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SEASONAL ABUNDANCE, NUMBER OF GENERATIONS AND HORIZONTAL DISTRIBUTION OF *Aulacaspis tubercularis* (NEW STEAD) AND ITS ASSOCIATED PARASITOIDS ON MANGO TREES

Mai I.A. Attia[1]; H.M. El-Sharkawy[2*]; H.A. Nabil[1]and F.S. El-Santeel[2]
1- Plant Protection Research Institute, Agricultural Research Center, Egypt
2- Plant Production Department, Faculty of Technology and Development, Zagazig Univ., Egypt. ****email:*** *hamzash@hotmail.com*

ABSTRACT

The seasonal abundance of Aulacaspis tubercularis (Newstead) and its associated parasitoids on mango trees varity hendi was studied in Inshas El-Raml district, Sharkia Governorate during the two successive years (2017 and 2018).

The obtained results were summarized as follows:

1. *Females, males and total alive stages population showed two peaks of activity during the two successive years.*
2. *Nymphs population appeared four and two peaks of activity during the two successive years, consecutively.*
3. *During the first year the mean percentage of total mortality (13.71%) was relatively lower than the mean percentage of total mortality during the second one (29.52%).*
4. *During the course of this work, two hymenopterous species were recorded as parasitoids of A. tubercularis. They were Aphytis sp. and Aspidiotiphagus sp.(Aphelinidae).The mean percentages of parasitism were 2.78 and 7.37% during the first and second years, respectively.*
5. *Coefficient of determination (C.D.%) affected total number of alive stages population by 70.60 and 87.13 % during the first and second years, consecutively.*
6. *The pest, A. tubercularis had three generations annually on mango trees varity hendi during the two successive years. The generation took about 3 to 5 months.*
7. *The insect and its associated parasitoids occurred in north eastern side of the trees.*

Conclusively, *seasonal abundance of Aulacaspis tubercularis (Newstead) and its associated parasitoids on mango trees varity Hendi showed that female, males and total alive stages population two peaks of activity during the two successive years. The pest, A. tubercularis had three generations annually during the two successive years. During the*

course of this work, two hymenopterous species were recorded as parasitoids of A. tubercularis. so, when uses pesticides it must be concentrate on the opposite side.

Key words: Seasonal Abundance, Number Of Generations, *Aulacaspis Tubercularis* , Associated Parasitoids, Mango Trees.

INTRODUCTION

Mango trees, *Mangifera indica* Linnaeus (Anacardiaceae) considered as one of the most popular fruits in Egypt. It contains a high percent of sugar, protein, fats, salts, vitamins. It plays an important role in food industrialization such as juices, which wanted with large amounts to export according to good reputation of Egyptian varieties. Now, the Egyptian policy strategy is to increase the quality level of exported crops to certain European countries, for this reason many efforts has been done to increase the total cultivated areas of mango in Egypt, as a favorable fruits in many countries.

A. tubercularis represented as the most important pests which infesting mango trees in many countries of the world. It causes serious damage to the infested trees. Such damages are distortion of foliage, discoloration of flowers, distorted blossoms and reduction in the general vigor of the trees. Joubert *et al.* (2000) reported that *A. tubercularis* injures the leaves and fruits, affecting the commercial value of the fruits and their export potential. Infested mango fruits have conspicuous pink blemishes around the feeding sites of the scales. In nurseries, severe early-stage infestation retards growth.

Young trees are particularly vulnerable to excessive leaf loss and death of twigs due to scale, during hot dry weather. *A. tubercularis* presents significant pest problems on mangoes in South Africa. It is also a problem on mangoes in Australia, East and West Africa, North and South America and the Caribbean Islands. Radwan (2003) reported that *A. tubercularis* had three generations on mango trees at Beni- Swief Governorate, Egypt. Kwaiz (2009) in Egypt, mentioned that this insect had three peaks on mango which occurred during March, June and November through each of the two studied years, while the lowest population was occurred in mid July. Also, data clearly showed that *A. tubercularis* had four overlapping annual generations during the two studied years. According to its economic importance in Egypt especially on mango trees, the present work was carried out to study the seasonal fluctuations of this insect, its natural enemies, and the effects of a biotic factors (temperature ºC, relative humidity RH% and light intensity Lux) on both insect and its natural enemies. El-Metwally *et al*. (2011), Abo-Shanab (2012) and Nabil *et al.* (2012). They revealed that *A. tubercularis* recorded three or four peaks of activity during the year. The pest activity appeared three annual generations in

either the top and bottom levels of mango trees. Also, they reported that the armored scale insect, *A. tubercularis* and its natural enemies concentrated in eastern side of the trees. Also, this pest preferred the upper surface of leaves during cold month.Therefore, the present investigation was aimed to study:

1- Population density and seasonal abundance of different stages of *A. tubercularis* and their number of annual generations.
2- Associated parasitoids as well as the role of biological control agents in reducing the infestation of this pest.
3- Effect of climatic factors (Maximum temperature, minimum temperature, relative humidity, light intensity and solar radiation) on both insects and its associated parasitoids.
4- Study the cardinal directions on the distribution of *A. tubercularis* and its associated parasitoids mathematically such study may help in determination the proper site of chemical application against this pest without any objection with natural biological control agent.

MATERIALS AND METHODS

Field experiments were carried out in mango farm located in Inshas El-Raml district, Sharkia Governorate. The study was continued for two successive years, from January 2016 until December 2018. The farm received normal agricultural practices and no chemical control was applied.

1- *Population densities and seasonal abundance:*

The study was started from January 2016 until December 2018, in an area of about one feddan for every variety of mango, *Mangifera indica* L. (Balady and Hendi). Five trees of each variety were selected and labeled. These trees were nearly similar in size, age and vegetation. Each tree was divided into four main directions (east, west, north and south).

Five leaves were picked up at random twice a month from each direction, *i.e.* 200 leaves per sample (5 trees × 4 directions × 5 leaves × 2 times of sampling). The samples were put in polyethylene bags and transferred into the laboratory for carefully inspection.

These samples were examined in the same day by the aid of stereomicroscope. The stages of scale insects and its associated parasitoids were counted and recorded. The annual generations of scale insects were determined according to Audemard and Milaire (1975) and emended by Jacob (1977).

2- *Estimation number of parasitism ratios*

To study the parasitism ratios of *A. tubercularis*, the previously collected samples for seasonal abundance were carefully inspected and sorted. Then,

samples were separated into healthy alive insects and parasitized ones which appearing emerging holes of adult parasitoids or including parasitoid immature stages (larvae or pupae). Each healthy alive insects and parasitized ones were counted and recorded.

Parasitized insects were preserved in glass jars covered with muslin cloth by the aid of rubber bands and kept under laboratory conditions until parasitoids emergence. Percentage of total parasitism for each sample was estimated. All emerging parasitoids were mounted in canada balsam and photomagnified under stereomicroscope camera.

3. *Effect of climatic factors on the insect population and natural enemies:*

The prevailing means of maximum and minimum temperature (˚C), relative humidity (RH%) and solar radiation (MJ/m^2) in the experimental area during the periods of the present study were obtained from the Central Laboratory for Agricultural Meteorology, Agricultural Research Center, Ministry of Agriculture. Light intensity (Lux) was measured at sampling days using Luxmeter at mid-day (12 *a.m.*) when the sunlight was perpendicular with the earth to obtain the highest light intensity.

The relationships between climatic factors and each of population densities of white mango scale insect, parasitism ratios and total insect populations were studied. Simple correlation, partial regression values and coefficient of determination (C.D.%) were calculated using COSTAT Computer Program (2005).

4. *The preferable direction for the insect stages and parasitoids*

To detect the effect of the cardinal directions on the distribution of scale insects and its associated parasitoids mathematically, the following formula was used.

$$H = \sqrt{F_1^{\,2} + F_2^{\,2} + 2\,F_1\,F_2\,\mathrm{Cos}\;Q}$$

This angle was calculated by dividing F_2 / F_1, Mahmoud (1981), Hassan (1998) and Nabil (2010)

H = Powers summation

F_1 = The population on the east minus the population on the west if the first is higher and reversed it if the later is higher.

F_2 = The population on the north minus the population on the south if the first is higher and the reverse is applied if the population on the south is higher.

The figure obtained represents the tangent, the corresponding values of which was obtained form the mathematical.

$$F_1 = E - W,\ F_2 = N - S,\ \mathrm{Tan}\ Q = F_2 / F_1$$

RESULTS AND DISCUSSION

1. *Seasonal abundance*

1.1.Females population:

Data in Tables (1 and 2) showed that the females population had two peaks of activity during the two successive years (2017 and 2018). They were in April and August during the first year (2017) with value of 151 and 370 females/ 200 leaves, respectively.

While, during the second year (2018) the female peaks activity occurred in April and June (574 and 456 females), consecutively.

The total number of females (2155 females) during the first year was obviously lower as compared with that during the second one (2888 females).

1.2. *Males population:*

Data in Tables (1 and 2) indicated that males population had two peaks of activity during the two successive years (2017 and 2018). They were in April and August during the first year (2017) with value of 628 and 1809 males, successively. While, during the second year (2018) the males peaks activity occurred in April and June (2641 and 2167 males), consecutively.

The total number of males (10421 males) during the first year was obviously lower as compared with the second one (13607 males).

1.3. *Nymphs population:*

Data presented in Tables (1 and 2) indicated that the nymphs population had four peaks of activity in February (12 nymphs), July (124 nymphs), September (39 nymphs) and November (37 nymphs) during the first year. While, during the second year, two peaks of nymphs activity were obtained in April (361 nymphs) and in October (33 nymphs).

The total number of nymphs population was clearly higher during the second year than those during the first one with 1045 and 338 nymphs, respectively.

1.4. *Total number of alive stages:*

As shown from obtained data in Tables (1 and 2) and during the two successive years (2017 and 2018), the total number of alive stages indicated that two peaks of activity were recorded in April and August during the first year with values of 787 and 2200 individuals, respectively. While, during the second year the total number of alive stages indicated that two peaks of activity were recorded in April (3576 individuals) and in June (2799 individuals).

Generally, the total number of alive stages during the second year (17540 individuals) was obviously higher in comparison with that during the

Table (1): Seasonal abundance of *Aulacaspis tubercularis* (New stead) and its associated parasitoid on mango trees, variety Hendi, in Inshas El-Raml district, Sharkia Governorate during the first year (2017)

Months	Number of insects / 200 leaves								Monthly average of climatic factors				
	Alive stages				Dead stages	Mortality %	Parasitoids		Min. temp. (°C)	Max. temp. (°C)	RH (%)	Light intensity (Lux)	Solar radiation (MJ/m²)
	Females	Males	Nymphs	Total			No.	%					
Jan.	23	80	9	112	11	8.94	2	1.63	13.0	25.4	76.2	60000	202.64
Feb.	18	83	12	113	10	8.13	0	0.00	13.0	27.4	81.9	61000	313.38
Mar.	19	101	7	127	34	21.12	0	0.00	15.0	33.0	71.3	81000	457.87
Apr.	151	628	8	787	116	12.85	2	0.22	17.0	36.4	67.0	89000	550.96
May	112	539	9	660	99	13.04	10	1.32	20.0	41.4	60.6	90000	604.24
Jun.	230	1063	23	1316	225	14.60	22	1.43	20.0	38.6	62.1	90000	610.90
Jul.	306	1478	124	1908	167	8.05	21	1.01	20.0	40.0	66.7	87000	569.43
Aug.	370	1809	21	2200	289	11.61	37	1.49	17.3	38.2	67.4	88000	503.11
Sep.	353	1767	39	2159	514	19.23	94	3.52	16.0	37.3	68.1	85000	432.37
Oct.	294	1447	27	1768	307	14.80	100	4.82	18.0	36.0	66.1	76000	309.24
Nov.	215	1002	37	1254	245	16.34	115	7.67	17.0	29.7	76.2	65000	223.65
Dec.	64	424	22	510	35	6.42	13	2.39	15.0	27.7	80.8	66000	187.74
Total	**2155**	**10421**	**338**	**12914**	**2052**		**416**						
Mean ±SE	**179.58 ± 38.37**	**868.42±187.6**	**28.17 ± 9.27**			**13.71**		**2.78**					

Table (2): Seasonal abundance of *Aulacaspis tubercularis* (Newstead) and its associated parasitoid on mango trees, variety Hendi, in Inshas El-Raml district, Sharkia Governorate during the second year (2018)

Months	Number of insects/200 leaves								Monthly average of climatic factors				
	Alive stages				Dead stages	Mortality %	Parasitoids		Min. temp. (°C)	Max. temp. (°C)	RH (%)	Light intensity (Lux)	Solar radiation (MJ/m²)
	Females	Males	Nymphs	Total			No.	%					
Jan.	44	73	20	137	14	9.27	1	0.66	13.5	26.9	77.3	61000	232.58
Feb.	73	242	36	351	38	9.77	2	0.51	14.0	27.9	77.4	63000	331.38
Mar.	177	821	69	1067	136	11.31	29	2.41	17.0	38.7	67.0	80000	463.15
Apr.	574	2641	361	3576	313	8.05	86	2.21	17.0	38.1	65.1	91000	559.92
May	452	2065	226	2743	612	18.24	189	5.63	20.0	40.0	59.7	89000	601.00
Jun.	456	2167	176	2799	1205	30.09	326	8.14	20.0	40.0	61.4	90000	652.44
Jul.	325	1588	55	1968	1097	35.79	312	10.18	17.0	39.6	65.1	89000	611.26
Aug.	280	1382	30	1692	1058	38.47	168	6.11	18.9	38.0	68.5	87000	527.94
Sep.	275	1326	33	1634	1838	52.94	442	12.73	16.8	36.7	67.5	82000	438.54
Oct.	137	698	18	853	691	44.75	200	12.95	18.0	36.5	67.6	75000	343.07
Nov.	73	372	12	457	320	41.18	76	9.78	15.0	33.9	70.5	74000	188.27
Dec.	22	232	9	263	25	8.68	3	1.04	14.0	24.2	73.4	70000	187.96
Total	2888	13607	1045	17540	7347		1834						
Mean ±SE	**240.67 ± 52.91**	**1133.92 ±247.92**	**87.08 ±31.79**			**29.52**		**7.37**					

first year (12914 individuals). These results are in agreement with the findings of Ascher *et al.* (1995) Kwaiz (2009), El-Metwally *et al*. (2011), Abo-Shanab (2012) and Amer *et al*. (2017) who reported that the population peaks of the pest occurred during different periods of the year, They reported that *A. tubercularis* recorded three or four peaks of activity these peaks were recorded during February, April, June and August.

1.5. ***Total number of dead stages:***

Data presented in Tables (1 and 2) and Figs. (1 and 2) revealed that the total number of dead stages in mango trees varity Hindi showed three peaks during the first year. They were in April (116 individuals), June (225 individuals) and September (514 individuals).

While, during the second year, two peaks were obtained in June (1205 individuals) and September (1838 individuals).

In general, the total number of dead stages during the second year (7347 individuals) was clearly higher than those during the first one (2052 individuals).

1.6. ***Percentages of total mortality:***

Data presented in Tables (1 and 2) showed that the percentages of total mortality during the two successive years (2017 and 2018). During the first year (2017) four peaks of total mortality percentage were recorded in March, June, September and November with values of 21.12, 14.60, 19.23 and 16.34%, successively.

While, during the second year (2018) two peaks of mortality percentages were noticed in March (11.31 %) and September (52.94%). The mean percentage of total mortality during the first year (13.71%) was relatively lower than the mean percentage of total mortality during the second one (29.52%).

1.7. ***Percentages of parasitism:***

During the course of this work, two hymenopterous species were recorded as parasitoids of *A. tubercularis*. They were *Aphytis* sp. and *Aspidiotiphagus* sp. (Aphelinidae). The seasonal abundance of the parasitoids was presented as percentages of parasitism.

Data presented in Tables (1 and 2) and showed that during the first year, the percentages of parasitism had two peaks of activity there were in June (1.43%) and November (7.67%). During the second year, three peaks of parasitism percentage were noticed in March (2.41%), July (10.18%) and October (12.95%).

The mean percentages of parasitism were 2.78 and 7.37% during the first and second years, respectively.

These results are in agreement with the findings of Kamel *et al.* (2003), Nabil *et al*. (2012) Hamdy (2016) who studied the seasonal abundance of 18 species of the genus *Aphytis* from Egypt, observed on ten host plants infested with eleven armored scale insect species (diaspidids). The maximum parasitism rates were between 0.8 and 14.6%.

2. *Effect of climatic factors*

2.1. On females:

Data concerning in Tables (3 and 4) showed that during the first year, there was a positive significant correlation between maximum air temperature and females population whereas r= 0.650*. While, during the second year, there were positive highly significant effects between females population and each of maximum temperature, light intensity and solar radiation whereas (r) values were 0.771**, 0.893** and 0.890**, respectively. Also, the relative humidity showed a negative highly significant effect on females population whereas (r) values were -0.829**. Statistical analysis showed that coefficient of determination (C.D.%) affected females population by 68.08 and 86.41 % during the first and second years, successively.

2.2. *On males:*

Data given in Tables (3 and 4) showed that during the first year (2017), there was a positive significant correlation between maximum temperature and males population whereas r= 0.631*. While, during the second year (2018), there were positive highly significant effects between males population and each of maximum temperature, light intensity and solar radiation whereas (r) values were 0.784**, 0.922** and 0.892**, respectively. Also, the relative humidity showed a negative highly significant effect on males population whereas (r) values were -0.853**. Statistical analysis showed that C.D.% affected males population by 71.22 and 90.16 % during the first and second years, consecutively.

2. 3. *On nymphs:*

Data presented in Tables (3 and 4) revealed that during the second year (2018), there were positive significant effects between nymphs population and each of light intensity and solar radiation whereas (r) values were 0.627* and 0.629*, respectively. Also, the relative humidity showed a negative highly significant effect on nymphs population whereas (r) value was -0.611*. Statistical analysis showed that C.D.% affected nymphs population by 49.38 and 50.61 % during the first and second years, respectively.

Table (3): Correlation coefficient (r) and coefficient of determination (C.D.%) indicating the effects of climatic factors on different stages of *Aulacaspis tubercularis* (New stead) and its associated parasitoid on mango trees, variety Hendi, in Inshas El-Raml district, Sharkia Governorate during (2017)

Stages	Min. temp. (°C)	Max. temp. (°C)	RH (%)	Light intensity (Lux)	Solar radiation (MJ/m^2)	Coefficient of determination (C.D.%)
Females	0.574	0.650*	-0.541	0.543	0.354	68.08
Males	0.552	0.631*	-0.510	0.521	0.319	71.22
Nymphs	0.453	0.342	-0.156	0.206	0.206	49.38
Total number of alive stages	0.562	0.635*	-0.511	0.522	0.326	70.60
Mortality %	0.144	0.299	-0.382	0.357	0.234	31.89
Parasitism %	0.124	-0.135	0.099	-0.295	-0.487	74.25

* $P<0.05$

Table (4): Correlation coefficient (r) and coefficient of determination (C.D.%) indicating the effects of climatic factors on different stages of *Aulacaspis tubercularis* (New stead) and its associated parasitoid on mango trees, variety hendi, in Inshas El-Raml district, Sharkia Governorate during (2018)

Stages	Min. temp. (°C)	Max. temp. (°C)	RH (%)	Light intensity (Lux)	Solar radiation (MJ/m²)	Coefficient of determination (C.D.%)
Females	-0.117	0.771**	-0.829**	0.893**	0.890**	86.41
Males	-0.098	0.784**	-0.853**	0.922**	0.892**	90.16
Nymphs	-0.158	0.478	-0.611*	0.627*	0.629*	50.61
Total number of alive stages	-0.108	0.764**	-0.837**	0.903**	0.879**	87.13
Mortality %	0.385	0.442	-0.298	0.301	0.124	47.65
Parasitism %	0.494	0.547	-0.466	0.394	0.221	57.41

* $P < 0.05$ ** $P < 0.01$

2.4. ***On total number of alive stages:***

Data concerning in Tables (3 and 4) showed that during the first year, there was a positive significant correlation between maximum air temperature and total number of alive stages population whereas r= 0.635*. While, during the second year, there were positive highly significant effects between total number of alive stages population and each of maximum temperature, light intensity and solar radiation whereas (r) values were 0.764**, 0.903** and 0.879**, successively. Also, the relative humidity showed a negative highly significant effect on total number of alive stages population whereas (r) value was -0.837**. Statistical analysis showed that coefficient of determination (C.D.%) affected total number of alive stages population by 70.60 and 87.13 % during the first and second years, consecutively.

2.5. ***On percentages of total mortality:***

Data in Tables (3 and 4) showed that C.D.% affected the percentages of total mortality by 31.89 and 47.65% during the first and second years, respectively.

2.6. ***On percentages of parasitism:***

The obtained data in Tables (3 and 4) showed that C.D.% affected the percentages of parasitism by 74.25 and 57.41% during the first and second years, respectively.

Generally, it was clear that temperature and light intensity and solar radiation had positive significant effects in all cases. These results are in agreement with the findings of Nabil *et al*. (2012) who revealed that the mean of temperature correlated significantly and positively with nymphs population, but it has negative effect on adults population. The relative humidity showed insignificant effect and mostly positive on most tested hosts. Mean of temperature seemed to be the most effective factor on the population activity.

3. ***Number of generations***

As *A. tubercularis* is known to have overlapping generations, it was necessary to utilize the formula proposed by Audemard and Milaire (1975) and emended by Jacob (1977) for estimating the number of generations and their annual durations. Data of monthly counts of nymphal stage were indicated on millimeter paper.

Data in Table (5) and Figure (1) indicated that *A. tubercularis* had three generations annually on mango trees varity hendi during the two successive years. During the first year (2017) the generations took about four months, The first generation was during the period extended from the beginning of January till the end of April. The second and strongest one occurred from the beginning

Table (5): Annual generations and durations of *Aulacaspis tubercularis* (Newstead) on mango trees, variety Hendi , in Inshas El-Raml district, Sharkia Governorate during the two successive years (2017 and 2018)

Months	Number of insects / 200 leaves during the first year (2017)				Number of insects / 200 leaves during the second year (2018)				
	Accumulated days of investigation	Monthly counts of nymphs	Accumulated monthly counts	Accumulated insects %	Months	Accumulated days of investigation	Monthly counts of nymphs	Accumulated monthly counts	Accumulated insects %
Jan.	31	9	9	2.66	**Jan.**	31	20	20	1.91
Feb.	59	12	21	6.21	**Feb.**	59	36	56	5.36
Mar.	90	7	28	8.28	**Mar.**	90	69	125	11.96
Apr.	120	8	36	10.65	**Apr.**	120	361	486	46.51
May	151	9	45	13.31	**May**	151	226	712	68.13
Jun.	181	23	68	20.12	**Jun.**	181	176	888	84.98
Jul.	212	124	192	56.80	**Jul.**	212	55	943	90.24
Aug.	243	21	213	63.02	**Aug.**	243	30	973	93.11
Sep.	273	39	252	74.56	**Sep.**	273	33	1006	96.27
Oct.	304	27	279	82.54	**Oct.**	304	18	1024	97.99
Nov.	334	37	316	93.49	**Nov.**	334	12	1036	99.14
Dec.	365	22	338	100.00	**Dec.**	365	9	1045	100.00

of May till the end of August. The third generation occupied the period from the beginning of September till the end of December.

While, during the second year (2018) the generations took about three to five months, the first generation was during the period extended from the beginning of January till the end of March. The second and strongest one occurred from the beginning of April till the end of July. The third generation occupied the period from the beginning of August till the end of December.

These results are conformable with those of Radwan (2003), Nabil *et al*. (2012) and Salem *et al*. (2019) who reported that *A. tubercularis* had three generations on mango trees.

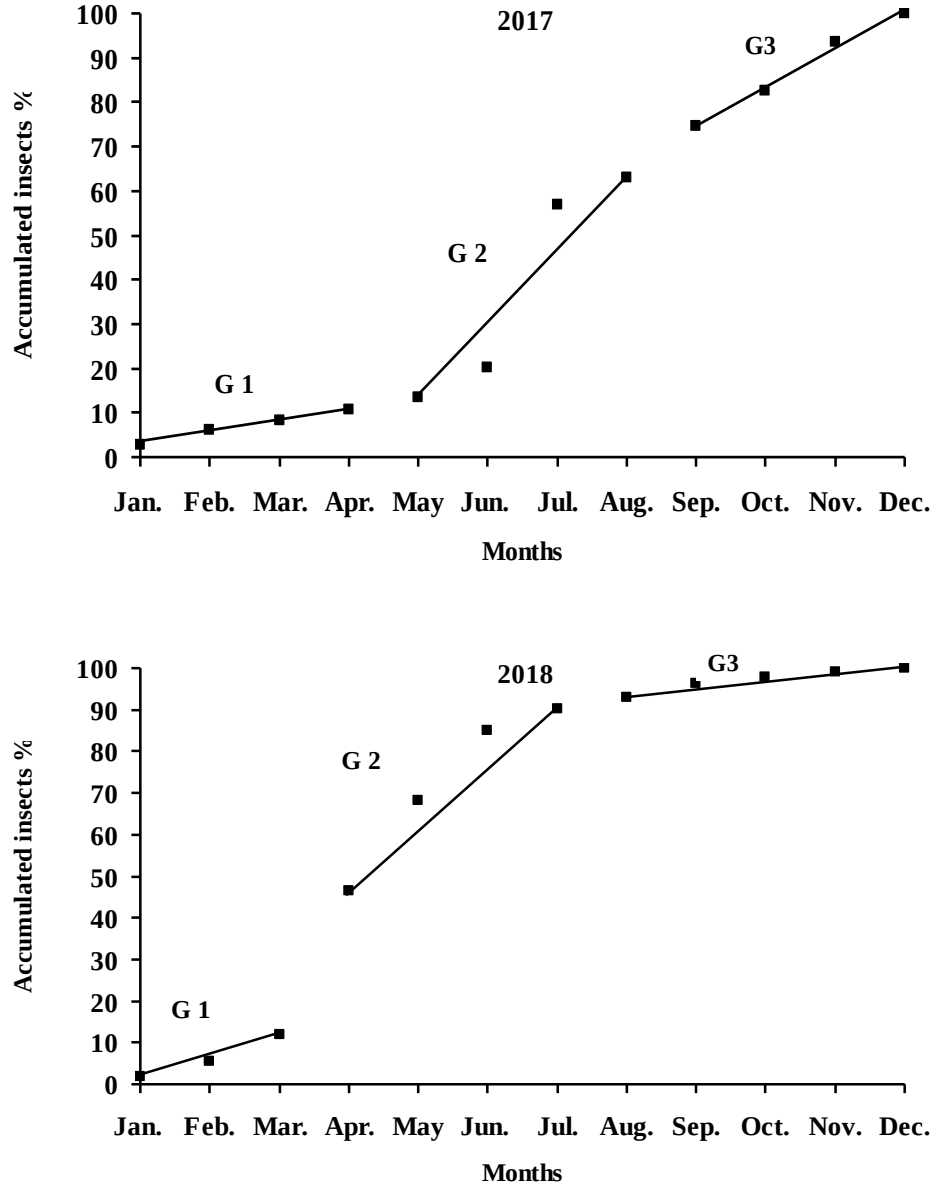

Fig.(1): Annual generations and durations of *Aulacaspis tubercularis* (Newstead) on mango trees, variety hendi, in Inshas El-Raml district, Sharkia Governorate during the first and second years (2017 and 2018).

4. *The preferable direction for the insect and its associated parasitoids*

Results illustrated in Tables (6 and 7) and Fig. (2) showed that during the first and second years the insect and its associated parasitoids occurred in north eastern side of the trees. During the first year (2017) the insect and its associated parasitoids occurred in north eastern side of the trees making angles 55˚ 17′ 28″and 86˚ 11′ 9″, respectively. The same results were obtained whereas the insect and its associated parasitoids preferred the north eastern side of the trees making angles 69˚ 18′ 2″and 43˚ 55′ 27″, Also, during (2018) consecutively. These results are in accordance with the findings of Nabil *et al*. (2012) and Amer *et al*. (2017) who mentioned that the highest population of this pest developing on eastern aspect of the trees.

Conclusively, seasonal abundance of *Aulacaspis tubercularis* (Newstead) and its associated parasitoids on mango trees varity Hendi showed that female, males and total alive stages population two peaks of activity during the two successive years. The pest, *A. tubercularis* had three generations annually during the two successive years. During the course of this work, two hymenopterous species were recorded as parasitoids of *A. tubercularis*. so, when uses pesticides it must be concentrate on the opposite side.

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Table (6): Monthly numbers of *Aulacaspis tubercularis* (Newstead) and its associated parasitoid on mango trees, variety Hendi, in Inshas El-Raml district, Sharkia Governorate during the first year (2017)

Months	Number of insects / 50 leaves							
	East		West		North		South	
	Alive stages	Parasitoid Number	Alive stages	Parasitoid Number	Alive stages	Parasitoid Number	Alive stages	Parasitoid Number
Jan.	24	0	15	0	28	2	45	0
Feb.	23	0	20	0	32	0	38	0
Mar.	20	0	22	0	24	0	61	0
Apr.	187	0	212	1	201	1	187	0
May	163	3	122	2	181	3	194	2
Jun.	468	5	224	5	312	7	312	5
Jul.	544	8	350	3	608	4	406	6
Aug.	552	11	417	9	735	8	496	9
Sep.	516	15	463	32	669	29	511	18
Oct.	432	19	563	24	397	27	376	30
Nov.	278	38	455	24	208	35	313	18
Dec.	125	5	167	2	99	4	119	2
Total	3332	104	3030	102	3494	120	3058	90
Mean	**277.67**	**8.67**	**252.5**	**8.50**	**291.17**	**10.00**	**254.83**	**7.50**

Table (7): Monthly numbers of *Aulacaspis tubercularis* (Newstead) and its associated parasitoid on mango trees, variety Hendi, in Inshas El-Raml district, Sharkia Governorate during the second year (2018)

Months	Number of insects / 50 leaves							
	East		West		North		South	
	Alive stages	Parasitoid Number	Alive stages	Parasitoid Number	Alive stages	Parasitoid Number	Alive stages	Parasitoid Number
Jan.	21	1	26	0	64	0	26	0
Feb.	38	0	43	0	238	2	32	0
Mar.	137	2	131	1	683	24	116	2
Apr.	694	20	725	16	1440	35	717	15
May	704	36	653	18	857	109	529	26
Jun.	844	97	656	58	645	74	654	97
Jul.	589	95	394	54	559	114	426	49
Aug.	597	82	407	19	456	49	232	18
Sep.	552	133	362	103	380	115	340	91
Oct.	243	51	207	48	194	45	209	56
Nov.	131	36	99	18	115	9	112	13
Dec.	64	0	68	1	62	1	69	1
Total	4614	553	3771	336	5693	577	3462	368
Mean	**384.5**	**46.08**	**314.25**	**28**	**474.42**	**48.08**	**288.5**	**30.67**

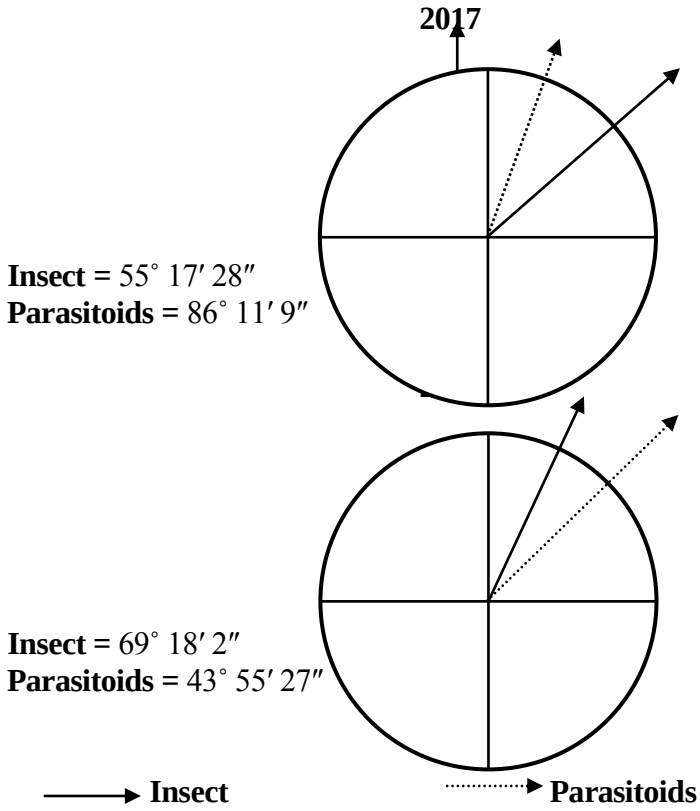

Fig.(2): The calculated directions of *Aulacaspis tubercularis* (Newstead) and its associated Parasitoids on mango trees, Varity Hendi in Inshas El-Raml district, Sharkia Governorate during the first and second years (2017 and 2018)

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الوفرة الموسمية وعدد الأجيال والتوزيع الأفقى لحشرة *Aulacaspis tubercularis* (Newstead) وطفيلاتها المرتبطة على أشجار المانجو

مى إبراهيم عبد الحميد عطية[1] - حمزة محمد الشرقاوى[2] - حسن أحمد نبيل[1] - فتحى السعيد السنطيل[2]

1- معهد بحوث وقاية النباتات – مركز البحوث الزراعية- مصر
2- قسم الانتاج النباتى- كلية التكنولوجيا والتنمية- جامعة القازيق- مصر

أُجريت هذة الدراسة بحدائق المانجو التابعة لوزارة الأوقاف بمنطقة أنشاص الرمل بمحافظة الشرقية على اشجار المانجو صنف الهندى خلال عامى (2017 و 2018) لدراسة الوفرة الموسمية وعدد الاجيال والتوزيع الافقى لحشرة المانجو القشرية البيضاء كذلك تأثير بعض العوامل الجوية على الحشرة والطفيليات المرتبطة بها. وقد لخصت النتائج كما يلى:

1- أظهر تعداد الإناث والذكور والأطوار الحية ذروتين للتعداد خلال عامى الدراسة.
2- أوضح تعداد الحوريات 2 و 4 ذروات للتعداد خلال عامى الدراسة على التوالى.
3- سُجل أعلى متوسط لنسب الموت الكلية (13.71%) خلال العام الأول والذى كان أقل من متوسط نسبة الموت الكلية خلال العام الثانى والتى كانت (29.52%).
4- خلال فترة الدراسة تم تسجيل نوعين من الطفيليات الحشرية هما *Aphytis* sp. and *Aspidiotiphagus* sp. (Aphelinidae) حيث كان متوسط نسبة التطفل 2.78 و 7.37% خلال عامى الدراسة على الترتيب.
5- كان تأثير العوامل المناخية على إجمالى تعداد الأطوار الحية 70.60 و 87.13% خلال عامى الدراسة على التوالى.
6- أظهرت حشرة المانجو القشرية البيضاء ثلاث أجيال خلال عامى الدراسة تراوحت فترة الجيل من 3 الى 5 شهور.
7- وجد أن الحشرة وطفيلياتها المرتبطة تفضل الإتجاه الشمالى الشرقى لأشجار المانجو موضع الدراسة.

التوصية: أظهرت الدراسه بأن تعداد الإناث والذكور والأطوار الحية ذروتين للتعداد خلال عامى الدراسة. وأظهرت حشرة المانجو القشرية البيضاء ثلاث أجيال خلال عامى الدراسة تراوحت فترة الجيل من 3 الى 5 شهور. ووجد أن الحشرة وطفيلياتها المرتبطة تفضل الإتجاه الشمالى الشرقى لأشجار المانجو موضع الدراسة ولذلك يفضل التركيز عند المعامله بالمبيدات على الاتجاهات الاخرى والتي لا تتركز فيها الطفيليات لتقليل الأضرار والخسائر الماديه لاستخدام المبيدات .