

# Inventory of Aphids and Their Parasitoids of Vegetable Crops in the Region of Setif (North-East of Algeria)

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**Abstract-** The importance of the damage caused by aphids in vegetable crops stimulated us to achieve, in Setif, the inventory of aphids and their parasitoids. The application of different sampling methods (trapping, hunting sight...) allowed us to find 25 aphid species with species: *Myzus persicae*, *Aphis gossypii*, *Aphis fabae*, *Rhopalosiphum maidis*, *Rhopalosiphum padi*, *Macrosiphum euphorbiae*, *Aphis craccivora*, *Nasonovia ribisnigri* the most frequent, and 16 species of parasitoids the most common are ; *Aphidius ervi*, *Aphidius colemani*, *Aphidius matricariae*, *Aphidius rhopalosiphii*, *Aphidius transcaspicus*, *Aphidius avenae*, *Lysiphlebus testaceipes*, *Lysiphlebus confusus* on vegetable crops in the region of Setif. The study also revealed that 111 tritrophic associations (parasitoid-aphid-plant) have been established.

**Keywords-** *Aphids, crops, parasitoids, tritrophic associations, Algeria.*

## I. INTRODUCTION

The vegetable crops are infested year-round by a great diversity of pests that cause producers to use pesticides frequently. Among the pests we find the aphids which are present on the majority of cultures; they exhibit high specific diversity and often an exponential multiplication rate. These characteristics make it permanent and formidable pests [1].

The Control agents against the aphids are numerous, but the parasitoids are recognized as being highly effective potential agents [2]; [3]. Among the parasitoids we find the Hymenoptera which comprise the majority of parasitoids. The families that parasitize the aphid belong to the suborder of Apocrita: Braconidae and Aphelinidae. There are several subfamilies, the best known is the Sub-family: Aphidiinae (Hymenoptera: Braconidae) contains no less than 400 species throughout the world. Some of these species are solitary and specific aphid parasitoids [4];[5].

The Tritrophic associations (plant-aphid-parasitoid) benefited numerous studies in several countries [4] [6] [7].

The literature demonstrates 17 species recorded in Algeria [8] [9]. According to [10], 47 aphid species were found on 85 vegetable species and 29 species of Hymenoptera parasitoids in eastern Algerian. In Tunisia, 19 aphid species were found on fruit trees [11]. In Egypt, the studies conducted by [12] have

identified 80 aphid species. In Iraq, the studies carried have been able to highlight a wealth of 90 aphid species [13].

## II. MATERIALS AND METHODS

This study was conducted in several fields of vegetable crops in various localities of the region of Sétif where the vegetable crops are highly developed and as well involve local species than the exotic species. The protocol was followed over ten month duration: from 17/07/2012 to 18/05/2013 through field outings.

The inventory of aphids has been done by visual examination of all the aerial parts of the plant for plants showing abnormalities in vegetative harbor, these pieces were cut with the scissors and placed in plastic bags. Aphids are harvested, at each observation, to the paintbrush and then put into test tubes filled with 70°alcohol. For the inventory of parasitoids, the mummified aphids are harvested in transparent capsules, and kept in a stove at a temperature from 25° C and a relative humidity of 70% until they hatch then put in tubes test with 70 °alcohol.

The microscopic identification of aphids requires mounting between slide and cover of the sample before identification of aphids. The technique of preparation is similar to that cited by [14]. For determining aphids, we used the keys proposed by [15];[16]. Well as precious aid of Mrs. Hakimi a teacher Doctorate of Department of Biology and Animal Physiology, Faculty of: Science of the nature and life, Setif University 1.

The following keys are used for the determination of parasitoids of aphids; [17]; [18]; [19]; [20]; as well as with the help of Mrs. Hakimi (University of Sétif 1).

## III. RESULTS AND DISCUSSION

The inventory of aphids and their parasitoids of vegetable crops in the region of Setif have identified 25 aphidian species and 16 species of parasitoids. The aphids, *Myzus persicae* (07 plant species), *Aphis fabae* (06 plant species), *Aphis gossypii* (06 plant species), *Macrosiphum euphorbiae* (06 plant species), *Acyrtosiphon pisum* (04 plant species), *Aphis craccivora* (04 plant species) are the most polyphagous. These results are consistent with the results of [21] who worked on aphids

vegetable crops in a few localities of eastern Algeria. The species inventoried on vegetable crops in the Setif region have been also reported by [22] who worked on the specific diversity of aphids in Algeria and by [10] who have studied the tritrophic Interactions plant-aphid-parasitic wasp observed in natural environments and cultivated in eastern Algeria.

As regards the parasitoids, the species *Aphidius avenae*, *Aphidius rhopalosiphii*, *Ephedrus niger*, *Diaeretiella rapae*, *Praon volucre*, *Trioxys angelicae*, each species has parasitized 01 species of aphids, the Species *Aphidius funebris*, *Aphidius transcaspicus*, *Lysiphlebus fabarum*, *Lysiphlebus testaceipes*, *Trioxys acalephae*, each one of the latter has been parasitized 02 aphid species, the Species *Ephedrus persicae*, *Lysiphlebus confusus*, each one has been able parasitize 03 aphid species, the species *Aphidius colemani* was able parasitize 05 aphid species, the species *Aphidius ervi* was able parasitize 09 aphid species, the species *Aphidius matricariae* were collected from of the mummies of 14 species of aphids. The 16 species of Hymenoptera parasitoids were equally reported by [10] in natural environments and cultured in eastern Algeria.

In Algeria, the study conducted by [10] led to the identification 29 species of Hymenoptera parasitoids in natural environments and cultivated in eastern Algeria.

In 2012, a study done by Chehma shows the presence of 19 species of Hymenoptera parasitoids into the natural environment and cultured in the region of Ghardaia [23].

In the other countries, studies show the presence of 11 species in Morocco [24] and 7 species in Tunisia [11]. 99 species are described in France [25], 11 species in Iran [19], and 21 species in Brazil [20].

The study also revealed that 111 tritrophic associations (parasitoid-aphid-plant) have been established. The species *Aphidius matricariae* has shown the most present. This parasitoid has formed 27 tritrophic associations with 14 aphid species (Tab. 01 and 02).

#### IV. CONCLUSION

The results of this work have established a first inventory of aphids and their parasitoids linked to flora species of vegetable crops in the region of Setif. A total of 16 species of Hymenoptera parasitoids is obtained from of the mummies of 25 aphid species restricted to 12 plant species belonging to 06 botanical families.

The species *Aphis fabae*, *Aphis gossypii*, *Macrosiphum euphorbiae*, *Myzus persicae* are the most represented. The study also revealed that 111 tritrophic associations (parasitoid-aphid-plant) have been established. The species *Aphidius matricariae* has shown the most present. This parasitoid has formed 27 tritrophic associations with 14 species of aphids. *Aphidius ervi*, who has parasitized 09 species of aphids mainly harmful to cultivated plants, can be used in biological control programs against these phytophagous.

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TABLE I. SPECIES OF APHIDS AND THEIR PARASITOIDS IN THE REGION OF SETIF DURING THE PERIOD FROM 17 JULY 2012 TO MAY 2013

Species of parasitoids	Species of Aphids	Vegetable crops
Aphidius avenae	Acyrtosiphon pisum	Phaseolus vulgaris.
Aphidius colemani	Aphis craccivora Aphis fabae  Aphis gossypii  Hyalopterus pruni Myzus persicae	Capsicum annuum, Vicia faba, Cynara cardunculus. Vicia faba, Solanum tuberosum, Lactuca sativa, Cynara cardunculus, Phaseolus vulgaris, Dacus carota. Solanum tuberosum, Capsicum annuum, Lycopersicon esculentum, Dacus carota, Cucumis sativus. Capsicum annuum. Lycopersicon esculentum, Capsicum annuum, Lactuca sativa, Cynara cardunculus.
Aphidius ervi	Acyrtosiphon pisum Aphis craccivora Aphis fabae  Hyadaphis foeniculi  Macrosiphum euphorbiae Myzus persicae Rhopalosiphum padi Myzus nicotianae Uroleucon ambrosiae	Brassica rapa, Brassica oleracea. Phaseolus vulgaris, Vicia faba, Capsicum annuum. Phaseolus vulgaris, Solanum tuberosum, Vicia faba, Cynara cardunculus, Dacus carota. Lycopersicon esculentum, Capsicum annuum, Cucurbita pepo. Lycopersicon esculentum, Capsicum annuum, Solanum tuberosum, Cynara cardunculus, Vicia faba, Brassica rapa. Brassica rapa, Lycopersicon esculentum Cucurbita pepo. Capsicum annuum. Capsicum annuum.Lactuca sativa.
Aphidius funebris	Brachycaudus cardui Uroleucon ambrosiae	Lycopersicon esculentum, Capsicum annuum, Cynara cardunculus. Lactuca sativa.
Aphidius matricariae	Acyrtosiphon pisum Acyrtosiphon lactucae Aphis fabae  Aphis gossypii Aphis nasturtii Aulacorthum solani Brachycaudus helichrysi Brevicoryne brassicae Hyalopterus pruni Macrosiphum rosae Myzocallis castanicola Myzus persicae Nasonovia ribisnigri Rhopalosiphum maidis	Capsicum annuum, Brassica oleracea, Brassica rapa. Lactuca sativa. Phaseolus vulgaris, Solanum tuberosum, Dacus carota, Cynara cardunculus, Vicia faba. Cucurbita pepo, Capsicum annuum. Cucumis sativus. Capsicum annuum. Cynara cardunculus, Capsicum annuum. Cynara cardunculus, Lycopersicon esculentum, Lactuca sativa. Brassica oleracea. Capsicum annuum. Cynara cardunculus. Lycopersicon esculentum. Lycopersicon esculentum, Capsicum annuum, Lactuca sativa. Lactuca sativa. Capsicum annuum.
Aphidius rhopalosiphii	Rhopalosiphum maidis	Capsicum annuum.
Aphidius transcaspicus	Chaitophorus sp Hyalopterus pruni	Capsicum annuum. Lycopersicon esculentum.
Ephedrus niger	Brachycaudus helichrysi	Lycopersicon esculentum, Lactuca sativa, Cynara cardunculus.
Ephedrus persicae	Acyrtosiphon pisum Lipaphis erysimi Myzus persicae	Phaseolus vulgaris Brassica oleracea, Brassica rapa. Solanum tuberosum, Capsicum annuum.
Diaeretiella rapae	Myzus persicae	Capsicum annuum, Lycopersicon esculentum, Solanum tuberosum.
Lysiphlebus confusus	Aphis gossypii Cavariella aegopodii Aphis nerii	Dacus carota. Cucumis sativus Dacus carota. Capsicum annuum.
Lysiphlebus fabarum	Aphis gossypii Myzus persicae	Vicia faba, Capsicum annuum. Cucumis sativus Lycopersicon esculentum.
Lysiphlebus testaceipes	Aphis fabae Rhopalosiphum maidis	Phaseolus vulgaris, Vicia faba. Capsicum annuum.
Praon volucre	Aphis fabae	Phaseolus vulgaris, Vicia faba, Dacus carota, Cynara cardunculus.
Trioxys acalephae	Aphis gossypii Aphis fabae	Capsicum annuum, Cucumis sativus Phaseolus vulgaris, Vicia faba
Trioxys angelicae	Aphis gossypii	Solanum tuberosum, Lycopersicon esculentum.

TABLE II. IMPORTANCE OF SPECIES PARASITIZED APHIDS, HOST PLANT SPECIES AND THE TRITROPHIC ASSOCIATIONS ESTABLISHED BY EACH SPECIES OF PARASITOID

<b>Parasitoids species (16 Species)</b>	<b>Number of Parasitized aphids (25 Species)</b>	<b>Host plants (12 Species)</b>	<b>Tritrophic associations (111 associations)</b>
Aphidius avenae	1	1	1
Aphidius colemani	5	10	19
Aphidius ervi	9	11	25
Aphidius funebris	2	4	4
Aphidius matricariae	14	12	27
Aphidius rhopalosiphi	1	1	1
Aphidius transcaspicus	2	2	2
Ephedrus niger	1	3	3
Ephedrus persicae	3	5	5
Diaeretiella rapae	1	3	3
Lysiphlebus confusus	3	3	4
Lysiphlebus fabarum	2	4	4
Lysiphlebus testaceipes	2	3	3
Praon volucre	1	4	4
Trioxys acalephae	2	4	4
Trioxys angelicae	1	2	2