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Preliminary study of some aphid natural enemies of Tulkarm- Northern West-Bank and their aphid-plant associations

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Abstract

Aphids are one of the major pests attacking cultivation in the city of Tulkarm. Chemical control often failed to reduce their numbers to a non-damaging level. In order to convert to organic production; we should know more about these pests and their naturally occurring antagonists; which is very essential in the integrated pest management programs. A field survey was carried out in Tulkarm, in 2009 and 2010; on aphid species attacking vegetative crops and orchards. Thirty species of different natural enemies were recorded; fourteen Coccinellidae, two Anthoridae and one Miridae, three Syrphidae, one species of each of Chrysopidae, Chamaemyiidae, and red soldier beetle. In addition to six parasitoid species and one entomopathogenic fungi. Results are also presented by host aphids and by their host plant species.

Keywords: Aphid, Predator, Parasitoid, West bank, Kadoorie

Introduction

Tulkarm Governorate in the northwestern West Bank its land area consists of 28,793 dunam and the population of approximately 58,962. Tulkarm's arable land allows the city inhabitants to produce citrus fruits, melons, olives, olive oil, tomatoes, potatoes, wheat, sesame, peanut, eggplant, peppers, green beans, guava, and other protected and non-protected products (PCBS 2006).

Aphids (Homoptera: Aphidoidea) are the most important agricultural pests worldwide (Minks and Harrewijn, 1987). They can damage their host plant directly by sucking the plant sap (Moran, 1992), induce gall formation (Qubbaj et al., 2004), and they can damage their host indirectly by transmitting plant viruses (Blackman and Eastop, 1994; Blackman and Eastop, 2000; Carter et al., 1980; Conti, 1985). Aphid natural enemies play a significant role in reducing aphid populations (Stry, 1988). More than 400 species, 60 genera and subgenera of aphid parasitoids are described worldwide (Stry, 1988; Dolphin & Quicke, 2001). All species are solitary endoparasitoids of aphids and have a great impact on pest aphid control (Hagvar and Hofsvang, 1991). Host finding starts with the selection of a suitable habitat, with the food plants of the host aphids playing an important role, because the parasitoids are attracted to odors released from aphid-infested plants (Pinto et al., 2004). Many Aphid parasitoid species and tritrophic associations were extensively studied worldwide (Stry et al., 2000; Talebi et al., 2009; Tomanovic et al., 2006). But only few investigations have been conducted on aphid parasitoids in our area (Khalil, 2006; Almatni and Khalil, 2008; Aslan & Karaca, 2005; Olmez & Ulusoy, 2003; Cohen et al., 1996; Argov & Rössler, 1988; Rosen, 1965). The purpose of this study was to elaborate the parasitoid fauna and provide information about the population structure, host range pattern, distribution and faunistic complexes of aphid parasitoids. Such information is essential in discovering new and potentially valuable biological control agents and choosing appropriate species and biotypes for the integrated pest management program.

Materials and Methods

Study location

Experiments were carried out at the Palestine Technical University Khdoorie campus, at the northern part of the west bank (32°18'_N, 35°01'_E), where the fields are cultivated with various fruit, forest trees, vegetable (protected and non protected) and field crops, some of these crops are Oleander, Poplar, Oak, Eucalyptus, Cypress, Apple, Almond, Peach, Grape, Citrus, Ornamentals, Cabbage, cauliflowers, Mallow, Faba bean, Bean, cucumber, pepper, squash...ect.

Surveying predators in the fields

From March 2009-2010, predators were sampled weekly with a sweep net, aspirators and different traps. After each collection, the contents of the sweep net were transferred to a plastic bag, killed with ether, and taken to the laboratory for counting and identification. All stages except eggs of predators were counted. The investigation for diversity and abundance of predators was carried at through the alfalfa zone surrounding the cotton field, which was mainly used to propagate natural enemies for cotton aphid control.

Samples from plants and weeds bearing aphid colonies consisting of both live and mummified aphids were collected from many localities of northern West Bank. Plants were brought to the labs of Kadoorei research center and later identified. Plant were transplanted in small pot and kept in separated wooden cages, live aphids were preserved in 90% ethyl-alcohol and 75% lactic acid 2:1. Mummified aphids of the same species and plant sample were placed in groups in small Petri-dishes. Next, the petri-dishes were put kept in insectariums. (20± 3 °C, 65% relative humidity, 16:8 L:D photoperiod). Parasitoids emerging from mummified aphids were collected and a slide was dissected and slide mounted in Canada balsam for later identification (Talebi et al., 2009).

Results and Discussion

Survey of natural enemies

The result shows that aphid Predators were more abundant, more diverse, and more efficient than aphid parasitoids. They appear effectively short after the activity of the aphids. Fourteen species of Coccinellidae, four species of Syrphidae, two species Anthocoridae and one species of Miridae were identified as predators of the aphid at the university campus station, while only six species of Braconidae were identified as parasitoids, and one Entomopathogenic fungi were isolated from infested aphid species (Table 1).

In the surrounding areas and regions; same number and species were recorded (Khalil, 2006, Almatni and Khalil, 2008, Aslan&Karaca, 2005, Olmez&Ulusoy, 2003). In southern Syria 24 species of coccinellidae were found on almonds (Khalil, 2006), and 30 natural enemies species (Almatni and Khalil, 2008). In Turkey sixteen aphid parasitoid were recorded in Diyarbakir Province (Olmez&Ulusoy, 2003), while nineteen aphid parasitoid was recorded in Kahramanmaraş Province (Aslan et al., 2004). In Isparta fruit region in Turkey; Aslan&Karaca (2005) recorded eight species from the family Coccinellidae (Coleoptera), three from Syrphidae (Diptera) and one species from Forficulidae (Dermaptera) were found as predator. In Sweida/ Syria; fifteen Coccinellidae, four Anthocoridae and four Miridae, three Syrphidae, one Chrysopidae and one Chamaemyiidae, one parasitoid was found in almond orchards (Almatni and Khalil, 2008). Halperin et al., (1995) have registered seventyone species of Coccinellidae, nineteen of these species were recorded for the first time.

A mixed association between host plant, aphid naturally occurring predators and parasitoid. Coccinellidae and Braconidae were dominant on all fruit trees, agricultural crops, ornamental trees and shrub species, as well as weeds and other plants that have been sampled in a variety of habitats in Tulkarm Province (Table 2). While Cecidomyiidae were more dominant on vegetables, crop field and weeds, were these plant are usually transplanted from local nurseries, which might have the over-wintering aphid midges pupae. Coccinellidae appeared on aphids earlier than Braconidae during this study. Our findings agree with Dixon, 1997; Kavallieratos et al., 2004a, 2004b).

Most of the collected predators and parasitoids were found on forest trees, fruit trees, ornamental trees, vegetative crops and weeds in the Kadoorie campus area. This indicates the presence of naturally occurring of predator and parasite despite the conventional use of chemical control on vegetables and field crops. In our opinion this is probably related to the intercropping systems used in this area, as well as the agricultural practices used which are usually dependant on rainfalls and in most cases absence of pesticide application. Even weeds grown in this area may be associated with aphids and their natural enemies they may harbor the dormant stages of both aphid species and their antagonist. This survey showed that the natural balance and ecosystem equilibrium in the studied areas have not yet been destroyed or totally damaged, and that aphids can be controlled by their natural enemies. We can consider this study as only a preliminary step in describing the aphid-predators / parasitoid complex of northern region of West Bank / Palestinian territories. Further experimentation is required in order to assess their interactions in the field for understanding better ways of biological control strategies in West Bank.

Table 1. Identified species of natural enemies on different aphid species collected in the Khdooriecampus field in Tulkarm Governorate, West Bank

Natural enemies / antagonist	Species of predators or parasitoids
Parasitoids:	<i>Aphidius ervi</i> Haliday
Braconidae	<i>Aphidius colemani</i> Vier.
	<i>Lysiphlebus</i> spp.
	<i>Aphelinus</i> spp.
	<i>Binodoxys</i> spp.
	<i>Diaeretiella</i> rapae
Predators:	<i>Coccinella septempunctata</i> L.
Coccinellidae	<i>coccinella undecimpunctata</i> L.
	<i>Adalia bipunctata</i> L.
	<i>Adalia decempunctata</i> L.
	<i>Chilocorus stigma</i> Say,
	<i>Hippodamia variegata</i> (Goeze)
	<i>Hippodamia convergens</i>
	<i>Nephus bipunctatus</i> (Kugelann)
	<i>Exochomus quadripustulatus</i>
	<i>Anatis 15-punctata</i>
	<i>Harmonia quadripunctata</i>
	<i>Psyllobora vigintimaculata</i>
	<i>Cycloneda munda</i>
	<i>Scymnus</i> sp.
Syrphidae	<i>Metasyrphus</i> sp. (Eupeodes)
	<i>Eupeodes corollae</i> (Fabricius)
	<i>Episyrphus</i> sp.
	<i>Syrphus</i> spp.
Anthocoridae	<i>Orius</i> spp.
Miridae	<i>Anthocoris</i> spp.
	<i>Deraeocoris</i> spp.
Chrysopidae	<i>Chrysoperla carnea</i>
Cecidomyiidae	<i>Aphidoletes aphidimyza</i>
Cantharidae	<i>Rhagothyra fulva</i>
Microbial	<i>Verticillium lecanii</i> (Zimmermann)
Plectosphaerellaceae	

Table 2. List of naturally occurring predators and parasitoids collected from host plant attacked by multiple aphid species in Khdooriecampus field in Tulkarm Governorate, West Bank

Plant name	Family Name							
	Braconidae	Coccinellidae	Syrphidae	Anthocoridae	Miridae	Chrysopidae	Cecidomyiidae	Cantharidae
Forest tree	*	*						
Poplar		*		*	*			
Oak		*		*		*		
Eucalyptus Cypress		*				*		
Fruit tree								
Apple	*	*	*	*		*		*
Almond	*	*	*	*	*			*
Peach	*	*	*	*		*		*
Grape	*	*		*				*
Citrus	*	*						*
Vegetable Cabbage	*	*	*	*	*		*	
cauliflowers	*	*		*	*	*	*	
Faba bean	*	*	*			*	*	
Bean	*	*		*			*	
cucumber	*	*					*	
pepper	*	*	*	*			*	
squash	*	*	*				*	
Field crop								
Wheat	*	*		*			*	
Wild Oat	*	*	*	*			*	*
Barley	*	*		*			*	*
Ornamental								
Oleander	*	*	*	*		*	*	*
Roses	*	*		*			*	*
Philodendron	*	*	*	*		*	*	*
Weeds								
Mallow	*	*	*	*			*	
Chenopodium	*	*	*	*			*	*
Nightshade	*	*	*	*		*	*	*

* indicated the presence of the natural enemies on the host plant

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