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## **New Hymenoptera records (Braconidae: Aphidiinae) from Algeria and the Northern Africa, and notes about other species**

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### **Abstract**

The invasion of local crops by aphids and the important damages caused by them have raised several questions that are linked to reducing these damages in Algeria. In this context, a survey was carried out on the Aphidiinae aphid parasitoids occurred in this area has been done. Thirteen Aphidiinae species have been identified in the north-western part of Algeria (Mostaganem), of which *Aphidius platensis* BRÈTHES, 1913 is recorded for the first time.

**K e y w o r d s :** aphids, Algeria, Mostaganem, Braconidae, *Aphidius platensis*.

### **Zusammenfassung**

Die Invasion von Blattläusen an Kulturpflanzen in Algerien und die damit verbundenen Schäden führte zu Maßnahmen mit dem Ziel das Auftreten der Schädlinge zu reduzieren. Es wurde das Vorkommen von Aphidiinae, der Parasitoiden dieser Schädlinge erfasst. Insgesamt konnten 13 Aphidiinae aus dem Nordwesten Algeriens registriert werden, wobei *Aphidius platensis* BRÈTHES, 1913 als Erstnachweis für Algerien eingestuft werden kann.

### **1. Introduction**

Parasitoids and predators limit the population of greenflies (aphids) (Hemiptera: Aphididae) (ESTEVEZ et al. 2000; WEI et al. 2005; LAAMARI et al. 2011; LOPES et al. 2012). Among the aphid parasitoids, the subfamily Aphidiinae (Hymenoptera: Braconidae) includes more than 400 species all over the world (STARY 1988; RAKHSHANI et al. 2006; LAAMARI et al. 2011). They are are endoparasitoids, solitary and koinobiontes of aphids (BOIVIN et al. 2012; KAVALLIERATOS et al. 2001) and ASLAN et al. 2004; HEMIDI et al. 2013). Tritrophic associations (plant-greenfly-parasitoid) have been explored in many countries in the Middle East (STARY et al. 1971; STARY et al. 1993; KAVALLIERATOS et al. 2001; CABALLERO-LÓPEZ et al. 2012; TOMANOVIC et al.

2003a). The Aphidiidae family is the most representative in terms of parasitic activity between the aphid parasitoids (REHMAN & POWELL 2010; DARSOUEI et al. 2011; BARAHOEI et al. 2012; RAKHSHANI et al. 2015). Aphidiides are known in all the principal habitats in the world, especially in the mild and sub-tropical areas of the north hemisphere (AKHTAR et al. 2011; BOIVIN et al. 2012).

In Algeria, the available data on these trophic relationships, and in particular on the parasitoids of greenflies, are very limited (LAAMARI et al. 2011). A map of the distribution patterns of these hymenopterans will be very useful to plan an effective biological control in order to choose and use the most effective and frequent species in the Algerian sector agriculture.

32 species of the aphid parasitoids (Hym., Brachonidae: Aphidiidae) have known from Algeria (Table 1) (LAAMARI et al. 2009, 2011, 2012); in the Eastern Algeria 29 species are known (LAAMARI et al. 2011, 2012), seven of them not identified yet; 15 in the South (LAAMARI 2012; HEMIDI et al. 2013; CHEHMA 2013; CHAOUICHE & LAAMARI 2015) and 16 in the Western Algeria (BOUALEM et al. 2014; MAAMERI 2013). Here we present the additional evidences and new records of aphidiinae from Western Algeria.

An inventory of the species present in the area is very important for the aphid biological control; this will also enable to know all the auxiliary species of the aphids. A precise identification of each collected species is necessary. Knowledge of auxiliary fauna of the aphids and abiotic environment help us to understand better the development factors of these parasitoids. The final objective is to found the favourable conditions developing to the most performance.

## **2. Materials and Methods**

An inventory of the fauna related with aphids has been done from 2011 to 2014, in the experimental exploitation of the Department of Agricultural Science at the Mostaganem University. Our study has focussed on different farming sites in many localities in the province of Mostaganem in the North-Western part of Mostaganem. All material has been collected by the first author.

During four consecutive years, from early January to early July, each week, the leaves which contain susceptible material to be studied have been collected. In total 300 leaves were collected and more than 700 samples. The mummies found within the aphid colonies were collected and carried to the laboratory, they were separated and placed in labelled tubes and followed until the emergence of adult parasitoids. Once adults emerge they were conserved individually in micro-tubes containing 90% of ethanol for a further identification.

The species mentioned in this study appears in alphabetical order. For each species the studied material, morphological aspects and hosts are indicated. In some species other comments are also added. For morphology we consulted MESCHELOFF et al. (1993), RAKHSHANI et al. (2012, 2015), STARÝ et al. (2014), TALEBI et al. (2009) and TOMANOVIC et al. (2003a).

### 3. Results

Thirteen species of Aphidiidae (Hym., Braconidae) have been identified in association with aphid species. *Aphidius platensis* is here recorded for the first time from Algeria; it is also a new record from Northern Africa.



Fig. 1: Adult of *Aphidius platensis*.

#### *Aphidius colemani* VIERECK, 1912

Material examined (2♀): Mazagran, on *Capsicum annum*, ex *Myzus persicae*, Ghelamallah col.: 27.iii.11: 1♀; 10.v.11: 1♀.

Host records. Around 40 species has been mentioned (STARY 1975). In Algeria is known from: *Aphis fabae*, *Aphis gossypii* and *Myzus persicae*, *Aphis nerii* B. de FONSCOLOMBE, *Aphis pomi* de GEER, *Aphis punicae* PASSERINI, *Hyalopterus pruni* (BOUALEM et al. 2014; LAAMARI et al. 2009, 2011, 2012).

Comments. Currently, it is present in the Mediterranean Europe, and parts of Asia, Africa, Australia and South America. It is as a commercial biological control agent in different cultures (MESSING et RABASSE, 1995; STEENIS, 1995; GOH et al. 2001; VASQUEZ et al. 2006).

#### *Aphidius ervi* HALIDAY, 1834

Material examined 7♂♂ & 6♀♀ - Mazagran, on *Capsicum annum*, ex *Myzus persicae*, 5.vi.11: 1♂; Mazagran, on *Brassica oleracea* L. var. *botrytis* L., *Brevicoryne brassicae*, Ghelamallah col.: 11.iv.2013: 1♀; 6.vi.2013: 1♀; 5.vi.2013: 1♀; 28.v.2014: 1♂; Mazagran on *Capsicum annum*, *Aphis gossypii*, 2.vii.2013: 1♂; 9.vii.2013: 1♀, Houssien, on *Capsicum annum*, ex *Myzus persicae*, 1.vii.11: ♂; 4.vii.11: 1♂; 8.vi.11: 1♀; 23.i.2012: 1♂; 28.iii.2012: 1♂; 28.v.2014: 1♀.

**H o s t s .** Although this species has been cited in multiple hosts, it attacks nine aphids species mainly harmful to cultivated plants (GHAZALI et al. 2015). In Algeria is known from: *Capitophorus elaeagni*, *Sitobion avenae*, *Sitobion fragariae*, *Acyrtosiphon pisum*, *Rhopalosiphum padi*, *Uroleucon sonchi*, *Aphis craccivora*, *Macrosiphum euphorbiae*, *Hyperomyzus lactucae*, *Aphis fabae*, *Acyrtosiphon bidentis*, *Acyrtosiphon gossypii*, *Uroleucon aeneum*, *Dysaphis* spp (AROUN & STELA, 2005; LAAMARI et al. 2011).

**C o m m e n t s .** *Aphidius ervi* attacks a number of aphid species on economically important crops such as legumes and cereals, widely reported as an effective biological control agent of both the pea aphid, *Acyrtosiphon pisum* (HARRIS), and cereal aphids (GUERRIERI et al. 1993, 1997; CACCIA et al. 2005; HE & WANG 2006; HE & WANG 2008).

### ***Aphidius funebris* MACKAUER, 1961**

**M a t e r i a l e x a m i n e d** (8♂♂ & 15♀♀): Mazagran, on *Brassica oleracea* L. var. *botrytis* L., *Uroleucon sonchi*, Ghelamallah col.: 15.iv.2014: 4♀♀; 25.iv.2014: 3♂♂ & 7♀♀; Houssien, on *Capsicum annuum*, ex *Myzus persicae*, 16.iv.2014: 5♂♂ & 4♀♀.

**H o s t s .** Around 10 species has been mentioned (TOMANOVIC et al. 2003b). In Algeria is known from: *Brachycaudus cardui*, *Hyperomyzus lactucae*, *Uroleucon aeneum*, *U. compositae*, *U. jacae*, *U. sonchi* (LAAMARI et al. 2011, 2012; CHAOUICHE & LAAMARI 2015).

**C o m m e n t s .** *Aphidius funebris* has a parasite spectrum of *Uroleucon* aphids feeding on different herbaceous plants in the Mediterranean area (STARÝ 1976). It is widely distributed in the Palaearctic region (RAKSHANI et al. 2011).

### ***Aphidius matricariae* HALIDAY, 1834**

**M a t e r i a l e x a m i n e d** (54♂♂ & 70♀♀): Mazagran, on *Capsicum annuum*, ex *Myzus persicae*, Ghelamallah col.: 2.v.2011: 1♀; 21.iii.2012: 1♂ & 1♀; 1.iv.2012: 1♂ & 1♀; 9.iv.2012: 1♂ & 1♀; 10.iv.2012: 2♂♂; 20.iv.2012: 2♂♂ & 1♀; 29.iv.2012: 1♂; 5.iv.2013: 8♂♂ & 2♀♀; 11.iv.2013: 1♂ & 3♀♀; 16.iv.2013: 1♂ & 5♀♀; 21.iv.2013: 2♂♂ & 2♀♀; 27.iv.2013: 1♀; 5.vi.2013: 1♀; 11.vi.2013: 1♂ & 3♀♀; 26.vi.2013: 2♂♂ & 4♀♀; 2.vii.2013: 2♂♂ & 3♀♀; 18.ii.2014: 1♂ & 7♀♀; 11.iii.2014: 2♂♂; 20.iii.2014: 2♀♀; 20.iii.2014: 1♂ & 1♀; 29.iii.2014: 4♂♂; 5.iv.2014: 5♂♂ & 4♀♀; 8.iv.2014: 15♂♂ & 9♀♀; 11.iv.2014: 1♂ & 4♀♀; 13.iv.2014: 2♂♂; 15.iv.2014: 5♂♂ & 7♀♀; 25.iv.2014: 1♂ & 1♀; 25.v.2014: 2♂♂; Houssyen, *M. persicae* on pepper, 3.vii.2011: 1♀; 4.iii.2012: 1♂; 5.iii.2012: 3♂♂ & 1♀; 15.iii.2012: 1♀; 16.iv.2014: 9♂♂ & 8♀♀; 28.v.2014: 8♂♂ & 17♀♀.

**H o s t s .** Around 40 species of aphids belonging to 20 genera have been recognized (ZAMANI et al. 2007; GIRI et al. 1982 according to Rashki et al. 2009). In Algeria is known from: *Acyrtosiphon pisum*, *Aphis craccivora*, *A. citricola*, *A. fabae*, *A. gossypii*, *A. nasturtii*, *A. nerii*, *A. punicae*, *A. umbrella*, *Brachycaudus amygdalinus*, *B. cardui*, *B. helichrysi*, *Brevicoryne brassicae*, *Capitophorus eleagni*, *Diuraphis noxia*, *Dysaphis plantaginea*, *D. lappae*, *Hyalopterus pruni*, *Hyperomyzus lactucae*, *Macrosiphum rosae*, *Myzus persicae*, *Nasonovia ri bisnigri*, *Rhopalosiphum maidis*, *R. padi*, *Sitobion avenae*, *Uroleucon compositae* (AROUN & STELA 2005; LAAMARI et al. 2011, 2012; GHAZALI et al. 2015). This species appeared on the plants from the families Asteraceae, Brassicaceae, Solanaceae, Apiaceae and Valerianaceae (KOS et al. 2008).

**C o m m e n t s .** A total of 27 tritrophic associations with 14 species of aphids are

known for this parasitoid (GHAZALI et al. 2015). *Aphidius matricariae* is an important parasitoid of the green peach aphid, *Myzus persicae* (SULZER), and it has been successfully used to its control in many experiments. It is able to overtake the aphid only when its reproductive rate has been checked by overcrowding (HUFFAKER 1971). This species, and also *Aphidius colemani*, *A. ervi* (Braconidae) and *Aphelinus abdominalis* (Aphelinidae) are commonly used for aphid pest control in greenhouses (GILLESPIE et al. 2002; ACHEAMPONG et al. 2012). *Aphidius matricariae* has been shown as the most common species in our study.

### ***Aphidius platensis* BRÈTHES, 1913\***

**M a t e r i a l e x a m i n e d** (1♀): Mazagran, 6.v.2012, *Capsicum annum*, *Myzus persicae*, Ghelamallah col.: 1♀. Collected for the first time in Algeria.

**M o r p h o l o g y**. This species is closely related to *A. colemani* and sometimes both are considered as synonyms (see comments). The morphological differences were commented in TOMANOVIC et al. (2014). *Aphidius platensis* differs from *A. colemani* by having a shorter R1, which is approximately one-third shorter than the stigma length (proportion between the length of R1 and the stigma in *A. platensis* is 0.77-0.89) and a narrower stigma than *A. colemani* and costae on the anterolateral area of the petiole (in *A. platensis* are sharper than in *A. colemani*).

**H o s t s**. Both *A. platensis* and *A. colemani* share a common host (TOMANOVIC et al. 2014). In Algeria is reported on *Myzus persicae* (see fig. 1).

**C o m m e n t s**. *Aphidius platensis* is considered several times as a synonym for *A. colemani* (STARY 1975; STARY et al. 2007) but recently TOMANOVIC et al. (2014) expose the differences between these species, along with *A. transcaspicus*. These three species (*A. colemani*, *A. platensis* and *A. transcaspicus*) are originated from the Mediterranean area and subsequently expanded to nearby areas with subtropical/tropical climates. Although *A. platensis* and *A. colemani* share a common host range pattern, it would be interesting to estimate and compare the role of these two species in future biological control strategies against aphids of economic importance. Currently, aphid parasitoids within global commercially distributed materials tend to be a mixture of *A. colemani*, *A. platensis* and possibly even *A. transcaspicus* (TOMONOVIC et al. 2014).

### ***Aphidius transcaspicus* TELENGA, 1958**

**M a t e r i a l e x a m i n e d** (8♂♂ & 3♀♀): Mazagran, on *Peach*, ex *Myzus persicae*, *Hyalopterus pruni*, Ghelamallah col.: 19.v.11: 1♀; 25.v.11: 3♂♂; 6.vi.11: 2♂♂; 8.vi.11: 2♀♀; 13.vi.11: 2♂♂; 20.vi.11: ♂.

**H o s t s**. *Aphidius transcaspicus* is recorded as a parasitoid of the following aphid genera *Hyalopterus* KOCH, *Melanaphis* (VAN DER GOOT) and *Rhopalosiphum* (KOCH) (GARANTONAKIS et al. 2009). The parasitoid's host range is thought to be restricted to *Hyalopterus* and closely related aphid genera under field conditions (WANG & MESSING, 2006). This Mediterranean parasitoid, treated in general papers, is specialized on *Hyalopterus* spp. (AHMADABADI et al. 2011). In Algeria is known from: *Aphis punicae*, *A. pomi*, *Hyalopterus pruni*, *Myzus persicae* (LAAMARI et al. 2011, 2012; HEMIDI et al. 2013).

**Comments.** This species has been selected for use as a biological control agent against the mealy plum aphid *Hyalopterus pruni* (GEOFFROY) (Hemiptera: Aphididae) in prune orchards in California (LATHAM & MILLS 2010).

### ***Binodoxys angelicae* HALIDAY, 1834**

**Material examined** (1♂ & 2♀♀): Mazagran, on *Capsicum annum*, *Myzus persicae*, Ghelamallah col.: 26/06/2013: 1♂; Houssien, on *Capsicum annum*, *Myzus persicae*, 24/03/2012: 2♀♀.

**Hosts.** Around 30 species has been mentioned (KAVALLIERATOS et al. 2004; STARY & HAVELKA 2008; KOS et al. 2008). In Algeria is known from: *Aphis craccivora* KOCH, *Aphis fabae* (SCOPOLI), *Aphis gossypii*, *Aphis nerii*, *Aphis umbrella*, *Aphis* sp., *Capitophorus eleagni*, *Hyalopterus pruni*, *Myzus persicae* (LAAMARI et al. 2012).

**Comments:** *Binodoxys angelicae* parasitize aphids from five families of host plants. This parasitoid appears on Asteraceae, Solanaceae, Fabaceae, Cucurbitaceae and Boraginaceae families.

### ***Diartiella rapae* M'INTOSH, 1855**

**Material examined** (10♂♂ & 4♀♀): Houssien, on *Capsicum annum*, ex *Myzus persicae*, Ghelamallah col.: 3.i.2012: 1♂; 23.i.2012: 1♂; 24.i.2012: 3♂♂ & 1♀; 27.i.2012: 1♂ & 1♀; 28.i.2012: 1♀; Mazagran, on *Brassica oleracea* L. var. *botrytis* L., *Brevicoryne brassicae*, 09.iii.2012: 1♂; 01.iv.2012: 1♀; 03.v.2014: 1♂; 25.v.2014: 2♂♂.

**Hosts.** Around 30 species has been mentioned (TOMANOVIC et al. 2003b; AKHTAR et al. 2011). In Argelia is known from: *Aphis gossypii*, *A. nerii*, *A. punicae*, *A. umbrella*, *Brachycaudus cardui*, *B. helichrysi*, *B. brassicae*, *Capitophorus eleagni*, *C. eleagni*, *Diuraphis noxia*, *Dysaphis tulipae*, *Euphorbia helioscopia*, *Hayhurstia atriplicis*, *Hyalopterus pruni*, *Myzus persicae*, *Rhopalosiphum maidis*, *Uroleucon ambrosiae* and *U. sonchi* (AROUN & STELA 2005; LAAMARI et al. 2012; HEMIDI et al. 2013; CHEHMA & LAAMARI 2014).

**Comments:** *Diaeretiella rapae* (M'INTOSH), is a polyphagous and cosmopolitan parasitoid of aphids and it very important to control of aphid pest in a variety of agricultural and horticultural crops (AKHTAR et al. 2011).

### ***Lysephlebus fabarum* MARSHALL, 1836**

**Material examined** (22♀♀): Mazagran, on *Capsicum annum*, ex *Aphis gossypii*, Ghelamallah col.: 28.i.2012: 1♀; 05.iii.2012: 1♀; 28.iii.2012: 2♀♀; 2.iv.2012: 10♀♀; 18.iv.2012: 2♀♀; 24.iv.2012: 1♀; 27.iv.2013: 1♀; 5.v.2013: 1♀; 2.vii.2013: 1♀; Mazagran, on *Vicia faba* L., *Aphis fabae*, 06.vi.2012: 1♀; Mazagran, on *Brassica oleracea* L. var. *botrytis* L., *Brevicoryne brassicae*, 05.vi.2013: 1♀.

**Hosts.** Around 47 species has been mentioned (TOMANOVIC et al. 2003b; RAKHSHANI et al. 2013). In Algeria is known from: *Aphis astragali*, *A. craccivora*, *A. gossypii*, *A. fabae*, *Brevicoryne brassicae*, *Capitophorus eleagni*, *Myzus persicae*, *Toxoptera aurantii*, *Uroleucon compositae* and *Dysaphis* sp., (AROUN & STELA 2005; LAAMARI et al. 2011; LAAMARI et al. 2012; CHEHMA & LAAMARI 2014).

**Comments:** *Lysephlebus fabarum* is the most abundant parasitoid of some economically important aphids such as *Aphis fabae* SCOPOLI and *Aphis craccivora* KOCH

on various different crops and hence could be useful in the biological control of this pest species (MATIN et al. 2005; RAKHSHANI et al. 2013).

### ***Lysephlebus testaceipes* CRESSON, 1880**

**Material examined** (18♂♂ & 13♀♀): Mazagran, on *Capsicum annuum*, ex *Myzus persicae*, Ghelamallah col.: 27.iv.2013: 1♂; 11.v.2013: 2♂♂; 06.vi.2013: 2♂♂; 11.vi.2013: 1♀; 20.vi.2013: 2♂♂ & 6♀♀; 14.iv.2014: 1♀; 17.iii.2014: 1♂; Mazaaran, on *Capsicum annuum*, ex *Aphis gossypii*, 27.iii.2012: 1♂; 15.iv.2014: 1♂ & 1♀; 3.v.2012: 1♂; 05.v.2013: 2♂♂; 19.v.2012: 1♂; Mazagran, on *Vicia faba* L., *Aphis fabae*, 26.xi.2011: 1♂; Houssien, on *Capsicum annuum*, ex *Myzus persicae*, 08.v.2014: 1♂; 16.iv.2014: 2♂♂ & 4♀♀.

**Hosts.** *Lysephlebus testaceipes* is one of the most common species of Aphidiinae in South America (STARÝ et al. 2007). STARÝ et al. (2007) also reported this species and add 19 aphids species as hosts in Brazil. In Algeria is known from: *Aphis astragali*, *A. craccivora*, *A. euphorbiae*, *A. fabae*, *A. gossypii*, *A. illinoisensis*, *A. nerii*, *A. pomi*, *A. potentillae*, *A. punicae*, *A. spiraecola*, *A. umbrella*, *Brachycaudus helichrysi*, *B. cardui*, *Dysaphis plantaginea*, *Dysaphis* sp., *D. pyri*, *D. tulipae*, *Hyalopterus pruni*, *Macrosiphum euphorbiae*, *Myzus persicae*, *Rhopalosiphum maidis*, *Uroleucon compositae* (LAAMARI et al. 2011; LAAMARI et al. 2012; CHEHMA & LAAMARI 2014).

**Comments:** The effectiveness of *L. testaceipes* is due in part to the fact that it attacks several genera of aphids (HOFFMAN & FRODSHAM 1993). The use of *L. testaceipes* as a biological control agent for *Aphis gossypii* has been reported (ARAUJO et al. 2013).

### ***Praon exsoletum* NEES, 1811**

**Material examined** (1♂): Mazagran, on, *Brassica oleracea* L. var. *botrytis* L., *Uroleucon sonchi*, Ghelamallah col.: 16/04/2014: 1♂.

**Hosts.** The *Praon* species presented in this work have been identified from 67 aphid taxa occurring on 120 plant taxa (KAVALLIERATOS et al. 2005). In Algeria is known from: *Therioaphis trifolii*, (LAAMARI et al. 2011, 2012).

**Comments:** With over 50 species described over the world, the genus *Praon* HALIDAY, 1833 is a large one in Aphidiinae (BARAHOEI et al. 2010). We report 87 parasitoid–aphid associations, which might provide useful information about the host range pattern of *Praon* spp., which is important in IPM programs (KAVALLIERATOS et al. 2005). The species of the genus *Praon* parasitize the numerous and variable aphids and many species of the genus are important biological control agents in various agro- and forest ecosystems (BARAHOEI et al. 2010).

### ***Praon volucre* HALIDAY, 1833**

**Material examined** (4♂♂ & 1♀): Mazagran, on *Capsicum annuum*, *Aphis gossypii*. Ghelamallah col.: 28/05/2014: 2♂♂; *Brassica oleracea* L. var. *botrytis* L, 16/04/2014: 1♀; Houssien, on *Capsicum annuum*, *Aphis gossypii*, 25/04/2013: 2♂♂.

**Hosts.** This is a Palearctic species and it is known from the Middle East, North Africa, India and Central Asia. It has an extensive and diverse host range, having been recorded from at least 90 aphid species in 35 genera. There is good evidence that *P.*

*volucre* exists as a complex of host-specific biotypes or sibling species (WATERHOUSE, 1998). In Algeria is known from: *Aphis gossypii*, *A. craccivora*, *A. fabae*, *A. salvia*, *Acyrtosiphon pisum*, *Brachycaudus cardui*, *Brevicoryne brassicae* L., *Hyalopterus pruni*, *Hyperomyzus lactucae*, *H. picridis*, *Liosomaphis berberidis*, *Macrosiphon impatientis*, *M. rosae*, *Myzus persicae*, *Sitobion avenae*, *S. fragariae*, *Uroleucon sonchi* (AROUN et al. 2005; LAAMARI et al. 2011 and 2012; HEMIDI et al. 2013).

**C o m m e n t s .** *Praon volucre* is not a native species but it has become established and makes up part of the parasitoid guild attacking *Uroleucon* species and might be a good candidate for use as a biological control agent against lettuce aphids in Brazil (CONTI et al. 2008). The aim of this work is to determine whether *P. volucre* is a potential biological control agent of *U. ambrosiae*, with the objective of controlling this aphid without introducing an exotic aphid parasitoid (CONTI et al. 2008). *Praon volucre* was imported from the Mediterranean area for the biological control of *Hyperomyzus lactucae*, a vector of lettuce necrotic yellows (Waterhouse, 1998).

### ***Trioxys angelicae* HALIDAY, 1833**

**M a t e r i a l e x a m i n e d** (2♂♂ & 1♀): Mazagran, on *Capsicum annum*, ex *Myzus persicae*, Ghelamallah col.: 16/04/2014: 1♂ & 1♀; 17/03/2014: 1♂

**H o s t s .** *Trioxys angelicae* is a solitary, koinobiont endoparasitoid that parasitizes species of *Aphis*, especially *A. fabae*, *A. citricola*, *A. gossypii* and *Toxoptera aurantii* (CAVALLORO & PROTA 1983; MAHMOUDI et al. 2010). In Algeria is known from: *Aphis citricola*, *A. craccivora*, *A. fabae*, *A. gossypii*, *A. punicae*, *A. umbrellae*, *Acyrtosiphon pisum*, *Aspidiotus nerii*, *Capitophorus elaeagni*, *Dysaphis plantaginea*, *Hyalopterus pruni*, *Macrosiphum euphorbiae*, *Myzus persicae*, *Toxoptera aurantii* (AROUN & STELA 2005; LAAMARI et al. 2011).

**C o m m e n t s :** *Trioxys angelicae* is a broadly oligophagous species which attacks a wide range of aphid species within the genus *Aphis* and related genera (WEISSER et al. 1994). This is widely distributed in Europe, Asia Minor and North Africa and has been reared from a wide range of hosts (WATERHOUSE 1998).

## **4. Discussion**

Nowadays, 32 species of hymenopterous aphids parasitoids have been recorded in Algeria (Table 1). In Maghreb, 11 species have been mentioned (STARY&SEKKAT 1987) and 7 species in Tunisia (BEN HALIMA-KAMEL & BEN HAMOUDA 2005). This number is still very far from the 100 species already identified in other countries on the Mediterranean basin, notably, those of Europe, this fauna is better known (STARY et al. 1971; STARY et al. 1973). According to the Fauna Europea database, 213 of them were recorded in Europe up to 2013 (van ACHTERBERG 2013 in LOPES et al. 2016). 37 species in Greece (KAVALLIERATOS et al. 2001), 74 species in Spain (TIZADO & NÚÑEZ PEREZ 1991), 99 species in France (STARY et al. 1971; STARY et al. 1973), 32 species in Belgium (LOPES et al. 2016), 65 species in Bulgaria (TODOROV 2008, 2012, 2014) and 44 species in Turkey (ERDOGAN et al. 2008; TOMANOVIC et al. 2008). In Asia, 125 species have been described from India (AKHTAR et al. 2011) and 78 species from Iran (BARAHOEI et al. 2014).



All Braconidae species mentioned in this study area are already signalled in the Mediterranean region (STARY et al. 1971; STARY 1979; STARY & SEKKAT 1987; BEN HALIMA & BEN HAMMOUDA 2005; LAAMARI et al. 2011, 2012; BOUALEM et al. 2014) and they have a very wide distribution, some cosmopolitan (CHOU 1981). All these parasitoids generally embody the most implicated primary species against green flies all over the world (FERRIERE 1965; PIKE et al. 1997; LESTER & HOLTZER 2001; BREWER et al. 2005).

According to AGGOUN (2016), the distribution of these parasitoids is mostly limited to Northern Europe, but some of them are observed even in the Mediterranean and Central Asia. The parasitoids recorded were able to reach all the bioclimatic stages at the level of Algeria (AGGOUN, 2016). This author cited the authors who recorded these hymenoptera in the northern part of Guelma in a sub-humid climate (SIDI ATHMANE 2013), Batna Khenchela & Oum El Bouaghi in a semi-arid climate (ABBES 2008), SALHOU (2009), SEGHIR (2013) and MESTEK (2014), and finally in Biskra, El Oued and Ghardaia (arid) by KHENISSA (2008), HALIMI (2010), Tahar Chaouche (2011), HEMIDI (2011), CHEHMA (2013) and NOURANI (2014).

LAAMARI et al. (2011 and 2012) reported the presence of 30 species in east Algeria (Table 01).

For the western part of Algerian, some authors have listed some species; among them, we can cite BOUALEM et al. (2014) (Table 01).

According to STARY (1970), the general distribution of aphids parasitoids is determined by several factors, including the distribution of the flora, the distribution of aphid and finally the anthropogenic factors.

According to POPE et al. (2008), the host plant can play a major role in the research behavior and orientation of auxiliaries. For example, the *Diaretiella rapae* parasitoid is more attracted to secondary metabolites emitted by Brassicaceae which are subject to attacks by phytophagous plants in comparison with non-infested plants.

The diversity of the reliefs, the richness of the vegetation cover and the geographic position of the study region may be among the factors responsible for this particular activity of these aphidian aids (AGGOUN 2016). Knowing that the Algerian northwest is sufficiently watered and cooler, these auxiliaries can find in the study area, hosts and favorable conditions to their survival throughout the year.

Considering the large area of the country (2,381,740 km<sup>2</sup>) with its various ecosystems, from the Mediterranean and the mountain to the desert, we can conclude that the actual diversity Braconidae in Algeria could be well placed or at least about 200 species. Much, then, there are still to do.

Although several biological control programs have been established with Aphidiinae in other countries, aphid parasitoids in Algeria are still unusable. One of the most important reasons is the absence of basic information which could be provided by systematic work such as this.

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**Tab. 1:** Aphidiinae species from Algeria: Eastern Algerian data are obtained from LAAMARI et al. (2011, 2012), CHAOUCHE and LAAMARI (2015) and AGGOUN (2015), Western data from BOUALEM et al. (2014) and MAAMERI (2013), and South data from HEMIDI et al. (2013), LAAMARI et al. (2012) and CHEHMA (2013). The \* are the species mentioned in this study.

Genus		Species	Eastern	Western	Southern
<i>Aphelinus</i>	1	<i>A. mali</i> HALDEMAN, 1851	+	-	-
<i>Aphidius</i>	2	<i>Aph. avenae</i> HALIDAY, 1834	+	+	-
	3	<i>Aph. colemani</i> VIERECK, 1913	+	+	+
	4	<i>Aph. eadyi</i>	+	-	-
	5	<i>Aph. ervi</i> HALIDAY, 1836	+	+	+
	6	<i>Aph. funebris</i> MACKAUER, 1961	+	+	+
	7	<i>Aph. matricariae</i> HALIDAY, 1834	+	+	+
	8	<i>Aph. platensis</i> BRÈTHES, 1913	-	*	-
	9	<i>Aph. rhopalosiphi</i> STEPHANI PEREZ, 1902	+	+	-
	10	<i>Aph. smithi</i> SHARMA & SUBBA RAO, 1959	+	+	-
	11	<i>Aph. sonchi</i> MARSHALL, 1896	+	-	-
	12	<i>Aph. transcaspicus</i> TELENGA, 1958	+	+	+
	13	<i>Aph. uzbekistanicus</i> LUZHETZKI, 1960	+	+	-
			<i>Aphidius</i> sp 1	+	-
		<i>Aphidius</i> sp 2	+	-	-
		<i>Aphidius</i> sp 3	+	-	-
<i>Binodoxys</i>	14	<i>B. acalephae</i> MARSHALL, 1896	+	-	+
	15	<i>B. angelicae</i> HALIDAY, 1834	+	+	-
	16	<i>B. centaureae</i> HALIDAY, 1833	+	-	-
<i>Diaeretiella</i>	17	<i>D. rapae</i> M'INTOSH, 1855	+	+	+
<i>Ephedrus</i>	18	<i>E. persicae</i> FROGGATT, 1904	+	-	+
	19	<i>E. niger</i> GAUTIER, BONNAMOUR & GAUMONT, 1929	+	-	-
<i>Lipoxelis</i>	20	<i>Lipoxelis gracilis</i> FORSTER	+	-	-
<i>Lysiphlebus</i>	21	<i>L. cardui</i> MARSHALL, 1896	+	-	-
	22	<i>L. confusus</i> TREMBLAY & EADY, 1978	+	-	+
	23	<i>L. fabarum</i> MARSHALL, 1896	+	+	+
	24	<i>L. testaceipes</i> (CRESSON, 1880)	+	+	+
	25	<i>Lysiphlebus</i> sp 1	+	-	-
<i>Praon</i>	26	<i>P. exoletum</i> NEES, 1811	+	+	-
	27	<i>P. volucre</i> HALIDAY, 1833	+	+	+
	28	<i>P. yomanae</i> TAKADA, 1968	+	+	-
		<i>Praon</i> sp 1	+	-	-
		<i>Praon</i> sp 2	+	-	-
<i>Trioxyx</i>	29	<i>T. acalephae</i> MARSHALL, 1896	+	-	+
	30	<i>T. angelicae</i> HALIDAY, 1833	+	+	+
	31	<i>T. complanatus</i> QUILLES, 1931	+	-	-
	32	<i>T. pallidus</i> HALIDAY, 1833	+	-	-
		<i>Trioxyx</i> sp 1	+	-	-



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