

POPULATION DYNAMICS OF THE SEYCHELLARUM MEALYBUG, *Icerya seychellarum* (WESTWOOD) (HEMIPTERA: MARGARODIDAE) ON THE ORNAMENTAL PLANT, *Hedera helix* L.

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ABSTRACT

The seasonal population dynamics and within- plant distribution of the seychellarum mealybug, *Icerya seychellarum* on *Hedera helix* plants was carried out at the Farm of Faculty of Agriculture, Assiut University during two successive seasons, 2012/2013 and 2013/2014. Results of both seasons revealed that the highest numbers of nymphs and the total number of the pest were recorded during the last week of August. The highest percentages of the total monthly mean count (out of the total year count) were found to be 30.57 and 33.24%, in August during the 1st and 2nd years, respectively. In addition, mealybug has four generations per year under the field conditions. The effect of weather elements on the pest population was also studied. Concerning the plant heights leaves and branches, the results indicated that the bottom portion had more insects than those of the middle or the top portions. As for the leaf surface, the lower surface sheltered more individuals than those of the upper surface. Leaves harbored a large number of insects than those of branches. Differences in seasonal patterns and within plant distribution should be considered in developing sampling protocols and managing plans for seychellarum mealybug control.

Keywords: Mealybug, Ivy, Seasonal abundance, Assiut.

INTRODUCTION

Hedra helix L. is an ornamental plant within its native range, the species is greatly valued for sustaining wildlife which its flowers have been visited by over 70 species of nectar- feeding insects, and its berries can be eaten by at least 16 species of birds. The foliage provides a dense ever green shelter, and is also browsed by deer. (Mitchell, 1975 and Metcalfe, 2005). Generally, it used for decoration, as groundcover, as a wall covering, climbing up a large tree trunk and for shady locations, especially the darker sides or building or under trees.

The common seychellarum mealybug, *Icerya seychellarum* (West.) is highly polyphagous insect, distributed in Australasian, Afrotropical, Oriental, Palaeartic and Neotropical regions (Kuwana, 1907; CABI, 1955; Kawai, 1980 and Ben-Dov, 2005) and mentioned in the coccid list of Ezzat and Nada (1986) as being in Egypt.

Seychellarum mealybug has piercing-sucking mouthparts. They feed by inserting slender mouthparts into plant tissues and sucking the sap. Plant parts may be spotted, curled, or wilted. Infestations reduce the vigor and growth of foliage plants, which reduce the beauty of the plant and affect its marketability (Newbery, 1981) or can even kill the plant in case of high densities or annually repeated infestation (Williams and Watson, 1990 and Ben-Dov, 2005). In addition, the pest can cause an indirect damage due to

the interaction with other insect pests or fungal diseases that are attracted by honeydew (Panis, 1980; Dreistadt *et al.*, 1994; Mittler and Douglas, 2003).

Several mealybug species are vectors of viral diseases for versatile crops e.g. *pseudococcus ficus* (Signoret) (Tanne *et al.*, 1989; Tsai *et al.*, 2010) and *P. virburni* (Offinis) both are vectors of GLRa v-3 virus on grapevine (Golino *et al.*, 1995). In such cases, tobacco mosaic virus and papaya rings pot virus have been transmitted by seychellarum mealybugs (Radles and Francki, 1965; Prasad 1986 and Follett, 2009). Therefore, the present work aims to study the population dynamics and the seasonal distribution of *I. seychellarum*. as well as constructing a key to the economic mealybug insect species infesting ornamental plant in Egypt.

MATERIALS AND METHODS

The study was carried out in the Farm of the Faculty of Agriculture, Assiut University during two successive seasons of 2012/2013 and 2013/2014. The normal agricultural practices were performed and no insecticides were used during the period from October, 2012 to September, 2014. Ten plants were chosen randomly for weekly inspection. Each plant was divided into three levels (bottom, middle and top level). From each plant level five leaves were picked up randomly and kept in polyethylene bag, then transferred to the laboratory for examination. The both sides of plant leaves (upper and lower surface) were examined under a stereomicroscope to count the number of the live nymphs and adults of the pest. The numbers of nymphs and adults of each inspected leaf were recorded at the front of each date. Concerning the plant branches, five branches were chosen from each plant level (15 cm. long). The same steps were followed as in plant leaves except for the examination was carried out in the field (in situ).

To calculate the age structure per sample, the mean number of each stage (Adult) was divided by the total and multiplied by 100. This way gave each stage (Adult) a percent proportion of the total per sample regardless the total number of the present insects (i.e. population density). Generation is defined, as the time required for an insect to complete its life cycle. The number and duration of the annual generations of Coccoidea pests, which were estimated depending on the weekly numbers, were worked out according to Audemard and Milaire (1975) formula. To facilitate the comparisons within each studied season and among the two seasons, the weekly counts were monthly accumulated. These monthly counts were estimated in percentages out of the annual total.

RESULTS AND DISCUSSION

Seasonal density monitoring:-

Data in tables 1 – 2 show the weekly population counts and the monthly incidence of seychellarum mealybug (nymphs and adults) on *H. helix* leaves during both seasons of 2012/2013 and 2013/2014.

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Season 2012/2013:

Data in Table 1 show that the pest population counts (nymphs and adults) started with 3059 nymphs and 850 adults /150 leaves, on the 2nd week of October increased slightly till the end of October. After that the Seychellarum mealybug population slightly decreased to reach its lowest numbers during the 1st week of March, since 24 and 58 individuals/150 leaves for nymphs and adults were recorded. Then, the pest population increased gradually to reach its highest level during the last week of August for nymphs and adults (18782 and 4691 individuals/150 leaves).

The population decreased slightly again till the end of the September.

Data in Table 2 show the total monthly mean counts of the pest on *H. helix* leaves and their percentages. The highest percentage of the total monthly mean count was recorded in August (30.57%) followed by July (21.67%). The lowest percentages were recorded during winter months.

Table (2). The monthly mean count of *I. seychellarum* and percentages out of the total year count during 2012/2013 and 2013/2014 seasons at Assiut Governorat.

Month	2012/2013 season		2013/2014 season	
	Mean monthly count /150 leavas	% out of the total year count	Mean monthly count /150 leavas	% out of the total year count
October	4197	6.04	3571	5.07
November	3659	5.26	2189	3.11
December	1308	1.88	799	1.14
January	493.3	0.71	126.3	0.18
February	174.3	0.25	79.5	0.11
March	147.5	0.21	173.3	0.25
April	733	1.05	551.6	0.78
May	3192	4.59	2045	2.91
June	8161	11.74	5629	8.00
July	15061	21.67	15191	21.58
August	21251	30.57	23397	33.24
September	11128	16.01	16642	23.64
Total	69505.1	100.00	70393.7	100.00

Season 2013/2014:

Data in Table 1 show the population fluctuations of the pest on *H. helix* leaves during the 2nd season. The population of the insect started with 2835 and 919 individuals/150 leaves (nymphs and adults), during the 1st week of October and decreased gradually to reach its lowest level during the last week of January and the 1st week of February (11 and 19 individuals/150 leaves for nymphs and adults). The mealybug population attained its highest level during the 3rd and the last week of August (6311 and 19662 individuals/150 leaves for adults and nymphs), then, decreased gradually till the end of the season.

Data in Table 2 show that the highest monthly percentages were recorded during August (33.24% of the total season count) followed by July

and September, (21.58 and 23.64 %), while during the months from December to April, these percentage ranged from 1.14 to 2.91% of the total year count.

Data of both seasons reveal that the highest weekly population and monthly percentages was recorded during the last week of August. The population of *I. seychellarum* increased and reached its highest level of abundance during the 1st week May on *Dodonia viscosa* ornamental plant, after which the population declined gradually (Mesbah *et al.*, 2012). Although, these results are in full agreement with our results concerning the declined of the pest population after May but differed concerning the period of the highest population. The differentiation between our results and their results may be due to the differentiation in the kind of host plants (e.g. Hill, 1980) and in the geographical and consequently the climatic nature of the location of study. . Esfandiari *et al.* (2007) found that the abundance of the cottony cushion, *I. purchasi* (Maskell) in Khuzestan was differed according to the studied districts and the citrus hosts.

The numbers of Seychellarum mealybug on *H. helix* leaves during 2012/2013 and 2013/2014 seasons were used to determine the number of their generations according to Audemard and Milaire (1975) this method was used to determine the number of field generations either for coccoidea pests or others by many investigators for example Abd-Rabou and Moustafa (2010) used this method to determine the number of field generations of the oyster shell olive scale, *Leucaspis riccae*.

The number of generations is shown in Figure (1). Illustration in Figure (1, A) revealed the occurrence of four generations of the pest during 2012-2013 season. Adults of the 1st generation were appeared in the field during the period from October, 29 to December, 3. This generation lasted 43 days. The 2nd generation started from December, 10 to May, 13 and lasted 158 days. The third generation was observed from May, 20 to July, 8 and lasted 50 days. The last generation lasted 93 days and appeared from July, 15 to September, 30; whereas illustration in Figure (1, B) indicated also four generations for *I. seychellarum* during 2013-2014 season. The 1st generation was observed from October, 22 to December, 10 and lasted 50 days. The 2nd generation began from December, 17 to April, 29 and lasted 134 days. The 3rd generation was observed in the field from May, 6 to July, 15 and lasted 72 days. The fourth generation occupied the period from July, 22 to September, 30 and lasted 71 days.

Results of both seasons revealed that there is four generations for *I. seychellarum* on *H. helix* leaves in Assiut region. The shortest generation was the 1st one where the temperature was in its highest levels during the period of this generation. Many authors (e.g. Moutia and Mamet, 1946 and Blackmore, 1981) obtained the same result in which the brown scale insect has four yearly generations. In additions, some other authors (e. g. Hill, 1980; Godse and Bhole, 2003 and Mona, 2012) revealed that the pest has 2-5 generations a year. The conflict in the results may be due to the differences in the regions, climatic elements, the differences in host plants and cultural practices.

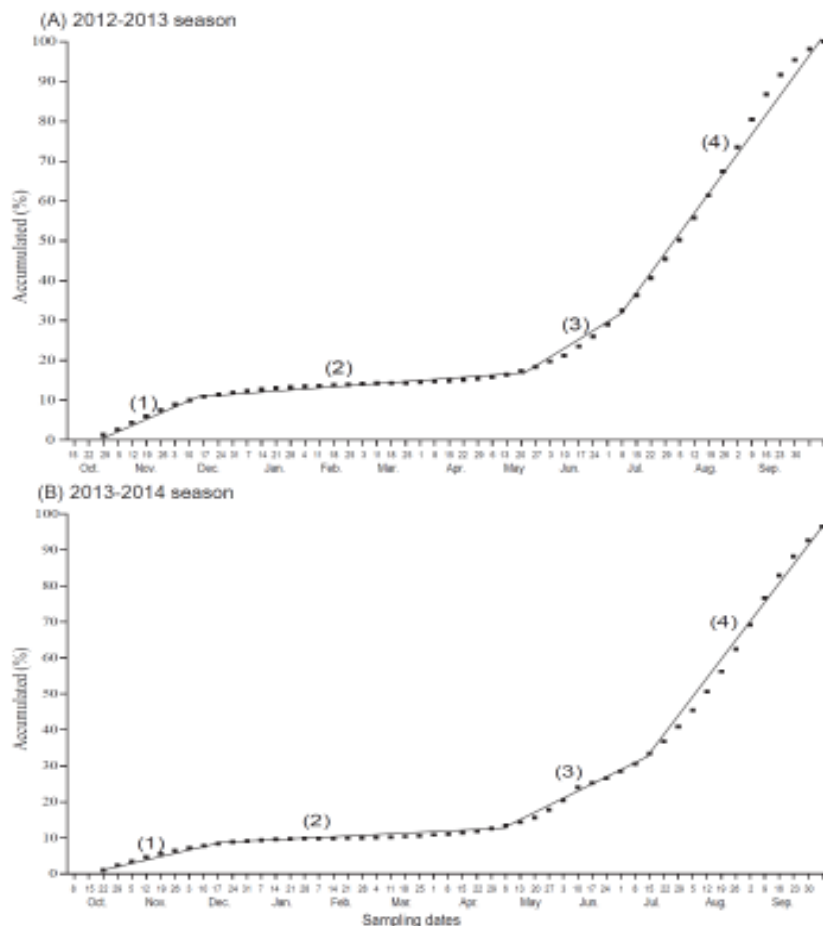


Fig. (1): Number of *I. seychellarum* field generations, arranged according to Audemard and Milaire (1975) method during 2012/2013 and 2013/2014 seasons in Assiut Governorate.

Weather elements:

2012/2013 season:

Data presented in Table 3 show that the simple correlation coefficient among temperature [Max.(x1) and Min.(x2)] and the pest population was positive highly significant, while the effect of relative humidity (x3) on the insect population was negative highly significant. Multiple-regression analysis showed that the three studied weather elements could be responsible for 70.67% of the changes in *Icerya seychellarum* population. The efficiency of each element on the pest population change was 55.16, 15.38 and 0.12 for minimum temperature, relative humidity and maximum temperature, respectively.

2013/2014 season:

Results in Table 3 indicate that the simple correlation between temperature [Max. and Min.] and relative humidity, and the pest population in the second season was similar to that of the first season. Also, Multiple-regression analysis revealed that the efficiency of the studied weather elements occupied the same arrangement of the first season.

It is seemed that the variation in the action of mortality factors such as weather elements cause a considerable population fluctuations. Mesbah *et al.* (2012) found that the pest population fluctuated with temperatures. Geiger *et al.* (2001) found that the survival of the *I. seychellarum* immature stages was minimal at 30% R.H.

Table (3): Multiple regression analysis between the total number of the seychellarum mealybug, *I. seychellarum* and some weather factors prevailing at Assiut during 2012/2013 and 2013/2014 seasons.

Growing season	Weather factors	r	R	R ² x100	Decrease in R ² x100	Efficiency
2012/2013	Non	—	0.8406	70.67	—	—
	Max. temp. (X ₁)	+0.4910**	0.8402	70.6	0.07	0.1253
	Min. temp. (X ₂)	+0.7351**	0.6178	38.17	32.5	55.1659
	Avg. R.H. % (X ₃)	-0.1696**	0.7849	61.61	9.06	15.3829
2013/2014	Non	—	0.8978	80.61	—	—
	Max. temp. (X ₁)	+0.5882**	0.8932	79.78	0.83	1.9236
	Min. temp. (X ₂)	+0.8281**	0.7402	54.79	25.82	59.5946
	Avg. R.H. % (X ₃)	-0.2532**	0.8505	72.34	8.27	19.1

r = Simple correlation.

R = Multiple regression.

R² = Coefficient of determination.

** = Highly significant at 0.01 level of probability.

Within-plant distribution:

The distribution of the seychellarum mealybug on plants was studied from several faces as follow:

On plant leaves:

On leaves level:

Season of 2012/2013:

Data of Table 4 show the mean monthly numbers of the insect pest and their percentages (out of the year count). The total mean monthly counts of the insect were 28794.78, 23104.47 and 17471.12 insect/150 leaves comprised 41.51, 33.31 and 25.19% of the total mean count of the pest during the whole season on bottom, middle and top level of *H. helix* plants, respectively.

Table (4): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* leaves regardless of leaf surface during 2012/2013 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> leaves								
Month and year	Plant level regardless of leaf surface						Total	
	Bottom level		Middle level		Top level			
	Mean No.	%	Mean No.	%	Mean No.	%	Mean No.	%
October,2012	2054.33	2.96	1376.67	1.98	765.67	1.10	4196.67	6.05
November	1815.75	2.62	1245.25	1.80	622.5	0.90	3683.5	5.31
December	728.4	1.05	398.8	0.57	180.4	0.26	1307.6	1.88
January,2013	288	0.42	140.75	0.20	64.5	0.09	493.25	0.71
February	99	0.14	51	0.07	24.25	0.03	174.25	0.25
March	83	0.12	44	0.06	20.5	0.03	147.5	0.21
April	385.8	0.56	237.4	0.34	109.8	0.16	733	1.06
May	1454.75	2.10	1043.5	1.50	693.5	1.00	3191.75	4.60
June	3662.25	5.28	2820.5	4.07	1999.25	2.88	8482	12.23
July	5916.4	8.53	5043.6	7.27	4101	5.91	15061	21.71
August	8109.5	11.69	6996	10.08	6145.75	8.86	21251.25	30.63
September	4197.6	6.05	3707	5.34	2744	3.96	10648.6	15.35
Total	28794.78	41.51	23104.47	33.31	17471.12	25.19	69370.37	100.00

Season of 2013/2014:

The mean monthly counts of the insect and their percentages (out of the whole year count) presented in Table 5. The total mean monthly counts, during the whole season, were 29807.60, 24053 and 19175.15 insects/150 leaves on the bottom, middle and top levels of *H. helix* plants, respectively. When these counts transferred to percentages, they resembled as 40.81, 32.94 and 26.25%, respectively.

Table (5): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* leaves regardless of leaf surface during 2013/2014 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> leaves								
Month and year	Plant level regardless of leaf surface						Total	
	Bottom level		Middle level		Top level			
	Mean No.	%	Mean No.	%	Mean No.	%	Mean No.	%
October,2013	1938.75	2.65	1065.25	1.46	566.75	0.78	3570.75	4.89
November	1204.25	1.65	640.75	0.88	343.5	0.47	2188.5	3.00
December	400.6	0.55	252.8	0.35	146.2	0.20	799.6	1.09
January,2014	74.75	0.10	35.75	0.05	18.25	0.02	128.75	0.18
February	48.5	0.07	22.75	0.03	8.25	0.01	79.5	0.11
March	101.5	0.14	48.5	0.07	23.25	0.03	173.25	0.24
April	1548	2.12	914	1.25	441	0.60	2903	3.97
May	942	1.29	687.5	0.94	454	0.62	2083.5	2.85
June	2606.5	3.57	1936.5	2.65	1335.5	1.83	5878.5	8.05
July	5899.8	8.08	5087.2	6.97	4203.6	5.76	15190.6	20.80
August	8601.75	11.78	7823	10.71	6972.25	9.55	23397	32.03
September	6441.2	8.82	5539	7.58	4662.6	6.38	16642.8	22.79
Total	29807.6	40.81	24053	32.94	19175.15	26.25	73035.75	100

On leaves surfaces:

Season of 2012/2013:

The mean monthly numbers of the *Icerya seychellarum* and their percentages as well as the total monthly count and its percentage on leaves surfaces of *H. helix* plants during the whole season were presented in Table 6. The total mean monthly counts of the pest were 30054.9 and 33276.87 insects/150 leaves during the whole season on upper and lower surface of *H. helix* leaves. These numbers comprised 43.33 and 56.67% out of the whole year count.

Table (6): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* leaves regardless of plant level during 2012/2013 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> leaves						
Month and year	Leaves surface regardless of plant level				Total	
	upper surface		lower surface			
	Mean No.	%	Mean No.	%	Mean No.	%
October,2012	1075	1.55	3121.667	4.50	4196.667	6.05
November	968	1.40	2715.5	3.91	3683.5	5.31
December	412.2	0.59	895.4	1.29	1307.6	1.88
January,2013	140.25	0.20	353	0.51	493.25	0.71
February	57.75	0.08	116.5	0.17	174.25	0.25
March	24.75	0.04	122.75	0.18	147.5	0.21
April	289	0.42	444	0.64	733	1.06
May	1329.25	1.92	1862.5	2.68	3191.75	4.60
June	3826	5.52	4656	6.71	8482	12.23
July	7105.2	10.24	7955.8	11.47	15061	21.71
August	10217.5	14.73	11033.75	15.91	21251.25	30.63
September	4610	6.65	6038.6	8.70	10648.6	15.35
Total	30054.9	43.33	33276.87	56.67	69370.37	100

Season of 2013 /2014:

Table 7 shows the mean monthly counts of the pest and their percentages out of the total year count on both surfaces of *H. helix* leaves. The total mean monthly counts of the pest during the whole season were 31916.7 and 38796.65 individuals /150 leaves on upper and lower surfaces of *H. helix* leaves. The percentages of the pest population out of the total season count were 45.14 and 54.86% on upper and lower surfaces of the leaves.

Table (7): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* leaves regardless of plant level during 2013/2014 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> leaves						
Month and year	Leaves surface regardless of plant level				Total	
	upper surface		lower surface			
	Mean No.	%	Mean No.	%	Mean No.	%
October,2013	1136	1.61	2434.75	3.44	3570.75	5.05
November	667	0.94	1521.5	2.15	2188.5	3.09
December	251.8	0.36	547.8	0.77	799.6	1.13
January,2014	30.75	0.04	98	0.14	128.75	0.18
February	21.75	0.03	57.75	0.08	79.5	0.11
March	28.75	0.04	144.5	0.20	173.25	0.25
April	221.8	0.31	358.8	0.51	580.6	0.82
May	839.75	1.19	1243.75	1.76	2083.5	2.95
June	2488	3.52	3390.5	4.79	5878.5	8.31
July	7055.2	9.98	8135.4	11.50	15190.6	21.48
August	11279.5	15.95	12117.5	17.14	23397	33.09
September	7896.4	11.17	8746.4	12.37	16642.8	23.54
Total	31916.7	45.14	38796.65	54.86	70713.35	100

On plant branches:

On branches levels:

Season of 2012/2013:

Data in Table 8 display that the total means monthly counts during the whole season were 13761.25, 10906.05 and 8387.3 individuals/150 on the bottom, middle and top branches of *H. helix* plants, respectively. The percentages out of the whole year count on these branches levels were 41.63, 33 and 25.37 %, respectively.

Table (8): Monthly incidence and percentages (out of the total year count) of The *I. seychellarum* on *H. helix* branches during 2012/2013 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> branches								
Month and year	Bottom level		Middle level		Top level		Total	
	Mean No.	%	Mean No.	%	Mean No.	%	Mean	%
October,2012	1169	3.54	779.7	2.36	388	1.17	2336.7	7.07
November	1122	3.39	716.8	2.17	309	0.93	2147.8	6.50
December	299.8	0.91	161.2	0.49	61.8	0.19	522.8	1.58
January,2013	125.3	0.38	48.75	0.15	19.25	0.06	193.3	0.58
February	36.5	0.11	16.5	0.05	6.25	0.02	59.25	0.18
March	38.75	0.12	16	0.05	6.5	0.02	61.25	0.19
April	151.4	0.46	82.8	0.25	33	0.10	267.2	0.81
May	524.5	1.59	348.3	1.05	552	1.67	1424.8	4.31
June	1632	4.94	1205	3.65	784.5	2.37	3621.5	10.96
July	2725	8.24	2344	7.09	1903	5.76	6972	21.09
August	3823	11.57	3482	10.53	3113	9.42	10418	31.52
September	2114	6.40	1705	5.16	1211	3.66	5030	15.22
Total	13761.25	41.63	10906.05	33.00	8387.3	25.37	33054.6	100

Season of 2013/2014:

The total mean monthly counts and their percentages out of the total year count of the pest were calculated in Table 9. The total mean monthly counts during the whole season were 10480.98, 10825.4 and 8538.2 individuals/150 branches which comprised as 35.12, 36.27 and 28.61 % of the total year count on *H. helix* bottom, middle and top branches, respectively.

Table (9): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* branches during 2013/2014 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> branches								
Month and year	Bottom level		Middle level		Top level		Total	
	Mean No.	%	Mean No.	%	Mean No.	%	Mean No.	%
October,2013	931.8	3.12	558.3	1.87	239	0.80	1729.1	5.79
November	544.5	1.82	302.3	1.01	130.8	0.44	977.6	3.28
December	184.4	0.62	106.6	0.36	54	0.18	345	1.16
January,2014	28.5	0.10	13	0.04	5.5	0.02	47	0.16
February	18.25	0.06	5.25	0.02	2	0.01	25.5	0.09
March	42.75	0.14	21.25	0.07	8	0.03	72	0.24
April	122.6	0.41	64.4	0.22	22.6	0.08	209.6	0.70
May	452.3	1.52	353.8	1.19	239.3	0.80	1045.4	3.50
June	1177	3.94	915.5	3.07	634	2.12	2726.5	9.14
July	27.88	0.09	2386	7.99	1964	6.58	4377.88	14.67
August	4009	13.43	3597	12.05	3234	10.84	10840	36.32
September	2942	9.86	2502	8.38	2005	6.72	7449	24.96
Total	10480.98	35.12	10825.4	36.27	8538.2	28.61	29844.58	100

On plant parts:

Season of 2012 /2013:

Comparing the number of pest individuals inhabited the plant leaves with those on the branches; it was found that the general mean on the leaves was 69505.1 insects / 150 leaves, over 32499.5 insects / 150 branches (Table 10). These data constituted as 68.14 % on leaves comparing with 31.86% on branches of the same host plant.

Season of 2013 /2014:

The mean monthly counts of the seychellarum mealybug and their percentages out of the year count on *H. helix* plants were calculated in Table 11. The total mean monthly counts were 70393.7 and 32606.35 insects on plant leaves and branches. These numbers comprised to 68.34 and 31.66 % of the total number (103000.05 insects/ 10 plants).

Table (10): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* plants (leaves and branches)during 2012/2013 season, at Assiut.

Mean monthly counts and percentages of insects on <i>H. helix</i> plant parts						
Month and year	Leaves		Branches		Total	
	Mean No.	%	Mean No.	%	Mean No.	%
October,2012	4197	4.11	2363	2.32	6560	6.43
November	3659	3.59	2145	2.10	5804	5.69
December	1308	1.28	523	0.51	1831	1.80
January,2013	493.3	0.48	193.3	0.19	686.6	0.67
February	174.3	0.17	59.25	0.06	233.55	0.23
March	147.5	0.14	63.75	0.06	211.25	0.21
April	733	0.72	267.2	0.26	1000.2	0.98
May	3192	3.13	920	0.90	4112	4.03
June	8161	8.00	3621	3.55	11782	11.55
July	15061	14.77	6972	6.83	22033	21.60
August	21251	20.83	10343	10.14	31594	30.97
September	11128	10.91	5029	4.93	16157	15.84
Total	69505.1	68.14	32499.5	31.86	102004.6	100

Table (11): Monthly incidence and percentages (out of the total year count) of the *I. seychellarum* on *H. helix* plants (leaves and branches)during 2013/2014 season, at Assiut.

Mean monthly counts and percentages of insects on on <i>H. helix</i> plant parts						
Month and year	Leaves		Branches		Total	
	Mean No.	%	Mean No.	%	Mean No.	%
October,2013	3571	3.47	1729	1.68	5300	5.15
November	2189	2.13	977.5	0.95	3166.5	3.07
December	799	0.78	347	0.34	1146	1.11
January,2014	126.3	0.12	47	0.05	173.3	0.17
February	79.5	0.08	25.5	0.02	105	0.10
March	173.3	0.17	72.75	0.07	246.05	0.24
April	551.6	0.54	209.6	0.20	761.2	0.74
May	2045	1.99	1045	1.01	3090	3.00
June	5629	5.47	2726	2.65	8355	8.11
July	15191	14.75	7138	6.93	22329	21.68
August	23397	22.72	10840	10.52	34237	33.24
September	16642	16.16	7449	7.23	24091	23.39
Total	70393.7	68.34	32606.35	31.66	103000.05	100.00

The distribution of the *I. seychellarum* on the plants was studied from several aspects as follow:

Data in Table 12 summarize the distribution of *I.seychellarum* on *H. helix* plants either concerning plant levels, leaf surfaces or plant parts. Concerning the level of leaves on plant, the percentages of the insect population on bottom, middle and top levels were 41.51, 33.31 and 25.19 during 2012/2013 season and in the second season (2013/2014), these

percentages constituted 40.81, 32.94 and 26.25 on the respective levels. This finding indicated that the mealybug individuals harbor the bottom level more than the middle or the top level.

In regard to the level of branches, the insect population on the bottom, middle and top levels were 41.63, 33.00 and 25.37 during 2012/2013 season and 35.12, 36.27 and 28.61 in the second season. Again, the branches at the bottom level seem to be the superior over the middle and the top levels as a refuge for insect population.

Table (12): Summarized the population distribution of the *I. seychellarum* on *H. helix* plants during 2012/2013 and 2013/2014 seasons, at Assiut.

Situation of plant parts			Seasons			
			2012/2013 season		2013/2014 season	
			Total mean count	%	Total mean count	%
Plant level	leaves (150 leaves)	Bottom	28794.78	41.51	29807.6	40.81
		Middle	23104.47	33.31	24053	32.94
		Top	17471.12	25.19	19175.15	26.25
		Total	69370.37	100.00	73035.75	100
	Branches (150 branches)	Bottom	13761.25	41.63	10480.98	35.12
		Middle	10906.05	33.00	10825.4	36.27
		Top	8387.3	25.37	8538.2	28.61
		Total	33054.6	100	29844.58	100
Leaf surface (150 leaves)	Upper	30054.9	43.33	31916.7	45.14	
	Lower	33276.87	56.67	38796.65	54.86	
	Total	69370.37	100	70713.35	100	
Whole plant	Leaves (150 leaves)	69505.1	68.14	70393.7	68.34	
	Branches (150 branches)	32499.5	31.86	32606.35	31.66	
	Total	102004.6	100	103000.05	100.00	

Concerning the leaf surface, the percentage of the pest population on the lower surface was higher than that on the upper surface. It was 56.67 and 43.33 % during the first season and 54.86 and 45.14 % during the second one. Data confirm that the *I. seychellarum* was negatively phototropic. The plant parts in bottom levels either of leaves or branches were in shade and not exposed to the effect of direct sun and consequently were protected from a high temperature. Ben-Dov (2005) found that *I. seychellarum* females seek out a protected place to lay eggs.

Concerning the plant parts, the population of this Coccoid pest was more abundant on leaves than that on branches during both seasons. It was 68.14 and 31.86 % during 2012/2013 season and 68.34 and 31.66 % during 2013/2014 season, respectively. The nature of leaf and branch phenology is different. The branch is cylindrical in shape and so, it has not upper or lower surface. But the leaf has upper and lower surface and if the insect wants to hide from sunlight or a high temperature, it can be harbored the lower surface and vice versa. Javadi and Mahdavian (2011) showed that in winter the population of *I. purchasi* was higher on exposed sunny trees than that on

shady ones, while in spring and summer it was inversed. The nature of leaf and branch anatomy is also different, whereas, the branches are hard enough than that of leaves which makes branches too thick for insects to penetrate and feed on. Thus, the tissue of leaves is more suitable for insect mouth parts to suck easily plant juice. Moreover, the food elements are metabolite within the leaf tissues, this may be make the insect food is more available in leaves than branches. Newbery (1981) found that the population of seychellarum mealybug was much more abundant on leaves and grapes than the bark. The author attributed this to that the leaves and grapes provide a much superior habitat than the bark.

Determining the appearance, population density and distribution of seychellarum mealybug on *H. helix* plants maybe enable us to define a time and a proper controlling way of the pest before its population causing serious damages. In addition knowing the preference of seychellarum mealybug for certain plant organs (leaves and branches) and location (bottom, middle and top levels) gives good information for IPM programmer to select a resistant plant, proper insecticides and proper controlling techniques.

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دراسة ديناميكية مجموع حشرة بق السيشيلارم الدقيقى علي نبات الهيدرا غادة صلاح محمد فرغلى قسم وقاية النبات - كلية الزراعة - جامعة جنوب الوادى

تم إجراء هذه الدراسة فى المزرعة البحثية التابعة لكلية الزراعة بجامعة اسيوط خلال موسمى ٢٠١٢/٢٠١٣ و ٢٠١٣/٢٠١٤ .
أوضحت النتائج خلال موسمى الدراسة أن أكبر عدد من الحوريات ومجموع الأفة يظهر خلال الأسبوع الأخير من شهر أغسطس . كما تظهر أعلى نسبة مئوية من التعداد الكلى السنوى فى شهر أغسطس (٣٠,٥٧ ، ٣٣,٢٤٪) و خلال سنتى الدراسة وجد ان لهذه الحشرة ٤ أجيال فى السنة وقد تم تحديد ميعاد بداية ونهاية كل جيل وبالتالي فترة بقاء الحشرة .
وقد تم دراسة تأثير العوامل الجوية على تعداد هذه الحشرة . وفيما يتعلق بتوزيع تعداد الحشرة داخل النبات دلت النتائج خلال موسمى الدراسة أنه بالنسبة لموقع الورقة أو الفرع من النبات فقد وجد أن تعداد هذه الحشرة كان مرتفعاً على الأوراق و الأفرع السفلية عن تلك الموجودة على الأوراق و الأفرع الوسطى أو العلوية . وبالنسبة لسطح الورقة ، فإن تعداد هذه الحشرة كان بصفة عامة مرتفعاً على السطح السفلى عن تلك الأعداد الموجودة على السطح العلوى للورقة .
أما بالنسبة للجزء النباتى ، فقد وجد أن تعداد الحشرات على الأوراق أعلى من التعداد الموجود على الأفرع .
وتفيد هذه الدراسة عند تصميم برنامج مكافحة متكاملة لهذه الأفة من حيث اختيار ميعاد إجراء المكافحة أو اختيار المركبات المستخدمة وطريقة إستخدامها .

Table (1): Population fluctuations of *I. seychellarum* on *H. helix* plants during 2012/2013 and 2013/2014 seasons, at Assiut Governorate.

Month and Year	Date	2012/2013 season						2013/2014 season									
		No. of insects /150 leaves			Meteorological records			No. of insects /150 leaves			Meteorological records						
		Nymphs	Adults	Total	Max.	Min.	R.H%	Nymphs	Adults	Total	Max.	Min.	R.				
October	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	15	3059	850	3909	37.4	15	52.07	2853	1056	3754	44.2	18.6	45	51	15.4	15.4	15.4
	22	3257	935	4192	39.6	16	47.43	2384	980	3364	40.6	15.4	15.4	52	15.4	15.4	15.4
	29	3326	1163	4489	42.2	17.8	39.43	2292	964	3256	37.8	16	16	47	16	16	16
Total	9642	2948	12590				10364	3919	14283								
November	5	3226	1056	4282	38.6	14.2	50.43	1926	762	2688	35.4	15.8	52	52	15.8	15.8	15.8
	12	2783	1010	3793	33.8	11.2	53	1722	774	2496	35.2	12.6	56	56	12.6	12.6	12.6
	19	2701	984	3685	29.8	11.2	53.43	1270	582	1852	36.4	13	51	51	13	13	13
	26	2143	732	2875	29.4	10.2	59.71	1186	534	1720	27.4	8.8	6	6	8.8	8.8	8.8
Total	10853	3782	14635				6104	2652	8756								
December	3	1676	635	2311	26.2	8.8	57.36	1002	464	1466	23.8	5.4	62	62	5.4	5.4	5.4
	10	836	328	1164	26.4	5.4	62.14	751	373	1124	26.4	6.4	59	59	6.4	6.4	6.4
	17	798	331	1129	29	8	58.93	413	246	659	25.8	6.6	61	61	6.6	6.6	6.6
	24	685	278	963	25	2.6	61.29	272	212	484	23.8	5.6	65	65	5.6	5.6	5.6
Total	31	686	285	971	22	5	61.93	124	138	262	23.8	4.6	61	61	4.6	4.6	4.6
		4681	1857	6538				2562	1433	3995							
	7	423	184	607	24.4	3.4	57	121	128	249	29.2	5.2	63	63	5.2	5.2	5.2
	14	438	166	604	21.6	3.6	58.07	58	86	144	20.8	4.8	68	68	4.8	4.8	4.8
January	21	288	135	423	24.6	5.4	61.14	35	39	74	22.8	4.2	6	6	4.2	4.2	4.2
	28	218	121	339	21.2	4.2	55.14	16	22	38	23.6	4	66	66	4	4	4
Total		1367	606	1973				230	275	505							

Table (1): Cont

Month and Year	Date	2012/2013 season						2013/2014 season					
		No. of insects /150 leaves			Meteorological records			No. of insects /150 leaves			Meteorological records		
		Nymphs	Adults	Total	Max.	Min.	R.H%	Nymphs	Adults	Total	Max.	Min.	R.H%
February	4	151	142	293	25.8	4.6	56.21	11	19	30	27.4	5.4	59.93
	11	54	70	124	27.8	5.2	63.93	29	67	96	23.8	4.2	59.57
	18	56	85	141	24.4	2.2	64.79	38	85	123	22.2	3	63.64
	25	55	84	139	29.4	4.4	57	58	147	205	32.4	8.6	61.5
	Total	316	381	697				136	318	454			
March	3	24	58	82	36.4	10	49.86	54	105	159	31	7.6	57.5
	11	32	60	92	34.2	7.2	50.79	67	150	217	33.8	8.4	52.93
	18	69	137	206	28.6	7.6	50.79	107	262	369	24.4	6	61.29
	25	63	147	210	30.2	7	55.5	58	176	234	28.6	7.8	57.57
	Total	188	402	590				286	693	979			
April	1	182	85	267	34.4	11.2	54	98	295	393	31.4	9	57.93
	8	337	138	475	35.4	10	49.71	136	410	546	28.43	11.97	52.5
	15	455	208	663	34.4	7	47.21	177	556	733	31.8	13.74	53.57
	22	612	270	882	38	12.6	41.93	229	721	950	33.66	15	46.43
	29	965	413	1378	37.2	11.8	42.86	284	776	1060	35.71	19.26	45.14
Total	2551	1114	3665				924	2758	3682				
May	6	1280	560	1840	37.4	15.6	43.71	365	1041	1406	36.6	14.8	42.67
	13	2017	718	2735	46.6	15	31.64	431	1785	2216	37.4	12.8	44.36
	20	2596	955	3551	46	16.8	37.14	538	2289	2827	38.4	15.4	42.29
	27	3532	1009	4641	40	12.4	37.64	739	3065	3804	42.2	18.6	38.86
	Total	9425	3242	12767				2073	8180	10253			

Table (1): Cont

Month and Year	Date	2012/2013 season					2013/2014 season					
		No. of insects /150 leaves			Meteorological records		No. of insects /150 leaves			Meteorological records		
		Nymphs	Adults	Total	Max.	Min.	Nymphs	Adults	Total	Max.	Min.	
June	3	4937	1565	6502	43.6	18.6	2842	927	2769	39.4	16.8	42.43
	10	5823	1655	7478	44.4	18.8	3688	1117	4805	40.6	20.4	42.93
	17	7106	2064	7887	40.4	19	4962	1610	6572	43.8	20.8	36.64
	24	8449	2329	10778	43.4	20	6599	1769	8368	43.8	19	41.14
Total	26315	7613	32645			18091	5423	22514				
July	1	9436	2578	12014	45.8	22.4	8564	2405	10969	45.2	19	41.21
	8	10596	2948	13544	39.8	21.2	10503	2870	13373	38.8	22.8	45.43
	15	11538	3215	14753	38.6	21.4	11997	3350	15347	40.2	22.4	52.07
	22	13443	3252	16695	38.8	21.2	13464	3906	17370	42	23	49
Total	14571	3728	18299	38.2	20.4	14584	4310	18894	42.8	23.8	45.07	
August	5	59584	15721	75305			59112	16841	75953			
	12	15517	3761	19278	39.6	20.2	16020	4709	20729	44.4	22.6	49.35
	19	16440	4102	20542	39.8	22.2	17437	5190	22627	45.2	21	47.29
	26	17597	4115	21712	37.8	21.2	18577	5682	24259	41.4	22.6	51.71
Total	18782	4691	23473	38.8	20.4	19662	6311	25973	40.6	24	53.56	
September	2	68336	16669	85005			71696	21892	93588			
	9	14132	4225	18357	37.6	20.2	16912	5228	22140	41.2	21.4	47
	16	11165	3327	14492	39.2	18.6	14784	4387	19171	42.2	20	45.36
	23	7984	2542	10526	41.4	21.2	12499	3762	16261	38.6	21	49
Total	5370	1845	7215	40.4	19.4	10925	3300	14225	37.2	19.2	52.07	
	30	3811	1237	5048	38	19	8546	2868	11414	44.2	21	39.21
Total	42462	13176	55638			63666	19545	83211				

