

Place of Hymenoptera Parasitoids of Aphids in Two Citrus Orchards in Boumerdès, Algeria

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Abstract

The purpose of this study is conducted in two Citrus orchards in Baghlia and Bordj Menaïel (Boumerdes), consists in determining the abundance of aphids as well as the inventory of their natural enemies. The inventory made between February 18th and May 30th, 2018, thanks to the unglazed yellow plates, yellow basins and sampling by hand, brought out in the citrus fruit orchard of Bordj Menaïel 14 Aphidian species. The predominant species *Aphis citricola* (AR = 65.01%) followed by *Toxoptera aurantii* (AR = 10.21%). In the Baghlia orchard 15 species collected are the same except *Aphis fabae*. The dominant species *Aphis citricola* (AR = 75.15%), followed by *Toxoptera aurantii* (AR = 8.93%). The parasitoids of the aphids are represented by 9 families collected in the Bordj Menaïel orchard (Braconidae, Ceraphronidae, Figitidae, Ichnomonidae, Proctotrupidae, Encyrtidae, Tricogrammatidae, Diapriidae, Eulophidae) represented by 15 species. The dominant species *Trichogramma* sp ind (AR = 25%). While in the Baghlia orchard 7 families are collected (Braconidae, Ceraphronidae, Figitidae, Encyrtidae, Tricogrammatidae, Diapriidae, Eulophidae) with 13 species. The dominant species is *Trichogramma* sp ind with (AR = 54%). The predatory species collected in the two orchards in our study are represented by 4 families (Syrphidae, Cecidomyiidae, Coccinellidae, Chrysopidae). The Shannon-weaver index (H') is 2.16 bits, 1.65 bits respectively in the orchard of Bordj Menaïel and Baghlia. The value of equitability E is equal to 0.42 and 0.33 respectively to Bordj Menaïel and Baghlia. For the method of yellow basins. This shows that the two orchards have a great diversity. As well as species tend to be in balance with each other.

Keywords: Hymenoptera; Aphids; Citrus Orchards; Boumerdès

Introduction

Citrus fruits are widespread across the world, although their production is mainly concentrated in certain geographical areas. This sector operates in a context of highly competitive globalized markets. In Algeria, citrus cultivation is of strategic importance.

Despite the improvement in production and productivity under various national programs in recent years. The Algerian citrus orchard still suffers from several constraints which reduce its yields. Insects are partly responsible for the drop in yield, in particular aphids which constitute a group of insects extremely widespread in the world [1]. The damage caused by these species results in the weakening of the tree by taking up the sap and reducing the photosynthetic surface of the leaves following the establishment of sooty mold. In addition, they are formidable vectors of viral diseases, such as mosaic and jaundice [2]. The intensive use of pesticides threatens the nutritional

value of fruits, disrupts the cycle of pollinators, pollutes the soil and generates the emergence of insect populations resistant to these products. In recent years, several state institutions and researchers have begun to take an interest in the auxiliaries associated with pest aphids. In Algeria, the work of Doumandji-Mitiche., *et al.* [3], Biche [1], Lammari., *et al.* [4], Sahraoui., *et al.* [5], Benoufella-Kitous., *et al.* [6] and Fekkoun., *et al* [7]. It is with the aim of supplementing the lack of identification of the enemies of aphids that exists in the region of Boumerdes that we carried out this study in a place not previously studied in two regions of the Wilaya of Boumerdes (Baghlia and Bordj Menaiel).

Aim of the Study

Our work aims, on the one hand, to carry out an inventory of aphids colonizing citrus orchards and on the other hand, to identify the aphid parasitoids that exist and which play an important role in biological control.

Materials and Methods

The present work was carried out in two citrus orchards in the region of Boumerdes (36° 46' 0" N, 3° 28' 0" E), the first orchard located in Bordj Menaiel on an area of 2 ha aged 10 years old carries the Thomson variety. While the second located in the municipality of Baghlia, it covers an area of 3 ha. The strain is a mix between Thomson and 11 year old Washington. The work carried out during the agricultural season is mainly plowing, irrigation and pruning of fruiting bodies. The organic and mineral amendments are regular, as well as the phytosanitary treatment against harmful insects such as mealybugs and aphids. Sampling of Aphids and their hymenoptera parasitoids is carried out using yellow plates, yellow plates sticky. These techniques are frequently used to assess the abundance of certain auxiliary insects such as Ladybirds and Hymenoptera, but also pest insects such as aphids [8]. In addition to these techniques there is the direct capture of insects by hand after observation on leaves and twigs. The installation of the traps is carried out during the period from February 18 to May 30, 2018.

Results and Discussions

Aphids present in the two citrus orchards

Samples collected using different sampling methods in the two citrus orchards Baghlia and Bordj Menaiel. Highlights the existence of 15 species of pest aphids. This inventory allowed us to draw up a list of these species of Aphids, recorded in table 1.

Order	Families	Species
Homoptera	Aphididae	<i>Acyrtosiphon pisum</i> Harris, 1776
		<i>Aphis craccivora</i> Koch, 1854
		<i>Aphis fabae</i> Scopoli, 1763
		<i>Aphis gossypii</i> Glover, 1877
		<i>Aphis nerii</i> Boyer de Fonscolombe
		<i>Aulacorthum solani</i> Kaltenbacher, 1843
		<i>Brachycaudus helychrysi</i> Kaltembacher, 1843
		<i>Brevicoryne brassicae</i> Linné, 1758
		<i>Hyperomyzus lactucae</i> Linné, 1758
		<i>Macrosiphum rosae</i> L., 1758
		<i>Myzus persicae</i> Sulzer, 1776
		<i>Rhopalosiphum maidis</i> Fitch, 1856
		<i>Rhopalosiphum padi</i>

Table 1: Aphididae collected in the two citrus orchards.

The most abundant species in the two orchards during the study period is *Aphis citricola* with 1615 individuals, followed by *Toxoptera aurantii* with 178 individuals, *Aphis gossypii* with 62 individuals, *Brachycaudus helycrisi* with 32 individuals. The other species are less frequent and correspond to low values. In a study of a citrus orchard in Tizi-Ouzou, Benoufella-Kitous, *et al.* [6] note four species of wingless aphids, in order of importance: *Aphis citricola*, *Aphis gossypii*, *Toxoptera aurantii* and *Aphis craccivora*.

Hymenoptera parasitoids of aphids in the two citrus orchards

The hymenoptera parasitoids identified in the two regions Bordj Menaïel and Baghliia are well detailed below. The inventory of aphid parasitoids species identified in the two orchards during the experimentation period are listed in table 2.

Order	Families	Species parasitoides
Hymenoptera	Braconidae	<i>Apanteles glomeratis</i> RobBrown, 1797
		<i>Aphedius colimani</i> Viereck, 1912
		<i>Lysiphlebus fabarum</i> Marshall, 1896
		<i>Rhabepyris fasciatus</i>
		<i>Aphedrus</i> sp
		<i>Opius</i> sp 1
		<i>Opius</i> sp 2
	Figitidae	<i>Aganaspis pelleranoi</i> De Santis 1965
	Ichnomonidae	<i>Diadegma hasctag</i>
	Proctotrupidae	<i>Proctotrupes</i> sp
	Diapriidae	<i>Trichopria</i> sp
	Ceraphronidae	<i>Basalys</i> sp
		<i>Ceraphron</i> sp
	Eulophidae	<i>Eulophidae</i> sp
	Encyrtidae	<i>Encyrtidae</i> sp
	Trichogrammatidae	<i>Trichogramma</i> sp ind

Table 2: The parasitoid Hymenoptera identified in two orchards Bordj Menaïel and Baghliia.

The use of the yellow basins and the yellow sticky patches revealed 16 parasitoid species distributed among 9 families belonging to the order Hymenoptera. The Braconidae family is the most dominant with 7 species. According to Fraval [9] aphid parasites are recruited from Braconidae, in particular from the genera Aphidiu, Aphedrus, Lysiphlebus, Praon.

The change in the frequency of parasitoid species of aphids in the two orchards has been monitored for the month from February 18 until May 30, 2018, the results obtained are shown in figure 1.

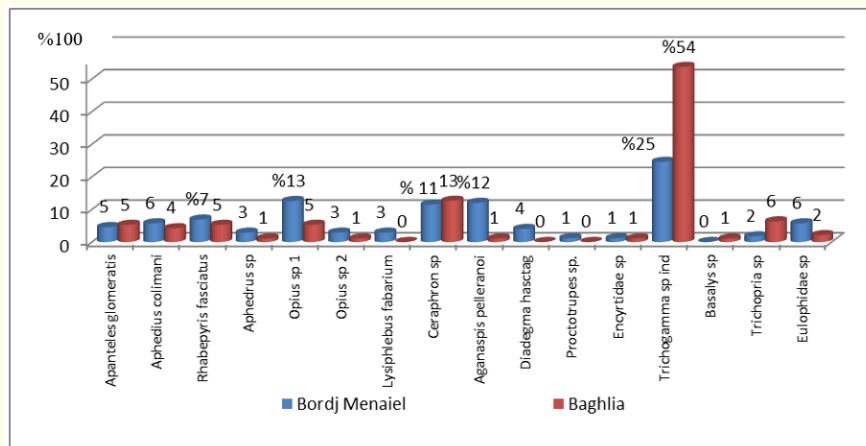


Figure 1: Frequencies of parasitoid species of aphids collected in the two citrus orchards.

A total of 15 species of aphid parasitoids collected in the Bordj Menaïel region. The dominant species is *Trichogramma sp ind* with AR = 25%; Followed by *Opius sp1* (AR = 13%); *Aganaspis pelleranoi* (AR = 12%); *Ceraphron sp* (AR = 11%) and *Rhabdopyris fasciatus* (AR = 7%). The other species present at low frequencies. In Baghlia 13 species of aphid parasitoids are noted. The same species which dominates *Trichogramma sp ind.* with AR = (54%); Followed by: *Ceraphron sp* with AR = 13%; *Trichopria sp.* (AR = 6%); *Opius sp1*, *Apanteles glomeratis* and *Rhabdopyris fasciatus* each represented by AR = 5%. The other species which remain present frequencies vary between 1 and 4%. Likewise, Fekkoun., et al. [7] note the dominance of *Trichogramma sp.* in an orange orchard in Khemis El Khechna. In Tunisia Ben Halima-Kamel., et al. [10] noted three parasitoids which dominate in the citrus orchard namely *Lysiphlebus confusus*, *Aphidius matricariae* and *Trioxys angelicae*. Gügan., et al. [11] noted that *Aphidius colemani* and *Binodoxys angelicae* are among the natural enemies of *Aphis citricola* and *Toxoptera aurantii* on Citrus.

Frequencies of citrus aphid predators in the two orchards

During the study period we noted the presence of 6 species belonging to three orders Diptera, Coleoptera and Neuroptera. The frequency of these species in the two orchards is well detailed in figure 2.

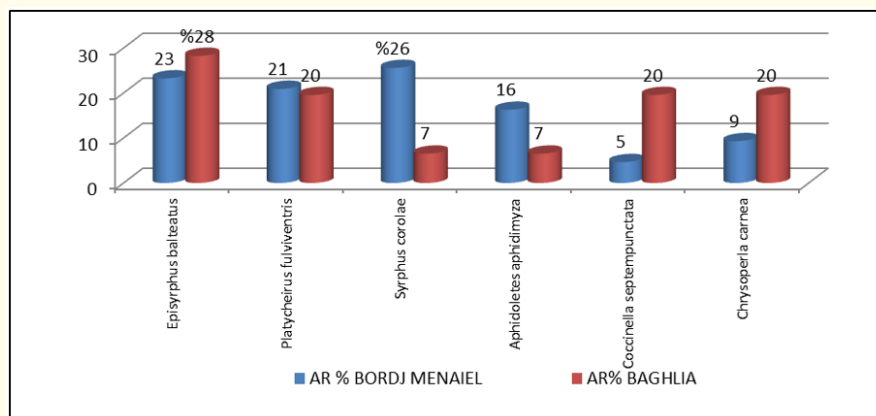


Figure 2: Frequencies of citrus aphid predators in both orchards.

In the Bordj Menaiel orchard the dominant species *Syrphus corolae* with AR = 26%; Followed by *Episyrphus baltatus* with AR = 23% and *Platycheirus fulviventris* AR = 21%. While in the orchard of Baghlia. Dominant species *Episyrphus baltatus* with AR = 28%; followed by *Platycheirus fulviventris*, *Coccinella septempunctata* and *Chrysoperla carnea* each represented by AR = 20%. The remaining two species *Syrphus corolae* and *Aphidoletes aphidimyza* each have a frequency of 7%. On the other hand Fekkoun, *et al.* [7] report the dominance of the order *Coleoptera* with the family *Coccinellidae*. Sahraoui, *et al.* [5] in an analysis of the distribution of ladybugs in Algerian geographical areas note that the species: *Coccinella septempunctata* (Linnaeus, 1758), *Hippodamia* (*Adonia*) *variegata* (Goeze, 1777), *Stethorus punctillum* (Weise, 1891), and *Henosepilachna argus* (Goeffroy, 1762), have a wide ecological plasticity. On the other hand in a similar study of the natural enemies of citrus aphids in Tunisia Ben Halima Kamel, *et al.* [10] note the dominance of *Episyrphus baltatus*, *Aphidoletes aphidimyza*, *Chrysoperla carnea* and *Coccinella septempunctata*.

Ecological index of structure applied to the species collected in the two citrus orchards

The values of Shannon-Weaver diversity and the fairness of the trapped species summarized in table 3.

	Methods of yellow basins		Yellow platelet methods	
	Orchard of Bordj M.	Orchard of Baghlia	Orchard of Bordj M.	Orchard of Baghlia
N	2292	2124	49	25
S	30	32	10	9
H max	5.06	5.02	3.33	3.18
H'	2.16	1.65	2.97	2.78
E	0.42	0.33	0.89	0.87

Table 3: The Shannon-Weaver diversity and species equity index.

N: Number of Individuals; S: Wealth; H max.: Maximum Diversity; H': Shannon-Weaver Diversity Index and E: Equity Index.

Our results show that the two orchards have great diversity. As well as species tend to be in balance with each other. According to Blondel [12], when living conditions in an environment are favorable, many species are found.

Conclusion

The different traps used in the present study in the two citrus orchards revealed the presence of 15 species of citrus aphids. We also identified 16 parasitoid Hymenoptera species distributed between 9 families and 6 aphid predatory species belonging to three orders *Diptera*, *Coleoptera* and *Neuroptera*. The diversity of parasitoid and aphid predator species can help ensure natural biological control.

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