

A primary survey of aphid species on almond and peach, and natural enemies of *Brachycaudus amygdalinus* in As-Sweida, Southern Syria

W. Almatni¹ and N. Khalil²

Abstract

*Syria is one of the biggest almond producer country in the world. Few arthropods that live on almond are considered as pests. Aphids are one of the major pests there. In order to change the product to organic we should know more about the pests and their natural enemies in order to use better bio- and organic decisions. A field survey was done to aphids that attack Almond and Peach in Al-Arab mountain at As-Sweida governorate, between 2002 and 2006. Three species of aphids were considered as important pests on both trees. They are *Brachycaudus amygdalinus* and *Brachycaudus helichrysi*, which are aphids that feed on the young leaves causing stunted growth; and *Pterochloroides persicae* which is a species that attacks the bark and excretes large quantities of honeydew. A survey of natural enemies of *B. amygdalinus* has been done in addition to study its population dynamics during the seasons of 2002, 2003 and 2004. 30 species of natural enemies were recorded includes 15 Coccinellidae, 4 of each Anthocoridae and Miridae, 3 of Syrphidae, one species of each of Chrysopidae and Chamaemyiidae, and one beetle, in addition to one parasitoid. Some Arachnids were also mentioned to prey on this aphid. Most numerous predator at the beginning of the season was *Coccinella septempunctata* followed later with *Scymnus* (*Pullus*) *subvillosus* and *Hyppodamia variegata*. Most numerous predatory bug was *Orius horvathi*.*

Key words: Almond, Peach, aphids, natural enemies, As-Sweida, Syria.

Introduction

Almond considered as a high important fruit tree in Syria, because of their high-price crop, good ability to tolerate stress conditions and even though bearing good yield, and because of small number of pests that they injure. Syria considered as one of the first productive countries of almonds in Asia, Africa in the last years. As-Sweida Governorate (southern Syria) is one of the important governorates that produce almonds in Syria.

Almond tree attacked by many of insect pests, which aphids and almond fruit wasp are the most important. Talhouk (1972, 1977) and Hussein and Qouar (1984) recorded three species of aphids on almond trees in Lebanon and adjacent countries which are: Almond leaf-curl aphid *Brachycaudus amygdalinus* (Schout.), Leaf-curling plum aphid *Brachycaudus helichrysi* (Kalt.), and black peach aphid *Pterochloroides persicae* (Kholodk.).

The first and second species attack the leaves, while the third species attacks the branch cortex (phloem).

¹ Pest Management Division, Department of Plant Protection, Ministry of Agriculture, Damascus, Syria. <almatni@scs-net.org>

² Division of Animal Biology, Faculty of Biology, Damascus University, Damascus, Syria. <khaliln@scs-net.org>

In contrary to what common believed, Hamdan (1986) did not find any presence of the green peach aphid, *Myzus persicae* (Sulz.) during his research in heights of north Jordan, while almond trees was attacked with severe injury by almond leaf-curl aphid, *B. amygdalinus*. This insect attacks almond and peach trees in the East Mediterranean causing sever damage. For this reason, farmers try to use several methods to control it and avoid it damage.

Natural enemies of almond aphid were mentioned shortly previously. Talhouk (1977) recorded on *B. amygdalinus* and *B. helichrysi* in Lebanon and east Mediterranean, and three coccinellids: *Scymnus (Pullus) subvillosus* (Goeze), *Synharmonia (=Harmonia) conglobata* (L.), *Exochomus quadripustulatus* (L.), and one mired bug *Deraeocoris pallens* Reut., and two dipteras: *Leucopis* sp. and *Aphidoletes aphidimyza* (Rond.), and two syrphids: *Syrphus ribesii* (L.), *Episyrphus balteatus* (Deg.), and one braconid *Aphidius matricariae* Hal.

Hussein and Qouar (1984) recorded on *B. amygdalinus* in Lebanon: *Adalia decimpunctata*, *Coccinella septempunctata* and *Scaeva pyrastris*.

This study aims to survey the natural enemies of almond leaf curl aphid (ALCA) at southern Syria and studies its population dynamics during the season. This is the first step in the biological control program against almond pests in this area.

Material and Methods

1- survey of aphid species in almond trees

This study was held in several sites of mountain of As-Sweida, southern Syria, in altitudes ranged from 1100 to 1700 m above the sea level, where wild almonds distributed there and almond orchards are widely planted. This study lasted five years: 2002 until 2006, throughout the aphid injury presence on almonds and peach. Several almond varieties has been chosen and two peach varieties: Alberta and Red Haven.

2- Survey of natural enemies

Samples of natural enemies were gathered using beating trap from the same locations in which aphid samples has been taken and in the same period. Ten blows (shots) by a stick has been applied on the branches on the surroundings of 5 chosen trees in order to collect predator insects. The operation repeated on the same chosen trees along the season in each field. Insect aspirator was used to collect the falling insects on the beating tray, and to collect of the hiding predator insects between the almonds leaves wrinkles. The adjacent aphid mummies were gathered from the leafs using a brush made of natural goat hair. Collected samples were kept in small glass vials in order to recognize the emerged parasitoids. Insect net was used to collect flying insects like the Chrysopa, Syrphid species and other flies. An addition, periodically collection of pieces of almond shoots with the curly leaves (that contains aphids) were taken and put in big glass jars to isolate insects that present in the aphid colonies .

3- Population dynamics of natural enemies throughout the season

An almond orchard has been chosen in Urman near to As-Sweida, in the south of Syria. This orchard planted recently (4-5 years old) by about 150 trees from a number of almond varieties.

The aphid injury occurred basically on Princess, Firanies and Ferraduel in which this study focused. The attacked trees were marked for stable samples throughout the seasons (2003 and 2004). Leaf samples has been taken from the start of leaf curling and until the aphid disappeared at the end of summer. Beating tray was used for sampling predators. 10 blows (hitting) with a stick on the surroundings branches of injured tree has been done for of five random trees weekly. All fallen insects were gathered and counted, and they were taken to the lab for the later identification and the statistics. The field samples were repeated by the mentioned way weekly from the beginning of injury symptoms (wrinkling leaves) until the end of the observation of the aphid colonies in the middle of August.

Results and Discussion

1- survey of aphid species in almond trees

Two species of aphids that presents in the curly almond leaves has been identified. The Almond leaf-curl aphid *Brachycaudus amygdalinus* (Schouteden), which represents more than 97 % of the examined aphid samples throughout the study period, and Leaf-curling plum aphid *Brachycaudus helichrysi* (Kaltenbach), that represents much less numbers than the previous species. *B. amygdalinus* occurred from April to mid August in all study years, whereas *B. helichrysi* appeared between end of July and beginning of July only. We did not found the green peach aphid *Myzus persicae* throughout the study period neither on almonds nor on peach except one situation in Jabal Urman where few peach trees were heavily attacked between mid May and mid July 2006. *B. amygdalinus* caused severe wrinkling of the leafs and later deformed the growing shoots. *M. persicae* caused stunting of the annual shoots and excreted abundant honeydew.

Those two species of aphid which caused wrinkling the almonds leaves were mentioned by Talhouk (1972, 1977) in Lebanon. On the other hand, this study confirms the non importance of *M. persicae* in Southern Syria corresponding to what Talhouk (1977) and Hamdan (1986) found in Lebanon and Jordan.

2- Survey of natural enemies

Predators were more diverse, numbers and efficiency than parasitoids. They appear effectively about one month after the activity of the aphids.

17 species of Coccinellidae were identified as predators of the ALCA (table 1). Khail (2006) found 24 species of coccinellidae on almonds, but some of that species don't feed on aphids. Hemipterous predators were 4 species of each of Anthocoridae and Miridae. Three species of Syrphid fly, one of each Chamaemyiidae and Chrysopidae. Hemipterous bugs were widespread in abundant on injured almond trees. One parasitoid from Aphidiidae was also mentioned but in limited numbers. In addition, we found seven species of spiders but we could not identify them yet. These spiders were general predators like most species of spiders, and can attack other natural enemies of ALCA, too.

Table 1. Identified species of predators and parasitoids on Almond curl leaf aphid, *Brachycaudus amygdalinus* at various locations in As-Sweida Mountain

Identified species	Family	Order
<i>Adalia decmipunctata</i> (Linnaeus)	Coccinellidae	Coleoptera
<i>Coccinella septempunctata</i> Linnaeus		
<i>Coccinella undecempunctata aegyptica</i>		
<i>Exochomus nigromaculatus</i> (Goeze)		
<i>Exochomus quadripustulatus</i> (Linnaeus)		
<i>Harmonia quadripunctata</i> (Pontoppidan)		
<i>Hypersapis histeroides</i> (Faldermann)		
<i>Hyppodamia variegata</i> (Goeze)		
<i>Nephus bipunctata</i> (Kugelann)		
<i>Nephus quadrimaculatus pictus</i> Ganglbauer		
<i>Oenopia conglobata</i> (Linnaeus)		
<i>Scymnus araraticus</i> Khnzorian		
<i>Scymnus apetzi</i> Mulsant		
<i>Scymnus flavicollis</i> Redtenbacher		
<i>Scymnus subvillosus</i> (Goeze)		
<i>Scymnus syriacus</i> (Marseul)		
<i>Stethorus gilvifrons</i> Mulsant	Staphelinidae	
<i>Tachyporus hypnorum</i> F.		
<i>Episyrphus balteatus</i> (DeGeer).	Syrphidae	Diptera
<i>Scaeva pyrastris</i> (Linnaeus)	Syrphidae	
<i>Eupeodes (Metasyrphus) corollae</i> (Fabricius)	Syrphidae	
<i>Leucopis</i> sp.	Chamaemyiid	
<i>Anthocoris nemoralis</i> (Fabricius)	Anthocoridae	Heteroptera
<i>Anthocoris minki</i> Dohrn		
<i>Orius (Orius)</i> sp.		
<i>Orius (Heterorius) horvathi</i> (Reuter)		
<i>Campylomma</i> sp.	Miridae	
<i>Campylomma verbasci</i> (Meyer-Dur)		
<i>Deraeocoris pallens</i> (Reuter)		
<i>Deraeocoris punctulatus</i> (Fallen)		
<i>Chrysoperla carnea</i> (Stephens)	Chrysopidae	Neuroptera
<i>Aphidius</i> sp.	Aphididae	Hymenoptera
<i>Theridion</i> sp.	Theridiidae	Araneae

3- Population dynamics of the natural enemies through the growing season

Oenopia conglobata appeared as the first predator in small numbers at the beginning of aphid injury. It followed by *C. septempunctata* after about 15 days of aphid appearance, i.e. in the middle of April or beginning of May until mid July as a dominant predator of this aphid in this period.

Its numbers developed quickly associating with the development of numbers of aphid population. Its peak numbers was in first week of June. It decreased thereafter quickly until he disappeared totally after end of June. Other coccinellids appeared there after throughout the season. *Scymnus araraticus*, *Scymnus subvillosus*, and *Oenopia conglobata* were the most abundant during the season and attack ALCA effectively. Some other coccinellids fed occasionally on almond aphid like *Nephus bipunctata* and *Stethorus gilvifrons*. Early appearance of *C. septempunctata* in spring agree with Almatni et al. (2002) finding on apple trees. Due to its huge size, *C. septempunctata* can attack ALCA just when aphid begin to establish its colonies.

Predator bugs were of a high importance in managing the ALCA. The first species of the predator bugs that noticed in 2003 was *Campylomma* sp. which appeared in high numbers coinciding with *Orius horvathi* which increases up and became more abundant and the dominant predator till the end of the season (fig. 1). It appears that it is the most important predator of hemipteraous due to its highest number in the weekly samples. It followed by *Anthocoris nemoralis* and *Deraeocoris punctulatus*. All mentioned bugs could fed on other arthropods on almond and peach trees like almonds tiger and spider mites, and due to their small size they can move effectively between curled leaves and prey on ALCA. *Deraeocoris punctulatus* is known as a common predator of small insects on fruit trees such as woolly apple aphid (Almatni et al., 2002) and pear psylla on pear (Almatni and Elabdulla, 2003; Abu Faour, 2002) and a number of the other insects . Hemiptera predators are common predators on various insect species on different crops in the study area.

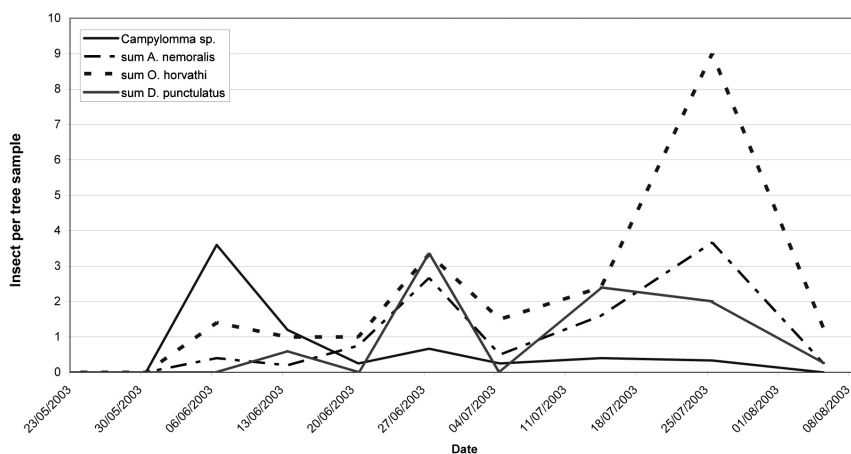


Fig. 1 Population dynamics of predatory bugs on almond trees in 2003

Four species of predator flies were noticed. The most abundant was *Leucopis* sp. which was present throughout the injury period in all seasons, especially at the end of spring. It has a superior ability to enter into the folds of the curly leaves catching aphids between it. It was very difficult to follow-up its numbers and link it with the development of the aphids. Their larvae's numbers differed from a date to another.

It seems that it has two generation per year. Syrphid flies were less important than *Leucopis*, because of the few numbers of both adults and larvae in samples. Some Syrphid larvae were noticed in first of the season with the start of leaf wrinkling. It is possible that the need of adults for nectar of flower is a limited factor that flowers exist only in the beginning of spring time in the study area. On the other hand, it is known that adults respond to honeydew for oviposition, but ALCA produce just few honeydew.

Lacewings *Chrysoperla* spp. doesn't play important role against *B. amygdalinus*, despite its great importance on the other species of aphids in the study area, i.e. woolly apple aphid on apple (Almatni et al., 2002) and pear psylla on pear (Almatni and Elabdulla, 2003). Its presence on the wrinkling leaves was accidentally and enables the assumption of its presence by chance. It is possible that our observation of the adults of green lace-wing *Chrysoperla carnea* flying between the injured leaves nevertheless its larvae were in very few numbers throughout the samples taking period. This is a result of the wrinkles leaves which don't allow the larvae to active freely.

One parasitoid was mentioned during this study. This was *Aphidius* sp which appears from mid May until the end of growing season. It is unknown yet the weak efficacy of this parasitoid on ALCA.

Results of this study confirm what Almatni et al. (2002) noticed about species of natural enemies and appearance dates in apple orchards. Some predators were also mentioned by Triggiani (1973) at Southern Italy. All recorded natural enemies could not achieve adequate control nor any kind of limitation of the development of the aphid populations in the area studied.. This result may differ from old almond and peach trees where annual growth is weak and sap flow is limited. It is recommended to release some successful natural enemies or to test natural insecticides like Neem in order to keep aphid population in almond and peach orchards below damage threshold.

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