SURVEY OF SCALE INSECTS AND MEALYBUGS ON MANGO TREES AND ECOLOGICAL STUDIES OF *INSULASPIS PALLIDULA* (GREEN) AT GIZA GOVERNORATE

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Abstract

A survey of scale insects and mealybugs on mango trees (*Mangifera indica* L.) was carried out in a private mango orchard at El-Saff, Giza Governorate, during two successive years 2014 and 2015. The infestation of mango trees with scale insects and mealybugs was determined. The results indicated that, the mango trees were infested by 12 species of scale insects and mealybugs belonging to four families: Diaspididae, Coccidae, Monophlebidae and Pseudococcidae. From the twice monthly collection, the white mealybug, *Icerya seychellarum* (Westwod) was the most dangerous and abundant of the collected species followed by *Insulaspis pallidula* (Green) then *Kilifia acuminata* (Signoret) and *Hemiberlesia lataniae* (Signoret). The Maskell scale insect, *I. pallidula* was selected for further ecological studies on four mango cultivars. The selected four mango cultivars are not equally susceptible to *I. pallidula* infestation. Hendi mango trees cultivar (cv.) were heavily infested and severely damaged, while trees of Fagrikalan cv. are the lowest infestation with *I. pallidula*. However, the susceptibility levels of mango cultivars to *I. pallidula* could be arranged in descending order as follows: Hendi >Alphonso-Naser > Dabsha > Fagrikalan. Population of *I. pallidula* recorded three generations and three activity peaks per year. In the first year of study three peaks of infestation were recorded in 1st-April, mid-July and 1st October, while in the second year 2015, these peaks were recorded during mid-April, mid-August and 1st November. The calculated infestation rates of *I. pallidula* were high in spring, summer and autumn months, whereas, relatively low rate of infestation were recorded with winter months in both years.

Keywords: Ecological studies, *Insulaspis pallidula*, susceptibility, mango trees.

INTRODUCTION

Mango trees, (*Mangifera indica* L.) (Anacardiaceae) are considered one of the most popular and economic fruit trees in Egypt and 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. Mango occupies the third rank after citrus and grapes from the commercial point of view (El-Masry, 2004). Egypt has several local mango cultivars that produce unique variety of mango fruits. such as Alphonso,

Baladi, Ewaisi, Zebda, Hendi and Sultani (El-Zohgbi and Mostafa, 2002). Several studies conducted in different Egyptian localities showed that different mango cultivars express varying levels of tolerance to scale insects and mealybugs infestation (Monzer *et al.*, 2006 and Salem *et al.*, 2007). Scale insects and mealy bugs are serious insect pests, attack the mango trees and cause a severely considerable damage in Egypt. These soft scale insects and mealybugs are sucking pest of plant sap and secret large amount of the honey dew which encourage the growth of sooty mold fungi, that consequently reduce the photosynthesis and respiration of plant leaves (Radwan, 2003).

The present work aimed to study the occurrence of scale insects and mealybugs inhabiting mango trees in a private mango orchard located at El-Saff, Giza Governorate, Egypt. Also, ecological studies on the most commonly species was conducted for two successive years, (2014 and 2015).

MATERIALS AND METHODS

Study site:

This study was conducted in a private mango orchard (called Fisher orchard) located at El-Saff, Giza Governorate, Egypt. Orchard total area was 200-feddan and contains 2000 trees of more than 10 mango cultivars, are grown. Most trees were planted in 1935 and trees were more than 4m high during the time of the study.

Sampling of survey:

Four local important mango cultivars were chosen (Fagrikalan, Alphonso-Naser, Hendi and Dabsha). The leaves sample collection was carried out twice monthly for two successive years, (2014 and 2015). Three representative trees from each cultivar were chosen randomly and marked. Selected trees were similar in size, shape, height and vegetation. The selected marked trees and four trees adjacent to each of them were excluded from any chemical treatment applied to the rest of the orchard. A sample comprising 10 leaves was collected randomly from each of the four cardinal directions (East, West, North and South) of the middle crown parts from each of the three marked trees for each cultivar *i.e.* 120 leaves per sample (3 trees x 4 directions x 10 leaves). Leaves of each tree were packed separately in paper bags and transferred into the laboratory for carefully inspection in the same day.

In the laboratory, scale insects and mealybugs were identified in department of scale insects and mealybugs. Population densities of the most commonly species of scale insects and mealybugs on Fagrikalan, Alphonso-Naser, Hendi and Dabsha cultivar leaves were estimated on three trees for each cultivar. Total numbers of a live

nymphs and adults on each leaf were counted and their total numbers for each cultivar on each inspection date were calculated. The number of generations was estimated from half monthly data of total nymphs according to the method mentioned by Assem (1990).

Meteorological data :

To reveal the relation between climatic condition and fluctuation of *I. pallidula* population, means of daily temperature and relative humidity at Giza Governorate were obtained from the Meteorological Station of the Agricultural Research Center, Egypt and the half monthly mean was calculated.

Statistical analysis :

All parameters concerning *I. pallidula* population density on mango leaves were reduced to three-specific means, and these means were used in statistical analysis. All data were evaluated statistically using ANOVA and means compared using Duncan's Multiple Range Test at $P<0.05$). The relationship between the population density of *I. pallidula* and both temperature (Maximum and minimum temperature) and relative humidity (R.H.) were tested using simple correlation and multiple regression analysis. All statistical analyses were done using the software package Costat (Costat, 2005).Ref.

RESULTS AND DISCUSSION

Survey of scale insects and mealybugs :

Field studies were carried out on scale insects and mealybugs on mango trees during two successive years, (2014 and 2015). The survey of scale insects and mealybugs infesting mango trees indicated that, mango trees were infested by 12 scale insects and mealybugs species: five species belonging to family Diaspididae, three species to family Coccidae, two species to families Monophlebidae and Pseudococcidae. The highest abundant species was *Icerya seychellarum* (Westwod) (48.14%) of the total collected species, followed by *Insulaspis pallidula* (Green) (29.01%), then *Kilifia acuminata* (Signoret) (12.74%) and *Hemiberlesia lataniae* (Signoret) (8.57%). The less abundant species were *Ceroplastes floridensis* (Comstock) (0.49%), *Parlatoria oleae* (Colvee) (0.29%), *Aulacaspis tubercularis* (Newstead) (0.22%), *Aonidiella aurantii* (Maskell) (0.18%), *Planococcus citri* (Risso) (0.11%), *Icerya aegyptiaca* (Douglas) (0.10%), *Pulvinaria vitis* (Linnaeus) (0.08 %) and *Planococcus ficus* (Signoret) (0.07%) (Table, 1).

Table 1. The collected scale insects that infest mango trees leaves at Fisher mango orchard, Giza Governorate during 2014 and 2015 years.

No.	Insect scientific name	Family	Mean counts/ 120leaves		Total	%
			2014	2015		
1	*Icerya seychellarum* (Westwod)	Monophlebidae	25873	16100	41963	48.14
2	*Insulaspis pallidula* (Green)	Diaspididae	12421	12852	25283	29.01
3	*Kilifia acuminata* (Signoret)	Coccidae	5389	5712	11101	12.74
4	*Hemiberlesia lataniae* (Signoret)	Diaspididae	3787	3686	7473	8.57
5	*Ceroplastes floridensis* (Comstock)	Coccidae	268	163	431	0.49
6	*Parlatoria oleae* (Colvee)	Diaspididae	254	-	254	0.29
7	*Aulacaspis tubercularis* (Newstead)	Diaspididae	188	-	188	0.22
8	*Aonidiella aurantii* (Maskell)	Diaspididae	60	98	158	0.18
9	*Planococcus citri* (Risso)	Pseudococcidae	48	46	94	0.11
10	*Icerya aegyptiaca* (Douglas)	Monophlebidae	89	-	89	0.10
11	*Pulvinaria psidii* (Linnaeus)	Coccidae	71	-	71	0.08
12	*Planococcus ficus* (Signoret)	Pseudococcidae	-	64	64	0.07
		Total	48448	38721	87169	100

According to these results, the population densities of most serious and abundant species *I. pallidula* was studied on leaves of four mango cultivars Fagrikalan, Alphonso-Naser, Hendi and Dabsha in this assay.

General trend of population fluctuation of *I. pallidula* on mango trees :

Results represented in Table, (2) and illustrated in Figure, **(1)** showed the half-monthly means of nymphs and adults (females) and total population density of *I. pallidula* infesting mango trees in Fisher mango orchard (mixed cultivars), Giza Governorate during 2014 year. Density of *I. pallidula* nymphs on mango leaves was low during December and January, then began to increase gradually to form a small significant peak on 1st April (256 nymphs/10 leaves), then two large approximately equal peaks on mid-July (397 nymphs/10 leaves) and the beginning of October (347 nymphs/10 leaves). Also, three peaks of adult females were observed on mid-April (130 adult females/10leaves), mid-July (186 adult females/10leaves) and mid-October (225 adult females /10leaves). Overall combined numbers of individuals (Nymphs and

adult females) on mango leaves indicated that activity of *I. pallidula* extended from February to November with a small activity peak on 1st April (380 individuals/10 leaves), peak of intermediate population density during mid-October (551individuals/10leaves) and the large peak on mid-July (583 individuals/10 leaves).

Results of the second year of investigation, (2015) as represented in Table, (3) and Figure, (2) showed that general population trends, number of peaks of nymphs and adult females of *I. pallidula* were similar to those in the previous year, (2014). Density of *I. pallidula* nymphs on mango leaves have significant peak on mid-August (345 nymphs/10 leaves), and two large approximately equal peaks on mid-April (375 nymphs/10 leaves) and the beginning of November (379 nymphs/10 leaves). The three peaks of adult females were observed on 1st April (174 adult females/10leaves), mid-August (232 adult females/10 leaves), and 1st November (182 adult females/10leaves). The total numbers of individuals (nymphs and adult females) on mango leaves indicated that activity of *I. pallidula* extended from February to December with three activity peaks on mid-April (516 individuals/10 leaves), mid-August (577individuals/10 leaves) and 1st November (561 individuals /10 leaves).

These results were in agreement with those obtained by Ali, (2010) who recorded that the pre-adult and adult females of *Lepidosaphes pallidula* (*Insulaspis pallidula*) had three peaks through the two years of investigation, (2005 and 2006) and the total population of *L. pallidula* had three peaks annually recorded end of winter, spring and autumn seasons. The highest peak recorded at March and the lowest abundance recorded at July. The results of Elwan, (1990) showed that, mango trees were heavily infested by *Lepidosaphes pallidula* during autumn in El-Qanater El-Khairia, Qalubyia governorate. Hassan, (1998) mentioned that the highest population density of *Insulaspis pallidula* on mango trees during the two successive years of the investigation was detected in 25th of September in the first year and 10th of March in the second year.

Infestation levels and population densities of *I. pallidula* :

Population densities of the *I. pallidula* on leaves of mango cultivars Fagrikalan, Alphonso-Naser, Hendi and Dabsha at the sampling date are shown in tables (2, 3) and figures. (1,2). The highest mean number of *I. pallidula* individuals per 10 leaves was found on Hendi cultivar 4679 (2933 nymphs and 1746 adult females) and 4831 (3104nymphs and 1727 adult females) followed by Dabsha 2016 (1266 nymphs and 750 adult females) and 2423 (1557 nymphs and 866 adult females) then Alfanso-Naser 1454 (912 nymphs and 542 adult females) and 1932 (1243nymphs and 689 adult females) and the lastly Fagrikalan 170 (105 nymphs and 65 adult females) and 489 (312 nymphs and 177 adult females) in the two successive

years, (2014) and (2015), respectively. Accordingly, the order of susceptibility levels of mango cultivars to *I. pallidula* could be arranged in descending order as follows: Hendi (highly susceptible) > Dabsha > Alfanso-Naser > Fagrikalan (highly tolerable). The calculated infestation rates of *I. pallidula* were high in spring, summer and autumn months, whereas, relatively low rates were recorded with winter months in both years. The highest abundance was recorded during October (13.23%) and August (11.25%), while, the lowest abundance was recorded during January (2.43 and 3.20 %) in the two successive years, respectively. The overall population densities were not similar among the two studied years, since, the population density of the first year was lower than the second one. This difference in *I. pallidula* activity is possibly attributed to the variation of the chemical composition (quantitvlly and qualitivlly) of the mango leaves cultivars or weathering conditions.

These differences in the population density between cultivars appeared more pronounced in mid-July where total number of *I. pallidula* on Hendi cultivar in 2014 year averaged 328 individuals/10 leaves compared with 142, 101 and 12 individuals/10leaves on Dabsha, Alfanso-Naser and Fagrikalan cultivars, respectively. Similarly, average numbers of *I. pallidula* on Hendi cultivar during 2015 year was significantly higher than that on the other three cultivars.

Table 2. Half monthly mean counts of *Insulaspispallidula* different stages, at Fisher mango orchard, Giza, Governorate during 2014year.

Date of inspection	Mean number of individuals/10 leaves														Total	Temp.		RH
	Fagri- Kalan			Alfanso-Naser			Hindi			Dabsha			Total					
	N	A	Total	N	A	Total	N	A	Total	N	A	Total	N	A		Max.	Min.	
1-Jan	2	2	4	7	5	12	25	17	42	11	7	18	45	31	76	18.6	10.2	68.0
15-Jan	2	2	4	12	10	22	38	32	70	16	8	30	68	58	126	21.0	11.1	50.1
1-Feb	3	2	5	18	11	29	59	38	97	23	18	41	103	69	172	20.1	10.5	59.7
15-Feb	3	2	5	24	15	39	77	47	124	33	20	53	137	84	221	20.9	11.6	62.5
1-Mar	3	2	5	29	16	45	92	51	143	40	22	42	164	91	255	23.2	13.9	44.9
15-Mar	4	3	7	36	18	54	115	58	173	50	25	75	205	104	309	24.6	13,6	53.3
1-Apr	5	2	7	45	22	67	144	70	214	62	30	92	256	124	380	26.6	14.7	46.1
15-Apr	4	3	7	40	23	63	131	73	204	56	31	98	232	130	362	30.3	17.8	45.9
1-May	4	2	6	37	22	59	118	68	186	51	30	81	210	121	431	30.3	19.9	40.5
15-May	4	2	6	32	21	53	105	67	172	45	30	75	136	120	306	32.2	20.1	44.5
1-Jun	5	3	8	40	19	59	128	61	189	55	26	81	228	109	337	32.7	21.5	45.0
15-Jun	5	3	8	43	26	69	139	84	223	60	36	96	247	149	396	35.1	22.5	44.9
1-Jul	6	3	9	53	29	82	178	93	271	80	40	120	316	165	481	34.8	23.1	53.2
15-Jul	8	4	12	69	32	101	223	105	328	97	45	142	397	186	583	33.6	23.4	54.0
1-Aug	6	3	9	54	31	85	175	100	275	76	43	119	311	177	488	34.7	24.3	53.1
15-Aug	5	3	8	43	30	73	137	96	233	59	42	101	244	171	415	35.4	24.6	56.1
1-Sep	5	3	8	51	27	78	160	87	247	69	38	107	285	155	440	33.7	23.9	51.9
15-Sep	6	4	10	56	33	89	180	106	286	78	46	124	319	189	508	33.1	22.9	49.7
1-Oct	7	5	12	61	35	96	195	115	310	84	45	129	347	200	547	29.7	19.1	55.4
15-Oct	6	4	10	57	39	96	184	127	311	79	55	134	326	225	551	28.2	19.1	51.1
1-Nov	5	3	8	48	27	75	156	87	243	67	37	104	277	154	431	26.2	16,5	53.6
15-Nov	3	2	5	25	22	47	80	70	150	34	30	64	142	124	266	22.1	14.2	64.6
1-Dec	2	2	4	20	16	36	63	52	115	27	22	49	112	92	204	23.5	13.7	57.5
15-Dec	1	1	2	10	13	23	31	42	73	14	18	32	56	74	130	20.1	11.5	56.4
Total	105	65	170	912	542	1454	2933	1746	4679	1266	750	2016	5216	3103	8415	670.7	423.7	1262
Average	4.37	2.71	7.08 [d]	38.00	22.58	60.58 [c]	122.20	72.75	194.96 [a]	52.75	31.25	84.00 [b]	217.30	129.29	350.62	27.94	17.65	52.58

F= 69.4793 P= 0.0000 *** LSD $_{0.05}$= 26.6633

N= Nymph A= Adult Temp.= Temperature R.H.= Relative Humidity

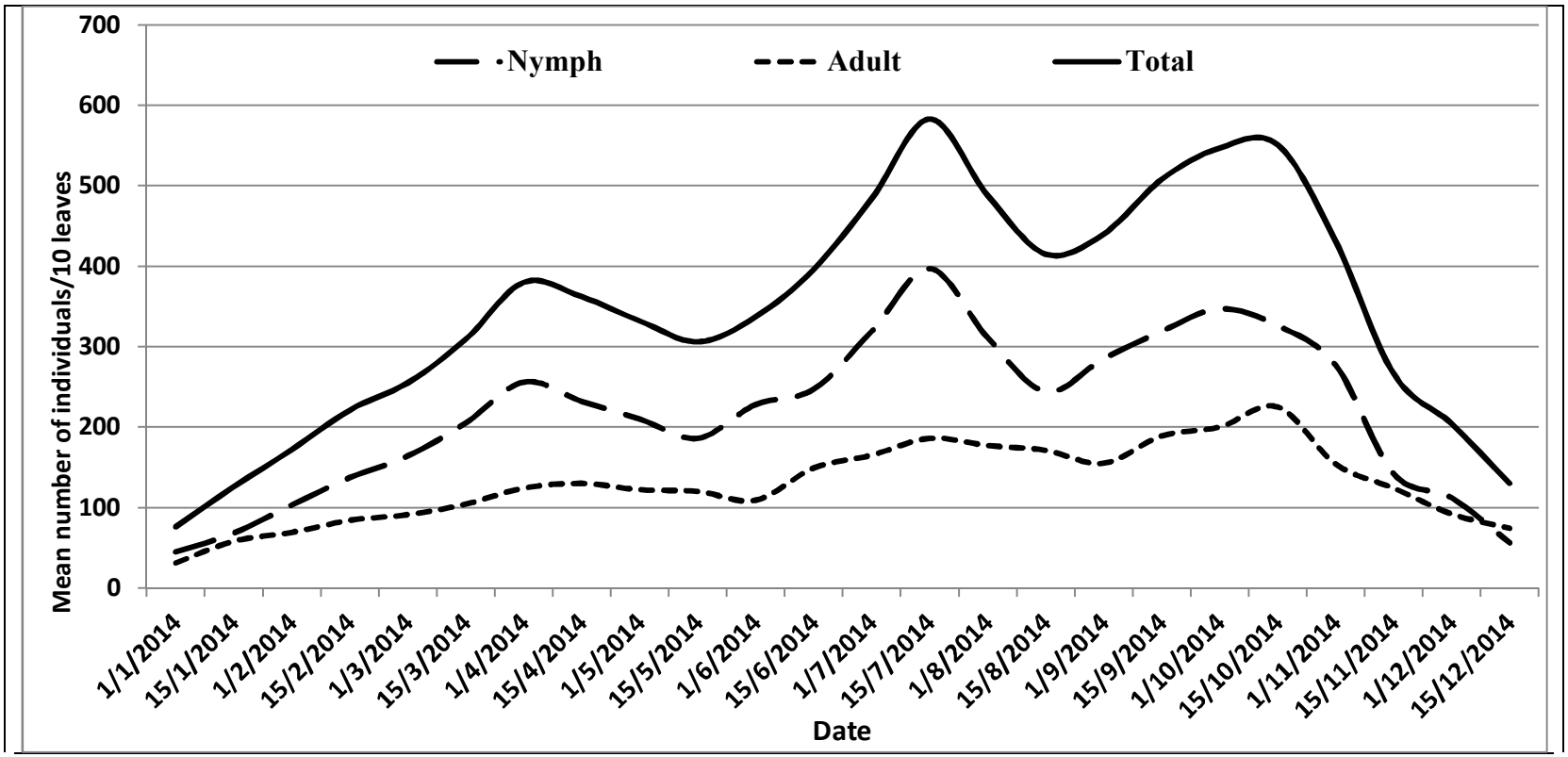

Fig. 1. Half monthly mean counts of *Insulaspispallidula* different stages, at Fisher mango orchard, Giza, Governorate during 2014 year.

Table 3. Half monthly mean counts of *Insulaspispallidula*different stages,at Fisher mango orchard, Giza, Governorate during 2015 year.

Date of inspection	Mean number of individuals/10 leaves														Total	Temp.		RH
	Fagri- Kalan			Alfanso-Naser			Hindi			Dabsha			Total					
	N	A	Total	N	A	Total	N	A	Total	N	A	Total	N	A		Max.	Min.	
1-Jan	4	3	7	17	12	29	44	28	72	21	15	36	86	58	144	15.1	8.6	51.5
15-Jan	5	4	9	18	13	31	46	37	83	23	20	43	92	74	166	20.2	11.3	49.3
1-Feb	6	5	11	22	18	40	57	41	98	29	22	51	114	86	200	20.0	10.6	41.4
15-Feb	7	6	13	28	23	51	70	57	127	36	28	64	141	114	255	18.4	9.9	57.6
1-Mar	11	7	18	43	27	70	107	67	174	54	34	88	215	135	350	23.0	13.2	58.7
15-Mar	13	8	21	54	31	85	134	78	212	67	38	105	268	155	423	24.4	13.3	48.4
1-Apr	15	9	24	60	35	95	150	87	237	75	43	118	300	174	474	24.3	14.0	48.3
15-Apr	19	7	26	75	28	103	187	70	257	94	36	130	375	141	516	28.0	15.3	41.5
1-May	17	6	23	67	26	93	168	64	232	84	32	116	336	128	464	29.2	17.3	50.3
15-May	15	5	20	62	21	83	154	53	207	78	27	105	309	106	415	33.6	20.2	41.6
1-Jun	14	5	19	56	18	74	141	45	186	71	23	94	282	91	373	31.3	20.4	51.5
15-Jun	11	6	17	45	23	68	114	58	172	57	29	86	227	116	343	33.1	22.4	47.9
1-Jul	10	8	18	40	32	72	100	79	179	50	39	89	200	158	358	32.7	22.4	55.4
15-Jul	12	9	21	49	36	85	123	88	211	62	44	106	246	177	423	35.9	23.8	49.0
1-Aug	15	11	26	60	40	100	148	102	250	73	52	125	296	205	501	37.3	26.7	47.8
15-Aug	17	12	29	69	46	115	173	116	289	86	58	144	345	232	577	35.0	25.3	56.2
1-Sep	15	11	26	63	42	105	157	105	262	78	52	130	313	210	523	35.1	24.4	57.9
15-Sep	13	10	25	54	39	93	136	97	233	67	48	115	270	194	464	35.5	24.9	44.5
1-Oct	15	7	22	60	29	89	149	74	223	74	37	111	298	147	445	31.6	21.9	58.2
15-Oct	18	8	26	71	32	103	178	81	259	89	40	129	356	161	517	29.6	20.3	58.4
1-Nov	20	9	29	78	36	116	184	92	276	97	45	143	379	182	561	25.5	16.7	68.5
15-Nov	17	8	25	68	34	102	172	86	258	86	43	129	343	171	514	24.6	15.3	59.7
1-Dec	15	8	23	54	26	80	136	66	202	68	33	101	273	133	406	19.90	11.30	63.8
15-Dec	8	5	13	30	22	52	76	56	132	38	28	66	152	111	263	20.40	11.30	64.4
Total	312	177	*489*	1243	689	*1932*	3104	1727	*4831*	1557	866	*2423*	6216	3459	9675	668.9	420.8	1271.8
Avarage	13	7.37	20.37 ^{d}	51.79	28.71	80.5 ^{c}	129.33	71.96	201.29 ^{a}	64.87	36.08	100.96 ^{b}	259	144.12	403.12	27.87	17.53	52.99

F= 90.7538 P= 0.0000 *** LSD $_{0.05}$= 23.0033

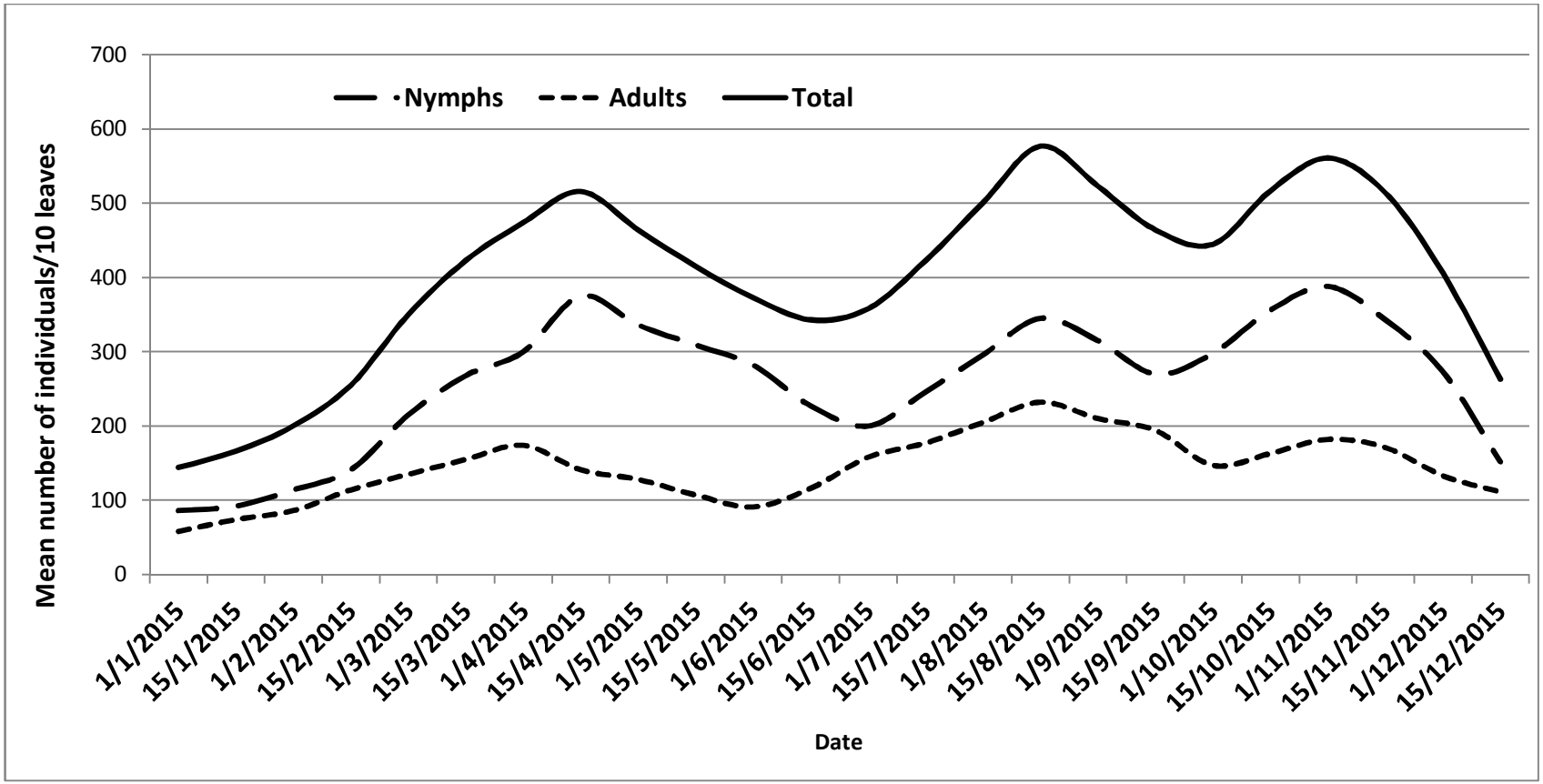

Fig. 2. Half monthly mean counts of *Insulaspispallidula*different stages,at Fisher mango orchard, Giza, Governorate during 2015 year.

Differences in susceptibility of various mango cultivars to scale insects had reported by several studies. Salem *et al*., (2007) showed that, population densities of the *I. seychellarum* on leaves of Sultani, Baladi, Hendi, Ewaisi and Alphonso mango cultivars were significantly different. They concluded that, Alphonso was completely resistant, while Sultani was highly susceptible to *I. seychellarum* and the order of susceptibility of the studied mango cultivars to *I. seychellarum* could be arranged in descending order as follows: Sultani > Baladi > Hendi > Ewaisi > Alphonso and the levels of susceptibility of mango cvs. for the mealybug, *I seychellarum* depend on the combined action of leaf nutrients, inhibitors, leaf properties and secondary metabolites. On other hand, Monzer *et al*., (2006) reported that, leaf nutrients, inhibitors and leaf properties cannot explain the completely resistant of Alphonso leaves to *I. seychellarum* infestation. They proved that, Alphonso leaves contain certain repellant or toxic secondary metabolites responsible for their resistance to *I. seychellarum* infestation. El-Badawy, (2014) reported that, the selected five mango cultivars are not equally susceptible to *I. seychellarum* infestation. Fagrikalan mango trees cultivar (cv.) were highly infested, while trees of Dabsha cv. are approximately complete free from *I. seychellarum* infestation and the susceptibility levels of mango cultivars to *I. seychellarum* could be arranged in descending order as follows: Fagrikalan >Alphonso-Naser >Baladi > Hendi >Dabsha.

However, the preference of *I. pallidula* to Hendi leaves and avoidance of Fagrikalan leaves can be interpreted by presences of leaf secondary metabolites especially essential oils, which are the most important secondary metabolites. The insecticidal or repellent activities of some essential oils of the high susceptible Fagrikalan cv. and the completely tolerable Dabsha cv. against *I. pallidula* revealed that, the chemical composition of essential oils plays an important role in this concern

Number and duration of annual field generations:

The number of annual generations of *I. pallidula* during the two years on Mango trees is graphically illustrated in Figures. (1 and 2). *I. pallidula* had three overlaping generations ; the first generation took about four months and half, started from 1st of January till the mid of May 2014 (the maximum number of nymphs occurred on the first of April). Duration of the second generation was nearly two months and half (extended from 1st of June till the mid of August), its peak was indicated on mid of July. Third generation was indicated on mid September till the mid December. Its peak was recorded on 1st October. This means that both second and third generations continued over 70 days each compared with the first generation which continued for 135 days.

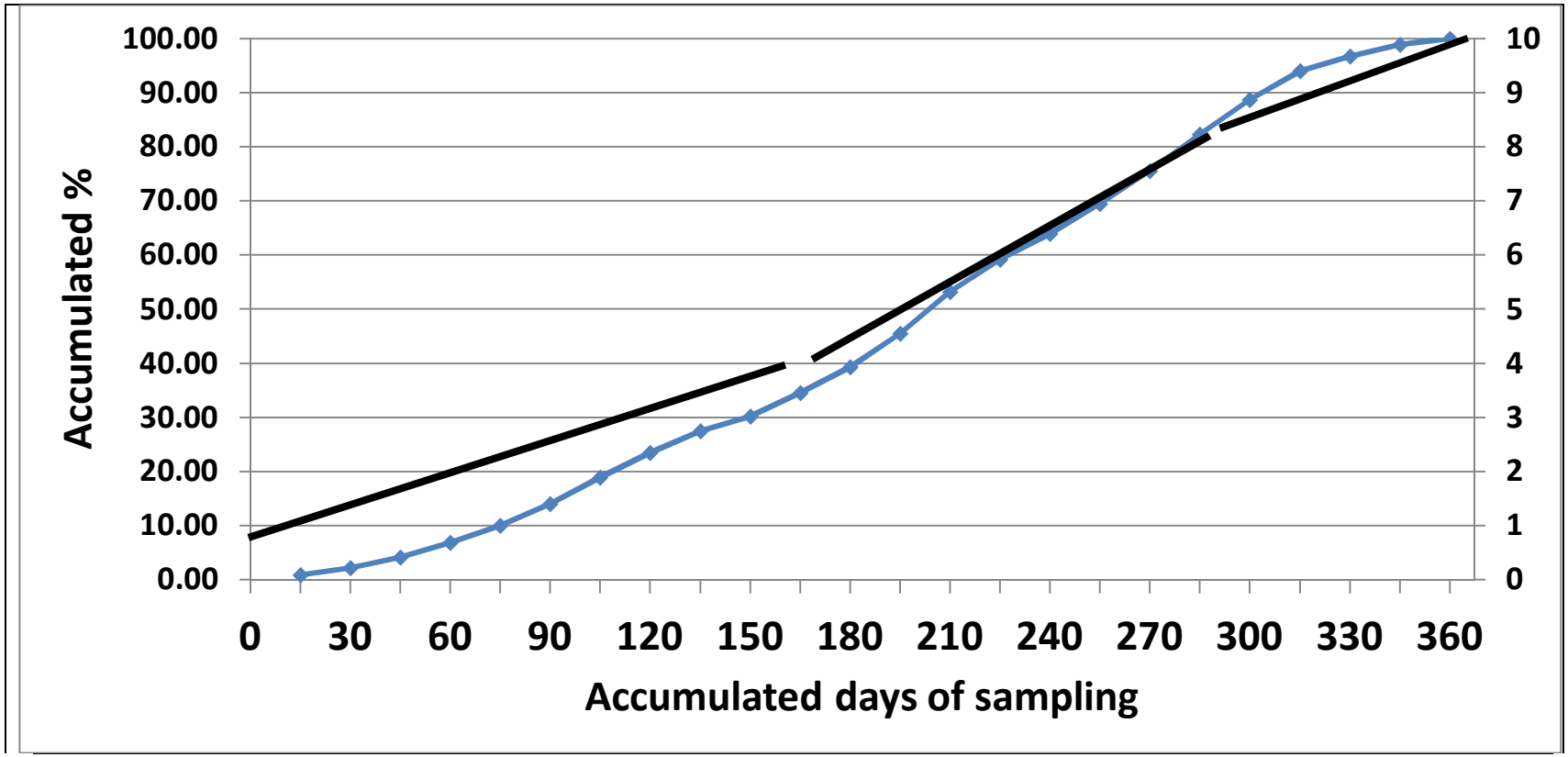

Fig. 3. Annual generations and their durations of *Insulaspispallidula*on mango trees , at Giza, Governorate during the firstyear (2014).

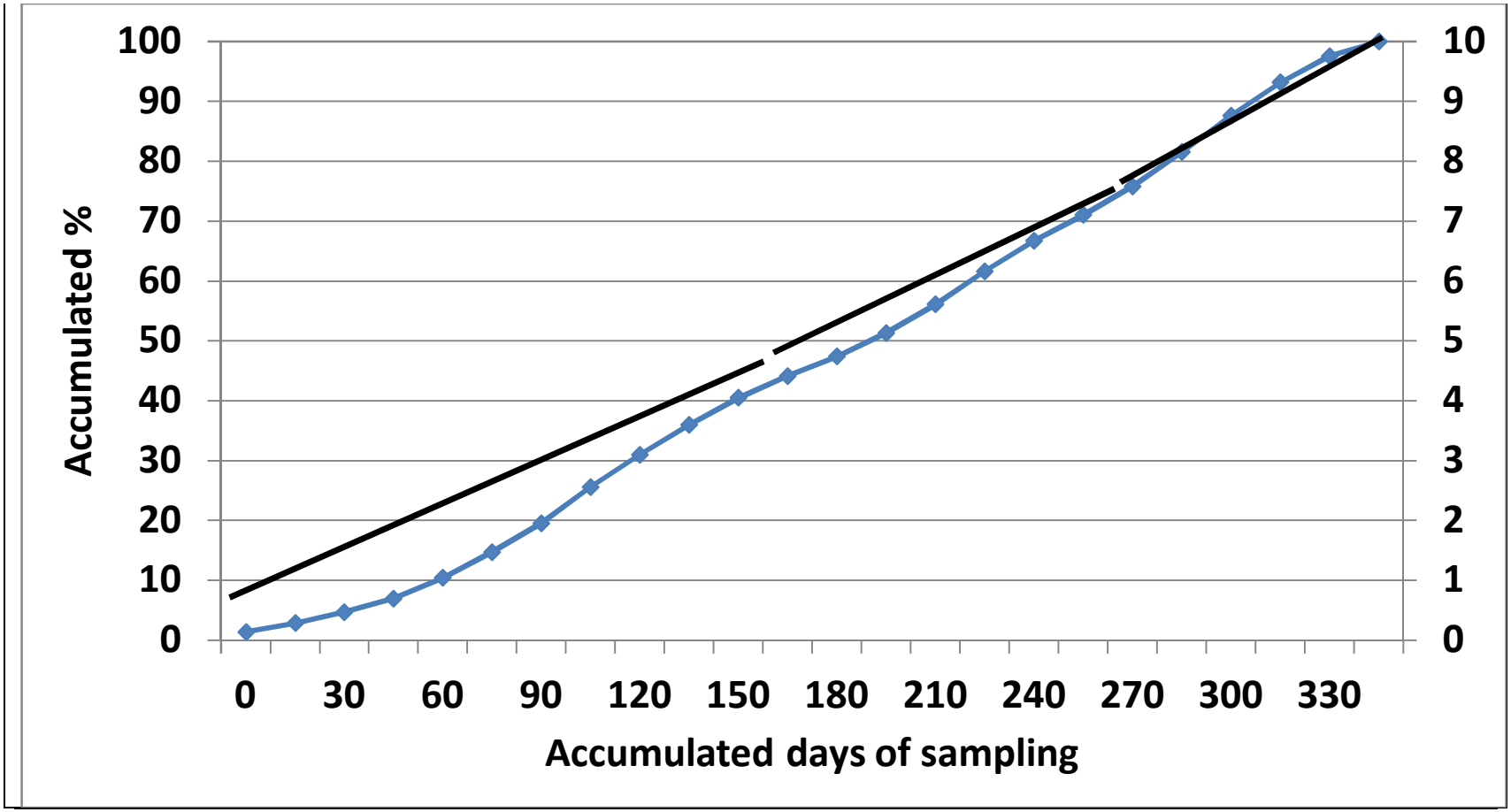

Fig. 4. Annual generations and their durations of *Insulaspispallidula*on mango trees , at Giza, Governorate during the secondyear (2015).

As for the results of the second year 2015 (Fig, 2); *I. pallidula* showed the same trend and had three generations. The duration of the first one was about six months and a half (extended from 1st of January to 1st of July) its peak attained on the mid of April. The second generation lasted for about two months from mid July to mid September, with the peak on the mid August. The third generation took about three months and half (from 1st October till mid December) its peak was evident in November.

These results are consistent with that obtained by Ali, (2010) stated that the Maskell scale, *L. pallidula* had three annual generations per year which recorded at winter, spring and autumn, the highest generation was autumn generation during the first year and winter generation during the second one. Elwan, (2005) recorded three annual generations for *L. pallidula*. Also, these results were in agreement with Salama and Hamdy, (1973) reported that *L. pallidula* had three generations per year; the 1st in January, the 2nd in April and the third one in October. This differences it depending on the host plant and the geographical location. The abundance fluctuations of the *I. pallidula* on Mango trees are not identical from habitat to the other and from the seasonal period to the other. Contrary, Hassan, (1998), showed that *I. pallidula* have four generations per year on mango fruit trees.

Using our findings three periods are recommended for control of this insect population (depending on population determination). The first period is during Apr. 15 to 30 to compact the first generation coming out of over wintering one. The second one is during Jul. 15 to 30 to protect the new formed fruits. The third one is during Sept. 15 to 30 to reduce the over wintering ones. Finally, from the previous ecological studies we could concluded that the scale insects should be controlled after knowing the following items the number of generations of the pest and the highest one. The climatic factors and the natural enemies effect on the population of the scale insects.

Effect of prevailing hygrothermic conditions on the population densities of *I. pallidula* :

The measured relationships between the population densities of *I. pallidula* and the main weather factors were showed in Table, (4). Daily temperature (maximum and minimum temperatures) and daily relative humidity were studied during two studied years, (2014-2015) in Giza governorate as in table, (4).

1) Effect of daily maximum temperature:

Results in the tables, (3 and 4) showed that, there are positive significant correlation between the total insect population activity and maximum temperature (r=0.806 and 0.642) in both years, (2014-2015). The partial regression coefficient

value (P.reg= 16.880 and 13.877) showed highly positive significant in the two years (t= 7.70 and 4.38).

2) Effect of the night minimum temperature:

The effect of minimum temperature on the total population during two years of study (Table, 4) indicated highly positive significant correlation during the two years (r=0.828 and 0.625) respectively. The single effect of this factor on the total population activity appeared from (P.reg = 7.73 and 5.929) which was positive significant effect (t= 8.29 and 4.30).

3) Effect of daily mean relative humidity:

Daily mean relative humidity (Table, 4) had negative relation, insignificant on the total population (r = -0.379) in 1st year but positive relation insignificant (r = 0.158). The single effect of this factor on the total population activity appeared from the partial regression coefficient value (P.reg = 58.85 and 49.105) which was positive insignificant effect (t = -1.88 and 0.65) in both years.

4) The combined effect of daily mean temperature and humidity:

The combined effect of climatic factors on the maskell scale, *I. pallidula* during the two years of study (Table, 4) was significant (F=14.193 and 9.110) and the explained variance (E.V) presented (68% and 57.7%) during the two years of study.

Our results were supported by Ali, (2010) their results indicated that the maximum and minimum temperature gave highly significant effect on *L. pallidula* population. Also, Hassan, (1998), stated that the maximum and minimum temperatures were significant on the population of *I. pallidula*, while the relative humidity factor had not significant correlation.

Table 4. Effect of both temperature and relative humidity on *Insulaspis pallidula* total population on mango leaves at El-Saff, Giza Governorate, Egypt during the two studied years (2014-2015).

Statistical	**First year (2014)**			**Second year (2015)**		
Parameters	**Temperature**		**R.H.%**	**Temperature**		**R.H.%**
	Tmax.	**Tmin.**		**Tmax.**	**Tmin.**	
Simple correlation						
Corr.Coef.(r)	0.806 ±0.13	0.828±0.12	-0.379±0.19	0.642 ±0.16	0.625 ± 0.17	0.158±0.21
Probability(p)	< 0.0001	< 0.0001	0.0680	0.0007	0.0011	0.4597
Correlation significant	Yes	Yes	No	Yes	Yes	No
Partial Regression						
Partial Regres. Coef (b)	16.88± 3.88	7.733 ± 3.20	58.855 ± 7.31	13.877±7.59	5.929 ± 5.18	49.105± 11.18
Regression Coefficient r^2	0.649	0.686	0.143	0.412	0.391	0.025
F-value	40.681	48.112	3.683	15.438	14.126	0.566
Probability (p)	< 0.0001	< 0.0001	0.0680	0.0007	0.0011	0.4597
Regression significant	Yes	Yes	No	Yes	Yes	No
	Combined factors					
E.V (Explained variance)	68.00			57.7		

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حصر الحشرات القشرية والبق الدقيقي علي أشجار المانجو ودراسات إيكولوجية لحشرة المانجو المحاربة ***Insulaspis pallidula*** **(Green) في محافظة الجيزة**

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يهدف هذا البحث إلي حصر للحشرات القشرية والبق الدقيقي في مزرعة للمانجو بمنطقة الصف–محافظة الجيزة خلال العامين المتتاليين ٢٠١٤ و ٢٠١٥ لدراسة ظاهرة قابلية إصابة أوراق أشجار المانجو بالحشرات القشرية والبق الدقيقي. وقد تم تسجيل ١٢ نوع من الحشرات القشرية والبق الدقيقي والتي تنتمي إلي أربع عائلات مختلفة وهي: Diaspididae, Coccidae, Monophlebidae and Pseudococcidae. قد أصابت أوراق المانجو. من خلال العينات الشهرية وجد أن البق الدقيقي *Icerya seychellarum* كان الأعلي كثافة في التعداد والأكثر خطورة علي أوراق أشجار المانجو يليه حشرة المانجو المحاربة *Insulaspis pallidula* ثم *Kilifia acuminata* ثم *Hemiberlesia lataniae*

أختريت حشرة المانجو المحاربة لإجراء الدراسات الإيكولوجية علي أربع أصناف من أشجار المانجو وأوضحت النتائج أن معدل التعداد السنوي لحشرة المانجو المحاربة اختلف بشكل ملحوظ في قابلية الأصناف الأربعة للإصابة، فوجد أن صنف الهندي هو اعلي الأصناف إصابة بينما صنف الفجرى كلان كان أقلهم إصابة. علي العموم كان الترتيب التنازلي للإصابة علي النحو التالي: صنف الهندي يليه صنف ألفونسو ناصر يليه الدبشة ثم الفجرى كلان.أظهر التعداد لحشرة المانجو المحاربة وجود ثلاثة أجيال وثلاث قمم نشاط سنويا. في السنة الأولى تم تسجيل ثلاث قمم إصابة في أول شهر أبريل، منتصف شهر يوليو و أول شهر أكتوبر، بينما في السنة الثانية، سجلت هذه القمم خلال منتصف أبريل، منتصف أغسطس وأول نوفمبر. معدلات الإصابة المحسوبة كانت عالية في أشهر الربيع والصيف والخريف ، في حين تم تسجيل معدل منخفض نسبيا من الإصابة مع أشهر الشتاء في كل سنة.