الأعداء الطبيعية للحشرات (Hemiptera:Coccidae) القشرية الرخوة على أشجار البساتين في المنطقة الجنوبية والساحلية السورية

عبد النبي بشير* **هشام الرز***

علاء صالح**

الملخص

دُرست الأعداء الطبيعية لبعض الحشرات القشرية اللينة التي تصيب أشجار بساتين (اللوز، التين، الزيتون والحمضيات) بين عامي 2015 و2017، وسُجلت الحشرات القشرية اللينة التالية: حشرة الفواكه القشرية على اللوز *Parthenolecanium corni* (Bouché) في ريف دمشق والقنيطرة، وحشرة الزيتون القشرية *Saissetia oleae* (Olivier) على الزيتون، وحشرة التين الشمعية *Ceroplastes rusci* L. على التين في محافظة القنيطرة، وقشرية الحمضيات الرمادية *Coccus pseudomagnoliarum* (Kuwana) وقشرية الحمضيات البنية *Coccus hesperidum* (Linnaeus) على أشجار الحمضيات في محافظة اللاذقية. كما وسُجلت المفترسات التالية من رتبة غمديات الاجنحة Coleoptera وفصيلة Coccinellidae *Chilocorus bipustulatus*، *Rhyzobius lophanthae* (Blaisdell), *Exochomus quadripustulatus L.*، *Pharoscymnus* sp. *Nephus redtenbacheri* (Mulsant) *Nephus bipunctatus* *Scymnus coniferarum* *Nephus quadrimaculatus* (Herbst) (Kugelann)

* أستاذ في قسم وقاية النبات، كلية الهندسة الزراعية، جامعة دمشق.

** مركز بحوث ودراسات المكافحة الحيوية. كلية الهندسة الزراعية. جامعة دمشق.

(Crotch)، *Scymnus rubromaculatus* (Goeze)، *Scymnus abietis* (Paykull)، *Scymnus* sp. و. وأيضاً *Eublemma scitula* (Rambur)، *Calymma communimacula* من رتبة حرشفيات الأجنحة وفصيلة Noctuidae، وأسد المَنْ *Chrysoperla carnea* (Stephens) و *Dichochrysa astur* (Banks) الذي يتبع لرتبة Neuroptera وفصيلة Chrysopidae و(Linnaeus) *Hemerobius humulinus* من فصيلة Hemeropiidae ، كما حُددت المتطفلات الحشرية التالية من فوق رتبة الكالسيدات Chalcidoidea وفصيلة Encyrtidae وهي: *Metaphycus helvolus* (Compere) ، *Blastothrix longipennis* (Howard)، *M. insidiosus* (Mercet), *Anagyrus kamali* (Moursi)، *Discodes coccophagus* (Ratzeburg)، *Cheiloneurus claviger* (Thomson) *Cerapterocerus mirabilis*، *Encyrtus aurantii* (Geoffroy), *Encyrtus* sp., (Westwood)، *Homalotylus* sp.,*flaminius* (Dalman), *Metaphycus flavus* ، *Microterys nietneri* (Motschulsky). و ، (Schlupfwespe) ومن فصيلة Aphelinidae *C.semicircularis* (Förster), *Coccophagus lycimnia* (Walker)، *Marietta picta* (André)، و*Ablerus* sp. Annecke). ومن فصيلة Eriaporidae: *Promuscidea unfasciativentris* (Girault)، ومن فصيلة Eulophidae:. *Tetrastichus* sp ، *Elasmus platyedrae* (Ferrière) و(Girault) *Aprostocetus ceroplastae* ومن فصيلة Pteromalidae: *Scutellista nigra* (Mercet)، *S. caerulea* (Fonscolombe) و *Pachyneuron muscarum* (Linnaeus). بالإضافة إلى: الأكاروس المتطفل *Pyemotes tritici* (Lagreze-Fossat and Montane) من فصيلة Trombidiformes وجد على يرقات الفراشة المفترسة C. communimacula داخل حشرة الفواكه القشرية *Parthenolecanium corni*.

كلمات مفتاحية: التين، اللوز، الزيتون، الحمضيات، المتطفلات الحشرية، المفترسات، حشرات قشريه رخوة.

Natural Enemies of Soft Scale insects (Hemiptera: Coccidae) on Orchard Trees in Syrian southern and coastal region

Abdulnabi Basheer[*] **Hicham Alrouz**[*]

Alaa saleh[**]

Abstract

Natural enemies of some soft scale insects which infest orchard trees (almonds, figs, olive, and citrus) were studied between 2015 – 2017. The following soft scale insects: European fruit lecanium *Parthenolecanium corni* (Bouché) on almonds in Damascus Countryside and Quneitra, black scale, *Saissetia oleae* (Olivier) on olive, fig wax scale (FWS) *Ceroplastes rusci* L. on fig trees in Quneitra, Citricola Scale, *Coccus pseudomagnoliarum* (Kuwana) and brown soft scale, *Coccus hesperidum* (Linnaeus) (Hemiptera: Coccidae) on citrus trees, in Lattakia, were recorded. The predators: *Chilocorus bipustulatus* L., *Exochomus quadripustulatus* L., *Rhyzobius lophanthae* (Blaisdell), *Nephus redtenbacheri* (Mulsant), *Pharoscymnus* sp., *Nephus quadrimaculatus* (Herbst), *Nephus bipunctatus* (Kugelann), *Scymnus coniferarum* (Crotch), *Scymnus abietis* (Paykull), *Scymnus rubromaculatus* (Goeze) and *Scymnus* sp. (Coleoptera: Coccinellidae), *Eublemma scitula* (Rambur) and *Calymma communimacula* (Denis and Schiffermüller) (Lepidoptera: Noctuidae) *Chrysoperla carnea* (Stephens) and *Dichochrysa astur* (Banks) (Neuroptera: Chrysopidae), *Hemerobius humulinus* (Linnaeus) (Neuroptera: Hemeropiidae), The following parasitoids were determined with: Chalcidoidea: Encyrtidae: *Metaphycus helvolus* (Compere), *M. lounsburyi* (Howard), *M. insidiosus* (Mercet), *Blastothrix longipennis*

[*] Dept. of Plant Protection, Faculty of Agriculture, Damascus University, Damascus; Syria

[**] Biological Control Studies and Research Center, Faculty of Agriculture, Damascus University

(Howard), *Discodes coccophagus* (Ratzeburg), *Anagyrus kamali* (Moursi), *Cheiloneurus claviger* (Thomson), *Cerapterocerus mirabilis* (Westwood), *Encyrtus* sp., *Encyrtus aurantii* (Geoffroy), *Homalotylus flaminius* (Dalman), *Homalotylus* sp., *Metaphycus flavus* (Schlupfwespe), and *Microterys nietneri* (Motschulsky). Aphelinidae: *Coccophagus lycimnia* (Walker), *C. semicircularis* (Förster), *Ablerus* sp., *Marietta picta* (André), and *Coccobius fulvus* (Compere and Annecke). Eriaporidae: *Promuscidea unfasciativentris* (Girault). Eulophidae: *Tetrastichus* sp., *Elasmus platyedrae* (Ferrière) and *Aprostocetus ceroplastae* (Girault). Pteromalidae: *Scutellista nigra* (Mercet), *S. caerulea* (Fonscolombe) and *Pachyneuron muscarum* (Linnaeus). In addition, the parasitic mite, *Pyemotes tritici* (Lagreze-Fossat and Montane), (Acari: Trombidiformes), was found attacking larvae of *C. communimacula* inside the soft scale *Parthenolecanium corni.*

Key words: Fig ; Almond; Olive ; Citrus, Parasitoids, Predators, Soft scale insects.

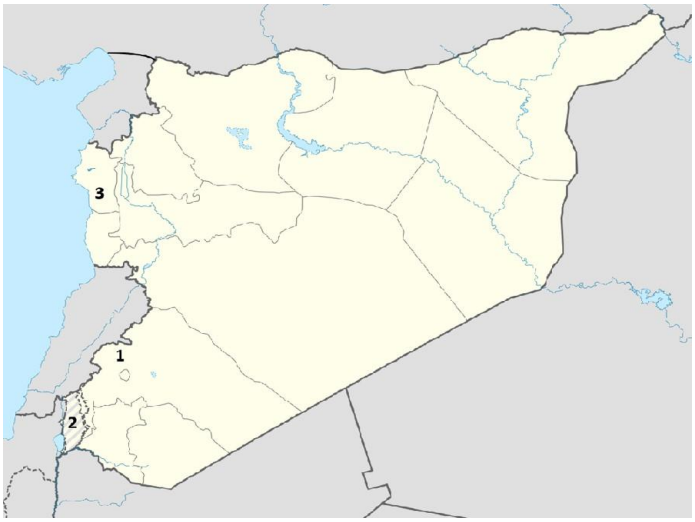
Introduction

The most studied soft scale insect species (Hemiptera: Coccidae) are pests of economic importance in agricultural, horticultural and silvicultural crops (Kosztarab, 1996; Ben-dov and Hodgson, 1997). Kosztarab (1997) estimated that worldwide management costs and losses from soft scale insect infestations were more than $1 billion annually (1/5 of that by all Coccoidea). Soft scale insects have many natural enemies and the identification and utilization of successful natural enemies would greatly improve biocontrol. Species of the Aphelinidae, Encyrtidae and Eulophidae are the most common natural parasitoids of soft scale insects (Hayat, 1997; Prinsloo, 1997; Viggiani, 1997), although predators are the most common natural enemies of soft scale insects (Hanson and Miller, 1984). Reports of coleopterans preying on soft scale insects include members of the families Coccinellidae, Anthribidae, Nitidulidae, Sylvanidae, Scarabaeidae, and Anobiidae (Ponsonby and Copland, 1997). Neuropterans in the families Chrysopidae (green lacewings), Hemerobiidae (brown lacewings), Coniopterygidae (dustywings), and Raphidiidae (snakeflies) are predators of soft scale insects (Miller *et al*., 2004; Ben-Dov *et al.*, 2015; Oswald, 2014). Chrysopis are the highly effective predators (Miller *et al.*, 2004). Species of hemipterans in the family Miridae have been reported to prey on soft scales (Wheeler, 2001). Mites; Phytoseiidae and Cheyletidae and spiders Agelenidae, Clubionidae and Linyphiidae are associated with soft scales infesting orchard trees (Hodges and Braman, 2004). Soft scale insects are serious pests of orchards, forest trees, ornamental plants and urban areas in Syria (Basheer *et al.*, 2016). Thus, this study aimed to survey the natural enemies of soft scale insects (Hemiptera: Coccidae) on olive, almonds, fig and citrus orchard trees in the governorates of Damascus Countryside, Quneitra and Lattakia in Syria.

Material and Methods

Surveys were carried out between April and September in the years 2015 - 2017 on almonds, fig, olive and citrus Orchard trees to determine the predatory and parasitoid insect species on various stages of soft scale insects. The samples were mainly collected from orchard trees, in Damascus countryside, Quneitra and Lattakia in Syria (Figure 1.). The

age of the trees was variable, between 10 and over (30) years. Soft scale insects infested plant parts and their predators were examined visually on the trees. Adult predators were collected by small handling aspirator, net and fine forceps, when they were observed feeding on soft scale insects and dropped into a killing jar. Immature predators were taken to the laboratory together with the plant material infested by their prey, for rearing to the adult stage (to determine the specie). Infested twigs and branches were cut into approximately 35-cm pieces and placed in polyethylene bags containing sheets of paper. Infested leaves, fruits and pieces of bark were collected in the same way. The groves were sampled twice a month during periods of rapid scale growth (April–October) and monthly during the cooler, winter months. Each grove was sampled for different periods of time, ranging from 8 to18 months. twenty, 15-cm long twigs with green-wood and fruits and fifty leaves were collected from a minimum of five trees. It was selected trees within trees that were infested with Soft Scale insects. The samples of each orchard were collected in a separate laboratory. The biological enemies were collected for each insect and for each orchard individually to facilitate the classification of the biological enemies of each crop. The soft scale insects infested plant material was examined under a Olympus SZX16 Stereomicroscope in the laboratory, and the mite predators were collected using a fine brush and preserved in 60% ethyl alcohol. Plant samples with scale insects containing parasitoids were placed in emergence boxes to obtain adult parasitoids. The emerging parasitoids were transferred into the glass vials containing 60% ethyl alcohol using a fine brush. The samples were taken from olive, almonds, fig and citrus Orchard trees infested with soft scale insects. Voucher specimens of the predators and parasitoids were deposited at the Biological Control Studies and Research Center, Faculty of Agriculture, Damascus University, Damascus, Syria. Identification of parasitoid specimens was passed on keys of Prinsloo (1997), Annecke and Mynhardt (1971, 1972, 1981) and Compere (1931). The specimens were identified by specialists in the Biological Control Studies and Research Center, Damascus University.



Figure(1):Location of samples

1. Damascus countryside 2. Quneitra 3. Lattakia.

Results and discussion:

Natural enemies of European fruit lecanium *Parthenolecanium corni* (Bouché) in almond orchards

Six predators were found to be associated with European fruit lecanium *P. corni* in almond orchards (*Prunus amygdalus*) in Damascus countryside and in Quneitra (*Prunus domestica*), belong to Coleoptera (four- Coccinellide), Neuroptera (one- Chrysopidae), and Lepidoptera (one- Noctuidae) Table 1.

Nine parasitoid and four hyperparasitoid species belonging to four families of Hymenoptera (Encyrtidae, Aphelinidae, Pteromalidae and Eulophidae) were collected from European fruit lecanium, *Parthenolecanium corni*. The parasitoids are *Microterys nietneri*, *Metaphycus insidiosus*, *Metaphycus lounsburyi*, *Blastothrix longipennis*, *Discodes coccophagus*, *Encyrtus* sp**.,** (Encyrtidae), *Coccophagus lycimnia*, *Coccophagus semicircularis*, *Coccobius fulvus*, (Aphelinidae), and *Elasmus platyedrae* (Eulophidae). The hyperparasitoid species are *Tetrastichus* sp. (Eulophidae), *Pachyneuron muscarum* (Pteromalidae), *Marietta picta* (Aphelinidae), *Cheiloneurus claviger*, *Cerapterocerus mirabilis* (Encyrtidae). (Table 1.).

Table (1): Natural enemies of European fruit lecanium *Parthenolecanium corni* (Bouche) in almond orchards in Damascus countryside and Quneitra.

Families of parasitoids	Parasitoid species	Mode of Parasitism	localities
Encyrtidae	*Microterys flavus* (Howard)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Damascus countryside
	Microterys nietneri (Motschulsky)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Damascus countryside
	Metaphycus insidiosus (Mercet)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Damascus countryside
	Metaphycus lounsburyi (Howard)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Damascus countryside
	Blastothrix longipennis (Howard)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Damascus countryside
	Discodes coccophagus (Ratzeburg)	Endo, adult and young females.	Damascus countryside, Quneitra.
	Cheiloneurus claviger (Thomson) **	Hyperparasitoid	Damascus countryside, Quneitra.
	Cerapterocerus mirabilis (Westwood) **	Hyperparasitoid	Damascus countryside, Quneitra.
	Encyrtus sp.(Latreille)	Endo, young females and 2nd instar-nymph parasitoid.	Damascus countryside.
Aphelinidae	*Coccophagus lycimnia* (Walker)	Endo, young females and 2nd instar-nymph parasitoid.	Damascus countryside, Quneitra.
	Coccophagus semicircularis (Förster)	Endo, young females and 2nd instar-nymph parasitoid.	Damascus countryside, Quneitra.
	Marietta picta (André) **	Hyperparasitoid	Quneitra.
	Coccobius fulvus	Endo, adult and young	Damascus

	(Compere and Annecke)	females and 2nd instar-nymph parasitoid.	countryside
Pteromalidae	*Pachyneuron muscarum* (Linnaeus) **	Hyperparasitoid	Damascus countryside, Quneitra.
Eulophidae	*Elasmus platyedrae* (Ferriere)		Quneitra.
	Tetrastichus sp. (Tetssp) **	Hyperparasitoid	Quneitra.
Acari			
Pyemmotidae	*Pyemotes tritici* (Lagreze-Fossat and Montane)*	Ecto, attacking larvae *Calymma communimacula* inside the insect *Parthenolecanium corni.*	Quneitra
Families of predators	Predator species	localities	
Coleoptea			
Coccinellidae	*Exochomus quadripustulatus* (Linnaeus)	Damascus countryside	
	Chilocorus bipustulatus (Linnaeus)	Damascus countryside	
	Nephus redtenbacheri (Mulsant)	Damascus countryside	
	Pharoscymnus sp. (Phrssp)	Damascus countryside	
Neuroptera			
Chrysopidae	*Chrysoperla carnea* (Stephens)	Damascus countryside	
Lepidoptera			
Noctuidae	*Calymma communimaculata* (Denis and Schiffermüller) *	Quneitra	

* First record for Syria. ** Hyperparasitoid species.

Natural enemies of soft scales in citrus orchards in Lattakia

Two soft scales were detected on *Citrus* spp. in citrus orchards in Lattakia namely Citricola Scale, *Coccus pseudomagnoliarum* (Kuwana)

and brown soft scale, *Coccus hesperidum* (Linnaeus). Seven predators were found to be associated with *C. pseudomagnoliarum* and *C. hesperidum* belong to Coleoptera (five Coccinellidae) and Neuroptera (two Chrysopidae). Table 2.

Five parasitoids were isolated from brown soft scale *Coccus hesperidum*c, which comprised *Metaphycus helvolus*, *Metaphycus insidiosus*, *Coccophagus lycimnia* , *Coccophagus semicircularis* and *Encyrtus aurantii*. Seven parasitoids and five hyperparasitoid species belonging to five families of Hymenoptera (Encyrtidae, Aphelinidae, Pteromalidae, Eriaporidae and Eulophidae) associated with *Coccus pseudomagnoliarum*, This complex comprised *Metaphycus helvolus*, *Metaphycus insidiosus*, *Microterys nietneri*,*Microterus flavus*. Two species of *Coccophagus* consisting of *C. lycimnia* and *C. semicircularis* and the encyrtid *Encyrtus aurantia*. The hyperparasitoid species comprised *Cheiloneurus claviger* that is hyperparasitoid of *Metaphycus* spp., *Ablerus* sp., *Marietta picta* and *Promuscidea unfasciativentris.* Table 2.

Table (2): Natural enemies of soft scales in citrus orchards in Lattakia.

Families of parasitoids	**Parasitoid species**	**Mode of parasitism**	**Soft scale insect host**
Hymenoptera			
Encyrtidae	*Microterys flavus* (Howard)	Endo, adult and young females and 2nd instar-nymph parasitoid.	*Coccus pseudomagnoliarum*
	Microterys nietneri (Motschulsky)	Endo, adult and young females and 2nd instar-nymph parasitoid.	*Coccus pseudomagnoliarum*
	Metaphycus insidiosus (Mercet)	Endo, adult and young females and 2nd instar-nymph parasitoid.	*Coccus hesperidum* and *Coccus Pseudomagnoliarum*
	Cheiloneurus	Hyperparasitoid	*Coccus*

	claviger (Thomson) **		*pseudomagnoliarum*
	Encyrtus aurantia. (Latreille)	Endo, young females and 2nd instar-nymph parasitoid.	*Coccus hesperidum and Coccus Pseudomagnoliarum*
Aphelinidae	*Coccophagus lycimnia* (Walker)	Endo, young females and 2nd instar-nymph parasitoid.	*Coccus hesperidum and Coccus Pseudomagnoliarum*
	Coccophagus semicircularis (Förster)	Endo, young females and 2nd instar-nymph parasitoid.	*Coccus pseudomagnoliarum*
	Ablerus sp. (Howard) *	Hyperparasitoid	
	Promuscidea unfasciativentris (Girault). *#	Hyperparasitoid	
Pteromalidae	*Pachyneuron muscarum* (Linnaeus)*	Hyperparasitoid	*Coccus pseudomagnoliarum*
Eulophidae	*Aprostocetus ceroplastae* (Girault) *	Hyperparasitoid	*Coccus pseudomagnoliarum*
Families of predators	Predator species	Soft scale insect host	
Coleoptea			
Coccinellidae	*Exochomus quadripustulatus* (Linnaeus)	*Coccus hesperidum and Coccus pseudomagnoliarum*	
	Chilocorus bipustulatus (Linnaeus)		
	Nephus redtenbacheri (Mulsant)		
	Pharoscymnus sp.		

	(Phrssp)	
	Rhyzobius lophanthae (Blaisdell)	
Neuroptera		
Chrysopidae	*Chrysoperla carnea* (Stephens)	*Coccus hesperidum and Coccus pseudomagnolia rum*
	Dichochrysa astur (Banks) #	

*Hyperparasitoid species # First record for Syria.

Natural enemies of fig wax scale *Ceroplastes rusci* L.on fig trees

Twelve predators were found to be associated with wax scale *Ceroplastes rusci* L.on fig trees belonged to Coleoptera (10 Coccinelli), one Lepidoptera (Noctuidae) and one Neuroptera (Chrysopidae). Table 3.

Four parasitoid and one hyperparasitoid species belonging to two families of Hymenoptera (Encyrtidae and Pteromalidae) were collected from fig wax scale *C. rusci*. The parasitoids are *Scutellista caerulea* (Fonscolombe), *Scutellista nigra* (Mercet) (Pteromalidae), *Anagyrus kamali* (Moursi), *Metaphycus helvolus* (Compere) (Encyrtidae). The hyperparasitoid is *Cheiloneurus claviger* Thomson (Encyrtidae). Table 3.

Table(3): Natural enemies of fig wax scale *Ceroplastes rusci* L. on fig trees.

Families of parasitoids	Parasitoid species	Mode of Parasitism	Localities
Hymenoptera			
Encyrtidae	*Metaphycus helvolus* (Compere)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Quneitra and Lattakia
	Anagyrus kamali (Moursi)	Endo, adult and nymph parasitoid.	Quneitra and Lattakia

	Cheiloneurus claviger (Thomson)**	Hyperparasitoid	Quneitra and Lattakia
Pteromalidae	*Scutellista nigra* (Mercet).	Endo, adult females	Quneitra
	Scutellista caerulea (Fonscolombe)	Endo, adult females	
Families of predators	Predator species		Localities
Coleoptera			
Coccinellidae	*Exochomus quadripustulatus* (Linnaeus)		Quneitra and Lattakia
	Chilocorus bipustulatus (Linnaeus)		Quneitra and Lattakia
	Nephus redtenbacheri (Mulsant)		
	Pharoscymnus sp. (Phrssp)		Quneitra and Lattakia
	Scymnus coniferarum (Crotch)		Quneitra and Lattakia
	Scymnus abietis (Paykull)		Quneitra
	Scymnus rubromaculatus (Goeze)		
	Scymnus sp. (Pullus)		
	Nephus quadrimaculatus (Herbst)		
	Nephus bipunctatus (Kugelann)		
Neuroptera			
Chrysopidae	*Chrysoperla carnea* (Stephens)		Quneitra and Lattakia
Lepidoptera			
Noctuidae	*Eublemma scitula* (Rambur)*		Quneitra

*First record for Syria . **Hyperparasitoid species.

Natural enemies of black scale, *Saissetia oleae* in olive orchards

Five predators were found to be associated with black scale, *Saissetia oleae* on olive orchards belonged to Coleoptera (three Coccinellidae) and Neuroptera (one Chrysopidae and one Hemerobiidae). Table 4.

Three parasitoids belonging to two families of Hymenoptera (Encyrtidae and Pteromalidae). The parasitoids are *Scutellista nigra* (Ptermalidae), *Metaphycus lounsburyi* and *Metaphycus helvolus* (Encyrtidae). Table 4.

Table (4): Natural enemies of black scale, *Saissetia oleae* in olive orchards.

Families of parasitoids	**Parasitoid species**	**Mode of parasitism**	**Localities**
Hymenoptera			
Encyrtidae	*Metaphycus helvolus* (Compere)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Quneitra
	Metaphycus lounsburyi (Howard)	Endo, adult and young females and 2nd instar-nymph parasitoid.	Quneitra
Pteromalidae	*Scutellista nigra* (Mercet)	Endo, adult females	Quneitra
Families of predators	Predator species		Localities
Coleoptera			
Coccinellidae	*Exochomus quadripustulatus* (Linnaeus)		Quneitra and Lattakia
	Chilocorus bipustulatus (Linnaeus)		Quneitra and Lattakia
	Nephus redtenbacheri (Mulsant)		Quneitra and Lattakia
	Pharoscymnus sp. (Phrssp)		Quneitra and Lattakia
Neuroptera			
Hemerobiidae	*Hemerobius humulinus* (Linnaeus) *		Quneitra

* First record for Syria.

Discussion

Sixteen species of predators and 27 species of parasitoids were found to be associated with five soft scale insect species, European fruit lecanium *Parthenolecanium corni* (Bouché) on almonds, black scale, *Saissetia oleae* (Olivier) on olive, fig wax scale (FWS) *Ceroplastes rusci* L. on fig trees, Citricola scale, *Coccus pseudomagnoliarum* (Kuwana)

and brown soft scale, *Coccus hesperidum* (Linnaeus) on citrus trees, in the surveys carried out in Damascus countryside, Quneitra and Lattakia.

The predators belong to Coleoptera (11- Coccinellidae), Neuroptera-3 (2- Chrysopidae, 1- Hemerobiidae), and Lepidoptera (2 - Noctuidae)

The parasitoids belong to Hymenoptera (14-Encyrtidae), (5-Aphelinidae) (1- Eriaporidae), (3- Pteromalidae), (3-Eulophidae) and Acari (1- Pyemmotidae).

Exochomus quadripustulatus (L.), *Chilocorus bipustulatus* (L.), *Nephus redtenbacheri* (Mulsant) and *Pharoscymnus* sp**.** were found to be the most common predators because they were associated with the five species of soft scale insects. The four common predators, that are known to be associated with Coccids in various regions of Syria and Jordan (Diab, 2011; Awamleh *et al.*, 2009) were found very abundant on fig wax scale (FWS) *Ceroplastes rusci* L. in Quneitra. *Exochomus quadripustulatus* was known as a common predator on coccids in various regions of the Syria, such as European fruit lecanium *P.corni*, black scale, *Saissetia oleae*, fig wax scale *C. rusci*, Citricola scale, *Coccus pseudomagnoliarum* and brown soft scale *Coccus hesperidum* (Berawe, 2011; Diab, 2011; Awamleh, *et al.*, 2009). *Exochomus quadripustulatus* was found on various soft scale insects, such as *Anapulvinaria pistaciae* (Bodenhemir) , *Fillipia folliculari* (Targ. Dozz) and *Sphaerolecanium prunastri* (Fonscolombe) in various regions of Turkey (Soydanbay 1976; Öncüer 1977; Ülgentürk 2001). *Rhyzobius lophanthae* (Blaisdell), were found to be the most common predator and to be associated with the Citricola scale, *C. pseudomagnoliarum* and brown soft scale *C. hesperidum* on citrus in Lattakia. The same predators were reported to be the most common and/or the most efficient predators of respective prey scale insects in various parts of Turkey (Erler and Tunç., 2001). Other coccinellid predators namely *Scymnus coniferarum* (Crotch), *Nephus quadrimaculatus* (Herbst), *Nephus bipunctatus* (Kugelann), *Scymnus abietis* (Paykull), *Scymnus rubromaculatus* (Goeze) and *Scymnus* sp. were found only on fig wax scale *C. rusci* in Quneitra. *Nephus bipunctatus* and *Scymnus* sp. were reported to be the most important predators. These results are consistent with several studies, in Turkey (Kaydan *et al.*, 2012) reporting that the species belong the genera *Exochomus*, *Nephus*, *Pharoscymnus* and *Symnus* were recorded on soft

scale insects, and *Exochomus quadripustulatus* was the most important. Özsemerci and Aksit (2003) confirmed that the most important predators on fig wax scale on fig trees in Turkey are *Chilocorus bipustulatus*, *Scymnus subvillosus* (Goeze), *S. rubromaculatus*, *Eublemma scitula*. In Egypt, predators *Exochomus flavipes*, *Nephus* sp., *N. includens*, *Pharoscymnus* sp., and *S. interruptus* of are the most common predators on soft scale insects, including fig wax scale (Hendawy, *et al.,* 2013). Morsi and Mousa (2004) reported that predators in Egypt were recorded on the fig wax scale: *Chilocorus* sp., *Exochomus flavipes*, *Scymnus* sp., *S. subvillosus*.

The predator, *Ch. carnea* (Stephens) (Neuroptera: Chrysopidae) was found to be the most common predator Because it was associated with the five species of soft scale insects in all studied area. The predator was recorded as an effective predator on scale insects in Jordan (Awamleh *et al.,* 2009), Syria (Mohammed, 2008), Turkey (Erler and Tunç., 2001; Ülgentürk *et al.,* 2004). Another Chrysopid predator *Dichochrysa astur* (Banks) was associated with the Citricola scale, *C. pseudomagnoliarum* and brown soft scale *C. hesperidum* on citrus in Lattakia. The Brown Lacewing *Hemerobius humulinus* (Linnaeus) was associated with the black scale, *Saissetia oleae* on Olea trees in Quneitra. Predatory moth *Eublemma scitula* (Rambur) has been recorded as a predator of fig wax scale *C. rusci* in Quneitra. *Eublemma scitula* has been recorded as a predator of scales from different parts of the world (Clauseh, 1940). Within the Noctuidae, the entire genus *Eublemma* is carnivorous on scale insects, except for *Eublemma radda* (Swinhoe), a species that feeds on insects trapped by pitcher plants. In India, *Eublemma amabilis* (Moore) feeds only on *Kerria*, whereas *Eublemma scitula* (Rambur) feeds on a wider range of scales comprising *Kerria* spp., *Anomalococcus*, *Lecanium*, *Ceroplastes*, and *Pulvinaria* (Pierce, 1995). Pierce (1995) listed noctuids, including *Eublemma* spp., recorded as predators on Homoptera. The caterpillars of *Calymma communimacula* (Denis and Schiffermüller) on *S. oleae* make a cocoon incorporating the remnants of the prey. The cocoon acts as a disguise, and protection its own natural enemies and from pesticides (Ülgentürk *et al.,* 2004). The straw itch mite, *Pyemotes tritici* (LagrezeFossat and Montane) is associated with virtually every insect order. More than 100 insect species are known as hosts of *P. tritici*

among Coleoptera, Hymenoptera, Lepidoptera, Homoptera, Strepspitera and Diptera, (Cross *et al.*, 1975; Bruce and Lecato,1980; Bruce and Wrensch, 1990). *Pyemotes tritici* produces a complex of neurotoxins, utilized in capturing its insect prey, causing muscle contractions and paralysis (Tomalski *et al.*, 1989; Tomalski and Miller, 1991).

Five parasitoid and one hyperparasitoid species belonging to three families of Hymenoptera (Encyrtidae, Pteromalidae and Eulophidae) were collected from fig wax scale *C. rusci*. This species has been reported previously as a parasitoid on *C. rusci* in Syria (Basheer *et al.*, 2016) and in Jordan (Awamleh *et al.*, 2009). Talhouk (1969) recorded the parasitoids from Jordan. These are: *S. caerulea*, *Tetrastichus* sp. and *Coccidophaga scitula* (Ramb). Previous studies of the parasitoid complex associated with FWS around the world have identified four dominant parasitoid species. These include *S. caerulea*, *Metaphycus* spp., *C. lyciminia* and *Tetrastichus* spp. (Ehler, 1978; Prokopenko and Mokrousova, 1981; Özsemerci and Aksit, 2003; Shaaban *et al.*, 2003; Hammad 2006; Morsi and Mousa, 2006). *Metaphycus helvolus* develops as a solitary parasitoid during the cooler months of the year and from very small FWS. However, it also develops gregariously in a larger FWS. This finding is consistent with Kapranas *et al.*, (2007).

Metaphycus species dominated the parasitoid complex exploiting black scale, *S.oleae*. *Metaphycus helvolus* attacks second instars black scale, this finding is consistent with previous studies (Lampson and Morse, 1992; Weppler *et al.*, 2003). Sixteen parasitoid wasps were recorded to be associated with this scale in Brazil and the most common species were *Coccophagus caridei* (Brèthes) (Hymenoptera: Aphelinidae), *Diversinervus elegans* (Silvestri) (Hymenoptera: Encyrtidae), and *Mesopeltita truncatipennis* (Waterston) (Hymenoptera: Pteromalidae) (Prado *et al.*, 2015). Argov *et al.*, (1993) and Viggiani (1978) pointed that species of this genus have been reported as effective against the black scale insects, particularly *M. helvolus* (Compere) and *M. lounsburyi* (Howard).

Nine parasitoid and four hyperparasitoid species belonging to four families of Hymenoptera (Encyrtidae, Aphelinidae, Pteromalidae and Eulophidae) were collected from European fruit lecanium, *P. corni*. In almond orchard at Kalamon region, Damascus, Syria, eight species of

parasitoids were sampled, plunging to families Aphelinidae, Encyrtidae, Eulophidae and Pteromalidae (Basheer *et al.,* 2016). Five were primary parasitoids *Metaphycus* sp., *Blastothrix longipennis*, *Microterys flavus, Coccophagus lycimnia,* and *Coccobius fulvus.* And three were hyperparasitoid species, *Aprostocetus* sp., *Pachyneuron* sp., and *Marietta picta* (Basheer *et al.,* 2011). Four parasitoids *Metaphycus insidiosus, Microterys nietneri, Coccophagus lycimnia* and *Coccophagus semicircularis,* and three hyperparasitoid species, *M. picta, Pachyneuron concolor* and *Pachyneuron solitarium* were recorded on *Parthenolecanium corni* in almond orchard in the region of Plovdiv in Bulgaria (Arnaoudov *et al.,* 2006). Mohamed (2013) showed that the female of the hyperparasitoid *Pachyneuron concolor* lay their eggs in *Metaphycus* sp., *Microterys nietneri* and *Coccophagus* sp. While, the female of the hyperparasitoid *Cheiloneurus claviger* lay their eggs in *Metaphycus* sp., *Microterys nietneri* and *Blastothrix confusa* (Sugonjaev and Babaev, 1978). *Marietta picta* is a hyperparasitoid of *Coccophagus lycimnia, Coccophagus semicircularis* and *Metaphycus insidiosus* (El-Serwy, 2001). *Tetrastichus* sp. is a hyperparasitoid of *Metaphycus insidiosus* (Sugonjaev and Babaev, 1978). *Metaphycus insidiosus* and *Metaphycus lounsburyi* appeared during the period June- September in both location, when preferable stages of *P.corni* for the parasitoids (second nymphal instar, virgin females and adult females) were available. Many studies reported its effectiveness as parasitoid of *P.corni* (Japoshivili *et al.,* 2008; Basheer *et al.,* 2011). Obtained results are agreed with Santas (1985), Lampson *et al.,* (1996) and Weppler *et al.,* (2003). *Blastothrix longipennis* ranked second in importance.

Five parasitoids were isolated from brown soft scale *Coccus hesperidum*. Fourteen parasitoid wasps were recorded to be associated with this scale in southern California citrus and the most common species were *Metaphycus* spp. Accounting for 75% of the emerging parasitoids this comprised *Metaphycus angustifrons* (38%), *M. luteolus* (18%), *M. stanleyi* (13%), and *M. helvolus* (6%). Also it was recovered four *Coccophagus* spp. (11%), (Kapranas et al 2007). The *Coccophagus* species that recovered are facultative or obligate, heteronomous hyperparasitoids of coccids including brown soft, citrucola, and black scales (Bernal *et al.,* 2001). Female *Coccophagus* are endoparasitoids of

soft scales, whereas males are secondary ectoparasitoids on conspecific or heterospecific female parasitoids (Prinsloo, 1997). Several *Coccophagus* spp. were observed with males emerging from a scale along with males of either *M. helvolus* or *M. insidiosus*, suggesting that the *Coccophagus* males are indeed hyperparasitic on the *Metaphycus* species attacking brown soft scales.

Seven parasitoid and five hyperparasitoid species belonging to five families of Hymenoptera (Encyrtidae, Aphelinidae, Pteromalidae, Eriaporidae and Eulophidae) associated with *Coccus pseudomagnoliarum*, The hyperparasitoid species comprised *Cheiloneurus claviger* that is hyperparasitoid of *Metaphycus* spp., *Ablerus* sp., *Marietta picta* and *Promuscidea unfasciativentris.*

References:

1. **Awamleh, R. A., T. M. AL- Antary and H. M. Bilal. 2009**. Survey of natural enemies of the fig wax scale *Ceroplastes rusci* L. (Homoptera: Coccidae) and seasonal abundance of the parasitoid *Scutellista caerulea* (Fonscolombe) (Hymenoptera: Pteromalidae) in Jordan. Jordan Journal of Agricultural Sciences 5(4):434-445
2. **Annecke, D.P. and M.J. Mynhardt. 1971.** The species of the zebratus-group of Metaphycus Mercet (Hymenoptera: Encyrtidae) from South Africa, with notes on some extra-limital species. Revue de Zoologie et de Botanique Africaines 83: 322–360.
3. **Annecke, D.P. and M.J. Mynhard.t 1972**. The species of the insidiosus-group of Metaphycus Mercet in South Africa with notes on some extra-limital species (Hymenoptera: Encyrtidae). Revue de Zoologie et de Botanique Africaines 85: 227–274.
4. **Annecke, D.P. and M.J. Mynhardt. 1981.** The species of the asterolecanii-group of Metaphycus Mercet (Hymenoptera: Encyrtidae) from South Africa with notes on some extralimital species. Journal of the Entomological Society of Southern Africa 44(1): 1–68.
5. **Argov, Y. and Y. Rössler. 1993.** Biological control of the Mediterranean black scale, Saissetia oleae (Homoptera: Coccidae) in israel. Entomophaga, 38(1): 89-100.
6. **Arnaoudo, V., R. Olszak and H. Kutinkova. 2006**. Natural enemies of plum brown scale Parthenolecanium corni (Bouche) (Homoptera: Coccidae) in plum orchards in the region of Plovdiv. Bulletin OILB/SROP 29(10): 105-109.
7. **Basheer, A.M., L. Asslan. A. Saleh. N. Diab. and E. Mohamed. 2016.** Scale insect species (Hemiptera: Coccoidea) in Syria. Bulletin OEPP/EPPO Bulletin 46(2), 305-307.

8. **Basheer, A.M., M. Z. Mahmalje. and A. Berawe. 2011.** Survey of the parasitoids of the fruit scale insect, Parthenolecanium corni Bouché (Homoptera: Coccidae) on almond trees at Kalamon, Damascus countryside, Syria. Egyptian Journal of Biological Pest Control 21(1):27-31.
9. **Ben-dov, Y., and C. J. Hodgson. (eds) 1997**. Soft scale insects: Their biology, natural enemies and control. World crop pests 7A. Elsevier, Netherlands.
10. **Ben-dov, Y., D. R. Miller. and ME. Gimpel. 2015.** ScaleNet. (http://www. sel.barc.usda.gov/scalenet/scalenet.htm). Last accessed 17 August 2015.
11. **Berawe, A., 2011**. Ecological study and Karyotyping of the fruit scale insect Parthenolecanium corni on stone fruit trees in Kalamon area. M.Sc. Thesis. College of Agriculture Damascus University, Damascus, Syria. p. 114.
12. **Bernal, J.S., R.F. Luck. Morse. JG. MS Drupy. 2001.** Seasonal and scale size relationships between citricola scale (Homoptera: Coccidae) and its parasitoid complex (Hymenoptera: Chalcidoidea) on San Joaquin Valley citrus. Biol. Control 20:210–21.
13. **Bruce, WA., and G. L. Lecato. 1980.** Pyemotes tritici: A Potential new agent for biological control of the r.d imported Fire ant, Solenopsis invicta. (Acari: Pyemotidae). International Journal of Acarology, 6: 271-274.
14. **Bruce. WA., and DL. Wrensch. 1990.** Reproductive Potential, Sex Ratio, and mating efficiency of the straw itch mite (Acari: Pyemotidae). Journal of Economic Entomology, 83: 384-391
15. **Clauseh, C.P. 1978.** Introduced parasites and predators of arthropod pests and weeds: A world review. United States Department of Agriculture, Agricultural Research Service, Agricultural Handbook No. 480. Division of Biological Control, University of California, Riverside, CA.
16. **Clauseh, C.P. 1940.** Entomophagous Insects. McGraw-Hill Book Company, Inc. New York, 688 pp.
17. **Compere, H. 1931.** A revision of the species of Coccophagus, a genus of hymenopterous, coccid-inhabiting parasites: Jourbook: Proceedings of the United States National Museum 78 (7) : 1-132.

18. **Cross, W.H., H.W. Mcgovern. and EA. Cross. 1975.** Insect hosts of parasitic mites called Pyemotes ventricosus (Newport). Journal of Georgia Entomological Society, 10: 1-8.
19. **Diab. N. 2011.** Ecological and biological study of Black Scale insect Saissetia oleae (Bern) on Olive trees in Quneitra. M.Sc. Thesis. College of Agriculture Damascus University, Damascus, Syria. p. 92.
20. **Ehler, L.E. 1978.** Competition between two natural enemies of Mediterranean black scale on olive. Environ. Entomol. 7: 521- 523.
21. **EL-Serwy, SA. 2001.** Ecology, Biology and natural enemies of the red-striped scale, Pulivinaria tenuivalvata (Neustead) (Hemiptera: Coccidae), a pest on sugarcane in Egypt. Bull. ent. Soc.Egypte (2001-2002), 79: 13:35.
22. **Erler, F., and I. Tunc. 2001**. A Survey (1992–1996) of Natural Enemies of Diaspididae Species in Antalya, Turkey. Phytoparasitica 29(4): 1-7.
23. **Hammad, K. 2006**. Seasonal abundance of Ceroplastes rusci Linnaeus and its natural enemies of fig trees at ElKhattara District, Sharkia Governorate. Zagazig University Journal, 32(5): 973-998.
24. **Hanson. P.E., and J.C. Miller. 1984**. Scale insects on ornamental plants: A biological control perspective. J. Arboricult. 10: 259–264.
25. **Harris, K.M. 1997**. Cecidomyiidae and other Diptera, pp. 61–68. In Ben-Dov Y., Hogson C. J., editors. (eds.), Soft scale insects: their biology, natural enemies and control, vol. 7B: Elsevier Science B.V., Amsterdam, The Netherlands.
26. **Hayat, M. 1997.** Aphelinidae, pp. 111–146. In Ben-Dov Y., Hogson C. J., editors. (eds.), Soft Soft scale insects: Their biology, natural enemies and control, vol. 7B Elsevier Science B.V., Amsterdam, The Netherlands.
27. **Hendawy, AS., IAI. Saas. and RH. Taha. 2013.** Survey of scale insects, mealy bugs and associated natural enemies on mulberry trees in the Nile Delta. Egypt. J. Agric. Res.; 91(4):1447-1458.
28. **Hodges, G.S., and S.K. Braman. 2004.** Seasonal occurrence, phenological indicators and mortality factors affecting five scale insect species (Hemiptera: Diaspididae, Coccidae) in the urban landscape setting. J. Entomol. Sci. 39: 611–622.

29. **Japoshivili, G., N. Gabroshyili. and B. Japshvili. 2008.** The parasitoide complex of Parthenolecanium corni Bouché in the city of Tbilisi and its surroundings and comparasion with some other European countries. - Bull. Entomol. Res., 98: 53-56.
30. **Kapranas, A., J.G. Morse, P. Pacheco, L.D. Forster and R.F. Luck. 2007**. Survey of brown soft scale Coccus hesperidum L. parasitoids in southern California citrus. Biological Control. Volume 42 (3) 288-299.
31. **Kaydan, M.B., R. Atlihan, N. Uygun and D. Şenal. 2012**. Coccinellid (Coleoptera: Coccinellidae) species feeding on coccoids (Hemiptera: Coccoidea) in Van Lake Basin, Turkey. Türk biyo müc derg. 3 (1): 37-46.
32. **Kosztarab, M. 1997**. Ornamentals and house plants, pp. 357–365. In Y. Ben Dovand C. J. Hodgson (eds.), Soft scale insects: Their biology, natural enemies and control, vol. 7B. Elsevier Science B.V., Amsterdam, The Netherlands.
33. **Kosztarab, M. 1996.** Scale insects of northeastern North America: Identification, biology, and distribution. Virginia Museum of Natural History, Special Publication Number 3, Martinsville, VA. 650 pp.
34. **Lampson, L.J., and J.G. Morse. 1992**. A survey of black scale, Saissetia oleae [Homoptera.: Coccidae] parasitoids [Hym.: Chalcidoidea] in southern California. Entomophaga 37: 373-90.
35. **Lampson, L.J., J.G. Morse and R.F. Luck. 1996.** Host selection, sex allocation, and host feeding by Metaphycus helvolus (Hymenoptera: Encyrtidae) on Saissetia oleae (Homoptera: Coccidae) and its effect on parasitoid size, sex, and quality. Environmental Entomology 25(2): 283-294.
36. **Miller, G.L., J.D. Oswald and D.R. Miller. 2004**. Lacewings and scale insects: A review of predator/prey associations between the neuropterida and coccoidea (Insecta: Neuroptera, Raphidioptera, Hemiptera). Ann. Entomol. Soc. Am. 97: 1103–1125.
37. **Mohamed, E. 2013.** Ecological and Biological study of Coccus sp. and the ability of rearing Encyrtus aurantii (Geoffroy, 1785) . PhD thesis. Damascus University, Syria. P. 242.

38. **Mohammed, E. 2008.** Ecological and Biological study of Parlatoria pergandii (Comstock) and Lepidosaphis beckii (Newman) and their parasitoids in citrus orchard in Lattakia. Scientific Thesis for Master Degree in plant protection. Tishreen University, Syria. 161 pp.
39. **Morsi, G and F. Mousa. 2004.** Seasonal abundance of the fig wax scale insect, Ceroplastes rusci Linneus (Homoptera : Coccidae) and its parasitoids in Middle Egypt. Egyptian Journal of Biological Pest Control, 14(1): 59-64.
40. **Öncüer, C. 1977**. The important soft scale pest and their natural enemy species, on orchards their distribution, effectives. Aegean Univ. Faculty of Agriculture :336, 129 pp.
41. **Oswald, J.D. 2014**. Neuropterida Species of the World. Version 3.0. (http:// lacewing.tamu.edu/Species-Catalogue/).
42. **Özsemerci. F and T. Aksit. 2003**. Investigations on some biological characteristics and fluctuation of Ceroplastes rusci L. (Homoptera : Coccidae) harmful to fig trees in Aydin province. Turkiye Entomoloji Dergisi, 27(1): 13-25.
43. **Pierce, N.E. 1995.** Predatory and parasitic Lepidoptera: Carnivores living on plants. Journal of the Lepidopterists' Society 49(4): 412–453.
44. **Ponsonby, D.J and M.J.W. Copland. 1997.** Coccinellidae and other Coleoptera, pp. 29–60. In Y. Ben-Dov and C. J. Hogson (eds.), Soft scale insects: Their biology, natural enemies and control, vol. 7B. Elsevier Science B.V., Amsterdam, The Netherlands
45. **Prado, E., TM. Alvarenga and L.V.C. Santa-cecllia. 2015.** Parasitoids associated with the black scale Saissetia oleae (Olivier) (Hemiptera: Coccidae) in olive trees in Minas Gerais State, Brazil. Acta Sci., Agron. 37 (4).
46. **Prinsloo, G.L. 1997.** Encyrtidae, pp. 69–109. In Ben-Dov Y., Hogson C. J., editors. (eds.), Soft scale insects: Their biology, natural enemies and control, vol. 7B Elsevier Science B.V., Amsterdam, The Netherlands.
47. **Prokopenko, A. and L. Mokrousova 1981.** Scutellista Mot. as a biological controller of the Japanese wax scale. Zashchita Rastenii, Moskva, 12 :43. Sciences, 5 (4) :434-445.

48. **Santas, L.A. 1985.** Parthenolecanium corni (Bouché) an orchard scale pest producing honeydew foraged by bees in Greece. Entomologia Hellenica 1985. 3 (2) : 53-58.
49. **Shaaban, A.R., A. Hafez.. and H. Badary. 2003.** Survey and dynamics of natural enemies of the Mediterranean black scale, Saissetia oleae (Homoptera: Coccidae) in Egypt. Egyptian Journal of Agriculture Research, 81(1): 113- 123.
50. **Soydanbay, M.C. 1976**. The list of natural enemies of some agricultural crop pests in Turkey. Part I: Plant Protection Bulletin, 16 (1): 32-46 (in Turkish).
51. **Sugonjaev, E.S. and T. Babaev. 1978.** On chalcids (Hymenoptera: Chalcidoidea) – parasites of Coccidae (Homoptera: Coccoidea) in Tadzhikistan. Entomologicheskoe Obozreniye, 57(1): 48–67.
52. **Talhouk, AS., 1969.** Insect and mite injurious to crops in the middle eastern countries. Monog. Angew. Entomol., 21: 1- 239.
53. **Tomalski, M.D., R. Kutney, W.A. Bruce, M.S. Brown Blum and J. Travis. 1989.** Purification and characterization of insect toxins derived from the mite Pyemotes tritici. Toxicon, 27: 1151-1167.
54. **Tomalski, M.D and L. K. Miller. 1991.** Insect paralysis by baculovirus-mediated expression of a mite neurotoxin gene. Nature, 352: 82-85.
55. **Ülgentürk, S. 2001.** Parasitoids and predators of coccidae (Homoptera: Coccoidea) species on ornamental plants in Ankara, Turkey. Acta Phytopathologica et Entomologica Hungarica. 36(3-4):369-375.
56. **Ülgentürk, S., J. Noyes, C. Zeki, MB. Kaydan. 2004.** Natural enemies of Coccoidea (Hemiptera) on orchard trees and the neighbouring areas plants in Afyon, Ankara, Burdur, Isparta provinces, Turkey. Proceeding of the X International Symposium on Scale Insect Studies. 19-23 April 2004, Adana, Turkey, 361-372.

57. **Viggiani, G. 1997.** Eulophidae, Pteromalidae, Eupelmidae and Signiphoridae, pp. 147–160. In Ben-Dov Y., Hogson C. J., editors. (eds.), Soft scale insects: their biology, natural enemies and control, vol. 7b Elsevier Science B.V., Amsterdam, The Netherlands.
58. **Viggiani, G. 1978.** Current state of biological control of olive scales. Bolletino del Laboratorio di Entomologia Agraria "Fillipo Silvestri'' 35. 30-38.
59. **Wheeler, A.G. 2001.** Biology of the Plant Bugs (Hemiptera: Miridae): Pests, Predators, Opportunists. Ithaca: Cornell University Press. 528 p.
60. **Weppler, R.A., R.F. Luck and J.G. Morse. 2003**. Studies on rearing Metaphycus helvolus (Hymenoptera: Encyrtidae) for augmentative release against black scale (Homoptera: Coccidae) on citrus in California. Biol. Control 28. 118- 128.