* were: 97.0; 107; 91.0; 97.0; 110; 67; 82; 93; 83; 99; 98 and 103 adult at temperature degrees 25.8; 23.1; 17.8; 12.6; 12.5; 12.1; 16.2; 24.5; 26.5; 29; 29.5 and 29.5 C˚ and relative humidity 69.8; 75.9; 77.8; 77.1; 79; 82.7; 74.5; 71.3; 59.6; 61.6; 72.5 and 73.6 % in September; October; November; December; January; February; March; April; May; June; July and August the second year , respectively.

B-On Balady orange:

Results in Tables (1 & 2 and fig.1) indicate that, the population of black scale insect, *Ch. aonidum* was significantly positively correlated with average temperature and nonsignificant negatively correlated with relative humidity .

The population of has one annual peak on fruits and leaves of balady orange in October 2015 (79 & 116 adult) at average temperature 23.7 °C and relative humidity 74.4 % in the first year and 87 & 126 adult in the second year at average temperature 23.1 °C and relative humidity 75.9 %. The population on fruits of balady orange was started with high numbers in September 2016 and increased in October then decreased in November until disappeared in December; and continuted January 2017; February; March to appears again and gradually increased from April to August. The numbers of adult stage were: 64.0; 79.0; 5.00; 0; 0; 0; 0; 32.0; 37.0; 44.0; 49.0 and 57.0 adult at temperature degrees: 27.8; 23.7; 18.7; 13.6; 13; 17; 19; 24; 26.5; 30; 29.5 and 30 C° and relative humidity: 64.7; 74.4; 83.4; 85.3; 79.9; 79.7; 72.9; 64.2; 58.1; 65.6; 71 and 73.4% in September; October; November; December; January; February; March; April; May; June; July and August in the first year , respectively.

Table 1. Population dynamics of adults of *Chrysomphalus aonidum* L. on leaves and fruits of two citrus varities (Navel orange and Balady orange) at Tukh district during period from September, 2015 to August, 2016

Date of inspection		Number of adult stage of *Chrysomphalus aonidum* / 25 leaves and 5 fruits						Mean	
		Navel orange			Balady orange			Temp.	R.H.
		Fruits	leaves	Total	Fruits	leaves	Total	ºC	%
Sept.2015		73	92	165	64	110	174	27.8	64.7
Oct.		82	103	185	79	116	195	23.7	74.4
Nov.		0	83	83	5	89	94	18.7	83.4
Dec.		0	88	88	0	95	95	13.6	85.3
Jan.2016		0	98	98	0	93	93	13.0	79.9
Feb.		0	56	56	0	64	64	17.0	79.7
Mar.		0	71	71	0	72	72	19.0	72.9
Apr.		29	79	108	32	88	120	24.0	64.2
May		44	75	119	37	91	128	26.5	58.1
June		51	83	134	44	88	132	30	65.6
July		56	92	148	49	98	147	29.5	71.0
Aug.		67	97	164	57	103	160	30	73.4
Total		402	1017	1419	367	1107	1474		
"r"	Temp. ºC	0.888	0.322	0.804	0.871	0.533	0.800		
	R.H. %	-0.582	0.071	-0.436	-0.561	-0.161	-0.452		

r- correlation coefficient

Table 2. Population dynamics of adults of *Chrysomphalus aonidum* L. on leaves and fruits of two citrus varities (Navel orange and Balady orange) at Tukh district during period from September, 2016 to August, 2017

Date of inspection		Number of adults of *Chrysomphalus aonidum* / 25 leaves and 5 fruits						Mean	
		Navel orange			Balady orange			Temp. ºC	R.H. %
		Fruits	leaves	Total	Fruits	leaves	Total		
Sept.2016		81	97	178	69	119	188	25.8	69.8
Oct.		89	107	196	87	126	213	23.1	75.9
Nov.		0	91	91	11	106	117	17.8	77.8
Dec.		0	97	97	0	101	101	12.6	77.1
Jan.2017		0	110	110	0	99	99	12.5	79.0
Feb.		0	67	67	0	79	79	12.1	82.7
Mar.		0	82	82	0	87	87	16.2	74.5
Apr.		37	93	130	41	89	130	24.5	71.3
May		51	83	134	45	105	150	26.5	59.6
June		62	99	161	52	98	150	29.0	61.6
July		65	98	163	63	109	172	29.5	72.5
Aug.		79	103	182	65	111	176	29.5	73.6
Total		464	1127	1591	433	1229	1662		
"r"	Temp. Cº	0.823	0.294	0.779	0.809	0.468	0.749		
	R.H. %	-0.518	-0.070	-0.459	-0.480	-0.205	-0.421		

r- correlation coefficient

In the second year, the population occurred in same trend in the first year while numbers of adult were :69; 87; 11; 0; 0; 0; 0; 41; 45; 52; 63 and 65 adult at temperature degrees 25.8; 23.1; 17.8; 12.6; 12.5; 12.1; 16.2; 24.5; 26.5; 29; 29.5 and 29.5 C˚ and relative humidity 69.8; 75.9; 77.8; 77.1; 79; 82.7; 74.5; 71.3; 59.6; 61.6; 72.5 and 73.6 % in in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

Furthermore, the population of black scale insect on leaves of balady orange started with high numbers of adults in September and reached to the annual peak in October, the numbers of insect were: 110 and 116 adult at temperature degrees 27.8 and 23.7 ˚C and relative humidity 64.7 and 74.4 % in September and October 2015 , respectively. After that, the population was decreased in November and increased again in December then gradually decreased in January and February 2016 . Finally, the population was gradually increased from March to May and turned to decreased in June the gradually increased in July and August. The numbers of adult stage of *Ch. aonidum* were: 89; 95; 93; 64; 72; 88; 91; 88; 98 and

103 adult at temperature degrees 18.7; 13.6; 13.0; 17.0; 19.0; 24.0; 26.5; 30.0; 29.5 and 30 C° and relative humidity 83.4; 85.3; 79.9; 79.7; 72.9; 64.2; 58.1; 65.6; 71; 73.4 % in November; December; January; February; March; April; May; June; July and August in the first year , respectively. In the second year, same trend of population was occurred where it started with high numbers in September 2016 and the highest numbers in October, the numbers of insect were: 119 and 126 adult at 25.8 and 23.1 °C and relative humidity 69.8 and 75.9 % in September and October, respectively. The population of the adults of black scale insect was gradually decreased from November 2016 to February 2017 and gradually increased from March to May and decreased in June then gradually increased in July and August. Numbers of insect were: 106; 101; 99.0; 79.0; 84.0; 89.0; 105; 98.0; 109; 111 adult at temperature degrees 25.8; 23.1; 17.8; 12.6; 12.5; 12.1; 16.2; 24.5; 26.5; 29; 29.5 and 29.5 C° and relative humidity 69.8; 75.9; 77.8; 77.1; 79; 82.7; 74.5; 71.3; 59.6; 61.6; 72.5 and 73.6 % in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

2-Population dynamics of *Ch. aonidum* at Qalub district on navel and balady orange

Data in Tables (3&4 and fig.2) show that the correlation between numbers of black scale insect and weather factors (Average of temperature and relative humidity) was positively significant with temperature degrees and nonsignificant negatively with relative humidity on both navel and balady orange.

A-On Navel orange:

The population of black scale insect, on fruits was began with high numbers in September 2015 and increased to reached its peak in October (64 and 72) then disappeared from November to March 2016 . Finally, the population of *Ch. aonidum* turned to appears again and gradually increased from April to August. The numbers of adult stage of *C. aonidum* were: 64.0; 72.0; 0; 0; 0; 0; 32.0; 36.0; 44.0; 49.0 and 54.0 adult at temperature degrees 30.2; 25.8; 20.6; 15.5; 13.7; 17.2; 19.7; 24.5; 26.3; 30.3; 29.7 and 29.8 C° and relative humidity 53.7; 60.1; 72.2; 74.2; 67.1; 62.7; 50.7; 47.0; 44.0; 47.5; 56.5 and 54.9 % in September; October; November; December; January; February; March; April; May; June; July and August in the first year , respectively. Same trend of *Ch. aonidum* population was occurred in the second year where the numbers of adult were: 71.0; 79.0; 0; 0; 0; 0; 0; 36.0; 42.0; 51.0; 56.0 and 67.0 adult at temperature degrees 28.3; 25.4; 20.2; 14.2; 13.4; 14.8; 18.9; 25.2; 26.5; 29.2;. 29.7 and 30 °C and relartive humidity 55.6; 62.4; 60.4; 65.4; 63.2; 63.5; 55.9; 60.0; 63.0; 66.0; 70.0 and 70.0 % in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

Moreover, the population of *Ch. aonidum* on leaves of navel orange has one annual peak in July (93 insect) at temperature 29.7 °C and relative humidity 56.5 %. The population was started with high numbers in September and fluctuated up and down until it reached to the highest number in July and decreased in August. The numbers of adults were 76.0 and 88.0; 75.0; 83.0; 89.0; 77.0;69.0; 74.0; 79.0; 86.0; 93.0 and 90.0 adult at temperature degrees 30.2; 25.8; 20.6; 15.5; 13.7; 17.2; 19.7; 24.5; 26.3; 30.3; 29.7 and 29.8 C° and relative humidity 53.7; 60.1; 72.2; 74.2; 67.1; 62.7; 50.7; 47.0; 44.0; 47.5; 56.5 and 54.9 % in September; October; November; December; January; February; March; April; May; June; July and August in the first year , respectively. In the second year, the black scale insect, . has one annual peak in July (103 insect) at temperature 29.7.6°C and relative humidity 70%. The population was began with high numbers in September and fluctuated up and down in numbers until reached to its highest numbers in July and decreased in August . The numbers of adults were: 83 and 95; 87; 77; 101; 68; 75; 78; 84; 93; 103 and 98 adult at temperature degrees 28.3; 25.4; 20.2; 14.2; 13.4; 14.8; 18.9; 25.2; 26.5; 29.2; 29.7 and 30°C and relative humidity 55.6; 62.4; 60.4; 65.4; 63.2; 63.5; 55.9; 60; 63; 66; 70 and 70 % in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

B-On balady orange:

Results in Tables(3 & 4 and fig.2) recorded that, the population of adults of was started with high numbers in September and increased to reached to its peak in October (58 and 64) and decreased in November, while it was disappeared from December to March and appeared again in April . Finally, the population gradually increased from April to August. numbers of adults were: 58.0; 64.0; 9.0; 0; 0; 0; 0; 29.0; 34.0; 42.0; 52.0 and 61.0 adult at temperature degrees 30.2; 25.8; 20.6; 15.5; 13.7; 17.2; 19.7; 24.5; 26.3; 30.3; 29.7 and 29.8 °C and relative humidity 53.7; 60.1; 72.2; 74.2; 67.1; 62.7; 50.7; 47.0; 44.0; 47.5; 56.5 and 54.9 % in September; October; November; December; January; February; March; April; May; June; July and August in the first year , respectively. Same trend in population of *Ch. aonidum* was occurred in the second year but the numbers of adult stage were: 63.0; 71.0; 23.0; 0; 0; 0; 0; 34.0; 43.0; 49.0; 61.0 and 70.0 adult at temperature degrees 28.3; 25.4; 20.2; 14.2; 13.4; 14.8; 18.9; 25.2; 26.5; 29.2; 29.7 and 30 °C and relative humidity 55.6; 62.4; 60.4; 65.4; 63.2; 63.5; 55.9; 60.0; 63.0; 66.0; 70.0 and 70.0 % in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

On leaves of balady orange, the population of black scale insect has one annual peak in July (108 adult) at temperature d 29.7 ˚C and relative humidity 56.5%. The population of adults was fluctuated up and down from September to August . The numbers of insect were: 94.0; 105; 93.0; 99.0; 89.0; 57.0; 79.0; 92.0; 94.0; 98.0; 108 and 104 adult at temperature degrees 30.2; 25.8; 20.6; 15.5; 13.7; 17.2; 19.7; 24.5; 26.3; 30.3; 29.7 and 29.8 ˚C and relative humidity 53.7; 60.1; 72.2; 74.2; 67.1; 62.7; 50.7; 47; 44; 47.5; 56.5 and 54.9 % in September; October; November; December; January; February; March; April; May; June; July and August in the first year , respectively. In the second year, the population of *C. aonidum* started with high numbers in September and fluctuated up and down until reached to its highest numbers in August. The numbers of adult stage were: 112; 121; 101; 115; 98.0; 65.0; 90.0; 99.0; 106.0; 110; 123 and 116 adult at temperature degrees 28.3; 25.4; 20.2; 14.2; 13.4; 14.8; 18.9; 25.2; 26.5; 29.2; 29.7 and 30˚ C and relative humidity 55.6; 62.4; 60.4; 65.4; 63.2; 63.5; 55.9; 60.0; 63.0; 66.0; 70.0 and 70.0 % in September; October; November; December; January; February; March; April; May; June; July and August in the second year , respectively.

Table 3. Population dynamics of adults of *Chrysomphalus aonidum* L. on leaves and fruits of two citrus varities (Navel orange and Balady orange) at Qalub district during period from September, 2015 to August ,2016

Date of inspection		Number of adults of *Chrysomphalus aonidum* / 25 leaves and 5 fruits						Mean	
		Navel orange			Balady orange			Temp. ºC	R.H. %
		Fruits	leaves	Total	Fruits	leaves	Total		
Sept.2015		64	76	140	58	94	152	30.2	53.7
Oct.		72	88	160	64	105	169	25.8	60.1
Nov.		0	75	75	9	93	102	20.6	72.2
Dec.		0	83	83	0	99	99	15.5	74.2
Jan.2016		0	89	89	0	89	89	13.7	67.1
Feb.		0	47	47	0	57	57	17.2	62.7
Mar.		0	69	69	0	79	79	19.7	50.7
Apr.		32	74	106	29	92	121	24.5	47.0
May		36	79	115	34	94	128	26.3	44.0
June		44	86	130	42	98	140	30.3	47.5
July		49	93	142	52	108	160	29.7	56.5
Aug.		54	90	144	61	104	165	29.8	57.9
Total		351	949	1300	349	1112	1461		
"r"	Temp. ºC	0.874	0.382	0.818	0.906	0.551	0.852		
	R.H. %	-0.478	0.009	-0.370	-0.434	-0.044	-0.326		

r- Correaltion Coefficient

Table 4. Population dynamics of adults of *Chrysomphalus aonidum* L. on leaves and fruits of two citrus varities (Navel orange and Balady orange) at Qalub district during period from September, 2016 to August,2017)

Date of inspection		Number of adults of *Chrysomphalus aonidum* / 25 leaves and 5 fruits						Mean	
		Navel orange			Balady orange			Temp. ºC	R.H. %
		Fruits	leaves	Total	Fruits	leaves	Total		
Sept.2016		71	83	154	63	112	175	28.3	55.6
Oct.		79	95	174	71	121	192	25.4	62.4
Nov.		0	87	87	23	101	124	20.2	60.4
Dec.		0	97	97	0	115	115	14.2	65.7
Jan.2017		0	101	101	0	98	98	13.4	63.2
Feb.		0	68	68	0	65	65	14.8	63.5
Mar.		0	75	75	0	90	90	18.9	55.9
Apr.		36	78	114	34	99	133	25.2	60.0
May		42	84	126	43	106	149	26.5	63.0
June		51	93	144	49	110	159	29.2	66.0
July		56	103	159	61	123	184	29.7	70.0
Aug.		67	98	165	70	116	186	30.0	70.0
Total		402	1062	1464	414	1256	1670		
"r"	**Temp. ºC**	0.839	0.335	0.824	0.899	0.618	0.861		
	R.H. %	0.212	0.645	0.377	0.273	0.365	0.329		

r- Correaltion Coefficient

Concerning, the total numbers of *Ch.aonidium* on the two citrus varieties under study, it clear that the population of the black scale insect recoreded two peaks (185 & 98 in October and 126 & 110 adult in January on the navel orange) while in balady orange recorded one peak (195 and 213 adult in October during the two years) in the first year (Tables 1 & 2 and fig.1) at Toukh district . Same trend of population was occurred in the second year, whereas recorded , also , two peaks (160& 89 in January during the two years, respectively) on the navel orange, while in balady orange recorded one peak (169 and 192 adult in October in the two years, respectively) at Qalub district (Tables 3 & 4 and fig. 2).

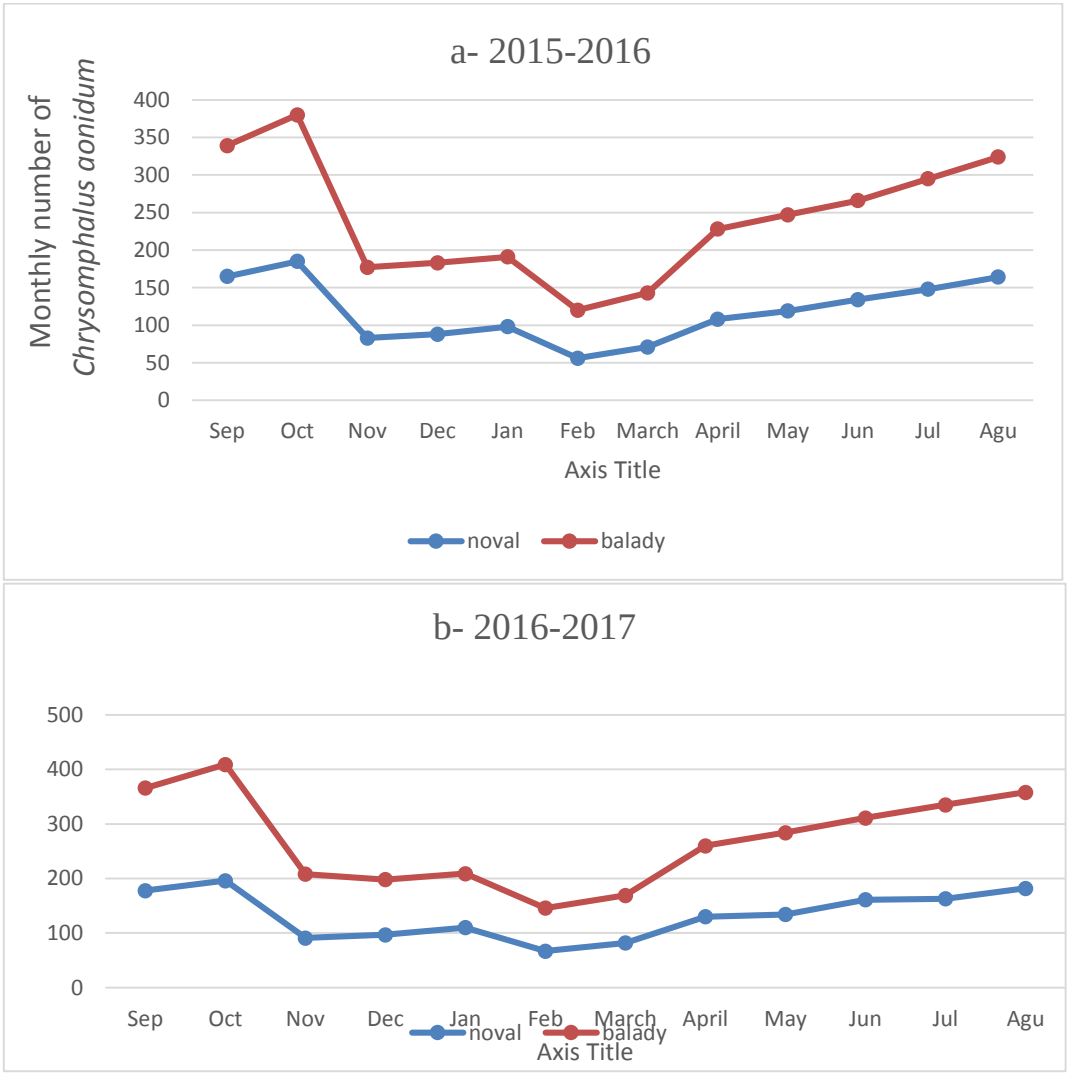

Fig. (1) Population dynamic of adults of *Chrysomphalus aonidum* during the 1 st year and 2 nd year at Tukh district (a- 2015-2016) b- (2016-2017)

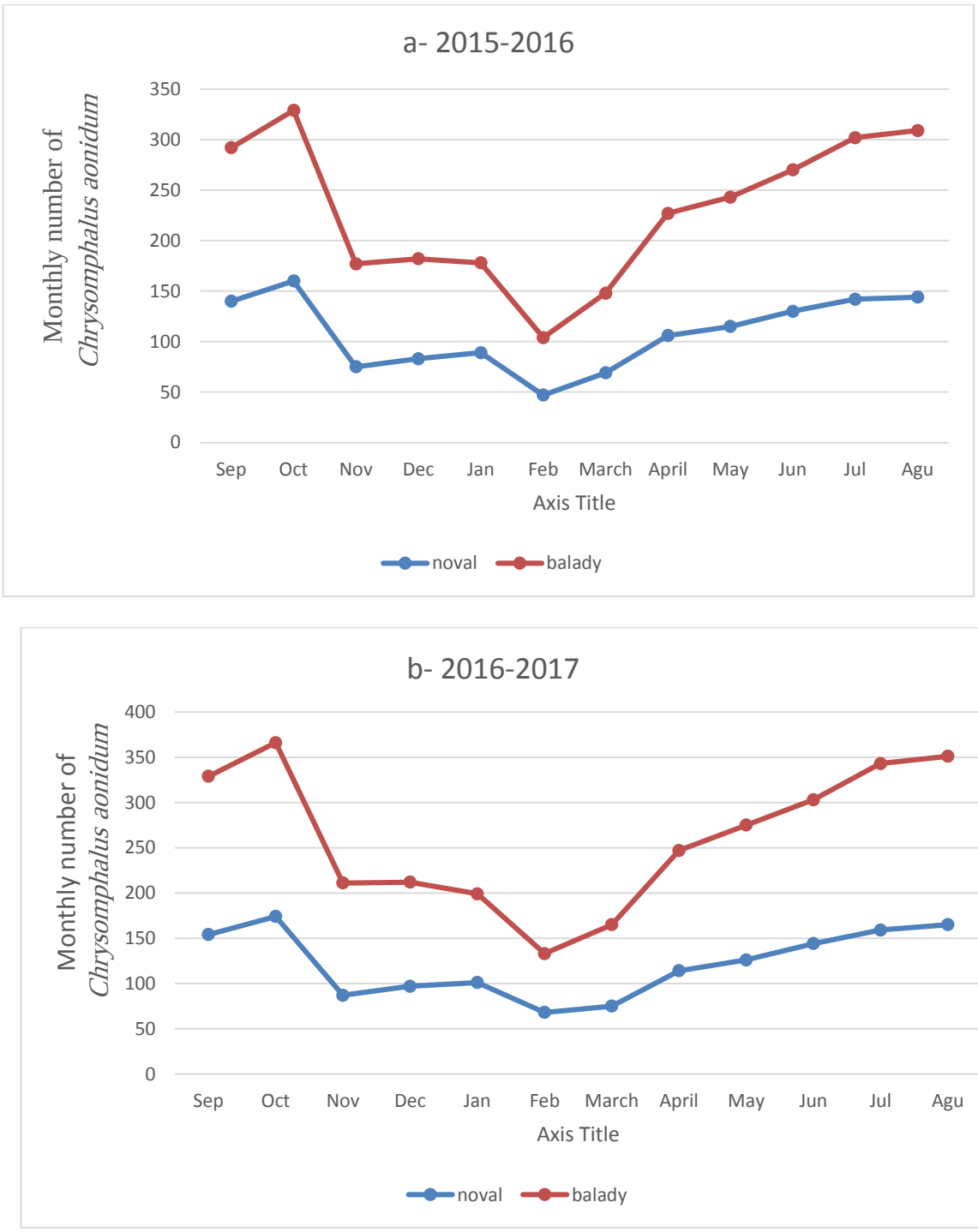

Fig. (2) Population dynamic of adults of *Chrysomphalus aonidum* during the 1 st and 2 nd year at Qalub district (a- 2015-2016) b- (2016-2017)

Discussion

The population dynamics of black scale insect, *Ch. aonidum* was studied by few authors in different countries such as **Soto *et. al.* (2008)** in Spain, they recorded three to four generations with higher population in summer but in Egypt **Habib *et al.*, (1971)** studied the population dynamics of *Ch. aonidum* on navel orange and mandarin at Kafr El-Dawar. they recorded two annual generations in June and October. Recently **Asmaa *et al.* (2017)** in Egypt recorded three peaks on the navel orange while in sweet orange recorded four peaks in the first year and three peaks in the second year but the heaviest infestation was recorded in September and October . In the present study the highest numbers of *Ch. aonidum* were recorded in October with total numbers 185 & 195 adult on Navel and Balady orange at average temperature 23.7 ˚C and relative humidity 74.4% in the first year and 196 & 213 adult in the second year when average temperature and relative humidity were 23.1 ˚C and 75.9% , respectively. Meanwhile , the highest numbers of

Ch. aonidum at Qalub district was recorded in October with total numbers 160 and 169insect on Navel and Balady orange at average temperature 25.8 ˚C and relative humidity 60.1% in the first year while , in the second year , the total numbers of *Ch. aonidum* were 174 & 192 adult on Navel and Balady orange at average temperature 25.4 ˚ C and relative humidity 62.4% .

Also, data revealed that the correlation between the population of black scale insect, *Ch.aonidum* and weather Factors was positively signifieant with average of the temperature and nonsignificant negatively with relative humidity on both navel and balady orange during t the two years of test . This result is agreement with whose obtained by **Cilliers (1971)** who stated that the population of *Ch.aonidum* was positively significant with temperature and nonsignificant negatively with relatiue humidity.

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حركة تعداد الحشرة القشرية السوداء *Chrysomphalus aonidum* L. على أشجار الموالح فى محافظة القليوبية

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تم دراسة حركة تعداد الحشرة القشرية السوداء *Chrysomphalus aonidum* L. على صنفين من الموالح (البرتقال ابوسرة – البرتقال البلدى) فى مركزى طوخ وقليوب من محافظة القليوبية خلال عامين متتالين من سبتمبر 2015 الى اغسطس 2017. حيث اظهرت النتائج أن اعلى تعداد للحشرة تم تسجيله فى شهر اكتوبر 185 و 195 حشرة على البرتقال ابو سرة والبرتقال البلدى عند متوسط درجة حرارة 23.7 م° ورطوبة نسبية 74.4 % خلال السنة الاولى بينما كانت اعداد الحشرة فى السنة الثانية 196 و 213 حشرة على البرتقال ابوسرة والبرتقال البلدى علي الترتيب عند متوسط درجة حرارة 23.1 م° ورطوبة نسبية 75.9 % وذلك فى مركز طوخ . بينما اشارت الدراسة ان اعلى تعداد للحشرة فى مركز قليوب تم تسجيله ايضا فى شهر اكتوبر حيث سجلت 160 و 169 حشرة على البرتقال ابوسرة والبرتقال البلدى عند متوسط حرارة 25.8 م° ورطوبة نسبية 60.1% وذلك خلال السنة الاولى بينما سجلت 174 و 192 حشرة عند درجة حرارة 25.4 م° ورطوبة نسبية 62.4% خلال السنة الثانية فى مركز قليوب.

كما أوضحت النتائج أيضاً أن هناك علاقة موجبة بين تعداد الحشرة القشرية السوداء ودرجة الحرارة ..... وعلاقة سالبة بين التعداد ودرجة الرطوبة النسبية على كلاً من البرتقال أبو سرة والبلدى.