



**HAL**  
open science

## **Assessment of aphid diversity (Hemiptera: Aphididae) in Algeria: a fourteen-year investigation**

Malik Laamari, Emmanuelle Jouselin, Armelle Coeur d'Acier

► **To cite this version:**

Malik Laamari, Emmanuelle Jouselin, Armelle Coeur d'Acier. Assessment of aphid diversity (Hemiptera: Aphididae) in Algeria: a fourteen-year investigation. *Entomologie faunistique - Faunistic Entomology*, 2009, 62 (2), pp.73-87. <hal-02654076>

**HAL Id: hal-02654076**

**<https://hal.inrae.fr/hal-02654076v1>**

Submitted on 29 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

# Assessment of aphid diversity (Hemiptera: Aphididae) in Algeria: a fourteen-year investigation

Malik Laamari<sup>(1)</sup>, Emmanuelle Jousselein<sup>(2)</sup>, Armelle Cœur d'acier<sup>(2)\*</sup>

<sup>(1)</sup> Département d'Agronomie, Faculté des Sciences, Université de Batna, 05000, Algérie. E-mail: [laamarimalik@yahoo.fr](mailto:laamarimalik@yahoo.fr).

<sup>(2)</sup> INRA, UMR CBGP (INRA/IRD/Cirad/Montpellier SupAgro), Campus International de Baillarguet, CS 30016, 34988 Montferrier-sur-Lez Cedex, France. E-mail: [jousseli@supagro.inra.fr](mailto:jousseli@supagro.inra.fr)

\* Corresponding author: Armelle Cœur d'Acier, E-mail: [coeur@supagro.inra.fr](mailto:coeur@supagro.inra.fr); Fax: +33 (0) 499 623 345; Phone: +33 (0) 499 623 343.

Received on 12<sup>th</sup> October, 2009; accepted on 20<sup>th</sup> December, 2009

Little is known about the aphid fauna of Algeria, with only 57 species of aphid recorded as present to date. This study, involving a literature survey and 14 years of trapping and host plant prospecting, extends the number of known Algerian aphid species to 120. Sixty-three of these species were recorded for the first time in this country, and 27 were recorded for the first time in the Maghreb region of North Africa. The aphid fauna of Algeria includes a large number of cosmopolitan species (42.1%) and no endemic species. It is very similar to the European aphid fauna and very different from the Sub-Saharan aphid fauna, despite the geographical proximity of this region. Most (68.3%) of the species identified are crop pests. This composition biased towards species with a broad geographical distribution that generally act as crop pests probably reflects current lack of knowledge about this fauna. Future studies should lead to an increase in the number of species identified as present in this country, probably resulting in a change in the general characteristics of this fauna.

**Keywords:** Aphid, fauna, Algeria, Maghreb, first citation.

La faune aphidienne d'Algérie est peu connue. Seulement 57 espèces de pucerons y ont été recensées à ce jour. Après une analyse bibliographique et 14 ans de piégeage des pucerons ailés à l'aide de bacs jaunes installés dans des cultures et de collectes d'aptères sur diverses espèces de plantes sauvages ou cultivées, 120 espèces de pucerons ont été recensées dont 63 sont mentionnées pour la première fois de ce pays et 27 pour la première fois du Maghreb.

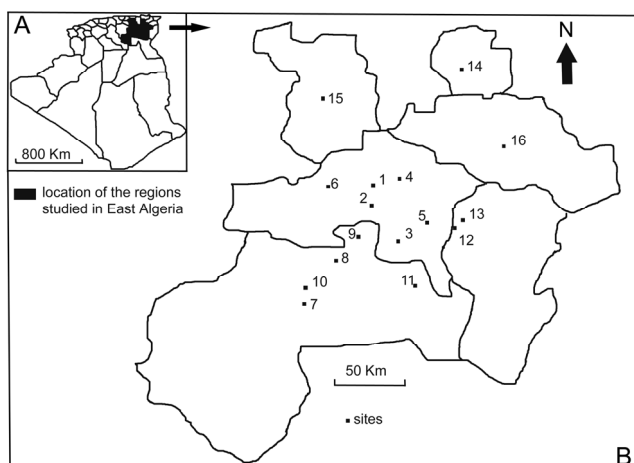
Cette faune se caractérise par un nombre important d'espèces cosmopolites (42.1%) et par l'absence d'espèces endémiques. Elle a de forte affinité avec la faune européenne et très peu avec la faune sub-saharienne pourtant géographiquement proche. Une grande majorité (68.3%) de ces espèces sont des ravageurs des cultures. Cette composition biaisée vers les espèces à large distribution géographique, en général des espèces nuisibles aux cultures, est probablement le reflet des limites étroites de notre connaissance actuelle de cette faune. De futurs travaux devraient permettre d'augmenter encore notablement le nombre d'espèces recensées dans ce pays.

**Mots-clés:** puceron, faune, Algérie, Maghreb, première citation.

## 1. INTRODUCTION

The aphid fauna of North Africa has been little studied (Ahmeid Al-Nagar & Nieto Nafria, 1998). In total, 150 species have been identified in Morocco (Mimeur & Bernard, 1946; Sary & Sekkat, 1987; Ahmeid Al-Nagar & Nieto Nafria, 1998), 99 in Egypt (Ahmeid Al-Nagar & Nieto Nafria, 1998), 73 in Libya (Ahmeid Al-Nagar & Nieto Nafria, 1998), 103 in Tunisia (Ahmeid Al-Nagar & Nieto Nafria, 1998; Boukhris-Bouhachem *et al.*, 2007) and only 57 in Algeria

(Remaudière, 1954a, 1954b, 1982, 1989; Remaudière & Leclant, 1972; Leclant & Remaudière, 1974; Dartigues, 1993; Ahmeid Al-Nagar & Nieto Nafria, 1998; Blackman & Eastop, 2000; Belkahla & Lapierre, 2002; Laamari & Akal, 2002; Nieto Nafria *et al.*, 2002; Nieto Nafria *et al.*, 2005). These numbers are much smaller than the 550 species identified in the French Mediterranean region (Leclant, 1978) or the 387 species identified in Sicily (Patti & Barbagallo, 1998).



**Figure 1:** Map of the regions and sites from which samples were collected. A: Map of Algeria showing the location of the study area, B: Study area, the site numbers are reported in the Table 1.

The low number of species recorded in Algeria in previous studies probably reflects the lack of studies carried out on this fauna. The available data are highly fragmented. Algeria is the largest country in the Mediterranean Basin, with a highly diverse flora including 3139 plant species (Quezel & Santa, 1962) and diverse climatic conditions. The aphid fauna is therefore probably much richer than suggested by previous publications.

We established an inventory of the aphid species present in East Algeria, based on the prospection work carried out by the first author from 1994 to 2007. This constituted a first step towards exploring the diversity of the Algerian aphid fauna and comparing the aphids present in the various countries of the Maghreb and around the

Mediterranean region.

## 2. MATERIALS AND METHODS

### 2.1. Experimental location description

The six regions and 16 sites sampled are presented in Figure 1 and Table 1. The Biskra region is located at low altitude (108 m) and has an arid climate with natural vegetation typical of the steppes in the north and of the Sahara region in the south. Date palm is the predominant crop in this region, and is cultivated together with fruit trees bearing olives, apricots, figs and pomegranate, grown in undercanopy. The other regions (Batna, Constantine, Khenchela, Oum El Bouaghi and Sétif) are located on the high plateaus and the South Constantine high plains. These regions have a semi-arid climate and their agriculture is dominated by winter cereal crops (barley, wheat and durum wheat). In the Sétif region, cereals occupy 50% of the agriculturally utilisable area (Ait Hamouda, 2000). During the 1990s, there was a considerable expansion of potato crops in this region, associated with the creation of the National Potato Development Institute at Guellal. The regions of Batna and Khenchela border the Aurès plateau, which has diverse natural vegetation dominated by *Cedrus atlantica* (Manetti), *Pinus halepensis* Mill. and *Quercus ilex* L. The plains of these regions are used to grow cereals, whereas the mountainous areas are used for fruit trees, principally apple trees in Khenchela and apricot trees at N'Gaous in the Batna region (Laamari, 2004).

Number	Region	Sites	Latitude	Longitude	Altitude (m)
1	Batna	Batna	35°19'14"N	5°50'01"E	1075
2		Ain Touta	25°24'40"N	5°56'36"E	958
3		Arris	35°16'09"N	6°26'41"E	1049
4		El Madher	35°37'51"N	6°18'44"E	922
5		Ichenoul	35°18'26"N	6°32'39"E	1439
6		N'Gaous	35°33'18"N	5°36'42"E	670
7	Biskra	Biskra	34°25'53"N	5°31'10"E	108
8		Djamora	35°04'06"N	5°50'15"E	530
9		El Kantara	35°13'26"N	5°42'24"E	520
10		El Outaya	34°56'13"N	5°39'16"E	201
11		M'Ziraa	34°41'53"N	6°15'38"E	15
12	Khenchela	El Kantina	35°21'43"N	6°38'46"E	1297
13		Chélia	35°20'07"N	6°40'00"E	2018
14	Constantine	El Khoub	36°15'11"N	6°41'13"E	598
15	Sétif	Guellal	35°41'30"N	5°41'47"E	845
16	Oum El Bouaghi	Bir Rogaa	35°47'27"N	7°03'26"E	858

**Table 1:** Regions and sites from which samples were collected. The numbers are reported on the map on figure 1

## 2.2. Methods of aphid collection and identification

Prospection was carried out between 1994 and 2007. Two methods were used to establish the inventory. The first involved catching aphids observed on host plants at the various sampling sites (Figure 1). The second technique was based on the trapping of winged individuals in square rectangular troughs (60 x 40 x 15 cm) placed at the four corners of plots of potatoes (Guellal), cereals (Guellal and El Madher), beans (El Outava and Batna) and fruit trees (Ichmoul and El Kantina). These traps were located 10 m from the plot margin, at two heights (2 troughs at 70 cm and 2 at ground level, for each plot sampled). The aphids collected were kept in alcohol (70°). They were identified using the keys of Blackman & Eastop (1994, 2000), Heie (1980, 1982, 1986, 1992, 1994, 1995), Nieto Nafria *et al.* (2002, 2005) and Remaudière *et al.* (1985). The nomenclature used was that proposed by Remaudière & Remaudière (1997).

For aphids collected after 2003, reference slides were sent to the aphid collection of the *Institut National de la Recherche Agronomique* (INRA) at the CBGP (the Population Biology and Management Centre) in Montpellier, France.

## 2.3 Biological and biogeographic data

The works of Blackman & Eastop (1994, 2000, 2006) and Remaudière *et al.* (1985) were used as a reference to define the geographic distribution of the species. Six categories were retained: African species (A), European species (E), Mediterranean species (M; corresponding to the countries of the Mediterranean Basin + Asia Minor + Iran + Afghanistan + North Pakistan), Palaearctic species (P; encompassing Europe and northern Asia), Holarctic species (H; Europe + North America) and cosmopolitan species (C; present on most continents).

Each species was classified as a pest or non-pest species on the basis of its presence or absence in the reference work "Aphids on the world's crops" (Blackman & Eastop, 2000). This reference text lists all the aphids known to develop on and damage crop plants worldwide.

## 3. RESULTS

The aphid species identified and the sites at which they were collected are listed in Table 2. The list of host plants sampled and the aphids collected from these host plants is provided in Appendix 1.

The literature survey and prospection carried out between 1994 and 2007 at 16 sites in East Algeria resulted in the establishment of a list of 120 species of aphid present in Algeria (Table 2). Information about the biology and world distribution of these 120 species can be obtained from the reference works of Blackman & Eastop (1994, 2000, 2006).

The species identified belonged to 61 genera and six subfamilies. The Aphidinae subfamily was the best represented, with 38 species, followed by Eriosomatinae (13 species), Calaphidinae (6 species), Lachninae (2 species), Anoeciinae and Chaitophorinae (1 species each). Only one species per genera was recorded for 70% (43 genera) of the identified species. Only eight genera were represented by more than three species. The genus *Aphis* was the most frequently recorded, with 18 species, followed by *Uroleucon* (7 species), *Dysaphis* (6 species), *Brachycaudus*, *Myzus* and *Rhopalosiphum* (5 species each), *Acyrtosiphon* and *Cinara* (4 species each).

The presence of 44 of the 57 species already reported to be present in Algeria was confirmed. However, the remaining 13 previously identified species were not identified in this study. Thirty-six of the 63 species reported for the first time in this country have already been found in other countries of the Maghreb, whereas the remaining 27 of these species have never before been recorded in these countries (Table 2). With the exception of *Aphis* (*Protaphis*) *pseudocardui* Theobald 1915 and *Asiphonella dactylonii* Theobald 1923, all the 120 species listed are also present in Europe (Nieto Nafria *et al.*, 2007). Many of these species are cosmopolitan (42.1%), the others having a Mediterranean (16.66%), European (9.6%), Palaearctic (20.17%) or Holarctic (10.5%) distribution (Table 2).

Of the 120 species identified, 68.3% (82 species) were considered to be crop pests (Blackman & Eastop, 2000). The percentage was even higher (72%) if we considered only those species already identified in Algeria or other Maghreb countries,

but was much lower (55.5%) if we considered only species identified in North Africa for the first time in this study.

We collected 157 samples, corresponding to 68 species of aphid, from 79 plant species from 26 families (Appendix 1). Most of these plants were spontaneous hosts (53 species), but the other 26 plant species were crop plants, principally tree crops (lemon, apple, pear, walnut, apricot, almond, cherry, peach), cereals (oats, wheat, durum wheat, barley, maize) and horticultural crops (cabbage, courgette, potato, broad beans). The plant families most frequently identified in our samples were Asteraceae (15 plants), Poaceae (11 plants) and Rosaceae (11 plants) (Appendix I).

With 12 host plants, *Myzus persicae* (Sulzer 1776) was the aphid species with the largest number of host plants, followed by *Macrosiphum euphorbiae* (Thomas 1878) (10 host plants), *Rhopalosiphum maidis* (Fitch 1856) (9 host plants), *Aphis craccivora* (Koch 1854) (8 host plants), *Aphis gossypii* (Glover 1877) and *Aphis fabae* (Scopoli 1763) (these last two species each having 7 host plants). Forty species were recovered only as winged individuals in the yellow traps (Appendix I).

*M. persicae* and *R. maidis* were the species collected at the largest number of sites (7 of the 16 sites), followed by *A. craccivora* (6/16), *A. gossypii*, *A. fabae*, *Diuraphis noxia* (Kurdjumov 1913), *D. plantaginea* (Passerini 1860) and *R. padi* (L. 1758) (each found at 5 of the 16 sites) (Table 2).

#### 4. DISCUSSION

##### History

Despite the restricted size of the investigated geographic zone, the number of aphid species observed to be present in Algeria was doubled. This finding seems to confirm that the small number of species reported in this country reflects a lack of appropriate studies rather than a real paucity of aphid species in this country.

Whereas the large number of species sampled during this study, 10.8% of the species previously recorded in Algeria were not found in this study. The first investigations of the Algerian aphid fauna were carried out in the Central Sahara, in

the regions of Fezzan, Ghat and Tassili N'Ajjer (Mimeur & Bernard, 1946; Remaudière, 1954a). The species cited in these studies were *M. persicae*, *B. harmalae* B.Das 1918 (under the name of *Pergandeida pegani* Mimeur 1935), *A. craccivora*, *A. euphorbiae* Kaltenbach 1843, *A. nerii* Boyer de Foscolombe 1841, *R. maidis*, *R. nymphaeae* L. 1761 and *A. gossypii* Mordvilko 1914. The last two of these species were not found in our study. *A. gossypii* was collected by Balachowsky, from undetermined host plants (Remaudière, 1954a). This was the first collection of this species in North Africa, the distribution of which was previously thought to be limited to Asia (Remaudière, 1954a). Its range is currently thought to include Southern Europe, North Africa, the Middle East, Central Asia, India, China and, probably, Korea and Japan (Blackman & Eastop, 2006). It inflicts damage on host plants principally from the Leguminosae, Malvaceae and Zygophyllaceae families and is considered to be a pest of cotton in Central Asia (Blackman & Eastop, 2000). *Rhopalosiphum nymphaeae* was captured by Balachowsky on *Potamogeton sp.* in the guelta de Dider area in 1949 (Remaudière, 1954a). The presence in Sahara of this species, which colonises exclusively the very humid areas, was as unexpected as that of its host. However, the Tassili N'Ajjer region includes areas permanently covered with water (gueltas), which have an unusual flora and fauna (Remaudière, 1954a). Future prospection studies in this environment should make it possible to confirm the presence of *R. nymphaeae* in Algeria. Among the species listed in this country, it would be interesting to find *A. lambersi* Leclant & Remaudière 1974 and *A. lichtensteini* Leclant & Remaudière 1972. The individuals collected in Algeria are paratypes on which the original descriptions of these species were based. *A. lichtensteini* is quite common around the Mediterranean, being found everywhere its host plant, *Cistus monspeliensis* L., grows. The paratypes of *A. lichtensteini* were collected at Algiers in 1960 (Remaudière & Leclant, 1972). *A. lambersi* lives on *Glaucium* spp. in Southern Europe, North Africa and the Middle-East. Paratypes were collected in Algeria, at Maison-Carrée (Algiers) on May 15<sup>th</sup> 1960 (Leclant & Remaudière 1974). A third species, *Cinara laportei* Remaudière 1954, was described on the basis of samples collected by Laporte from Ben Akoun (Algiers) in Algeria on 24.iv.1953 (Remaudière 1954b). We found this species on

*Cedrus atlantica* on Mount Chélia (2328 m altitude, Khenchela region). Finally, six of the other species identified in previous studies in Algeria but absent from our sample – *Baizongia pistaciae* (L. 1767), *Forda marginata* Koch 1857, *F. riccobonii* Stefani 1899, *F. rotunda* Theobald 1914, *Paracletus donisthorpei* Theobald 1929 and *Rectinatus buxtoni* Theobald 1914 – grow on *Pistacia*, and another two of these species, *Pemphigus bursarius* (L. 1758) and *P. vesicarius* Passerini 1861, grow on poplars. Targeted searches on these two plant hosts should lead to the detection of these species.

### Relationship to European and Sub-Saharan species

The Algerian aphid fauna is very similar to that present in Europe. This is not particularly surprising as the flora and climate of northern Algeria closely resemble those of Mediterranean regions of Europe (France, Italy, Spain). Only two of the species in our list have not been identified in Europe (Nieto Nafria *et al.*, 2007). *Asiphonella dactylonii* Theobald 1923 develops on the roots of *Cynodon dactylon* (L.) Pers. and other grasses (*Digitaria decumbens* Stent., and *Oplismenus compositus* (L.) P. Beauv.). It has been identified in Asia (China, Philippines), Africa (Egypt, Sudan, Zimbabwe) and South America (New Mexico, Guyana, Brazil, Argentina). It is considered to be a species of oriental origin that has become subcosmopolitan (Remaudière *et al.*, 1985). The second of these species, *Aphis (Protaphis) pseudocardui* Theobald 1915, lives on the stems, adaxial surfaces of the leaves, flowers and collar of many members of the Asteraceae. It was first described in southern Africa and was subsequently found in various countries in Sub-Saharan Africa (Remaudière *et al.*, 1985), the Mediterranean region and the Middle East (Blackman & Eastop, 2006). It is considered to be a species of Mediterranean origin (Remaudière *et al.*, 1985). There is extensive trade and tourist travel between the Mediterranean regions of Europe and North Africa. These exchanges are probably responsible for many introductions of species into the various concerned countries. However, the flora and climates of these two regions are very similar, making it difficult to determine whether the presence of a species in one of these regions is due to introduction or reflects the natural distribution of the species concerned. For the species in our list, introduction

into Europe has been documented for only one species, *Cinara laportei*. This species lives on the cedar, *C. atlantica*. It was described by Remaudière in 1954 (Remaudière, 1954b), on the basis of samples collected in Algeria. In 1967, Emmonot reported the introduction of this species into the Mediterranean region of France, where it caused major damage to cedar plantations (Emmonot *et al.*, 1967).

Despite the geographical proximity of Algeria and Sub-Saharan Africa, the Algerian aphid fauna contained few Sub-Saharan species. The Sub-Saharan aphid fauna is known to be much less diverse than the holarctic fauna. The total of 219 species identified in this biogeographic region (Remaudière *et al.*, 1985) is much smaller than the 1,416 species reported in North America (Footitt *et al.*, 2006) or the 1,373 species present in Europe (Nieto Nafria *et al.*, 2007). However, 87 of these 219 species are endemic to Sub-Saharan Africa (Remaudière *et al.*, 1985). Only one of these species, *Aloephagus myersi* Essig 1950, was present in our list. This species has considerably expanded its distribution. It was introduced with its host (*Aloe*) into southern Europe and North America (Remaudière *et al.* 1985). There are two probable reasons for the absence of Sub-Saharan species from North Africa. The first is the major obstacle constituted by the Sahara Desert (Remaudière *et al.*, 1985). The second relates to the climate and flora of the region. From one part of the Sahara Desert to another, the climate and flora may be so dissimilar that they are incompatible with the acclimation of Sub-Saharan aphid species.

Finally, we found no species endemic to Algeria or to the Maghreb, and a strong predominance of cosmopolitan species. However, this apparent situation may not accurately reflect the reality. Indeed, the apparent relative paucity of endemic aphids in Algeria may result from our poor knowledge of this fauna. For example, if we compare the fauna of the Ethiopian region known in 1961 (Eastop, 1958; 1961) with that known in 1985, based on many fauna studies (Remaudière *et al.*, 1985), we observe a gradual change in the general characteristics of the recorded fauna, with a 7.4% increase in the proportion of endemic species over time and a 14.1% decrease in the proportion of cosmopolitan, subcosmopolitan and pantropical species (Remaudière *et al.* 1985).

Most of these species with a broad distribution are crop pests. Previous studies in Algeria and, to some extent, our own, have probably biased this aspect by carrying out prospection studies principally on crops and their cosmopolitan weeds and on the vegetation of urban and suburban zones, which are easily accessible and in which the proportion of alien plants (including ornamental plants in particular) is very high.

Prospection studies targeting the Sahara and the steppe regions known to have a highly endemic vegetation would probably lead to the discovery of species new to science and endemic to Algeria or to the Maghreb.

#### 4. CONCLUSION

In this study, 63 aphid species were reported for the first time in Algeria, bringing to 120 the number of species known to be present in this country. These species included a large number of cosmopolitan species and no endemic species. This composition biased towards species with a broad geographical range, mostly pest species, probably reflects the more intense sampling of agricultural than of other environments.

Given the high level of climate and plant diversity in Algeria, the expansion of prospection activities to a larger number of plant species and environments would undoubtedly provide us with a more accurate picture of the Algerian aphid fauna and would increase the number of species known to be present in this country. Many aphids very common in the Mediterranean region and known to live on host plants present in Algeria have not yet been recorded. Furthermore, prospection studies in the Sahara and steppe zones, which are known to have a highly endemic flora, might lead to the description of species new to science.

#### REFERENCES

- Ahmeid Al-Nagar O.A. & Nieto Nafria J.M. (1998). Notes on Libyan aphids: new recorded species from North Africa. In Nieto Nafria JM & Dixon AFG, (ed.). *Aphids in natural and managed ecosystems*, p. 325-327. Universidad de Leon, Secretariado de Publicaciones, Leon.
- Ait Hamouda F. (2000). *Détermination des causes de l'inégalité des performances chez les céréaliculteurs: cas de la wilaya de Sétif*. Thèse Magister agronomique, Institut National Agronomique- El Harrach, Algérie, p. 106.
- Belkahla H & Lapierre H. (2002). Analyse par elisa et immunocapture-rt-pcr des virus associés à la jaunisse nanisante de l'orge (BYD) sur blé tendre. *Revue Science et technologie Numéro spécial- D*, p. 5-9.
- Blackman R.L. & Eastop V.F. (1994). *Aphids on the World's Trees: an Identification and Information guide*. C.A.B. International (ed.), Wallingford, 987 p.
- (2000). *Aphids on the World's Crops - An identification and information guide*. Ltd JWS (ed.), The Natural History Museum, London, 466 p.
- (2006). *Aphids on the World's Herbaceous Plants and Shrubs*. Ltd JWS (ed.), The Natural History Museum, London, 1439 p.
- Boukhris-Bouhachem S., Souissu R., Turpeau E., Rouzé-Jouan J., Fahem M., Ben Brahim N. & Hüllé M. (2007). Aphid (Hemiptera; Aphidoidea) diversity in Tunisia in relation to seed potato production. *Annales de la Société Entomologique de France (NS)* 43(3), p. 311-318.
- Dartigues D. (1993). Analyse comportementale des interactions entre la fourmi *Tapinoma simrothi* et le puceron *Toxoptera aurantii*. *Entomologia Experimentalis et Applicata* 68, p. 25-30.
- Eastop V.F. (1958). *A Study of the Aphididae (Homoptera) of East Africa*. Colonial research Publication (ed.). London, UK, 126 p.
- (1961). *A Study of the Aphididae (Homoptera) of West Africa*. British Museum (Natural History) (ed.), London, UK, 93 p.
- Emonnot P., Gayraud Y., Leclant F. & Remaudière G. (1967). Sur la présence en France de *Cedrobium laportei* Remaudière puceron nuisible au cèdre. *Comptes-Rendus de l'Académie d'Agriculture de France*, 1967, p. 966-972.
- Footitt R.G., Halbert S.E., Miller G.L. (2006). Adventive aphids (Hemiptera: Aphididae) of America North to Mexico. *Proceedings of the Entomological Society of Washington* 108, p. 583-610.
- Heie O.E. (1980). The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. I. General part. The families Mindaridae, Hormaphididae, Thelaxidae, Anoeciidae and Pemphigidae. *Fauna Entomologica Scandinavica* 9, p.1-236.
- (1982). *The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. II. The family Drepanosiphidae*.

- Andersen NM, Hedqvist KJ, Kauri H, Krogerus H, Lyneborg L, Nielsen ES (ed.), Klampenborg, Denmark, 176 p.
- (1986). The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. III. Family Aphididae: subfamily Pterocommatinae & tribe Aphidini of subfamily Aphidinae. *Fauna Entomologica Scandinavica* **17**, p.1-314.
- (1992). *The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. IV. Family Aphididae: Part 1 of tribe Macrosiphini of subfamily Aphidinae*. Brill, E.J. (ed.), Leiden, The Netherland, 188 p.
- (1994). *The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. V. Family Aphididae: part 2 of tribe Macrosiphini of subfamily Aphidinae*. Brill, E.J. (ed.), Leiden, The Netherland, 239 p.
- (1995). *The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. VI. Family Aphididae: part 3 of tribe Macrosiphini of subfamily Aphidinae, and family Lachnidae*. Brill, E.J. (ed.), Leiden, The Netherland, 217 p.
- Laamari M. (2004). *Etude éco biologique des pucerons des cultures dans quelques localités de l'Est algériens*, Thèse de Doctorat, Institut National Agronomique- El Harrach., Alger, Algérie, 204 p.
- Laamari M. & Akal Y. (2002). Aphid population dynamics and the rate of virus diseases in potato fields in the Setif region of Algeria. *Arab Journal of Plant Protection* **20**(2), p. 111-117.
- Leclant F. (1978). *Etude Bioécologique des Aphides de la région méditerranéenne. Implications agronomiques*. Thèse d'Etat, Université des sciences et techniques du Languedoc, Montpellier, France, 327 p.
- Leclant F. & Remaudière G. (1974). Un *Acyrtosiphon* nouveau vivant sur *Glaucium* (Hom., Aphididae). *Annales de la Société Entomologique de France* **10**(4), p. 875-883.
- Mimeur J.M. & Bernard F. (1946). Mission française au Fezzân (17 Février-22 Avril 1944). I. Hémiptères Aphididae. *Bulletin de la Société d'Histoire Naturelle d'Afrique du Nord* **37**, p. 43-44.
- Nieto Nafria J.M., Andreev A.V., Binazzi A., Mier Durante M.P., Pérez Hidalgo N., Rakauskas R. & Stekolshchikov A.V. (2007). Aphidoidea. Fauna Europaea version 1.3. <http://www.faunaeur.org>; 2/10/2009.
- Nieto Nafria J.M., Mier Durante M.P., Binazzi A. & Perez Hidalgo N. (2002). *Hemiptera Aphididae II*. Ramos, M.a. et al. (eds.), Madrid, Espana, 350 p.
- Nieto Nafria J.M., Mier Durante M.P., Garcia Prieto F. & Perez Hidalgo N. (2005). *Hemiptera Aphididae*
- III. Ramos, M.a. et al. (eds.), Madrid, Espana, 362 p.
- Patti I. & Barbagallo S. (1998). *An approach to the knowledge on the Italian aphid fauna*. In Nieto Nafria JM & Dixon AFG, (ed.). *Aphids in natural and managed ecosystems*, p. 397-405. Universidad de Leon, Secretariado de Publicaciones, Leon.
- Quezel P. & Santa S. (1962). *Nouvelle flore d'Algérie et des régions désertiques méridionales*. CNRS (ed.), Paris, 362 p.
- Remaudière G. (1954a.) Aphidoidea récoltés au Sahara Central par A.S. Balachowsky en 1949. *Extrait des Travaux de l'institut de Recherches Sahariennes, Série de Tassili* **3**, p.147-149.
- (1954b). Les Cinarini (Hom. Aphidoidea Lachnidae) du Cèdre en Afrique du Nord. *Revue de Pathologie Végétale et d'Entomologie Agricole de France* **33**(2), p. 115-122.
- (1982). Contribution à la connaissance des aphides (Homoptera, Aphidoidea) de la Grèce et description d'un Thelaxes nouveau. *Annales de l'Institut Phytopathologique Benaki* **13**(2), p. 99-119.
- (1985). Reconnaissance des principaux pucerons de la région éthiopienne. In Remaudière G & Autrique A., (eds.). *Contribution à l'écologie des aphides africains*, p 141-173. Organisation des Nations Unies pour l'Alimentation et l'Agriculture, Rome.
- (1989). Le genre *Therioaphis* Walker au Moyen-Orient (Homoptera: Aphididae). *Annales de la Société Entomologique de France* **25**(2), p.171-198.
- Remaudière G., Eastop V.F. & Autrique A. (1985). Distribution des aphides de la région éthiopienne. In Remaudière G & Autrique A., (eds.). *Contribution à l'écologie des aphides africains*, p 77-93. Organisation des Nations Unies pour l'Alimentation et l'Agriculture, Rome.
- Remaudière G. & Leclant F. (1972). Nouveaux *Drepanosiphoniella*, *Macrosiphoniella* et *Aphis* du bassin méditerranéen et du massif alpin (Hom. Aphididae). *Annales de la Société Entomologique de France* **8**(1), p. 73-109.
- Remaudière G. & Remaudière M. (1997). *Catalogue des Aphididae du monde - Catalogue of the world's Aphididae [Homoptera, Aphidoidea]*. INRA (ed.), Paris, 376 p.
- Stary P. & Sekkat A. (1987). Parasitoids (Hymenoptera, Aphidiidae) of aphid pests in Morocco. *Annales de la Société Entomologique de France (NS)* **23**(2), p.145-149.











**Appendix I:** List of host plants and the aphids living on them sampled in Algeria

- Amaranthus retroflexus*** L. [Amaranthaceae]  
*Macrosiphum euphorbiae* (Thomas 1878)
- Anchusa undulata*** L. [Boraginaceae]  
*Aphis fabae* Scopoli 1763
- Atriplex halimus*** L. [Chenopodiaceae]  
*Hayhurstia atriplicis* (L. 1761)
- Avena sterilis*** L. [Poaceae]  
*Macrosiphum euphorbiae* (Thomas 1878)  
*Metopolophium dirhodum* (Walker 1849)  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)  
*Schizaphis graminum* (Rondani (1847) 1852)  
*Sitobion avenae* (Fabricius 1775)  
*Sitobion fragariae* (Walker 1848)
- Beta vulgaris*** L. [Chenopodiaceae]  
*Aphis fabae* Scopoli 1763
- Brassica napus*** L. [Brassicaceae]  
*Brevicoryne brassicae* (L. 1758)
- Brassica oleracea*** L. [Brassicaceae]  
*Brevicoryne brassicae* (L. 1758)
- Calendula arvensis*** L. [Asteraceae]  
*Macrosiphum euphorbiae* (Thomas 1878)
- Calendula* spp.** [Asteraceae]  
*Aphis fabae* Scopoli 1763  
*Aphis gossypii* Glover 1877
- Calotropis procera*** Act. [Asclepiadaceae]  
*Aphis nerii* Boyer de Fonscolombe 1841  
*Myzus persicae* (Sulzer 1776)
- Capsicum annuum*** L. [Solanaceae]  
*Aphis gossypii* Glover 1877
- Carduus pycnocephalus*** L. [Asteraceae]  
*Brachycaudus cardui* (L. 1758)
- Carduus* spp.** [Asteraceae]  
*Brachycaudus helichrysi* (Kaltenbach 1843)
- Cedrus atlantica*** (Manetti) [Pinaceae]  
*Cinara laportei* (Remaudière 1954)
- Centaurea solstitialis*** L. [Asteraceae]  
*Aphis spiraeicola* Patch 1914  
*Uroleucon jaceae* (L. 1758)
- Chenopodium album*** Lud. [Chenopodiaceae]  
*Aphis fabae* Scopoli 1763
- Citrus sinensis*** L. [Rutaceae]  
*Aphis spiraeicola* Patch 1914  
*Toxoptera aurantii* (Boyer de Fonscolombe 1841)
- Convolvulus arvensis*** L. [Convolvulaceae]  
*Aphis craccivora* Koch 1854  
*Myzus persicae* (Sulzer 1776)
- Crataegus monogyna*** L. [Rosaceae]  
*Aphis pomi* de Geer 1773  
*Macrosiphum euphorbiae* (Thomas 1878)
- Cucurbita pepo*** L. [Cucurbitaceae]  
*Aphis fabae* Scopoli 1763
- Cynara cardunculus*** L. [Asteraceae]  
*Brachycaudus cardui* (L. 1758)
- Diptotaxis virgata*** DC. [Brassicaceae]  
*Myzus persicae* (Sulzer 1776)
- Erigeron canadensis*** L. [Asteraceae]  
*Myzus persicae* (Sulzer 1776)
- Euphorbia bupleuroides*** Desf  
[Euphorbiaceae]  
*Aphis tirucallis* Hille Ris Lambers 1954
- Euphorbia helioscopia*** L. [Euphorbiaceae]  
*Aphis euphorbiae* Kaltenbach 1843  
*Myzus persicae* (Sulzer 1776)
- Foeniculum officinale*** All. [Apiaceae]  
*Cavariella aegopodii* (Scopoli 1763)  
*Hyadaphis coriandri* (B. Das 1918)
- Foeniculum vulgare*** (Mill.) Gaertn.  
[Apiaceae]  
*Dysaphis foeniculus* (Theobald 1923)  
*Hyadaphis foeniculi* (Passerini 1860)
- Gossypium hirsutum*** L. [Malvaceae]  
*Aphis gossypii* Glover 1877
- Hertia cheirifolia*** L. [Asteraceae]  
*Myzus persicae* (Sulzer 1776)
- Hordeum mirinum*** L. [Poaceae]  
*Rhopalosiphum insertum* (Walker 1849)  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)  
*Sipha elegans* del Guercio 1905
- Hordeum* spp.** [Poaceae]  
*Rhopalosiphum maidis* (Fitch 1856)
- Hordeum vulgare*** L. [Poaceae]  
*Diuraphis noxia* (Kurdjumov 1913)  
*Metopolophium dirhodum* (Walker 1849)  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)  
*Schizaphis graminum* (Rondani 1852)  
*Sipha elegans* del Guercio 1905  
*Sitobion avenae* (Fabricius 1775)  
*Sitobion fragariae* (Walker 1848)
- Inula viscosa*** L. [Asteraceae]  
*Aphis gossypii* Glover 1877  
*Uroleucon inulae* (Ferrari 1872)
- Juglans regia*** L. [Juglandaceae]  
*Chromaphis juglandicola* (Kaltenbach 1843)  
*Panaphis juglandis* (Goeze 1778)

- Lolium multiflorum*** Lamk. [*Poaceae*]  
*Sitobion avenae* (Fabricius 1775)
- Malus communis*** L. [*Rosaceae*]  
*Aphis craccivora* Koch 1854  
*Aphis pomi* de Geer 1773  
*Aphis spiraeicola* Patch 1914  
*Dysaphis plantaginea* (Passerini 1860)  
*Eriosoma lanigerum* (Hausmann 1802)  
*Rhopalosiphum insertum* (Walker 1849)
- Malva sylvestris*** L. [*Malvaceae*]  
*Aphis craccivora* Koch 1854  
*Aphis davletshinae* Hille Ris Lambers 1966  
*Aphis fabae* Scopoli 1763  
*Aphis gossypii* Glover 1877
- Marrubium vulgare*** L. [*Labiatae*]  
*Aphis gossypii* Glover 1877  
*Aphis pseudocardui* Theobald 1915
- Medicago arborea*** L. [*Leguminosae*]  
*Aphis craccivora* Koch 1854  
*Therioaphis trifolii* (Monell 1882)
- Medicago sativa*** L. [*Leguminosae*]  
*Aphis craccivora* Koch 1854
- Medicago* spp.** [*Leguminosae*]  
*Aphis craccivora* Koch 1854
- Moricandia arvensis*** D.C. [*Brassicaceae*]  
*Aphis gossypii* Glover 1877  
*Brevicoryne brassicae* (L. 1758)  
*Lipaphis erysimi* (Kaltenbach 1843)
- Myoporum laetum*** G.Forst. [*Myoporaceae*]  
*Brachycaudus helichrysi* (Kaltenbach, 1843)
- Nerium oleander*** L. [*Asclepiadaceae*]  
*Aphis nerii* Boyer de Fonscolombe 1841
- Nicotiana tabacum*** L. [*Solanaceae*]  
*Myzus persicae* (Sulzer 1776)
- Peganum harmala*** L. [*Zygophyllaceae*]  
*Brachyunguis harmalae* B. Das 1918
- Pergularia tomentosa*** L. [*Asclépiaceae*]  
*Aphis nerii* Boyer de Fonscolombe 1841
- Phragmites communis*** Trin. [*Poaceae*]  
*Hyalopterus pruni* (Geoffroy 1762)
- Picris echioides*** L. [*Asteraceae*]  
*Hyperomyzus picridis* (Börner & Blunck 1916)  
*Uroleucon picridis* (Fabricius 1775)
- Pinus halepensis*** Mill. [*Pinaceae*]  
*Cinara pini* (L., 1758)
- Pistacia* spp.** [*Anacardiaceae*]  
*Smynthurodes betae* Westwood 1849
- Plantago* spp.** [*Plantaginaceae*]  
*Dysaphis plantaginea* (Passerini 1860)
- Prunus amygdalus*** Stoker [*Rosaceae*]  
*Brachycaudus amygdalinus* (Schouteden 1905)  
*Myzus persicae* (Sulzer 1776)
- Prunus armeniaca*** L. [*Rosaceae*]  
*Myzus persicae* (Sulzer 1776)  
*Hyalopterus pruni* (Geoffroy 1762)
- Prunus cerasi*** L. [*Rosaceae*]  
*Myzus persicae* (Sulzer 1776)
- Prunus domestica*** L. [*Rosaceae*]  
*Brachycaudus helichrysi* (Kaltenbach 1843)  
*Hyalopterus pruni* (Geoffroy 1762)  
*Myzus ornatus* Laing 1932
- Prunus persica*** L. [*Rosaceae*]  
*Brachycaudus amygdalinus* (Schouteden 1905)  
*Hyalopterus pruni* (Geoffroy 1762)  
*Myzus persicae* (Sulzer 1776)
- Punica granatum*** L. [*Punicaceae*]  
*Aphis gossypii* Glover 1877  
*Aphis punicae* Passerini 1863
- Pyrus communis*** L. [*Rosaceae*]  
*Dysaphis plantaginea* (Passerini 1860)  
*Dysaphis pyri* (Boyer de Fonscolombe 1841)
- Quercus ilex*** L. [*Fagaceae*]  
*Hoplocallis pictus* (Ferrari 1872)  
*Lachnus roboris* (L. 1758)
- Robinia pseudoacacia*** L. [*Fabaceae*]  
*Aphis craccivora* Koch 1854
- Rosa agrestis*** Savi [*Rosaceae*]  
*Macrosiphum euphorbiae* (Thomas 1878)
- Rosa* spp.** [*Rosaceae*]  
*Macrosiphum rosae* (L., 1758)
- Rubus caesius*** L. [*Rosaceae*]  
*Macrosiphum rosae* (L. 1758)
- Senecio vulgaris*** L. [*Asteraceae*]  
*Aphis jacobaeae* Schrank 1801
- Setaria verticillata*** B.P. [*Poaceae*]  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)
- Silene inflata*** Sm. [*Caryophyllaceae*]  
*Brachycolus cucubali* (Passerini 1863)
- Sinapis arvensis*** L. [*Brassicaceae*]  
*Macrosiphum euphorbiae* (Thomas 1878)  
*Myzus persicae* (Sulzer 1776)
- Solanum nigrum*** L. [*Solanaceae*]  
*Aphis fabae* Scopoli 1763  
*Macrosiphum euphorbiae* (Thomas 1878)
- Solanum tuberosum*** L. [*Solanaceae*]  
*Aphis fabae* Scopoli 1763  
*Aphis nasturtii* Kaltenbach 1843  
*Macrosiphum euphorbiae* (Thomas 1878)  
*Myzus persicae* (Sulzer 1776)

***Sonchus asper*** L. [Asteraceae]

- Hyperomyzus lactucae* (L. 1758)  
*Macrosiphum euphorbiae* (Thomas 1878)  
*Macrosiphum funestum* (Macchiati 1885)  
*Myzus ascalonicus* Doncaster 1946  
*Uroleucon sonchi* (L. 1767)

***Sonchus oleraceus*** L. [Asteraceae]

- Hyperomyzus lactucae* (L. 1758)  
*Uroleucon sonchi* (L. 1767)

***Tragopogon pratensis*** L. [Asteraceae]

- Brachycaudus tragopogonis* (Kaltenbach 1843)

***Triticum aestivum*** L. [Poaceae]

- Macrosiphum euphorbiae* (Thomas 1878)  
*Metopolophium dirhodum* (Walker 1849)  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)  
*Schizaphis graminum* (Rondani (1847) 1852)  
*Sitobion avenae* (Fabricius 1775)  
*Sitobion fragariae* (Walker 1848)

***Triticum durum*** L. [Poaceae]

- Diuraphis noxia* (Kurdjumov 1913)  
*Metopolophium dirhodum* (Walker 1849)  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)  
*Schizaphis graminum* (Rondani (1847) 1852)  
*Sitobion avenae* (Fabricius 1775)  
*Sitobion fragariae* (Walker 1848)

***Ulmus campestris*** L. [Ulmaceae]

- Eriosoma lanuginosum* (Hartig 1839)

***x tritico secale*** Wittm. [Poaceae]

- Metopolophium dirhodum* (Walker 1849)  
*Rhopalosiphum maidis* (Fitch 1856)  
*Rhopalosiphum padi* (L. 1758)  
*Sitobion avenae* (Fabricius 1775)  
*Sitobion fragariae* (Walker 1848)

***Vicia faba*** L. [Fabaceae]

- Acyrtosiphon pisum* (Harris 1776)  
*Aphis craccivora* Koch 1854  
*Aphis fabae* Scopoli 1763

***Zea mays*** L. [Poaceae]

- Rhopalosiphum maidis* (Fitch 1856)

**Caught in yellow traps only**

- Acyrtosiphon malvae* (Mosley 1841)  
*Aloephagus myersi* Essig 1950  
*Amphorophora* spp.  
*Anoecia corni* (Fabricius 1775)  
*Anuraphis farfarae* (Koch 1854)  
*Aphis idaei* van der Goot 1912  
*Aphis verbasci* Schrank 1801  
*Aploneura lentisci* (Passerini 1856)  
*Asiphonella dactylonii* Theobald 1923  
*Aulacorthum solani* (Kaltenbach 1843)  
*Brachycaudus rumexicolens* (Patch 1917)  
*Capitophorus elaeagni* (del Guercio 1894)  
*Coloradoa achilleae* Hille Ris Lambers 1939  
*Coloradoa rufomaculata* (Wilson 1908)  
*Cryptomyzus ballotae* Hille Ris Lambers 1953  
*Dysaphis tulipae* (Boyer de Foscolombe 1814)  
*Dysaphis apiifolia* (Theobald 1923)  
*Elatobium abietinum* (Walker 1849)  
*Helosiphon eryngii* Leclant 1969  
*Hyalopteroides humilis* (Walker 1852)  
*Macrosiphoniella persequens* (Walker 1852)  
*Macrosiphoniella tapuskae* (Hottes & Frisson 1931)  
*Megoura viciae* Buckton 1876  
*Myzus cerasi* (Fabricius 1775)  
*Myzus cymbalariae* Stroyan 1954  
*Nasonovia ribisnigri* (Mosley 1841)  
*Ovatus crataegarius* (Walker 1850)  
*Pentalonia nigronervosa* Coquerel 1859  
*Phorodon humuli* (Schrank 1801)  
*Prociphilus bumeliae* (Schrank 1801)  
*Rhopalosiphum rufiabdominale* (Sasaki 1899)  
*Schizaphis rotundiventris* (Signoret 1860)  
*Takecallis taiwanus* (Takahashi 1926)  
*Tetraneura nigriabdominalis* (Sasaki 1899)  
*Tinocallis platani* (Kaltenbach 1843)  
*Uroleucon compositae* (Theobald 1915)  
*Uroleucon erigeronense* (Thomas 1878)  
*Uroleucon solidaginis* (Fabricius 1779)  
*Wahlgreniella arbuti* (Davidson 1910)