

PARASITOIDS AND HYPERPARASITOIDS OF APHELINIDS (HYMENOPTERA: APHELINIDAE) ASSOCIATED WITH ARMORED SCALE, SOFT SCALE INSECTS (HEMIPTERA: COCCOIDEA) AND WHITEFLIES (HEMIPTERA: ALYERODOIDEA) ON OLIVE IN EGYPT

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ABSTRACT

Aphelinids (Hymenoptera : Aphelinidae) are the most important parasitoids of, armored scale, soft scale insects (Hemiptera: Coccoidea) and whiteflies (Hemiptera: Alyerodoidea). The present work dealt with the diagnosis and abundance and the role of this group in controlling armored scale, soft scale insects and whiteflies. The results indicated that 17 parasitoids and hyperparasitoids were reared from samples of armored , soft scale insects and whiteflies in different locations in Egypt. These parasitoid and hyperparasitoid species were collected from 7 armored, soft scale insects and whiteflies and distributed in 5 Governorates (Alexandria, Assuit, Ismailia, Fayoum and Matruh). The maximum rate of parasitism of armored scale insects parasitoids ranged between 12-59% during the two years under consideration. While the maximum rate of parasitism of soft scale insects and whiteflies parasitoids ranged between 13-28% and 39-58%, during the two years under consideration, respectively. This result indicated that some parasitoids of armored, soft scale insects and whiteflies were effective in controlling them.

INTRODUCTION

Armored scale insects (Hemiptera : Diaspididae) excrete honeydew, a sweet, sticky liquid produced by sucking insects that ingest large quantities of plant sap. Sticky honeydew and the blackish sooty mold growing on honeydew can bother people even when scale populations are not harming plants. When plants are heavily infested with scales, leaves may look wilted, turn yellow, and drop prematurely. Scales sometimes result in curl leaves or cause deformed blemishes or discolored halos in fruit, leaves, or twigs. Bark infested with armored scales may crack and exude gum. Certain armored scales also feed on fruit, but this damage is often just aesthetic (Abd-Rabou, 2003a).

Soft scales (Hemiptera : Coccidae) infest leaves and twigs but rarely feed on fruit. A major concern with soft scales is their excretion of abundant honeydew, which contaminates fruit, leaves, and surfaces beneath plants. Honeydew encourages the growth of black sooty mold and attracts ants, which in turn protect scales from natural enemies. When found in numerous abundance, some scale species weaken plants and cause them to grow slowly. Branches or other plant parts may die if they remain heavily infested with scales. If plant parts die quickly, dead brownish leaves may remain on branches, giving them a scorched appearance. Several years of severe

infestations may kill young plants. Soft scales reduce plant vigor, but seldom kill trees or shrubs (Gill, 1997).

Whiteflies (Hemiptera : Aleyrodidae) injure olive plants by consuming large quantities of sap, which it obtains with its sucking mouth parts. Further indirect injury is caused by sooty mold fungus which grows over fruit and foliage in the copious amount of honeydew excreted by the whitefly. This black fungus may cover the leaves and fruit so completely that it interferes with the proper physiological activities of the trees. Heavily-infested trees become weak and produce small crops of insipid fruit. Only three species of whiteflies have been recorded attacking olive trees in Egypt (Abd-Rabou, 2001b). These are *Aleurolobus olivinus* (Silvestri) (Abd-Rabou, 1996), *Bemisia tabaci* (Gennadius) (Abd-Rabou, 1997) and *Siphoninus phillyreae* (Haliday) (Hemiptera : Aleyrodidae) (Abd-Rabou, 2003 b).

Parasitic wasps are often the most important natural enemies of scales and whiteflies . Parasitoids include many species of *Aphytis* spp., *Coccophagus* spp., *Encarsia* spp., *Eretmocerus* spp. (Hymenoptera : Aphelinidae) and *Metaphycus* spp. ((Hymenoptera : Encyrtidae) (Dreistadt *et al.*,2004).

The aim of this work is to study the diagnosis, abundance and the role of aphelinids in controlling armored scale, soft scale insects and whiteflies.

MATERIALS AND METHODS

A preliminary survey was conducted during 2013-2014 on different host plant infested by different species of armored scale, soft scale insects and whiteflies in Egypt to determine the presence of these pests. In the mean time through this survey the distribution of the aphelinid parasitoids and hyperparasitoids associated with armored scale, soft scale insects and whiteflies. Another survey conducted also during 2013-2014 in 5 governorates to determine the impact of the parasitoids and hyperparasitoids on existing in armored scale, soft scale insects and whiteflies.

Samples of various armored, soft scale insects and whiteflies were collected to study the population dynamics of aphelinids on olive (*Olea europaea*). The selected plants for the present investigation did not receive any chemical control for several years ago before this study. The samples were collected half monthly from in Alexandria, Assuit, Ismailia , Fayoum and Matruh. Each leaf was stored in a well-ventilated emergency glass tube and monitored daily for the emergence of parasitoids.

All armored , soft scales and whiteflies found on the whole area of each leaf were counted and recorded. The parasitism rate was determined by dividing the number of emerging parasitoids by the number of hosts.

RESULTS AND DISCUSSION

1. List of aphelinid parasitoids and hyperparasitoids associated with armored scale, soft scale insects and whiteflies in Egypt:

- 1.1. *Ablerus aegypticus* Abd-Rabou
- 1.2. *A. atomon* (Walker)
- 1.3. *Aphytis chrysomphali* (Mercet)
- 1.4. *A. diaspidis* (Howard)
- 1.5. *A. libanicus* Traboulsi
- 1.6. *Aphytis matruhi* Abd-Rabou
- 1.7. *A. maculicornis* (Mercet)
- 1.8. *A. paramaculicornis* De Bach & Rosen
- 1.9. *Coccophagoides aegypticus* Abd-Rabou
- 1.10. *Coccophagus cowperi* Girault
- 1.11. *C. lycimnia* (Walker)
- 1.12. *C. scutellaris* (Dalman)
- 1.13. *Encarsia aurantii* (Howard)
- 1.14. *E. citrina* (Craw)
- 1.15. *E. inaron* (Walker)
- 1.16. *E. olivina* (Masi)
- 1.17. *Marietta leopardina* Motschulsky

2. Armored scale, soft scale insects and whiteflies of aphelinid parasitoids and hyperparasitoids hosts of olive in Egypt:

- 2.1. Armored scale insects:
 - 2.1.1. *Hemiberlesia lataniae* (Signoret).
 - 2.1.2. *Leucaspis riccae* Targioni –Tozzetti.
 - 2.1.3. *Parlatoria oleae* (Colvée).
- 2.2. Soft scale insects:
 - 2.2.1. *Saissetia oleae* Olivier.
 - 2.2.2. *Saissetia coffeae* (Walker).
- 2.3. Whiteflies:
 - 2.3.1. *Aleurolobus olivinus* (Silvestri)
 - 2.3.2. *Siphoninus phillyreae* (Haliday)

3. Diagnostic and abundance of aphelinid parasitoids and hyperparasitoids in different locations on olive in Egypt:

***Ablerus aegypticus* Abd-Rabou**

Diagnosis: Antennal scape more than 3 times as long as broad, Third funicle segment as long as wide, Club 3.5 times as long as wide. mesoscutum about 1.8 times as long as wide and Marginal fringe 0.5 as long as the width of disc. Mid tibial spur about 1.3 times as long as basitarsus.

Abundance: Only 30 individuals were collected associated with *H. lataniae* in Alexandria during the two years under consideration (Table,1).

Remarks: This species described and recorded in Egypt for the first time by Abd-Rabou (2014).

***Ablerus atomon* (Walker)**

Diagnosis: Antenna 7-segmented (1,1,4,1), first funicle segment 3 times as long as wide, third funicle segment 1.5 times as long as wide; submarginal

vein with one setae, marginal fringe 1.6 times as long as the width of disc; mesoscutum 2-4 pairs of setae.

Abundance: Only 28 individuals were collected associated with *H. lataniae* in Ismailia during the two years under consideration (Table,1).

Remarks: This species was recorded for the first time in Egypt associated with *C. stantophri* by Abd-Rabou (1999).

Aphytis chrysomphali (Mercet)

Diagnosis:. This is a cosmopolitan and uniparental species. Thoracic setae paler, thoracic sterna faintly dusky, with a conspicuous longitudinal median black line on the stem of mesosternal furca. Antennae slender; propodum 0.7 as long as scutellum, 6 times as long as metanotum; non overlapping crenulae.

Abundance: The parasitism was observed for *A. chrysomphali* on *H. lataniae* infesting *O.europaea* at Ismailia. Maximum rate of parasitism reached 22 and 45% with means of 12.7 and 20.7% over 2013 and 2014, respectively. Dates of maximum activity were June 2013 and 2014. The seasonal activity of this parasitoid on *H. lataniae* is presented in (Table,1 and Fig. 1).

Data in Table (2), showed that the simple correlation between percent parasitism of parasitoid, *A. chrysomphali* and the mean number of *H. lataniae* were positive ($r = 0.59376$ and 0.55724) were significant,during 2013 and 2014, respectively. On the other hand, results in Table (2), showed that the simple regression for changing the percent parasitism of parasitoid, *A. chrysomphali* on the mean number of *H. lataniae* were positive ($b = 2.33$ and 2.12) were significant, during 2013 and 2014, respectively.

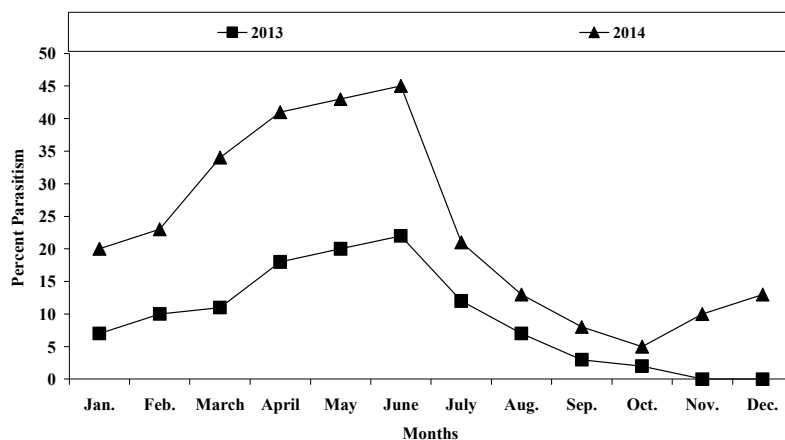


Fig. (1): Percent parasitism of *Aphytis chrysomphali* associated with *Hemiberlesia lataniae* infested olive in Ismailia during 2013 and 2014.

Table (2): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.59376	0.0418	2.33	0.0418
Percent parasitism. 2014	0.55724	0.0598	2.12	0.0598

Remarks: This species was recorded for the first time in Egypt by Abd-Rabou and Hayat (2003). About 13000 individuals of *A.chrysomphali* was released on olive trees infested by *P.oleae* in Northern Coast, the parasitism rates reached maximum 11% (Abd-Rabou, 2001e). Abd-Rabou (2000) recorded the parasitoid, associated with five armored scale insects in different locations in Egypt.

Aphytis diaspidis (Howard)

Diagnosis: This is biparental and uniparental. Occiput with a fuscous to black bar on each side of foramen, the mouth margin and malar sulcus fuscous. Gaster uniformly fuscous or dusky dorsally, with distinct darker cross-bands on terga. Pedicel and flagellum rather uniformly fuscous, tip of club usually blackish, 7 sensilla. Mesoscutum with 16 setae, crenulae usually wider, more rounded and 6 non overlapping. The relative length of the ovipositor 1.3 times as long as midtibia.

Abundance:

The parasitism was observed for *A. diaspidis* on *P.oleae* infesting *O.europaea* at Ismailia. Maximum rate of parasitism reached 30 and 55 % with means of 10.6 and 27.8 % over 2013 and 2014, respectively. Dates of maximum activity were May 2013 and 2014. The seasonal activity of this parasitoid on *P.oleae* is presented in (Table,1and Fig. 2). Data in Table (3), showed that the simple correlation between percent parasitism of parasitoid, *A. diaspidis* and the mean number of *P.oleae* were positive ($r = 0.64360$ and 0.8779) were significant and highly significant,during 2013 and 2014, respectively. On the other hand, results in Table (3), showed that the simple regression for changing the percent parasitism of parasitoid, *A. diaspidis* on the mean number of *P.oleae* were positive ($b = 2.66$ and 5.79) were significant and highly significant, during 2013 and 2014, respectively.

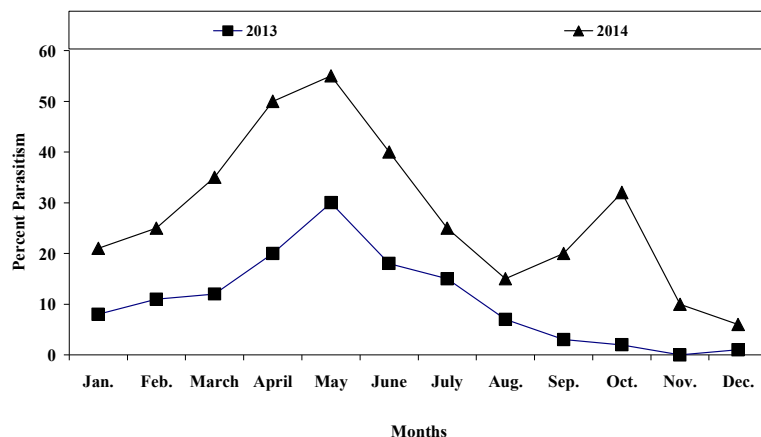


Fig. (2): Percent parasitism of *Aphytis diaspidis* associated with *Parlatoria oleae* infested olive in Ismailia during 2013 and 2014. .

Table (3): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "P"	Regression	Probability "P"
Percent parasitism. 2013	0.64360	0.0239	2.66	0.0239
Percent parasitism. 2014	0.87779	0.0002	5.79	0.0002

Remarks: This species was recorded for the first time in Egypt by Priesner & Hosny (1940). The maximum parasitism rate of *A. diaspidis* on *P.oleae* on *O. europaea* in Northern Coast was 26.1% during May, with an average rates 7.9% (Abd-Rabou,2001e).

***Aphytis libanicus* Traboulsi**

Diagnosis:. This is Mediterranean and biparental species. Occiput without such bars on sides of foramen, mouth margin and malar sulcus usually not fuscous. Propodeal crenulae short, non-overlapping; posterior margin of scutellum pale as rest of scutellum; thoracic setae paler; ovipositor stylets about 1.8 times as long as mid tibia. Mesoscutum 11 setae and marginal fringe 0.2 as long as width of disc.

Abundance: The parasitism was observed for *A. libanicus* on *L. riccae* infesting *O.europaea* at Fayoum. Maximum rate of parasitism reached 29 and 33 % with means of 18.7 and 18.4 % over 2013 and 2014, respectively. Dates of maximum activity were November 2013 and May 2014,

respectively. The seasonal activity of this parasitoid on *L. riccae* is presented in (Table,1and Fig. 3).

Data in Table (4), showed that the simple correlation between percent parasitism of parasitoid, *A. libanicus* and the mean number of *L. riccae* were positive ($r = 0.48027$ and 0.70357) were non-significant and significant,during 2013 and 2014, respectively. On the other hand, results in Table (4), showed that the simple regression for changing the percent parasitism of parasitoid, *A. libanicus* on the mean number of *L. riccae* were positive ($b = 1.73$ and 3.13) were non-significant and significant, during 2013 and 2014, respectively.

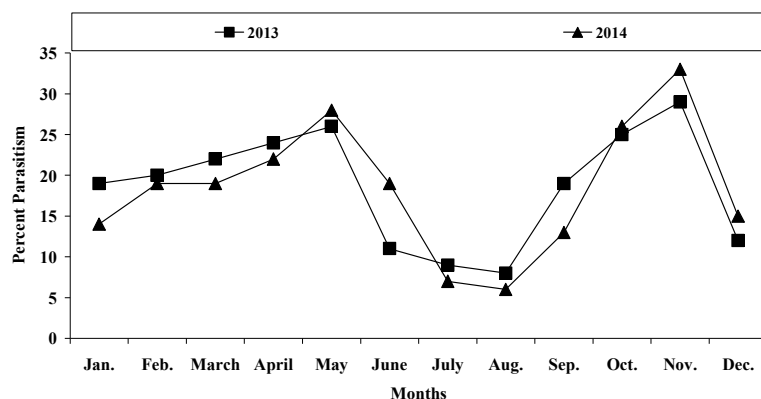


Fig. (3): Percent parasitism of *Aphytis libanicus* associated with *Leucaspis riccae* infested olive in Fayoum during 2013 and 2014.

Table (4): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.48027	0.1140	1.73	0.1140
Percent parasitism. 2014	0.70357	0.0107	3.13	0.0107

Remarks: Abd-Rabou and Hayat (2003) recorded this species for the first time in Egypt. The maximum parasitism rates of *A. libanicus* on *L. riccae* on *O. europaea* in Fayoum was 28.6% during Nov. with an average rates 6.8% (Abd-Rabou, 2001e).

Aphytis maculicornis (Mercet)

Diagnosis: This is palearctic and uniparental species. Occiput with a fuscous to black bar on each side of foramen, the mouth margin and malar sulcus fuscous. Antennal club with basal part paler than funicle, apex blackish, usually more than 3 times as long as broad; pedicel usually twice as long as wide. Mesoscutum 8-10 setae; delta are sometime not clearly separated from row of setae; propodeal crenulae elongate.

Abundance: The parasitism was observed for *A. maculicornis* on *P.oleae* infesting *O.europaea* at Alexandria. Maximum rate of parasitism reached 45 and 25 % with means of 28.4 and 16.2 % over 2013 and 2014, respectively. Dates of maximum activity were July 2013 and 2014. The seasonal activity of this parasitoid on *P.oleae* is presented in (Table,1and Fig. 4).

Data in Table (5), showed that the simple correlation between percent parasitism of parasitoid, *A. maculicornis* and the mean number of *P.oleae* were positive ($r = 0.28280$ and 0.39344) were non significant, during 2013 and 2014, respectively. On the other hand, results in Table (5), showed that the simple regression for changing the percent parasitism of parasitoid, *A. maculicornis* on the mean number of *P.oleae* were positive ($b = 0.93$ and 1.35) were non significant, during 2013 and 2014, respectively.

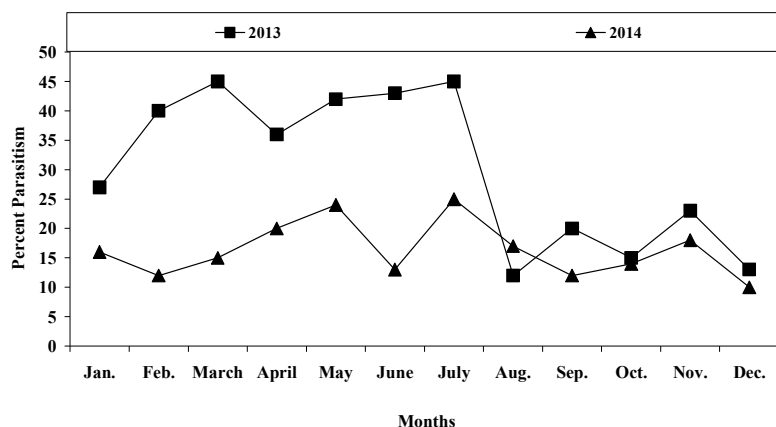


Fig. (4): Percent parasitism of *Aphytis maculicornis* associated with *Parlatoria oleae* infested olive in Alexandria during 2013 and 2014. .

Table (5): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.28280	0.3731	0.93	0.3731
Percent parasitism. 2014	0.39344	0.2058	1.35	0.2058

Remarks: This species was recorded for the first time in Egypt by Priesner and Hosny (1940).

Aphytis matruhi Abd-Rabou

Diagnosis: Biparental species. Body yellow, thoracic setae paler. club 2.8 times as long as wide and 7 sensilla; parapsis 4 setae; axilla 2 setae; scutellum 4 setae; 1.6 times as long as propodeum; anteromedian apodeme robust, metanotum 1.1 times as long as apodeme. Forewing hyaline, 2.6 times as long as wide, veins pale, marginal vein 12 setae, submarginal vein 2 setae, 18 bullae, delta 44 setae in 4 rows, marginal fringe 0.1 as long as width of disk. Basitarsus Ovipositor 1.9 times as long as midtibia.

Abundance: The parasitism was observed for *A. matruhi* on *H. lataniae* infesting *O.europaea* at Matruh. a Maximum rate of parasitism reached 35 and 22 % with means of 21.9 and 14.8 % over 2013 and 2014, respectively. Dates of maximum activity were May 2013 and November 2014, respectively. The seasonal activity of this parasitoid on *H. lataniae* is presented in (Table, 1 and Fig. 5).

Data in Table (6), showed that the simple correlation between percent parasitism of parasitoid, *A. matruhi* and the mean number of *H. lataniae* were positive ($r = 0.66877$) during the first year (2013) and were negative ($r = -0.37353$) during the second year (2014) were non-significant, during 2013 and 2014, respectively. On the other hand, results in Table (6), showed that the simple regression for changing the percent parasitism of parasitoid, *A. matruhi* on the mean number of *H. lataniae* was positive with ($b = 2.84$) during 2013 and negative with ($b = -1.27$) during 2014, were significant and non-significant, during 2013 and 2014, respectively.

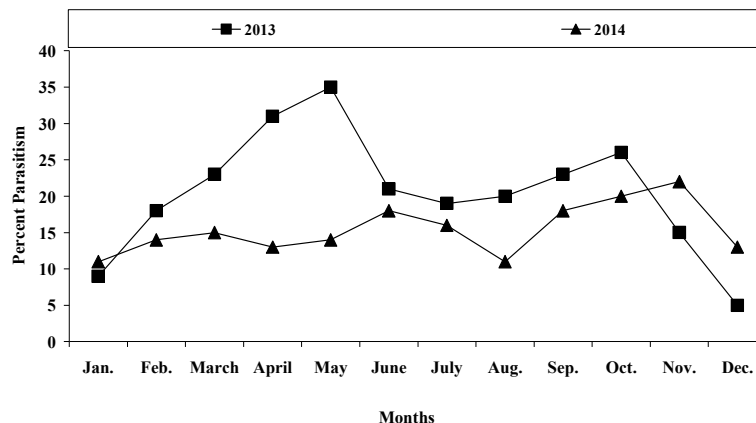


Fig. 5: Percent parasitism of *Aphytis matruhi* associated with *Hemiberlesia lataniae* infested olive in Matruh during 2013 and 2014. .

Table (6): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.66877	0.0174	2.84	0.0174
Percent parasitism. 2014	-0.37353	0.2317	-1.27	0.2317

Remarks: Abd-Rabou (2004a) collected this species for the first time in Egypt.

Aphytis paramaculicornis De Bach & Rosen

Diagnosis: This is biparental and solitary parasitoid species. Occiput with a fuscous to black bar on each side of foramen, the mouth margin and malar sulcus fuscous. Pedicel 1.8 times as long as wide, antennal club with basal part paler than funicle, apex of club usually about 3 times as long as broad; delta 130 setae in 10 rows and mesoscutum 14 setae.

Abundance: Only 53 individuals were collected associated with *P.oleae* in Alexandria during the two years under consideration (Table,1).

Remarks: This species was recorded for the first time in Egypt by Abd-Rabou and Hayat (2003). About 57000 individuals of *A.paramaculicornis* was released on olive trees infested by *P.oleae* in Northern Coast, parasitism rates increased from 7% to 16% (Abd-Rabou, 2001e).

Coccophagoides aegypticus Abd-Rabou

Diagnosis: Body dark brown, except antennae and coxae dark yellow, sensorial in female antennae only of F2 and last segment of club, scutellum with 6 setae, marginal fringe 0.4 of wing of width, midtibial spur longer than basitarsus and ovipositor 1.9 as long as mid tibia.

Abundance: Only 21 individuals were collected associated with *P. oleae* in Alexandria during the two years under consideration (Table,1).

Remarks: This species described and recorded for first from Northern Coast associated that *P. oleae* on *Olea* sp. (Abd-Rabou,2013).

Coccopagus cowperi Girault

Diagnosis: Hind tibia usually entirely yellowish, hind femur black, scutellum entirely yellow, anterior margin more or less black. Scutellum with three pairs of setae, rarely with a few extra setae near cephalic margin. Fore wing hyaline. All coxae usually black or blackish or at least partly so.

Abundance: Only 35 individuals were collected associated with *Saissetia coffeae* (Walker) (Hemiptera: Coccidae) in Matruh during the two years under consideration (Table,1).

Remarks: Abd-Rabou (2004b) impoted, mass reared and released this species for the first time in Egypt associated with *S. coffeae*. The hemispherical soft scale, *S. coffeae* is one of the most important pest attacking olive trees in Egypt. During the period 2001- 2003, a total of about 300000 individuals of the parasitoid, *C. cowperi* obtained from India was released at 35 sites for biological control of *S. coffeae* on olive trees in Egypt. The maximum parasitism rates by these individuals reached 53 and 62%, while, average parasitism rates were 17.2 and 30.8 % in Matruh and El-Arish locations, respectively. The results indicate the establishment of this parasitoid on this important economic insect pest in Egypt.

C. lycimnia (Walker)

Diagnosis: Face and cheeks black to blackish brown thorax black except scutellum entirely or almost entirely yellowish or whitish; antenna 7 segmented (1,1,3,2), first funicle segment longer than pedicel; stigmal vein not swollen, submarginal vein with a row at setae usually more than 5 setae; mesoscutum with numerous setae.

Abundance: The parasitism was observed for *C. lycimnia* on *Saissetia oleae* (Olivier) (Hemiptera: Coccidae) infesting *O. europaea* at Alexandria. Maximum rate of parasitism reached 27 and 13 % with means of 14.4 and 8.4 % over 2013 and 2014, respectively. Dates of maximum activity were May 2013 and 2014. The seasonal activity of this parasitoid on *S. oleae* is presented in (Table,1 and Fig. 6).

Data in Table (7), showed that the simple correlation between percent parasitism of parasitoid, *C. lycimnia* and the mean number of *S. oleae* were positive ($r = 0.88882$ and 0.68563) were highly significant and significant, during 2013 and 2014, respectively. On the other hand, results in Table (7), showed that the simple regression for changing the percent parasitism of parasitoid, *C. lycimnia* on the mean number of *S. oleae* were positive ($b = 6.13$ and 2.98) were highly significant and significant, during 2013 and 2014, respectively.

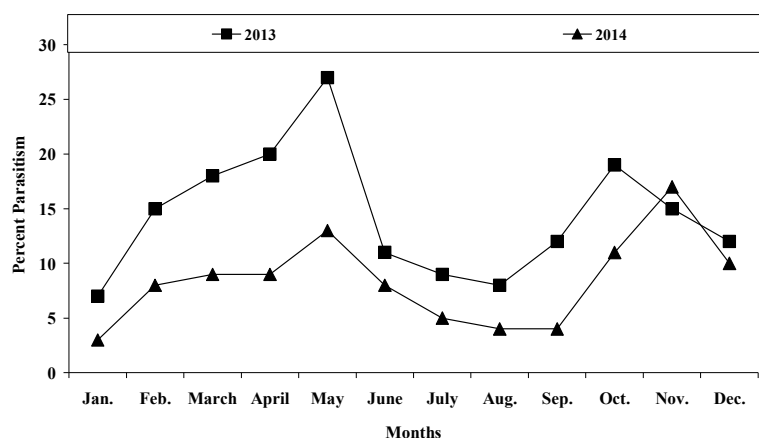


Fig. (6): Percent parasitism of *Coccophagus lycimnia* associated with *Saissetia oleae* infested olive in Alexandria during 2013 and 2014. .

Table (7): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.88882	0.0001	6.13	0.0001
Percent parasitism. 2014	0.68563	0.0138	2.98	0.0138

Remarks: This species was collected for the first time in Egypt associated with *Coccus hesperidum* Linnaeus (Hemiptera: Coccidae) by Abd-Rabou *et al.* (1999). *C. lycimnia* one of the most effective parasitoids associated with *S. oleae* in different localities in Egypt (Abd-Rabou, 2001a). Also *C. lycimnia* appeared to be quite important parasitoids of *S.coffeae* in Alexandria and Northern Coast with average parasitism rates of 8.3 and 10.8% and the maximum parasitism rates were 28 and 26% during November in Northern Coast and Alexandria, respectively (Abd-Rabou, 2001c).

***C. scutellaris* (Dalman)**

Diagnosis: Scutellum with numerus setae, fore coxa yellow. First funicle segment more than twice as long as wide and first club segment longer than wide.

Abundance: The parasitism was observed for *C. scutellaris* on *S. oleae* infesting *O.europaea* at Assuit. Maximum rate of parasitism reached 28 and 23 % with means of 14.2 and 16.0 % over 2013 and 2014, respectively. Dates of maximum activity were November 2013 and 2014. The seasonal activity of this parasitoid on *S. oleae* is presented in (Table,1and Fig. 7).

Data in Table (8), showed that the simple correlation between percent parasitism of parasitoid, *C. scutellaris* and the mean number of *S. oleae* were positive ($r = 0.26711$ and 0.40868) were non significant, during 2013 and 2014, respectively. On the other hand, results in Table (8), showed that the simple regression for changing the percent parasitism of parasitoid, *C. scutellaris* on the mean number of *S. oleae* were positive ($b = 0.88$ and 1.42) were non significant, during 2013 and 2014, respectively.

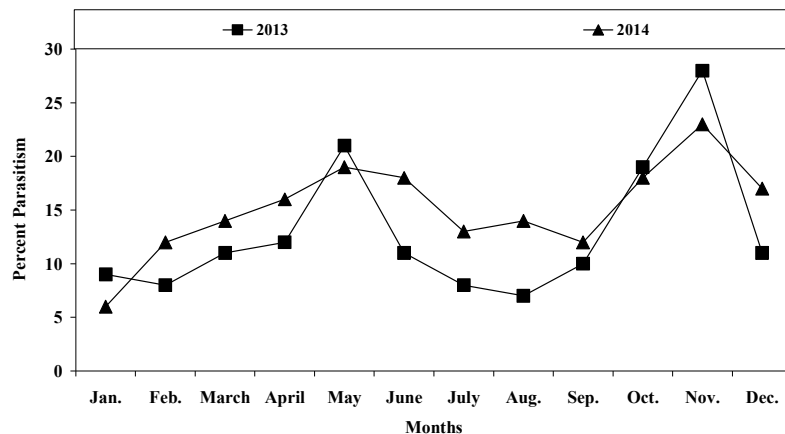


Fig. (7): Percent parasitism of *Coccophagus scutellaris* associated with *Saissetia oleae* infested olive in Assuit during 2013 and 2014.

Table (8): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.26711	0.4013	0.88	0.4013
Percent parasitism. 2014	0.40868	0.1872	1.42	0.1872

Remarks: This species collected for the first time in Egypt by Priesner and Hosny (1940). This species is one of the best known species of the family Aphelinidae. *C.scutellaris* recorded in Alexandria by Priesner and Hosny

(1940) parasitizing *C. hesperidum* and *Pulvinaria floccifera* (Westwood) on *Citrus* sp. and *Ficus* sp., respectively. Recently Abd-Rabou (2002) recorded this species attacking 6 species of soft scales, mentioned that the maximum parasitism rates of this species on *S. coffeae* and *S. oleae* reached 26 and 22%, respectively. Abd-Rabou *et al.* (1999) found it in Gharbiya, where the percentage parasitism on *P.guajava* was 1.1%, with a peak of 7% in Nov. *Encarsia aurantii* (Howard)

Diagnosis: Face without dark brown cross bands above the toruli, gaster except apex of T7, largely brown to dark brown. Side lobes of mesoscutum each with two or fewer setae. Antennal club 3-segmented, ovipositor very short, clearly much shorter than mid tibia.

Abundance: The parasitism was observed for *E. aurantii* on *P.oleae* infesting *O. europaea* at Alexandria. Maximum rate of parasitism reached 35 and 34 % with means of 10.8 and 10.8 % over 2013 and 2014, respectively. Dates of maximum activity were May 2013 and November 2014. The seasonal activity of this parasitoid on *P.oleae* is presented in (Table,1and Fig. 8).

Data in Table (9), showed that the simple correlation between percent parasitism of parasitoid, *E. aurantii* and the mean number of *P.oleae* were positive ($r = 0.41186$) during 2013 and negative with ($r = -0.37763$) during 2014 were non significant, during 2013 and 2014, respectively. On the other hand, results in Table (9), showed that the simple regression for changing the percent parasitism of parasitoid, *E. aurantii* on the mean number of *P.oleae* were positive ($b = 1.43$) during 2013 and negative with ($b = -1.9$) during 2014 were non significant, during 2013 and 2014, respectively.

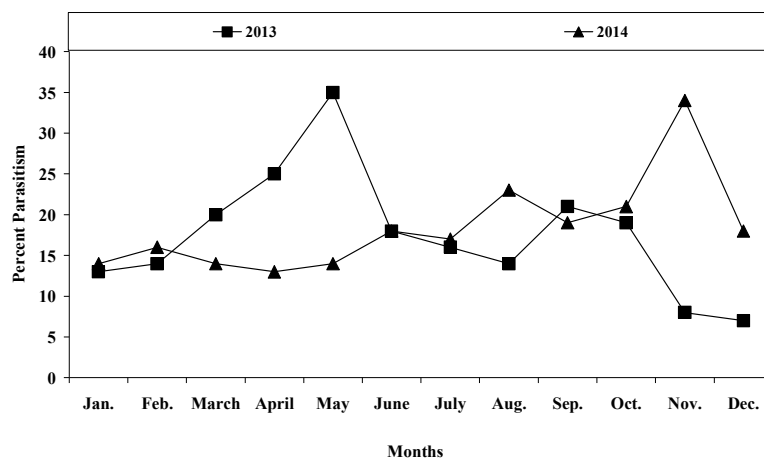


Fig. (8): Percent parasitism of *Encarsia aurantii* associated with *Parlatoria oleae* infested olive in Alexandria during 2013 and 2014.

Table (9): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.41186	0.1834	1.43	0.1834
Percent parasitism. 2014	-0.37763	0.2262	-1.29	0.2262

Remarks: This species was recorded for the first time in Egypt by Hafez (1988). About 44000 individuals of *E. aurantii* was released on olive trees infested by *P. oleae* in Northern Coast, the parasitism rates increased from 44% to 71% (Abd-Rabou, 2001e).

***Encarsia citrina* (Craw)**

Diagnosis: Body largely pale. Longest seta on marginal fringe of fore wing less than the maximum width of wing disc. Submarginal vein of fore wing with 2 setae.

Abundance: The parasitism was observed for *E. citrina* on *L. riccae* infesting *O. europaea* at Fayoum. Maximum rate of parasitism reached 12 and 9 % with means of 5.3 and 2.5% over 2013 and 2014, respectively. Dates of maximum activity were May 2013 and November 2014. The seasonal activity of this parasitoid on *P. oleae* is presented in (Table,1and Fig. 9).

Data in Table (10), showed that the simple correlation between percent parasitism of parasitoid, *E. citrina* and the mean number of *L. riccae* were positive ($r = 0.05991$ and 0.21467) were non significant, during 2013 and 2014, respectively. On the other hand, results in Table (10), showed that the simple regression for changing the percent parasitism of parasitoid, *E. citrina* on the mean number of *L. riccae* were positive ($b = 0.19$ and 0.70) were non significant, during 2013 and 2014, respectively.

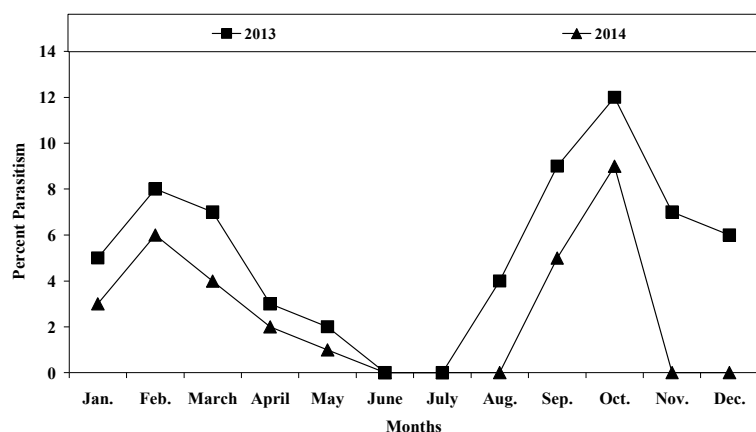


Fig. (9): Percent parasitism of *Encarsia citrina* associated with *Leucaspis riccae* infested olive in Fayoum during 2013 and 2014.

Table (10): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.05991	0.8533	0.19	0.8533
Percent parasitism. 2014	0.21467	0.5028	0.70	0.5028

Remarks: This species was recorded for the first time in Egypt by Priesner & Hosny (1940). Abd-Rabou (1997) mentioned that *E. citrina* should be considered a promising candidate for utilization in biological control of armored scale insects in Egypt. This species was reared from 8 species of diaspidid scale insects and maximum parasitism rates ranged between 23 and 65%.

***Encarsia inaron* (Walker)**

Diagnosis: Head, thorax and gaster brown to black. Female with antennal club 2-segmented. Mesoscutum 12 setae. Stigmal vein of fore wing without an evident a setose area proximally. At least one small seta proximal to the stigmal vein. F1 with at least one longitudinal sensillum. Male antenna 8-segmented. Fifth and sixth funicular segments of male antenna separate.

Abundance: The parasitism was observed for *E. inaron* on *S. phillyreae* infesting *O.europaea* at Fayoum. Maximum rate of parasitism reached 58 and 39 % with means of 38.9 and 23.3% over 2013 and 2014, respectively. Dates of maximum activity were May 2013 and November 2014. The seasonal

activity of this parasitoid on *S. phillyreae* is presented in (Table,1and Fig. 10).

Data in Table (11), showed that the simple correlation between percent parasitism of parasitoid, *E. inaron* and the mean number of *S. phillyreae* were positive ($r = 0.68318$ and 0.38675) were significant and non-significant,during 2013 and 2014, respectively. On the other hand, results in Table (11), showed that the simple regression for changing the percent parasitism of parasitoid, *E. inaron* on the mean number of *S. phillyreae* were positive ($b = 2.96$ and 1.33) were significant and non-significant, during 2013 and 2014, respectively.

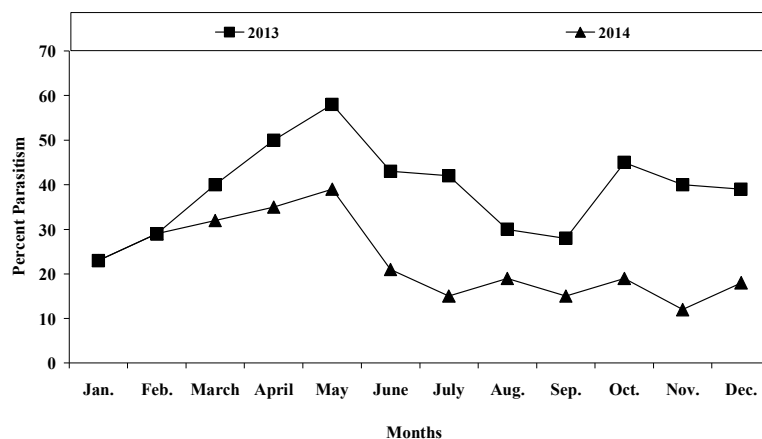


Fig. (10): Percent parasitism of *Encarsia inaron* associated with *Siphoninus phillyreae* infested olive in Fayoum.during 2013 and 2014.

Table (11): Simple correlation and regression values of the population dynamics of insect and its parasitoids within 2013 and 2014.

Variable	Simple correlation "r"	Probability "p"	Regression	Probability "p"
Percent parasitism. 2013	0.68318	0.0143	2.96	0.0143
Percent parasitism. 2014	0.38675	0.2143	1.33	0.2143

Remarks: This species was recorded for the first time in Egypt by Priesner & Hosny (1940). Abd-Rabou (1998) concluded that the parasitoid *E. inaron* has some potential for suppressing population of *S. phillyreae* on pomegranate. Later Abd-Rabou (2001d) recorded two strains of *E. inaron* in Egypt and he

reared, released and evaluated these strains on *Punica granatum* and *Ricinus communis* in different localities in Egypt.

***E. olivina* (Masi)**

Diagnosis: Gaster mostly blackish, antenna with narrow scape, about 4 times as long as wide, second and third funicle segments subcylindrical each about twice as long as wide, club 3-segmented, about 1/5 longer and slightly wide than funicle, each segment about as long as third funicle segment.

Abundance: Only 30 individuals were collected associated with *A. olivinus* in Fayoum during the two years under consideration (Table,1).

Remarks: This species was recorded for the first time in Egypt by Abd-Rabou (1999).

***Marietta leopardina* Motschulsky**

Diagnosis: Antennal scape less than 6 times as long as wide, or with one or two brownish bands or spots; antennal scape with the band short; extending caudad from about middle of ventral margin; propodeum distinctly shorter than, metanotum; apex of fore wing without infusate band in middle, mesoscutum 4 setae.

Abundance: Only 25 individuals were collected associated with *H. lataniae* in Ismailia during the two years under consideration (Table,1).

Remarks: This species was recorded for the first time in Egypt by Priesner and Hosny (1940). This species is a hyperparasitoid of different species of armored and soft scale insects in Egypt (Abd-Rabou, 2003c). He mentioned that *M.leopardina* was reared out of 48 Hemiptera and scales parasitic Hymenoptera species. The survey covered 16 governorates in Egypt. Classically orders, families and species of the host insects associated with this hyperparasitoid are given together with locality and month of abundance.

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الطفيليات الأولية و الثانوية من فصيلة الافيليند والتي تتطفل على الحشرات القشرية المسلحة والرخوة والذباب الأبيض على الزيتون فى مصر.
ناديه عبدالله على
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى- جيزة - مصر

تعتبر مجموعة الأفيليند من أهم الطفيليات التى تكافح آفات الحشرات القشرية المسلحة والرخوة والذباب الأبيض فى مصر. هذا البحث يتضمن أهم الصفات التصنيفية والتوزيع الموسمى لهذه المجموعة ودورها فى مكافحة الحشرات القشرية المسلحة والرخوة والذباب الأبيض على الزيتون. وقد أشارت النتائج الى تسجيل ١٧ نوع من هذه الطفيليات الأولية و الثانوية التى تتطفل على ٧ أنواع من الحشرات القشرية المسلحة والرخوة والذباب الأبيض وموزعة فى ٥ محافظات وهى الأسكندرية وأسيوط والأسماعيلية و الفيوم ومرسى مطروح. أما نسب التطفل بهذه الطفيليات على الحشرات القشرية المسلحة تراوحت بين ١٢-٥٩% اثناء سنتى الدراسة اما بالنسبة للحشرات الرخوة والذباب الأبيض فقد تراوحت نسب التطفل بين ١٣-٢٨% و ٣٩-٥٨% اثناء سنتى الدراسة على الترتيب. ويتضح من هذه النتائج ان هذه المجموعة من طفيليات الأفيليند لها دور فعال فى مكافحة الحشرات القشرية المسلحة والرخوة والذباب الأبيض فى مصر.

Table (1): Percentage of parasitism on armored scale insects, soft scale insects and whiteflies in different Governorates.

Governorate	Percentage of Parasitism on														
	Armored Scale Insects					Soft Scale Insects					Whiteflies				
	Species		Parasitoid		% Parasitism	Species		Parasitoid		% Parasitism	Species		Parasitoid		% Parasitism
Pest	Hemiberlesia lataniae	Parasitoid	Ablerus aegypticus	2013	2014	Pest	Saissetia oleae	Parasitoid	Coccopagus lycimnia	2013	2014	Pest	Parasitoid	2013	2014
Alexandria	Hemiberlesia lataniae	Ablerus aegypticus	30 Ind.	30	13	Saissetia oleae	Coccopagus lycimnia	27	13						
	Parlatoria oleae	Aphytis maculicornis	28.4	16.2											
	Parlatoria oleae	Aphytis paramaculicornis	53 Ind.												
	Parlatoria oleae	Coccophagoides aegypticus	21 Ind.												
	Parlatoria oleae	Encarsia auranitii	10.8	10.8											
Assuit						Saissetia oleae	Coccopagus scutellaris	14.2	16.0						
Ismailia	Hemiberlesia lataniae	Ablerus atomon	28 Ind.												
	Hemiberlesia Lataniae	Aphytis chrysomphali	12.7	20.7											
	Parlatoria oleae	Aphytis diaspidis	10.6	27.8											
	Hemiberlesia lataniae	Marletta leopardina	25 Ind.												
Fayoum	Leucaspis riccae	Aphytis libanicus	18.7	18.4								Siphoninus phillyreae	Encarsia inaron	38.9	23.3
	Leucaspis riccae	Encarsia citrina	5.3	2.5								Aleurolobus olivinus	Encarsia olivina	30 Ind.	
Matruh	Hemiberlesia lataniae	Aphytis matruhi	21.9	14.8											
Matruh						Saissetia coffeae	Coccopagus cowperi	35 Ind.							

Ind.: Individuals

