

Qualitative and quantitative survey of mite and insect pests infesting ornamental plants in Giza Governorate

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Abstract:

Ornamental plants are grown for decorative purposes in gardens and landscape design and play important role in human health and psychology. The aim of this research paper is to study the survey mites and insects infesting three ornamental plants, *Lantana camara* L., *Hibiscus rosa-sinensis* L. and *Acalypha wilkesiana* Müll. Moreover, biweekly sampling was done for two successive years extending from January 2014 to December 2015 to evaluate the population density and the population dynamic of phytophagous pests and their natural enemies infesting these previous plants in Giza Governorate. The survey revealed the presence of 28 mite species and 24 genera belonging to 12 families and four orders collected from leaves and debris under the previous plants; while survey of insect were 23 insect species and 18 genera belonging to 11 families and five orders. The frequent pests were the two spotted spider mites (TSSM), *Tetranychus urticae* Koch (Acari : Tetranychidae), the mealybug, *Ferrisia virgata* (Cockerell) (Hemiptera : Pseudococcidae) and the aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) and the predatory mites, *Phytoseiulus persimilis* (Athias-Henriot) and *Amblyseius swirskii* (Athias-Henriot) (Mesostigmata: Phytoseiidae). The results showed that the mealybug was the most dominant species on hibiscus followed by the TSSM on acalypha then the aphid on lantana, while the predators were abundant on hibiscus shrubs.

Introduction

Ornamental plant is grown for decoration, rather than food or other by-products, flowerbed, shaped into a hedge. They are most often intentionally planted for aesthetic appeal. *Lantana camara* L. plants are

known for their drought tolerance, cold hardiness and colorful flowers that generally bloom from March through October. However, there are several sucking pests that attack lantana. They are spider mites (Acari :

Tetranychidae), aphids (Hemiptera: Aphididae), whiteflies (Hemiptera: Aleyrodidae) and mealybugs (Hemiptera : Pseudococcidae). The aphids, whiteflies and mealybugs excrete a sweet, sticky material called honeydew, which drips down on the plant and accumulates on the leaves and stem of the plant cause sooty mold, a black fungus, often grows on the honey dew and cause problems to plants (Mott and Merchant, 2015). *Hibiscus rosa-sinensis* L. trees or shrubs have attractive flowers and grow relatively easily in sunny areas with good soil drainage, although they occasionally suffer from insect infestations. Hibiscus are susceptible to a variety of insect pests including aphids, scale insects ((Hemiptera: Coccoidea), mealybugs, thrips (Thysanoptera: Thripidae), whiteflies and mites. Dyer (2018) recorded aphids and whiteflies as serious pests attacking hibiscus plants.

Acalypha wilkesiana Müll is an evergreen shrub which can grow to 3 meters tall. The stem is erect with many branches of closely arranged crown. Leaves are about 12cm long and 5cm wide are coppery green. Mealybugs and red spider mites attack the acalypha plant and cause damage to it.

The objective of this work is to survey and study the population density and the population dynamics of spider mites and insect pests and their associated predators on the three ornamental shrubs, *L. camara*, *H. rosa-sinensis* and *A. wilkesiana*. Moreover, the relationship between the population of the piercing sucking pests infesting the three ornamental plants and the maximum and minimum temperature was studied.

Materials and methods

1. Ecological and field study:

1.1. Survey study:

Survey of spider mites and insect pests infesting the ornamental plants *L. camara*, *H. rosa-sinensis* and *A.*

wilkesiana in the Orman Park and in different public gardens scattered in the District of Giza Governorate were reported. Moreover, seasonal abundance of the phytophagous pests and their natural enemies were studied in the Land of the agricultural experiments of the Agriculture Research Centre in Giza Governorate throughout two successive years extending from January 2014 to December 2015.

1.2. Population study:

Three ornamental plants were selected for this study, the first was *L. camara* located in an area of about 100 m² in the form of hedge each side of 10 m² long and two m² height and a set of these shrubs scattered in the middle of the area; the second plant was *H. rosa-sinensis* found as a set of trees composed of 30 shrubs of 2-3.5m. height around a building for decoration and beautification the place, the third plant was *A. wilkesiana*, a total of 20 shrubs were located on either side of the road of the Agriculture Research Centre entrance, each was 3-4 m high.

1.3. Counting of the phytophagous pests and their natural enemies:

Fifteen leaves from three selected shrub trees of the three mentioned ornamental plants were randomly picked up every two weeks and continued for two successive years 2014 and 2015 to study the population density of the different phytophagous pests and their associated predators. Moreover, debris under every investigated shrub was obtained by taking half kilograms of debris dry weight. Samples of leaves and debris were kept each alone in paper bags tightly closed including all necessary information concerning habitat, locality and date of collection was stuck on each bag, then transferred to the laboratory. Mites were extracted by using very thin spin then mounted in Hoyer's medium on glass microscopic

slides and preserved for identification, while the collected insects were kept in glass vials containing 70% ethyl alcohol and some droplets of glycerine. Sampling continued every two weeks for two successive years. The general climate registered concerning the minimum and maximum temperatures obtained from the meteorological station of Central Laboratory for Agricultural Climate, Agriculture Research Centre.

1.4. Preservation and identification:

Identification of mites of the family level was done according to the key given by Krantz (1978), Zaher (1986) and further segregated to the genus and species level by using different specific keys. The collected insects were identified in the Entomological Collection of the Classification and Pests Survey Research Department, Plant Protection Research Institute, Agriculture Research Centre, Egypt.

2. Population density and population dynamic of the phytophagous pests and their associated predators:

Population dynamic of the phytophagous pests, the mite, *Tetranychus urticae* Koch (Acari : Tetranychidae), the mealybug, *Ferrisia virgata* (Cockerell) (Hemiptera : Pseudococcidae) and the aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae) and their associated predators, *Phytoseiulus persimilis* (Athias-Henriot) and *Amblyseius gossypii* Elbadry (Mesostigmata: Phytoseiidae) and the meteorological studied factors within the inspected periods through the examined years, were discussed.

3. Statistical analysis:

Statistical analysis using Pearson Simple Correlation Coefficient

Calculator (Social Science Statistics, 2019).

Results and discussion

1. Survey studies:

1.1. Survey of mites inhabiting *Lantana camara*, *Hibiscus rosa-sinensis* and *Acalypha wilkesiana* plants:

Obtained results of mites inhabiting the mentioned ornamental shrubs indicated the occurrence of 28 mite species and 24 genera belongs to 12 families and four Orders (Table, 1).

1.1.1. Functional group of collected mites:

The collected mite fauna from the three shrubs were classified into the main functional groups: Herbivores, detritivores and predators.

1.1.2. Phytophagous mites (herbivores):

The phytophagous mites are plant feeders of economic importance, comprise four genera, five species belonging to 2 families Tetranychidae and Tenuipalpidae of the Order Prostigmata.

1.1.3. Predaceous mites (carnivores):

It considers the biotic factors or the predators associated with the pests in ornamental plants and reduce the degree of infestation by different pest. The identified predatory mites were belonging to 13 genera and 15 species of the families Phytoseiidae, Ascidae and Laelapidae (Mesostigmata) and families Cheyletidae, Stigmaeidae and Eupodidae (Prostigmata).

1.1.4. Miscellaneous mites (fungivores and detritivores):

The miscellaneous are group of different mites, each of which has a different diet i.e. they are saprophytic, fungivores or pollen grain feeders. Represented this group Ameroseiidae (Mesostigmata), Acaridae (Astigmata) and two families of Cryptostigmata (Oribatulidae and Oppiidae). Most mite species in our survey consistent with the results of Embarak and Aiman (2010), they collected the phytophagous mites and their associated predators on lantana plants in Assuit Governorate .

1.2. Survey of insects inhabiting *Lantana camara*, *Hibiscus rosasinensis* and *Acalypha wilkesiana* plants:

The total of insects inhabiting *Lantana camara*, *Hibiscus rosasinensis* and *Acalypha wilkesiana* plants: belonged to five Orders, 11 families, 18 genera and 23 species (Table, 2) .

1.2.1. Functional group of collected insects:

The collected insect fauna invaded the three ornamental shrubs were classified into the main functional groups: Herbivores, detritivores and carnivores (predators).

1.2.2. Phytophagous insects (herbivores):

The phytophagous insects are plant feeders, provide some important insect pests causing economic damage to different plant Table (2). They comprise 12 genera, 15 species belonging to 8 families and 3 Orders. The most common families were Aphididae, Margarodidae, Pseudococcidae, Aleyrodidae and Cicadellidae.

1.2.3. Predator's insects or the carnivores:

The predators represented by families Coccinellidae and Scarabaeidae (Coleoptera) and Vespidae (Hymenoptera) found on leaves of the three-ornamental plant under investigation.

1.2.3.The miscellaneous insects:

Noted in few numbers in debris under the three ornamental plants and represented by (Formicidae) of the Order Hymenoptera. Embarak and Aiman (2010) surveyed the phytophagous insects and their associated predators on lantana plants in Assuit Governorate , most of their collection was coincide with our results.

2. Population density and population dynamic of phytophagous pests infesting ornamental plants and their associated predators:

The Experimental field of the Agricultural Research Centre was visited twice monthly for two years (January 2014 To December 2015) in Giza Governorate . The seasonal abundance of three pests (*T. urticae*, *F. virgata* and *A. gossypii*) and their associated predators (*P. persimilis* and *A. swirskii*) were determined by counting the number of individuals, occurred on 15 leaves for each of the three selected plants (lantana, hibiscus and acalypha) and placed in paper bags then transferred to the laboratory for examination. Motile stages of the different pests were estimated by counting their numbers per leaves on the low surface and calculating the monthly average number of collected arthropods (Tables, 3-7). Also, the monthly average values of temperature and relative humidity were given in the same Figures.

Table (1): Survey of mites attacking *Lantana camara*, *Hibiscus rosa-sinensis* and *Acalypha wilkesiana* plants and their associated predators during two successive years 2014 and 2015.

Taxonomic rank	Habitat and Habits					
	Lantana		Hibiscus		Acalypha	
	Leaves	Debris	Leaves	debris	leaves	debris
Order: Mesostigmata						
Family:Phytoseiidae						
<i>Amblyseius swirskii</i> Athias-Henriot	15	---	45	---	30	---
<i>Amblyseius hutu</i> Pritchard and Baker	8	---	---	---	---	---
<i>Euseius scutalis</i> Athias-Henriot .	13	---	8	---	15	---
<i>Phytoseiulus persimilis</i> Athias-Henriot	11	---	9	---	8	---
<i>Typhlodromus athiasae</i> Porath and Swirski	10	---	22	---	15	---
Family :Ascidae						
<i>Blattis ociustarsalis</i> (Berlese)	---	6	---	5	---	---
<i>Arctoseius citrates</i> (sellinck)	---	11	---	3	---	6
<i>Proctolaelaps aegyptiaca</i> Nasr	---	7	---	5	---	2
<i>Proctolaelaps orientalis</i> Nasr	---	14	---	8	---	3
Family :Laelapidae						
<i>Laelaspis astronomicus</i> (Koch)	---	4	---	2	---	2
<i>Hypoaspis orientalis</i> (Hafez, El-Badryand Nasr)	---	6	---	2	---	4
Family :Ameroseiidae						
<i>Kleeman niaplumosus</i> (Oudemans)	---	12	---	3	---	5
Order: Prostigmata						
Family :Tetranychidae						
<i>Tetranychus urticae</i> Koch	65	---	55	---	50	---
<i>Oligonychus mangiferus</i>	14	---	20	---	16	---
<i>Eutetranychus orientalis</i> (Klein)	6	---	---	---	9	---
Family :Tenuipalpidae						
<i>Brevipalpus californicus</i> (Banks)	12	---	6	---	8	---
<i>Brevipalpus obovatus</i> Donnadieu	5	---	---	---	---	---
Family :Stigmaeidae						
<i>Agistemus exsertus</i> Gonzalez	8	---	5	---	---	---
<i>Agistemus vulgaris</i> Soliman and Gomaa	4	---	---	---	---	---
Family :Cheyletidae						
<i>Hemicheyletia bakeri</i> (Ehara)	---	16	---	---	---	---
<i>Eucheyletia bakeri</i> Volgin	---	20	---	---	---	---
Family :Eupodidae						
<i>Euopodes niloticus</i> Abo-Awadand El-Bagoury	---	4	---	2	---	2
Order: Astigmata						
Family: Acaridae						
<i>Tyrophagus putrescentiae</i> (Schrank)	---	3	---	1	---	4
<i>Rhizoglyphus robini</i> Claparède	---	6	---	3	---	---
<i>Acarus siro</i> L.	---	14	---	---	---	---
Order: Cryptostigmata						
Family:Oribatulidae						
<i>Siculobata sicula</i> (Berlese)	- 9		- 2		---	5
<i>Zygori batulasayed</i> (El-Badryand Nasr)	- 11		- 6		---	4
Family:Oppiidae	4		1		1	

Table (2): Survey of insects attacking *Lantana camara*, *Hibiscus rosa-sinensis* and *Acalypha wilkesiana* plants and their associated predators during two successive years 2014 and 2015

Taxonomic rank	Habitat and Habits					
	Lantana		Hibiscus		Acalypha	
	leaves	debris	leaves	debris	leaves	debris
Order: Thysanoptera						
Family: Thripidae						
<i>Thrips tabaci</i> Lindeman	54	----	45	----	35	----
Order: Hemiptera						
Family: Aphididae						
<i>Aphis gossypii</i> Clover	60	----	56	----	32	----
<i>Aphis nerii</i> (Boyer)	11	----	25	----	10	----
<i>Aphis craccivora</i> Koch	8	----	5	----	6	----
<i>Myzus persicae</i> (Sulz.)	24	----	9	----	4	----
<i>Macrosiphum rosae</i> (L.)	----	----	5	----	----	----
<i>Macrosiphum persici</i> (Harris)	----	----	3	----	----	----
Family: Margarodidae						
<i>F. virgata</i> (Cockerell)	112	----	103	----	90	----
<i>Icerya purchasi</i> Maskell	24	----	----	----	16	----
Family: Pseudococcidae						
<i>Planococcus citri</i> (Risso)	8	----	----	----	----	----
<i>Maconellicoccus hirsutus</i> (Green)	6	----	----	----	----	----
Family: Aleyrodidae						
<i>Bemisia tabaci</i> (Gennadius)	100	----	75	----	65	----
Family: Cicadellidae						
<i>Cicadulina bipunctata</i> (Melichar)	----	20	----	----	----	12
<i>Empoasca decipiens</i> Paoli	----	16	----	9	----	8
Order: Hymenoptera						
Family: Vespidae						
<i>Vespa orientalis</i> F.	16	----	24	----	10	----
Family: Formicidae						
<i>Cataglyphis bicolor</i> Fab	----	5	----	3	----	7
<i>Monomorium pharaonis</i> L.	----	13	----	----	----	----
Order: Lepidoptera						
Family: Noctuidae						
<i>Spodoptera littoralis</i>	16	----	5	----	----	----
Order: Coleoptera						
Family: Coccinellidae						
<i>Coccinella septempunctata</i> L.	16	----	8	----	11	----
<i>Coccinella undecimpunctata</i> L.	10	----	6	----	4	----
<i>Cydonia vicina</i> Mulsant	6	----	2	----	3	----
Family: Scarabaeidae						
<i>Potosia cuprea</i> (Fabricius)	2	----	8	----	1	----
<i>Tropino tasqualida</i> Scopoli	4	----	7	----	1	----

2.1. Monthly fluctuation of the spider mites *Tetranychus urticae*:

Data recorded in Table (3) showed the infestation levels of *T. urticae* motile stages to the three shrub plants mentioned previously throughout two successive years 2014 and 2015.

Two peaks of infestation were recorded, the first occurred in May; when the number of the spider reached 262, 166 and 337 individuals on the three shrubs, lantana, hibiscus and acalypha, respectively; while the second peak of 190.5, 96.5 and 199.5 individuals in September on lantana, and in October on hibiscus and acalypha, respectively. In the second year 2015, the population density of *T. urticae* motile stages followed the same trend of the first year with slight change. The motile stages of *T. urticae* were peaked in May and June of mean 273 and 243 individuals, on lantana shrub of the first peak; acalypha plant recorded three peaks on hibiscus plant of mean 106.5, 189.5 and 50.5 individuals in March, June and November, respectively. The highest population in the second peak of mean count 71,50.5 and 84.5 individuals, on lantana, hibiscus and acalypha, respectively. The plant acalypha

recorded the highest infestation by the spider mites which peaked in June accounted to 352.5 individuals and the second peak recorded 84.5 individuals in November. Pooled data of the two years indicated that the lowest population of the *T. urticae* were recorded in January when max. and Mini. temp., were (19.8 and 10.6°C) and (17.6 and 9.9°C) and RH 65 and 50.3%, in the two years respectively; while the highest population recorded when max. and Mini. temp. were (31.2 and 20°C) and (31.6 and 21.4°C) and RH 42.5 and 49.6% in May and June in the two years, respectively.

These results was registered before by El-Halawany *et al.* (1990) who reported a gradual increase in the population of *T. urticae* from February till May, followed by a steady decline in the population through the summer months till the beginning of the next autumn. Moreover, El-Saiedy *et al.* (2011) and El-Halawany and Abou-Setta (2013) indicated that the mite populations reached its peak during May and June then decreased in July to October.

Table (3): Monthly fluctuation of *Tetranychus urticae* on lantana, hibiscus and acalypha in 2014 and 2015 in Giza Governorate.

Date	<i>Tetranychus urticae</i> in 2014 on			Temperature		RH%	<i>Tetranychus urticae</i> in 2015 on			Temperature		RH%
	Lantana	Hibiscus	Acalypha	Max.	Mini.		Lantana	Hibiscus	Acalypha	Max.	Mini.	
January	29	19	13	19.8	10.6	65	29	17	16.5	17.6	9.9	50.3
February	56	30.5	50	20.5	11.1	61.2	70.5	41	35.5	19.2	10.4	50
March	122.5	67	110.5	23.9	13.7	49.1	120	106.5	88.5	23.7	13.2	53.4
April	201.5	85.5	216	28.5	16.3	45.9	147	64.5	121	26.2	12.6	44.8
May	262	166	337	31.2	20	42.5	273	78	249	31.4	18.9	45.8
June	160	96	207.5	32.4	22	44.9	243.5	189.5	352.5	31.6	21.4	49.6
July	38	15.5	58	34.2	23.3	49	92.5	87	161	34.3	23.1	52.2
August	106	7.5	37	35	24.4	53.6	9.5	13.5	31.5	33.6	25	51.9
September	190.5	20	145	33.4	23.4	53.9	24	13.5	20	35.3	22.4	51.15
October	172	96.5	199.5	28.9	19	52.5	47	35	80	30.6	21.1	58.2
November	77.5	61.5	96.5	24.2	15.4	52.3	71	50.5	84.5	25.1	16	64.1
December	37.5	15.5	33	21.7	12.6	56.9	37	13	38	17.8	11.3	64.1
Total	1452.5	680.5	1503			262	1164	709	1278			

2.2. Monthly fluctuation of the pest *Ferrisia virgata*:

In the first year, the population of the mealybug (Table, 4) recorded two peaks. The first peak was sharp, observed in June of monthly mean 218.5, 364 and 238 individuals infested lantana, hibiscus and acalypha, respectively, a second peak in October of mean population 113.5 and 162 individuals infested the leaf plants of lantana and acalypha, respectively; while 194 individuals infested the plant hibiscus in November. It was observed in the second year 2015, that the infestation rate of the mealybug was higher than the first season. Moreover, leaves of hibiscus shrub suffered the highest infestation in June recorded 493.5 and 344.5 individuals for the two peaks; while those of lantana and acalypha recorded the first peak of the mealybugs population in June of mean count 342 and 352.5 individuals, and 264.5 and 297.5 individuals for the second peak in November and October for the two plants, respectively. Pooled data of the two years indicated that the lowest population of the mealybug was recorded in January (54, 46.5 and 40 individuals) and (77.5, 97.5 and 57.5 individuals) in the two years on lantana,

hibiscus and acalypha, respectively; when max. and Mini. temp. was (19.8 and 10.6°C) and (17.6 and 9.9°C) and R.H. 65 and 50.3% in 2014 and 2015, respectively. While the highest population recorded in June when max. and Mini. temp. were (32.4 and 22°C) and (31.6 and 21.4°C) and R.H. 44.9 and 49.6% in the two years, respectively. High temp. during July and August and low temp. during November, December and January reduce the populations of the mealybug, *F. virgata*.

Data obtained for *F. virgata* in accordance with that obtained by Abd-El-Said (1997) and Balboul (2003) who revealed the occurrence of two peaks of the Egyptian mealybugs population; the first peak was recorded in June and the second was in October and November. The result showed that the environmental conditions through the months, June and November caused significant increase in the mealybug population. The maximum temperature during July, August and September and minimum temperature during January, February and March reduced the population.

Table (4) : Monthly fluctuation of *Ferrisia virgata* on lantana, hibiscus and acalypha in 2014 and 2015 in Giza Governorate.

Date	<i>Ferrisia virgata</i> in 2014 on			Temperature		RH%	<i>Ferrisia virgata</i> in 2015 on			Temperature		RH%
	Lantana	Hibiscus	Acalypha	Max.	Mini.		Lantana	Hibiscus	Acalypha	Max.	Mini.	
January	54	46.5	40	19.8	10.6	65	77.5	97.5	57.5	17.6	9.9	50.3
February	50	75	57.5	20.5	11.1	61.2	84.5	157.5	52	19.2	10.4	50
March	44.5	118.5	76	23.9	13.7	49.1	95.5	241.5	111	23.7	13.2	53.4
April	59.5	178.5	127	28.5	16.3	45.9	145	287	152.5	26.2	12.6	44.8
May	103	265.5	185	31.2	20	42.5	242.5	416	256	31.4	18.9	45.8
June	218.5	364	238	32.4	22	44.9	342	493.5	352.5	31.6	21.4	49.6
July	184.5	197.5	204.5	34.2	23.3	49	259	335.5	308.5	34.3	23.1	52.2
August	100	110	135	35	24.4	53.6	180	242.5	326	33.6	25	51.9
September	60	96.5	138	33.4	23.4	53.9	207.5	222	360.5	35.3	22.4	51.15
October	113.5	159	162	28.9	19	52.5	246	344.5	297.5	30.6	21.1	58.2
November	110	194	151.5	24.2	15.4	52.3	264.5	322.5	212	25.1	16	64.1
December	83	85.5	118	21.7	12.6	56.9	202.5	289	132	17.8	11.3	64.1
Total	1180.5	1890.5	1632.5				2346.5	3449	2618			

2.3. Monthly fluctuation of the pest *Aphis gossypii*:

Table (5) revealed that the aphid had one sharp peak of high population in April of monthly mean 181.5, 113.5 and 154.5 individuals for lantana, hibiscus and acalypha, respectively. In November, a second peak was observed of moderate population recorded 52, 55 and 73 individuals for the three-shrub mentioned before, respectively. In the second year, the population of the aphid fluctuated and reached its maximum infestation in May of count 175.5, 136.5 and 140.5 individuals infested lantana, hibiscus and acalypha, respectively. A second peak was observed in December 35.5 and 45 individuals on hibiscus and acalypha plants, respectively. These results are similar to data obtained by Habashi *et al.* (2007), in which the population of aphids reach its peak in the third week of May.

2.4. Monthly fluctuation of the predator *Phytoseiulus persimilis*:

As indicated in Table (6), the population of the predator *P. Persimilis* reached to its maximum population in June on lantana, hibiscus and acalypha of monthly mean (19.5, 16.5 and 16 individuals) and (15, 23.5 and 20 individuals), respectively, when max. and mini. temp. recorded (32.4 and 22°C) and (31.6 and 21.4°C) in the two years, respectively. A second peak was observed in October recorded (12.5 and 9 individuals) and (7 and 5.5 individuals) in lantana and hibiscus, when max. temp. rises to 28.9 and 30.6 °C in the two years 2014 and 2015, respectively. Rasmy *et al.* (2003) and Abou-Awad *et al.* (2005) reported that the phytoseiid mites seemed to be important to suppress the population density of *T. urticae*.

2.5. Monthly fluctuation of the predator *Amblyseius swirskii*:

The population of the predator, *A. swirskii* increased to the first peak in June on the three shrubs of monthly

mean 47.5, 98.5 and 87.5 individuals on lantana, hibiscus and acalypha, respectively (Table,7). A gradual decreased observed in the following months then the population increased again to the second peak in October accounted 32, 77.5 and 83.5 individuals on lantana, hibiscus and acalypha, respectively. In the second year, the same observations were indicated, two peaks were observed, the first peak counted 50.5 individuals in June on lantana shrub and 100.5 individuals in July on both other plant's hibiscus and acalypha. The second peak was in October of mean count 35 and 59 individuals on lantana and hibiscus, respectively and 92 individuals in November on acalypha plants. Pooled data of the two years indicated that the lowest population of the predator, *A. swirskii* occurred when the Mini. and max. temp. ranged between 10.6– 19.8°C and R.H. 65 % in the first year and 9.9-17.6 °C and R.H. 50.3% in the second year. The population reached its maximum infestation; when the temperatures ranged between 32.4 – 22°C and 31.6 – 21.4°C and relative humidity 44.9– 49.6 % in 2014 and 2015, respectively. The obtained results agree with the finding of Ismail *et al.* (2005) who proved that the predator *A. swirskii* appeared in early of May associated with the sucking pests, whiteflies and aphids and increased gradually till July. In addition, El-Halawany and Abou-Setta (2013) recorded this predator associated with the spider mites on guava trees and reached its peak in August at max. and mini. temp. 35.3 and 24.7°C. Abdel-Gawad *et al.*(1990) detected the highest population of the predator, *A. swirskii* which associated with phytophagous pests [(*Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) and *Thrips* sp.), during September on different plants in the field (okra, bean, cotton and soya bean plants).

Table (5): Monthly fluctuation of *Aphis gossypii* on lantana, hibiscus and acalypha in 2014 and 2015 in Giza Governorate.

Date	<i>Aphis gossypii</i> in 2014 on			Temperature		RH%	<i>Aphis gossypii</i> in 2015 on			Temperature		RH%
	Lantana	Hibiscus	Acalypha	Max.	Mini.		Lantana	Hibiscus	Acalypha	Max.	Mini.	
January	13	24.5	45.5	19.8	10.6	65	24	39	55.5	17.6	9.9	50.3
February	46.5	45	59.5	20.5	11.1	61.2	54.5	56.5	42	19.2	10.4	50
March	111.5	85	101	23.9	13.7	49.1	107	96	99.5	23.7	13.2	53.4
April	181.5	113.5	154.5	28.5	16.3	45.9	94.5	73	95.5	26.2	12.6	44.8
May	132	85.5	111	31.2	20	42.5	175.5	136.5	140.5	31.4	18.9	45.8
June	93	32	39	32.4	22	44.9	104	88.5	97.5	31.6	21.4	49.6
July	16.5	8	0	34.2	23.3	49	17.5	22	30	34.3	23.1	52.2
August	0	0	14.5	35	24.4	53.6	0	0	0	33.6	25	51.9
September	27	13	32	33.4	23.4	53.9	6.5	0	0	35.3	22.4	51.15
October	54.5	36	51.5	28.9	19	52.5	58	5.5	7	30.6	21.1	58.2
November	52	55	73	24.2	15.4	52.3	21	21	29	25.1	16	64.1
December	14.5	35	49	21.7	12.6	56.9	8.5	35.5	45	17.8	11.3	64.1
Total	742	532.5	730.5				671	573.5	641.5			

Table (6): Monthly fluctuation of *Phytoseiulus persimilis* on lantana, hibiscus and acalypha in 2014 and 2015 in Giza Governorate.

Date	<i>Phytoseiulus persimilis</i> in 2014 on			Temperature		RH%	<i>Phytoseiulus persimilis</i> in 2015 on			Temperature		RH %
	Lantana	Hibiscus	Acalypha	Max.	Mini.		Lantana	Hibiscus	Acalypha	Max	Mini	
January	0	0	0	19.8	10.6	65	0	0	0	17.6	9.9	50.3
February	3	1	0	20.5	11.1	61.2	4	1.5	2	19.2	10.4	50
March	6.5	7.5	1.5	23.9	13.7	49.1	6.5	7	4.5	23.7	13.2	53.4
April	11	14	9	28.5	16.3	45.9	11	12.5	10	26.2	12.6	44.8
May	13.5	16.5	11.5	31.2	20	42.5	12.5	17	16.5	31.4	18.9	45.8
June	19.5	16.5	16	32.4	22	44.9	15	23.5	20	31.6	21.4	49.6
July	2.5	4	7	34.2	23.3	49	2.5	15	12	34.3	23.1	52.2
August	0	0	1.5	35	24.4	53.6	0	2.5	2	33.6	25	51.9
September	5	1	1	33.4	23.4	53.9	35	1	0	35.3	22.4	51.15
October	12.5	12.5	9	28.9	19	52.5	7	5.5	1.5	30.6	21.1	58.2
November	1.5	6.5	5.5	24.2	15.4	52.3	1.5	7.5	1.5	25.1	16	64.1
December	0	0	0	21.7	12.6	56.9	0	0	0	17.8	11.3	64.1
Total	75	79.5	62				95	93	70			

Table (7): Monthly fluctuation of *Amblyseius swirskii* on lantana,hibiscus and acalypha in 2014 and 2015 in Giza Governorate.

Date	<i>Amblyseius swirski</i> in 2014 on			Temperature		RH%	<i>Amblyseius swirski</i> in 2015 on			Temperature		RH%
	Lantana	Hibiscus	Acalypha	Max.	Mini.		Lantana	Hibiscus	Acalypha	Max.	Mini.	
January	5.5	11.5	1.5	19.8	10.6	65	4	5.5	6	17.6	9.9	50.3
February	6.5	16	10	20.5	11.1	61.2	11	12.5	7.5	19.2	10.4	50
March	13.5	32.5	25	23.9	13.7	49.1	20.5	32	20.5	23.7	13.2	53.4
April	14	54	41.5	28.5	16.3	45.9	28	62	37	26.2	12.6	44.8
May	35.5	76.5	68.5	31.2	20	42.5	34.5	83	65.5	31.4	18.9	45.8
June	47.5	98.5	87.5	32.4	22	44.9	50.5	99.5	92.5	31.6	21.4	49.6
July	32	87.5	63.5	34.2	23.3	49	38	100.5	100.5	34.3	23.1	52.2
August	20	62.5	40	35	24.4	53.6	27.5	54.5	69	33.6	25	51.9
September	20.5	51.5	43.5	33.4	23.4	53.9	24.5	49.5	44.5	35.3	22.4	51.15
October	32	77.5	83.5	28.9	19	52.5	35	59	45	30.6	21.1	58.2
November	31	49	39	24.2	15.4	52.3	30.5	52.5	92	25.1	16	64.1
Dec.	12.5	11	14.5	21.7	12.6	56.9	16.5	22	23	17.8	11.3	64.1
Total	270.5	628	518				320.5	632.5	603			

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