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Some Ecological Aspects on Mango White Scale, *Aulacaspis tubercularis* and Associated Natural Enemies Infesting Mango Trees in Qalyubiya Govrnorate [(Hemiptera :Sternorrhyncha :Diaspididae)]

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ABSTRACT

Ecological studies on scale insect infesting mango trees were carried out at the Farm of Faculty of Agriculture , Shoubra EL-Kheima throughout two successive years 2012 & 2013. Results showed that mango trees were infested by four diaspdid species. *Aulacaspis tubercularis, Lepidosaphes pallidula, Parlatoria oleae, Lidingaspis floridana* Seasonal abundance of these species revealed that *A. tubercularis* was the most dominate species. Two hymeopterous parasitoids, *Aphytis mytiaspidis* and *Encarsia citrini* and two predacious mites one from Cheyletidae and another from Stigmaeidae, were found associated with these species. Seasonal fluctuation of different developmental stages of *A. tubercularis* throughout the both years, recorded three peaks for total numbers of alive population, as well as three peaks for immature stages and two peaks for adult stages. This scale insect recorded its maximum activity during autumn and early winter seasons. The natural enemies found associated with this species recorded two main periods of seasonal activity. The first period winter season, while the second during late and early summer. This diaspid species recorded 3-4 generations per year throughout the both years. Therefore, it could be concluded that the proper time for spraying mineral oil to control this pest must be during autumn after harvesting the fruits where the most insect population of immature stages as well as to avoid harmful effects on natural enemies found associated with these scale insects
Keywords: *Aulacaspis tubercularis*, Diaspididae, Seasonal activity , Natural enemies, Number of generation.

INTRODUCTION

Mango tree, *Mangifera indica* L. is considered one of the most favorable fruit crop in Egypt from a long time ago. The cultivated area has been rapidly increasing from year to another specially in the newly reclaimed areas. Acorroding the records of Ministry of Agriculture of Egypt in 2013 the cultivated area of mango trees occupied 118933 feddans distributed allover different Governorates.

Mango orchards in Egypt are attacked by different groups of pests, i.e. floral malformation; powder mildew; anthracnose, fruit flies ; stem borer; acarina; mealybugs and scale insect. Several coccid species are considered as pests in mango orchards, i.e.: *Icerya aegyptiaca* Doug., *I. purchase* Mask., *I. seychellarum* (West.)., *Planococcus citri* (Resso); *Kilifia acuminate* (Signort) *Cerolplastes floridensis* Comstok., *Lepidosaphes pallidula* (Green)., *Hemiberlesia latania* (Signort)., *Parlatoria oleae* (Colvee)., *Lindingaspis floridana* (Ferris).

Morsi *etal*. (2002) recorded *Aulacaspis tubercularis* (Newstead) as a new pest on mango trees in Minia Governorate. Afterwards, this new pest began to distribute allover the country and became a key pest on mango trees at different Governorates, of Egypt.

Ecological studies on *A. tubercularis* attracted the attentions many authors allover the world i.e. Williams and Watson (1988); Ascher *et al*. (1995); Labuschange *et al*.(1995); Saconato *et al*. (2007); Urias-LÓpez *et al*. (2010) and Bautista-Rosales *et al*.(2013). In Egypt few attentions were given a bout ecological studies on this pest, i.e. Morsi *et al*. (2002); Kwaiz (2009); Reda *et al*. (2009); Abo-Shanab (2012), Nabil *et al*. (2012) and Hassan *et al*. (2013).

The present studies aim to obtain some basic ecological data about this new pest in order to plan an Integrated Pest Management for this new pest.

MATERIALS AND METHODS

An orchard of mango, *Mangifera indica* at the Farm of Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Qalyubiya Governorate was chosen for sampling purposes for two successive year (2012 & 2013). Five mango trees of the same age, similar size and height as well as growth vegetation were chosen for sampling purposes. These tree were infested by some coccoid species. No control measures were undertaken for several years ago as well as throughout sampling procedures.

Regular half-monthly excursions were conducted to the chosen orchard. Leaves samples were picked from the selected mango trees throughout two successive years 2012 & 2013. Each sample was about 30 leaves from the terminal branches of four cardinal directions (north, south, east and west) as well as core of these trees at three different heights (lower middle and upper) of the selected trees (15 samples). These samples were kept in polyethylene bags and transferred to the laboratory for counting procedures. Out of there samples 10 leaves were picked at random to represent each sample (5 directions x 3 heights). So 150 leaves were chosen to represent each half-monthly count. Each sample was examined carefully by using stereoscopic microscope. The insect individuals on these leaves were sorted into different developmental stages and counted (immature and adults as well as alive and dead individuals). Also, the natural enemies (parasitoids & predators) found associated with insect population of these scale insect were also recorded and counted.

The seasonal activity of the parasitoid species associated with these scale insect species were estimated from each half – monthly counts. Leaves samples were kept inside box which dark from inside and fitted with sample tubes. Then, the emerged adults of the parasitoids species were attracted to light outside the box and captured in the sample tubes then counted and the numbers of each count represented seasonal activity of parasitoid species. Some individuals were used for identification procedures. Temporary and permanent mounts were prepared for identification procedures of these parasites. Taxonomic key was used to identify *Aphytis* spp was constructed by Shaaban and

Noha (2012). While, taxonomic key was used to identify *Encarsia* spp. was constructed by Giregory and Fred (1995). The predacious mites species were also recorded for each sample. The identification procedure was carried out by using specific key for different families of Acarnia (Cheyletidae & Stigmeaidae).

Seasonal fluctuations of insect population was investigated from data obtained of half-monthly samples throughout the two successive years. These data were used to calculate some ecological parameters. Mean of total numbers of alive individuals/ leaf in each sample was considered as population index. The rate of increase in the population density was calculated by dividing the total numbers of alive population in any count over the numbers of the previous one. Also, average annual fluctuation was calculated by dividing the maximum numbers of total population over the minimum one (according Bodeinheimer, 1951). These two parameters were used to detect the favorable time to increase for insect population. Number and duration of annual field generations were estimated from data of the half-monthly counts of alive total population. These data were worked out according to the methods suggested by Audemard and Milaire (1975) and emended by Iacob (1977). The graphical representation of these data was carried out by using computer software program (Sigmaplot, ver. 11).

RESULTS AND DISCUSSION

A. Identification Procedures:

Identification procedures showed that mango trees at the Farm Faculty of Agriculture, Shoubra EL-Kheima throughout two successive years (2012 & 2013) were infested by four diaspid species. Three species are: white mango scale ,*Aulacaspis tubercularis* (Newstead); mango oyster-shell scal, *Lepidosaphes pallidula* (Williams); plum scale insect, *Parlatoria oleae* (Colvèe) and *Lindingaspis floridina* (Ferris). Data of population densities of the four species showed that *A. tubercularis* was the most dominate species and represented by 92 and 89% of population throughout 2012 & 2013 respectively. Therefore all ecological aspects will be mainly on this species.

Also, identification procedures of associated natural enemies indicated that this scale insect was attacked by two species of hymenopterous parasites, i.e. *Aphytis mytiaspidis* and *Encarsia citrini* in addition two predacious Acari mites one from Cheyletidae and the other from Stigmaeidae.

B. Seasonal fluctuation of different alive developmental stages of *Aulacaspis tubercularis* and associated natural enemison mango trees in Qalyubiya Governorate

Data obtained of seasonal fluctuation of different developmental stages of *A. tubercularis* which represented by half-monthly mean numbers of alive individuals for each stage per leaf throughout the two successive years are given in Tables (1 &2) and graphically illustrated in Figs. (1 & 2).

Results showed that population density of this scale insect species was more abundant during 2013 than 2012. Thus the annual means for total population were 72.78 and 77.68 alive individuals/ leaf during 2012 & 2013, respectively. Also, the average annual fluctuation (which calculated by dividing maximum numbers of total population by minimum one) for both years were 33.05 and 37.79 during both year, respectively.

During 2012 results showed that half-monthly mean numbers of alive total population were recorded three peaks of seasonal abundance throughout this years. These peaks were occurred on 1st January, the highest one, 1st May and mid-September, 2012. These means were represented by 185.43, 72.36 and 14.04 individuals/ leaf, respectively.

Regarding the half-monthly means of both total immature stages (1st Nymph, 2nd Nymph, prepupa and pupae) and total adult stages (females and males), results showed that immature stages were more abundant than adults in all counts. The annual means for both stages were 64.26 immature/ leaf and 18.52 adults/ leaf. Statistical analysis showed highly significant differences between the both means (t=25.16). Seasonal fluctuation of alive immature stages throughout first year showed that mean numbers of alive immature were recorded three annual peaks of seasonal abundance. These peaks were occurred on 1st January, mid-September and mid-December 2012 and represented by 141.16, 129.34 and 86.94 immature/ leaf, respectively. While, half-monthly mean number of alive total adults were recorded two peaks only of seasonal abundance throughout the year. These peaks were occurred on 1st January ad mid-March, 2012 and represented by 44.26 and 51.32 adults/leaf, respectively.

The rate of increase for half-monthly counts of total population (as calculated by dividing mean numbers of any count by proceeding one), during 2012 results showed that two maximum rates of increase were recorded throughout the year. The first one was occurred on mid-September (3.08), while, the second one (11.82), which the highest one, was occurred on 1st December, 2012.This period was extended from September to December during autumn and early winter seasons. Also, the seasonal abundance of insect population was reached its maximum activity from January to mid-February during winter season. These two periods seemed to be favorable conditions for build-up insect population.

During 2013, obtained results (Table, 2), showed that seasonal fluctuation of different developmental stages of alive population followed the same trend of previous year with few exception. Half-monthly means of alive total population were also recorded three peaks of seasonal abundance throughout the year. These peaks were occurred on 1st January %, 1st May, the highest one, and mid-October, 2013. The means of total alive population were 162.58, 268.74 and 72.87 individuals/ leaf, respectively. The half-monthly means of both immature stages and adult stages revealed that immature stages were more abundant than adult stages. The annual means for both stages were 65.35 immature individuals/leaf and 21.33 adults/ leaf. Results of

statistical analysis showed highly significant difference between the two means (t= 11.21). Half-monthly means alive total immature stages were also recorded three peaks of seasonal abundance. These peaks were occurred on 1st January, 1st May which the highest one and mid-October, 2013 which in harmony with peaks of total alive population. These peaks were represented by 117.28, 213.68 and 57.47 immature/ leaf respectively. While the half-monthly means of alive total adults were recorded two peaks of seasonal abundance the first one was occurred on 1st January (45.3 adults/leaf) and the second one was occurred on 1st June (81.00 adults/ leaf).

Table (1): Half- monthly counts of different developmental stages of *Aulacaspis tubercularis* on mango trees (alive individuals /leaf) and associated natural enemies at the Farm of Faculty of Agriculture, Shoubra El – Kheima, Qalyubiya Governorate during 2012.

Sampling dates	Total Immature	Total Adults	Total alive Population/ leaf	Quotation of increase	Natural Enemies		
					No.of wasp	No.of Acari1	No.of Acari2
January ,1	141.16	44.26	185.43	--	10.33	4.72	3.86
,15	118.42	36.62	155.04	0.83	8.04	3.68	3.01
February,1	104.21	33.39	137.6	0.89	6.85	3.13	2.56
15	92.026	36.26	128.28	0.93	7.07	3.23	2.64
March ,1	70.32	17.92	88.24	0.69	1.85	0.84	0.69
15	33.10	51.32	84.43	0.96	4.99	2.28	1.870
April ,1	21.69	37.42	59.11	0.70	3.63	1.66	1.35
15	26.56	32.17	58.73	0.99	1.92	0.88	0.72
May ,1	56.11	16.24	72.36	1.23	1.26	0.57	0.47
15	50.84	12.17	63.01	0.87	1.33	0.60	0.49
June ,1	50.23	9.126	59.36	0.94	1.33	0.61	0.50
15	29.04	14.06	43.11	0.72	1.55	0.71	0.58
July ,1	50.52	12.74	63.26	1.46	1.22	0.55	0.45
15	29.93	11.23	41.16	0.65	1.23	0.56	0.46
August ,1	34.78	14.34	49.12	1.19	1.26	0.58	0.47
15	49.00	18.84	67.84	1.38	2.89	1.32	1.08
September ,1	33.54	12.00	45.54	0.67	1.73	0.79	0.65
15	129.34	10.70	140.04	3.08	1.69	0.77	0.63
October ,1	7.22	5.42	12.65	0.09	0.36	0.16	0.13
15	12.90	1.93	14.83	1.17	0.24	0.11	0.093
November ,1	6.56	1.62	8.18	0.55	0.18	0.08	0.069
15	3.72	1.88	5.61	0.68	0.25	0.11	0.096
December ,1	63.91	2.55	66.46	11.85	0.25	0.11	0.095
15	86.94	10.30	97.24	1.46	1.79	0.82	0.67
Total	1302.14	444.58	1746.72		63.36	28.99	23.72
Mean	54.26	18.52	72.78		2.60	1.20	0.98

t value= 25.163 LSD = 3.903**

Average annual fluctuation = 185.43/5.61= 33.05

Wasp parasitoids = *Aphytis mytilaspidis*, attacking: nymphs, adults, + *Encarsia citrina*, attacking: nymphs, adults.

Predacious mites Acari1= Cheyletidae , Acari2= Stigmeaidae

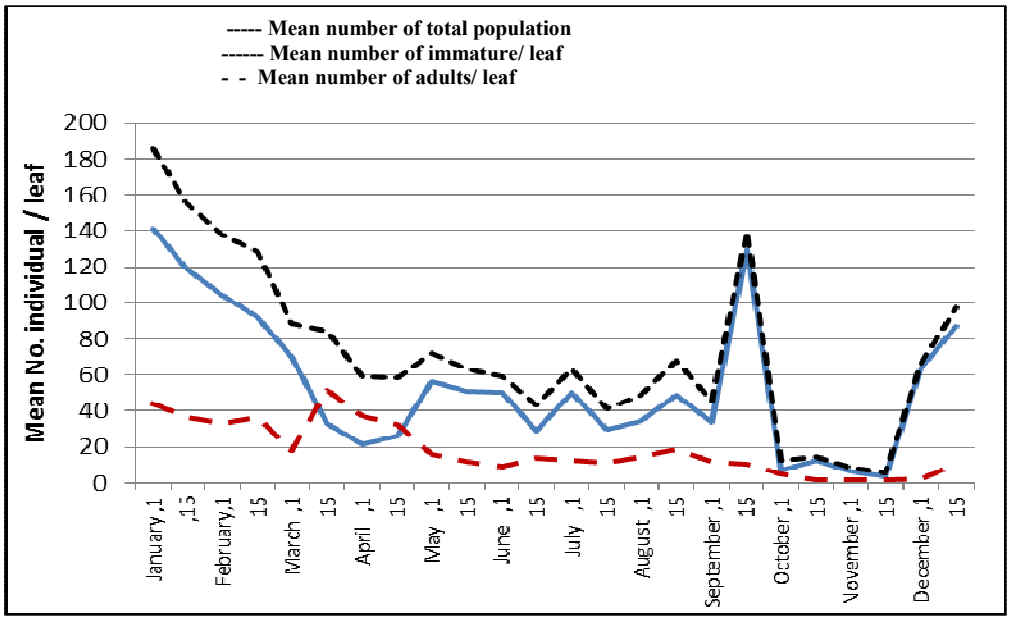


Fig (1): Seasonal fluctuations of different developmental stages as alive populations of *Aulacaspis tubercularis* represented by half monthly means/leaf, on mango trees at the Farm of Faculty of Agriculture, Ain Shams University Qalyubiya, 2012 year.

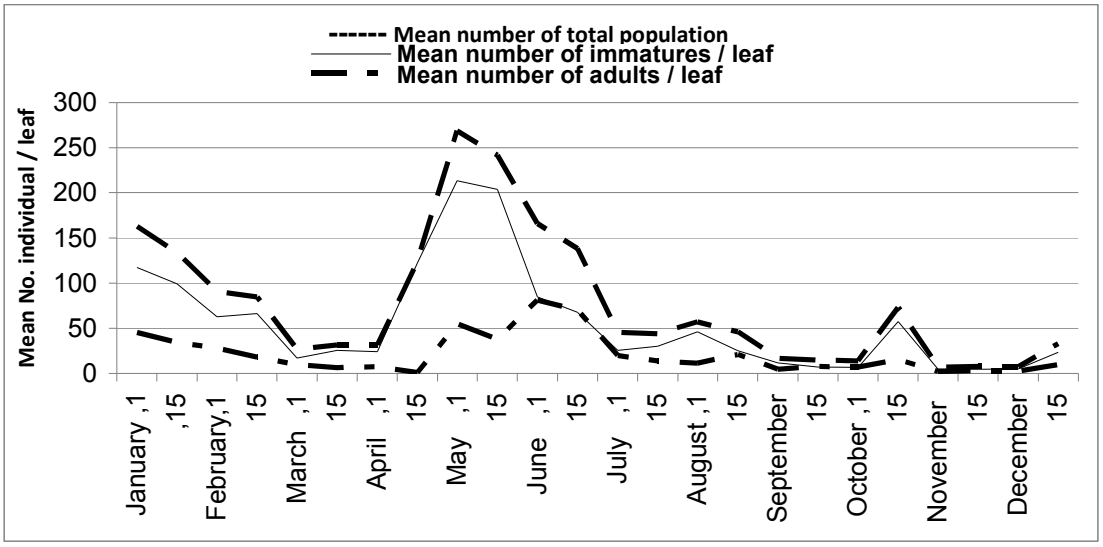


Fig (2): Seasonal fluctuations of different developmental stages as alive populations of *Aulacaspis tubercularis* represented by half monthly means/leaf, on mango trees at the Farm of Faculty of Agriculture, Ain Shams University Qalyubiya, 2013 year.

Table (2): Half- monthly counts of different developmental stages of *Aulacaspis tubercularis* on mango trees (alive individuals /leaf) and associated natural enemies at the Farm of Faculty of Agriculture, Shoubra El – Kheima, Qalyubiya Governorate during 2013.

Sampling dates	Total Immature	Total Adults	Total a live Population	Quotation of Increase	Natural Enemies		
					No.of wasp	No.of Acari1	No.of Acari2
January ,1	117.28	45.3	162.58		10.45	4.78	3.91
,15	99.18	34.24	133.43	0.82	7.83	3.58	2.93
February,1	62.68	27.87	90.56	0.67	6.22	2.84	2.32
15	66.36	18.14	84.51	0.93	3.75	1.71	1.40
March ,1	17.12	9.70	26.83	0.31	1.62	0.74	0.60
15	25.34	6.2	31.54	1.17	0.5	0.22	0.18
April ,1	24.14	7.37	31.52	0.99	0.86	0.39	0.32
15	122.24	1.20	123.44	3.92	0.15	0.071	0.058
May ,1	213.68	55.06	268.74	2.17	10.76	4.92	4.02
15	204.12	37.62	241.75	0.89	3.94	1.80	1.47
June ,1	84.82	81.00	165.82	0.69	16.64	7.61	6.23
15	67.82	70.27	138.09	0.83	14.23	6.51	5.32
July ,1	25.48	19.92	45.40	0.33	2.50	1.14	0.93
15	30.01	13.74	43.76	0.96	1.80	0.82	0.67
August ,1	46.02	11.16	57.18	1.32	1.42	0.65	0.53
15	25.04	20.95	45.99	0.80	2.89	1.32	1.08
September ,1	11.82	4.68	16.50	0.36	0.44	0.20	0.16
15	7.10	7.74	14.84	0.88	0.39	0.17	0.14
October ,1	6.72	7.06	13.78	0.93	0.34	0.15	0.12
15	57.47	15.4	72.87	5.29	1.55	0.71	0.58
November ,1	4.86	2.25	7.11	0.09	0.26	0.12	0.09
15	4.65	3.02	7.67	1.08	0.52	0.23	0.19
December ,1	5.04	2.49	7.53	0.98	0.18	0.08	0.07
15	23.42	9.52	32.94	4.38	1.69	0.77	0.63
Total	1352.49	511.98	1864.47		91.03	41.66	34.08
Mean	56.35	21.33	77.69		3.79	1.73	1.42

t value = 11.212 LSD = 35.021**

Average annual fluctuation = 268.74/7.11 = 37.79

Wasp parasitoids = *Aphytis mytilaspidis*, attacking: nymphs, adults, + *Encarsia citrina*, attacking: nymphs, adults.

Predacious mites Acari1 = Cheyletidae , Acari2= Stigmeaidae

Regarding the rate of increase for half-monthly counts of alive total population throughout 2013, results showed that insect population also, recorded two maximum rates throughout the year. The first one was occurred in mid-April, 2013 while the second one was occurred on mid-October 2013 (5.28), which the highest one. These two periods were elapsed during spring and autumn seasons. These periods seemed to be favorable conditions for build-up insect population. This phenomenon was in harmony with that obtained during first year.

The natural enemies found associated with *A. tubercularis* were occurred throughout all half – monthly counts during the both years. The two parasitoids species *Aphytis mytilaspis* and *Encarsia citri* recorded two main periods of seasonal activities during the both years. During, 2012 these periods were extended from mid-January to 1st April, while the

second one from mid-June to mid-September. During, 2013 these periods were extended from 1st January to 1st March, while the second from mid-May to mid-July. The population of cheyletid predacious mite recorded one period of seasonal activity during, 2012 which extended from 1st January to 1st April; while during 2013, it recorded two main periods of seasonal activity which extended from 1st January to mid-February and 1st May to 1st July, 2013. Also, the population of Stigmeaidae predacious mite recorded one period of seasonal activity during first year which extended from 1st January to 1st March, while during the second year recoded two periods of seasonal activity which extended from 1st January to mid-February, 2013 and the second one extended from 1st May to 1st July,2013.

From these results it could be concluded that the natural enemies found associated with *A. tubercularis* had two main periods of seasonal activities. The first period during winter season, while the second one during late spring and early summer.

From the above mentioned results it could be concluded that seasonal fluctuations of different developmental stages of *A. tubercularis* found to have three peaks of seasonal abundance for both alive total population and alive total immature stages throughout the both years. While population of total adults recorded two peaks during the both year. The rate of increase for insect population was occurred throughout autumn and winter seasons. Also, the insect population reached its maximum activity of insect population were occurred during January 2012 and May 2013. These periods were elapsed during winter and spring seasons. These period found to be optimal conditions for build-up insect population.

These results were closely related with the findings obtained by Kwaiz *et al.* (2009) who stated that *A. tuberculauis* had three peaks of seasonal abundance on mango trees in Egypt. These peaks were occurred on March, June and November, while the lowest population was occurred on mid-July. On the contrary, Ascher *et al.* (1995) and Labuschangne *et al.* (1995) recorded one peak of seasonal abundance for *A. tubercularis* on mango trees in South Africa. This peak was occurred on August at Kaapmuiden and on November at Nelspruit. Also, Nabil *et al.* (2012) in Egypt and Bautista-Rosales (2013) in Mixco recorded one peak of seasonal abundance for the same species. Urias-López *et al.* (2010) stated that population density of *A. tubercularis* passed through different stage, a low density period from the end of rain season (September-December), a second stage of gradual population grow from March to the beginning of the rainy season and the last stage of drastic fall in population during the rainy season (July-August) on mango trees in Mexico.

On the other hand, Abo-Shanab (2012) recorded four annual peaks of seasonal abundance for *A. tubercularis* on mango trees in Egypt. These peaks were occurred on April, August, October and December, 2008, while these peaks were occurred on March, July, September and December, 2009.

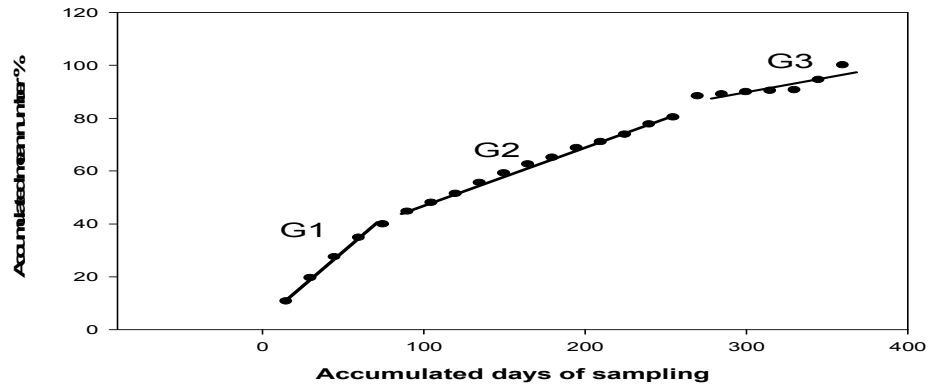
C. Number and duration of annual field generations.

Date of the half-monthly counts represented by mean number of alive total population per leaf of *A. tubercularis* on mango leaves in Qalyubiya Governorate throughout the two successive years were used to estimate number and duration of annual field generations. The formula proposed by Andemard and Milaire (1975) and emended by Iacob (1977) were applied for the data of each year. Results obtained for the both years are given in graphically illustrated in Figs. (3 & 4).

During 2012, results revealed that *A. tubercularis* was passed throughout three annual field generations. While, during 2013 the same species was passed throughout four annual generations on mango trees under field conditions in Qalyubiya Governorate.

During 2012 the first generation was extended from 1st January to 1st March and lasted 75 days. The second one was elapsed from 15th March to 1st September and lasted 180 days duration of this generation was the longest one. The third generation was extended from 15th September to 15th December, 2012 and lasted 105 days. While during 2013 resulted showed that this diaspid species was passed thorough four annual field generations. The first generation was elapsed from 1st January to 15th March, 2013 and lasted 90 days. The second generation was extended from 1st April to 1st June and lasted 75 days. The third generation was elapsed from 15th June to 1st October and lasted 120 days, this generation was the longest one during this year. The fourth generation was extended from 15th October to 15th December, 2013 and lasted 75 days.

From the above mentioned results it could be concluded that white mango scale, *A. tubercularis* was passed throughout 3-4 overlapping annual field generations on mango trees under local conditions of Qalyubiya Governorate. These results were in harmony with previously mentioned results of seasonal fluctuations of different developmental stage throughout the both year whereas total alive population and immature stages were recorded three peaks of seasonal abundance throughout the both years.



Fig(3): The sequence, duration and annual field generations of *A .tubercularis* on mango trees at the Farm of Faculty of Agriculture, Ain Shams University, Shoubre El Kheima Qalyubiya Governorate during 2012 year.

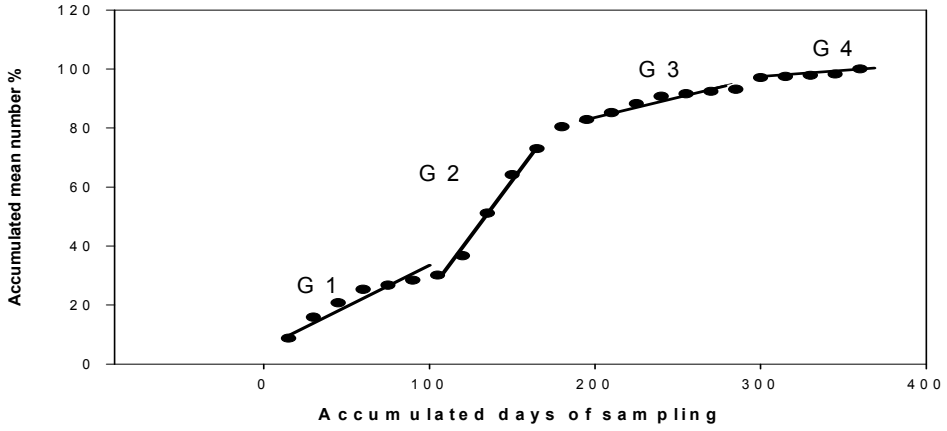


Fig (4) : The sequence, duration and annual field generations of *A .tubercularis* on mango trees at the Farm of Faculty of Agriculture, Ain Shams University, Shoubre El Kheima Qalyubiya Governorate during 2013 year.

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بعض المظاهر البيئية على حشرة المانجو القشرية البيضاء *Aulacaspis tubercularis* وأعدائها الحيوية المصاحبة على أشجار المانجو بمحافظة القليوبية

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أجريت بعض الدراسات البيئية عن حشرة المانجو القشرية البيضاء *Aulacaspis tubercularis* والاعداء الحيوية المصاحبة لها على اشجار المانجو بمحافظة القليوبية خلال عامين متتالين ٢٠١٢ و ٢٠١٣ . واشارت النتائج المتحصل عليها ان اشجار المانجو في هذه المنطقة تتعرض للاصابة باربعة انواع من الحشرات القشرية هي *Aulacaspis tubercularis* و *Lepidosaphes pallidula* و *Parlatoria oleae* و *Lidingaspis floridana* و كانت اكثر الانواع انتشارا هي حشرة المانجو القشرية البيضاء. كما تم رصد نوعين من الطفيليات من رتبة غشائية الاجنحة هما *Aphytis mytiaspidis* و *Encarsia citrine* بالاضافة لنوعين من الاكاروسات المفترسة التابعة لفصيلتي Cheyletidae و Stigmaeida . تم رصد النشاط الموسمي لجماعات هذه الحشرة و كذلك الاطوار المختلفة لها و كذلك الاعداء الحيوية المصاحبة لها من خلال قراءات نصف شهرية لعينة من الاوراق المصابة خلال العامين . حيث اوضحت ان الكثافة العددية للافراد الحية لجماعات الحشرة سجلت ثلاث فترات للنشاط الموسمي خلال عامي الدراسة بالنسبة للعدد الكلي للافراد الحية فقد سجلت ثلاث قمم للنشاط خلال العامين و تم رصد تلك القمم خلال اول يناير, اول مايو, منتصف سبتمبر لعام ٢٠١٢ و خلال اول يناير, اول مايو , منتصف اكتوبر لعام ٢٠١٣ و كذلك اعداد الاطوار غير الكاملة سجلت ثلاث قمم خلال العامين وقد تم رصد تلك القمم خلال اول يناير, منتصف سبتمبر, منتصف ديسمبر لعام ٢٠١٢ و خلال اول يناير , اول مايو , منتصف اكتوبر خلال ٢٠١٣, بينما الاطوار الكاملة فقد سجلت قمتان فقط في عام ٢٠١٢ خلال اول يناير, منتصف مارس وكذلك قمتان خلال اول يناير , اول يونيو لعام ٢٠١٣. اما الاعداء الحيوية من طفيليات و مفترسات فقد سجلت فترتان للنشاط الموسمي الاولى خلال موسم الشتاء و الثانية خلال موسم الربيع و بداية الصيف اما بالنسبة لعدد الجيال فقد تم رصد ثلاثة اجيال في عام ٢٠١٢ واربعة اجيال متراكبة خلال عام ٢٠١٣. و ذلك من خلال طرق احصائية متقدمة. على ضوء تلك النتائج فان انسب موعد لاجراء المكافحه الكيماوية باستخدام الزيوت المعدنية رشا يكون في نهاية الخريف بعد الانتهاء من جمع المحصول و قبل الشتاء حيث ان الاطوار غير الكاملة تمثل اغلب تعداد الحشرة كما ان الاعداء الحيوية تكون في اقل فترات نشاطها.