

Predators of scale insects (Hemiptera: Coccoidea) and their role in control in Egypt.

Abd-Rabou, S.; Ahmed, N. and Moustafa, M.

Plant Protection Research Institute, Agriculture Research Center, Dokki, Giza, Egypt

ABSTRACT

Predators are one of the most important bioagents in natural and biological control of scale insects (Hemiptera: Coccoidea). This review includes the literatures of Egyptian scale insects predators including lists of armored scale insects, soft scale insects, mealybugs and other scale insects families predators.

Keywords: Predators of scale insects, control, Egypt

INTRODUCTION

Predators is a major component of natural control and integrated pest management programs of scale insects (Hemiptera: Coccoidea). A predator is an organism that attacks, kills, and feeds on several to many other individuals in its lifetime. Scales are often controlled by predators as beetles, bugs, lacewings and mites. The ladybird beetle, *Rodolia cardinalis* (Mulsant) is one of the most important one as scale insects predators. Predation by *Chilocorus*, *Hyperaspis* and *Rhyzobius* species lady beetles (ladybugs) can easily be overlooked because they are tiny, colored and shaped like scales or feed beneath scales. *Hyperaspis* species are tiny, shiny, black lady beetles with several red, orange or yellow spots on the back. *Rhyzobius lophanthae* has a reddish head, underside and a grayish back densely covered with tiny hairs. The present review includes the role of predators in controlling scale insects in Egypt.

RESULTS

1. Predators of armored scale insects in Egypt:

1.1. list of recorded predators of armored scale insects in Egypt:

Coleoptera: Coccinellidae

1. *Chilocorus bipustulatus* L.
2. *Coccinella undecimpunctata* L.
3. *Exochomus flavipes* Thunb.
4. *Pharoscygnus various* Kirsch.
5. *Rhyzobius lophanthae* (Blaisdell)
6. *Rodalia cardinals* Muls
7. *Scymnus syriacus* Mars.
8. *Stethorus* sp.

Hemiptera: Anthocoridae

9. *Orius laevigatus* Fieb.

Neuroptera: Chrysopidae

10. *Chrysoperlla carnae* Steph.

11. *Chrysopa vulgaris* L

Acarina: Phytoseiidae

12. *Typhlodromus* sp.

1.2. Abundance of recorded predators of armored scale insects in Egypt:

Osman (1971) found that *Mycetaspis personata* (Comstock) (Hemiptera: Diaspididae) was predated by *Chrysopa vulgaris*. Hamed and Fawzi (1991) carried out a survey on the predators of important scale insects. They recorded nine predators belonging to Coccinellidae and Chrysopidae. Eight predaceous insect species and seven predatory mite species were reported on branches infested with *Parlatoria oleae* Colvee from different host plants at different locations (Asfoor, 1997). Morsi (1999) recorded eleven predators and eight predaceous mites on 7 armored scale insects. *Chilocorus bipustulatus* L. (Coleoptera: Coccinellidae) was found to be the most promising predator of armored scale insects (Abd-Rabou, 2001). Predatory mite *Typhlodromus* sp. and coccinellid species were found associated with *Aonidiella aurantii* Maskell (Mohamed, 2002). Tawfik *et al.* (1970) recorded the insect predators associated with the black scale, *Chrysomphalus ficus* Ashmead in Egypt. These predators were *C. bipustulatus*, *Scymnus syriacus* Muls., *Pharoscymnus varius* Kirsch., *R. cardinalis*. The larvae of *Chrysopa carnea* Steph. (Neuroptera: Chrysopidae) and *C. bipustulatus* seemed to be the most important predators of this scale infesting citrus orchard. They were obtained in considerable numbers especially in May, June and August. Larvae and adults of these predators were observed feeding on different stages of *C. ficus*. *R. cardinalis* occurred in moderate numbers in infested citrus orchards. The latania scale, *Hemiberlesia lataniae* (Signoret) (Hemiptera: Diaspididae) had 9 species of predators. They were: *C. bipustulatus*, *C. carnae*, *Coccinella undecimpunctata* L., *Exochomus flavipes* Thunb. *R. cardinalis*, *Scymnus syriacus* Mars. (Coleoptera: Coccinellidae); *Orius laevigatus* Fieb. (Hemiptera: Anthocoridae), *Pharoscymnus varius* Kirsch. and *Syrphus corollae* Fabricius (Diptera: Syrphidae) (Moustafa and Abd-Rabou, 2011). The insect population of *Parlatoria oleae* Leonardi (Hemiptera: Diaspididae) and the predator *C. bipustulatus* L. reached maximum during February and March over two years, respectively (Abd-Rabou and Ahmed, 2011).

2. Predators of soft scale insects in Egypt:

2.1. List of recorded soft scale insects predators in Egypt:

Coleoptera : Coccinellidae

1. *Chilocorus bipustulatus* L.
2. *Clitostethus arcuatus* Rossi
3. *Coccinella septempunctata* L.
4. *Coccinella undecimpunctata* L
5. *Cydonia vicina isis* Cr.
6. *Cydonia vicina nilotica* Muls.
7. *Exochomus flavipes* Thunb
8. *Pharoscymnus varius* Kirsch.
9. *Rhyzobius lophanthae* (Blaisdell)
10. *Rhyzobius littura* Fab.
11. *Rodalia cardinalis* Muls
12. *Scymnus interruptus* Goeze
13. *Scymnus seriacus* Mars.
14. *Stethorus* sp.

Coleoptera : Steaphilinidae

15. *Paederus alfieri* Koch

Diptera: Syrphidae

16. *Metasyrphus corollae* Fab.
17. *Paragus compeaitus* Wied.

Hemiptera: Anthocoridae18. *Orius laevigatus* Fieb.19. *Orius albidipennis* (Reuter)**Neuroptera: Chrysopidae**20. *Chrysoperlla carnae* Steph.21. *Chrysopa septempunctata* Wesm.22. *Chrysopa vulgaris aegyptica* (Schneider)***Neuroptera: Phloeothripidae**23. *Haplothrips andresi* Priesner**2.2. Abundance of soft scale insects predators in Egypt:**

Abd Allah (1988) recorded that coleopterous predators fed on soft scales infesting citrus, mango and ledge plants in Mansoura region were *Cydonia vicina isis* Cr., *C. v. nilotica* Muls., *Coccinella septempunctata* L., *C. undecimpunctata*, *Scymnus interruptus* Goez, *S. cyriacus*, *Exochomus flavipes* Thunb., *R. cardinalis* and *Paederus alfieri* Koch. He added two neuropetrous predators, *C. carnea* and *C. septempunctata* Wesm.; two hemipterous predators, *Orius laevigatus* Fieb. and *O. albidipennis* and two dipterous predators, *Metasyrphus corollae* Fab. and *Paragus compeaitus* Wied. The predators, *C. bipustulatus*, *S. syriacus*, *Pharaoscymnus* Varius Kirsch and *R. cardinalis* were found feeding on some soft scale insects. *Chrysop* sp. larvae were very common and polyphagous predators feeding on many soft scale insects (Hamed and Hassanein, 1991). *C. bipustulatus*, *S. syriacus*, *C. carnea*, *C. septempunctata* and *Orius laevigatus* Fab. were recorded associated with different species of soft scale insects in Kafr El-Sheikh (El-Agamy *et al.*, 1994). El-Batan (1997) investigated the searching behavior of larvae of *Exochomus flavipes* (Thunberg) and *C. carnea* for *Coccus hesperidum* L. She found that larvae of *C. carnea* and early instars (1st and 2nd) of *E. flavipes* showed equal searching capacity for *C. hesperidum* placed on both the top and bottom surfaces of galss plates. The 3rd and 4th larval instars of *E. flavipes* showed a preference for prey attached to the bottom surface. Before contacting prey, straved 3rd instar larvae of *C. carnea* and 4th instar larvae of *E. flavipes* searched relatively rapidly with a low turning rate. After contacting prey, searching speed decreased and turning rate increased by about double fold. Hendawy (1999) mentioned that the highest peak of soft scale insects was detected in November, which coincided with the highest peak of predator. Then the population of predators gradually declined and peaked in May before the peak of scale insects. However, the last peak of the predators occurred during August, directly after a peak of scale insects. He concluded that, peaks of scale insects and those of the predators were coincided. *Scymnus syriacus* Marseul was recorded as a predator of *C. rusci* (Morsi, 1999). Badari (2002) recorded 19 predators of *Saissetia oleae* Olivier and studied the population dynamics of six of them. They were *C. bipustulatus*, *C. carnea*, *C. undecimpunctata* (L.), *E. flavipes*, *Orius* sp. and *Scymnus syriacus* Marseul. Two peaks were recorded annually for *C. bipustulatus* and *C. undecimpunctata* while one peak in case of *C. carnae* and *S. syriacus*, *E. flavips* and *Orius* sp. were recorded as a low population throughout the two years under considerations. Badary (2011) stated taht genus *Saissetia* was recorded associated with 16 predator species. Numbers by the predator *Scymnus syriacus* Mars., (Coleoptera: Coccinellidae) reached maximum (2/60 leaves) during August, in the first year and during September in the second year. The predators, *Coccinella undecimpunctata* L. and *E. flavipes* reached maximum of 5.8 and 28/ 60 leaves and 30 twigs during September and August, in the first year, respectively and 24, 19.4 and 22 / 60 leaves and 30 twigs during September in the second year, respectively.

Abd-Rabou and Badary (2010) recorded the predator, *S. syriacus* on the niger scale, *Parasaissetia nigra* (Nietner) (Hemiptera: Coccidae) in Egypt.

The abundance of the predator, *S. syriacus* of *Saissetia coffeae* (Walker) (Hemiptera: Coccidae) reached maximum during October during two successive years. The predator *E. flavipes* (Coleoptera: Coccinellidae) reached maximum during October during two successive years, respectively (Abd-Rabou and Ahmed, 2011).

2.3. Applied biocontrol using predators of soft scale insects in Egypt:

Six releases of the predator, *E. flavipes* on the green shield scale, *Pulvinaria psidii* Maskell (Hemiptera: Coccidae) on guava trees in Gahrbiya was conducted. This predator was reared under defined climatic conditions (25–27°C and 65–75% RH) in the laboratory. A significant reduction in the number of *P. psidii* population was recorded compared with control plots. Six months after the release, the average population of *P. psidii* was decreased from 1897 to 475/30 leaves in the treated plot. The present study indicated that *E. flavipes* is a potential biocontrol agent of *P. psidii* on guava in Egypt (Abd-Rabou, 2011).

3. Predators of mealybugs in Egypt:

3.1. List of reported predators of mealybugs in Egypt:

Coleoptera : Coccinellidae

1. *Cryptolaemus montrouzieri* Mulsant
2. *Rodolia cardinalis* (Muls.)
3. *Scymnus interruptus* Goeze
4. *Scymnus seriacus* Mars.

Diptera: Cecidomyiidae

5. *Diadiplosia* sp.

Lepidoptera: Noctuidae

6. *Autoba beraudi* Joannis
7. *Autoba gaynceri* Rothschild
8. *Rivula sericealis* Scop.

Lepidoptera: Oecophoridae

9. *Stathmopoda auriferella* Mayr.

Neuroptera: Chrysopidae

10. *Chrysopa vulgaris aegyptica* (Schneider)

3.2. Abundance of predators of mealybugs in Egypt:

Osman (1972) recorded *R. cardinalis* as a predator of the margarodid, *Icerya purchasi* Maskell. The predators, *Scymnus includens* Kirck, *Cryptolaemus montrouzieri* Muls, *C. carnae*, *Sympherobius amicus* Navas and *Hyperaspis vincigurrae* associated with the pseudococcid *F. virgata* (Rashad, 1975). The predators, *Scymnus interruptus* Goez. and *P. varius* were recorded associated with *Pseudococcus* sp. (Osman, 1977). Hamid and Hassanian (1991) recorded *S. interruptus* associated with *Saccharicoccus sacchari* (Cockerell) and *R. cardinalis* associated with the margarodids, *I. purchasi* and *Icerya* spp. Moustafa (2012) recorded *R. cardinalis* associated with the seychellarum mealybug, *Icerya seychellarum* (Westwood) on citrus trees in Demmyat. Nine species of predators were recorded to attack the citrus mealy bug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae). These species were 3 coleopteran species, one dipteran, four lepidopterans and one neuropteran (Ahmed and Abd-Rabou, 2010).

3.3. Applied biocontrol using predators of mealybugs in Egypt:

Biological control measures against mealybugs using *C. montrouzieri* started in 1926. It was reared and distributed on a limited scale (as its rearing was time consuming). The insect fed freely on various species of mealybugs. Due to its low

reproductive potential, slow spreading, the necessary protection to stand our winter condition and the annual release of new colonies, the work on this predator species was abandoned (Kamal, 1951). Second trial to introduce and rear this coccinellid predator from France to Egypt was conducted. Releasing *C. montrouzieri* against the striped mealybug, *Ferrisia virgata* gave a positive effect in reduction of the mealybug population. The percent of reduction reached to 100.0, 98.9 and 94.4% for crawlers, nymphs and adults of *F. virgata*, respectively after 3 months of release (Attia and El Arnaouty, 2007). The coccinellid predator, *C. montrouzieri* was used to control the citrus mealybug, *Planococcus citri* (Risso.) (Hemiptera: Pseudococcidae) on the croton ornamental shrubs, *Codiaeum variegatum* L. at Giza governorate, Egypt. *C. montrouzieri* as 50 adults/Croton shrub, were released once on October 27, 2008 in the open field. Obtained results indicated that percentages of reduction among the egg masses, nymphs and adults of *P. citri*, one month after releasing the predator reached to 41.5, 42.3 and 57.5%, respectively. Two months later, the corresponding rates were 80.6, 86.5 and 91.5%. Finally, after three months of releasing the predator, reduction rates reached to 100% for all stages of the pest (Afifi *et al.*, 2010).

4. Predators of other families of scale insects:

Moustafa (2012a) recorded two species of predators attacked the red date scale, *Phoenicococcus marlatti* Cockerell (Hemiptera:Phoenicococcidae). These species belonging to Order: Coleoptera, Family Coccinellidae, *Pharoscymnus varius* (Kirsch) and *Scymnus punetillum* Weise. The predator recorded in El-Arish region was *P. varius*. During the first year (2009-2010). No occurrence of predators was noticed from October 15th 2009 to February 15th 2010. The population reached its maximum numbers of individuals as 62 individuals /sample. During the second year (2010-2011) no occurrence of predators was noticed from November 1st to February 15th 2011. The population reached maximum numbers of individuals 58 individuals per samples. Ahmed (2011) recorded three species of predators attacked *Pollinia pollini* (Costa) (Hemiptera: Asterolecanidea) in Egypt. These were the coccinellids, *Coccinella undecimpunctata* L., *Scymnus seriacus* Mars. and the Neuroptera species, *C. carnae* Moustafa and Abd-Rabou (2010) recorded seven species of predators attacked, the guava soft scale, *Pulvinaria psidii* (Maskell) (Hemiptera : Coccidae) .

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ARABIC SUMMARY

مفترسات الحشرات القشرية ودورها في المكافحة في مصر

شعبان عبدربه و نها أحمد و منى مصطفى
معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى- جيزة – مصر

المفترسات من أهم العناصر البيولوجية في الطبيعة و المكافحة البيولوجية للحشرات القشرية. هذا المقال تضمن المراجع العلمية التي لها علاقة بمفترسات الحشرات القشرية المسلحة و الحشرات الرخوة و البق الدقيقى وبعض فصائل الحشرات القشرية الأخرى في مصر.