

Entomologie

AN INVENTORY OF MOSQUITOES (DIPTERA: CULICIDAE) IN ALGERIA

par

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A survey of immature and adult mosquitoes was conducted in 15 departments with the aims of inventorying the Culicidae and documenting inter-species relationships in different habitats. In total, 3 families, 7 genera and 17 species were collected, including the first report of *Culex territans* larvae captured at an altitude of 1750 m and the confirmation of the presence of *Aedes albopictus* (Dengue, Chikungunya and other arboviruses vector) in Algeria and the Maghreb, based on a second capture in this country.

Keywords: Arbovirus, *Culex*, *Aedes*, Culicidae, mosquitoes.

Inventaire des moustiques (Diptera : Culicidae) de l'Algérie

Une étude des moustiques immatures et adultes a été menée dans 15 départements de l'Algérie dans le but d'inventorier des Culicidae et de documenter les relations entre les espèces dans leurs différents biotopes. 3 familles, 7 genres et 17 espèces récoltées dont deux records significatifs : des larves de *Culex territans* collectées à 1750 m d'altitude et la confirmation de la présence d'*Aedes albopictus* (vecteur de la Dengue,

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Chikungunya et autres arboviroses) en Algérie qui est la seconde capture dans notre pays et à l'échelle Maghrébine.

Mots-clés: Arboviroses, *Culex*, *Aedes*, Culicidae, moustiques.

Introduction

Far from being controlled, in many regions of the world mosquito-borne diseases are flourishing, causing significant global morbidity and mortality, particularly in children and adolescents (MACKENZIE *et al.*, 2004). The family Culicidae is a diverse group of largely haematophagous insects. A number of species are vectors of viruses, nematodes and protozoa. Due to their wide geographical distribution, abundance and harmfulness, mosquitoes are important vectors for various pathogens

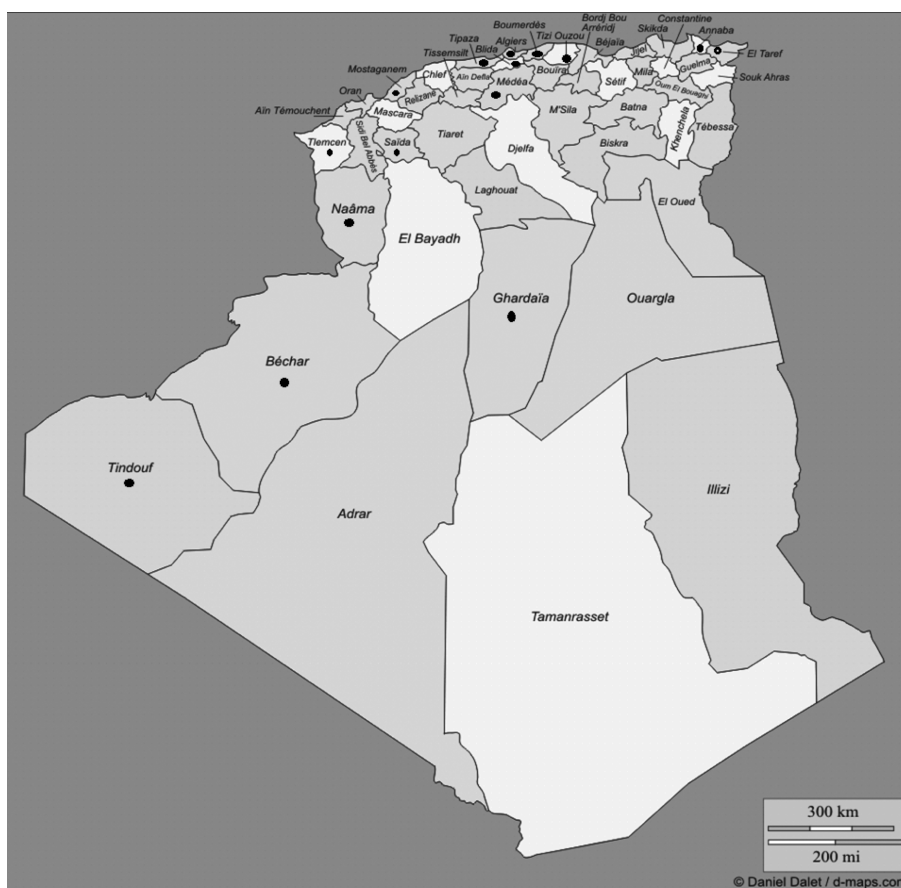


Figure 1

Trapping locations of mosquitoes in Algeria.
Lieux de capture et de collecte des moustiques en Algérie.

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affecting both humans and animals, such as *Plasmodium*, lymphatic filariasis, West Nile Virus and other arboviruses (DHADIALLA & RAIKHEL, 1994; RAIKHEL & LEA, 1991). For these reasons, regular campaigns are undertaken with the aims of controlling these diseases, as well as to reduce the nuisance caused by mosquitoes in urban and touristic centres. Recent studies have been carried out on the Culicidae of Algeria, especially concerning their systematics, biochemistry, morphometry, and the means of their chemical and biological control (BOUABIDA *et al.*, 2012; BOUDMAGH *et al.*, 2013). The objectives of the present work were to inventory the Culicidae of 15 departments of Algeria (Figure 1) and to compare the specimens obtained with previous faunal surveys in terms of the effects of climatic, demographic and global variations.

Materials and methods

Sampling method

Specimens collected from different departments were harvested at the larval and adult stages.

The study was carried out from September 2010 to June 2014. Mosquito larvae were collected using the "Dipping" technique. This method consists of dipping a ladle in several places of water. For animal shelter, we used a bucket with a capacity of 5 litres and a rope. The capture of adults was carried at animal shelters (cows, goats, sheep, chickens, equids and rabbits) and inside human habitations. In each household a single CDC light trap (John W. Hock Company, Gainesville, FL, USA) was installed and run for over 12 hours (6:00 PM – 8:00 AM) to capture mosquitoes.

Mounting and identification of specimens

The mosquitoes were returned to the laboratory, where larvae were cleared in 5% NaOH (for 3 days), rinsed with distilled water (3 baths for 2 to 5 minutes), and mounted between a slide and a cover slip in a drop of glycerine. Larvae and adult mosquitoes were identified using the morphological keys of BRUNHES *et al.* (1999).

Inventory

In total, 1394 adult mosquitoes and 3196 larvae were trapped in 15 departments in Algeria (Table 1). These species belong to two subfamilies: Culicinae and Anophelinae. Their identification revealed the presence of seven genera, *Uranotaenia*, *Aedimorphus*, *Aedes*, *Ochlerotatus*, *Culex*, *Culiseta* and *Anopheles*, with 17 species: *Aedes albopictus* Skuse, 1894, *Aedimorphus vexans* Meigen, 1830, *Anopheles labranchiae* Falleroni, 1926, *An. multicolor* Cambouliu, 1902, *Culex deserticola* Kirkpalrick, 1924, *Cx. hortensis* Ficalbi, 1889, *Cx. pipiens* Linnaeus, 1758, *Cx. territans* Walker, 1856, *Cx. theileri* Theobald, 1903, *Culiseta litorea* (Shute, 1928), *C. longiareolata* Macquart, 1838, *Ochlerotatus coluzzii* Rioux,

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Table 1

List of Culicidae captured in 15 departments of Algeria.
Liste des Culicidae capturés dans 15 départements d'Algérie.

| Season | Number of individuals | | Sites (North / South / West / East) |
|---------------------------------------------------------------|-----------------------|--------|----------------------------------------------------------------------------------------------------------------------------|
| | Larvae | Adults | |
| <i>Aedes (Stegomyia) albopictus</i> Skuse, 1894 | - | 2 | Tizi-Ouzou (N) |
| <i>Aedimorphus vexans</i> Meigen, 1830 | 13 | - | Ghardaïa (S) |
| <i>Anopheles (Anopheles) labranchiae</i> Falleroni, 1926 | 35 | 174 | Blida, Tizi-Ouzou (N) |
| <i>Anopheles (Cellia) multicolor</i> Cambouliu, 1902 | 137 | 102 | Tamanrasset, Ghardaïa, Tindouf (S) - Naama, Tlemcen (W) |
| <i>Culex (Culex) pipiens</i> Linné, 1758 | 1365 | 823 | El Tarf, Annaba (E) - Saida, Mostaganem, Tlemcen (W) - Algiers, Blida, Tipaza, Médéa, Tizi-Ouzou (N) |
| <i>Culex (Culex) theileri</i> Theobald, 1903 | 34 | - | Algiers (N) |
| <i>Culex (Maillotia) deserticola</i> Kirkpalrick, 1924 | 29 | - | Algiers, Blida (N) |
| <i>Culex (Maillotia) hortensis</i> Ficalbi, 1889 | 57 | - | Algiers, Blida (N) - Tindouf (S) |
| <i>Culex (Neoculex) territans</i> Walker, 1856 | 3 | - | Tizi-Ouzou (N) |
| <i>Culiseta (Allotheobaldia) longiareolata</i> Macquart, 1838 | 1250 | 271 | El Tarf, Annaba (E) - Saida, Mostaganem, Tlemcen, Bechar (W) - Algiers, Blida, Tipaza, Médéa, Tizi-Ouzou (N) - Tindouf (S) |
| <i>Culiseta (Culicella) litorea</i> Shute, 1928 | 60 | 20 | Algiers (N) |
| <i>Ochlerotatus flavescens</i> Muller, 1764 | 41 | - | Tipaza (N) |
| <i>Ochlerotatus (Finlaya) geniculatus</i> Olivier, 1791 | 64 | - | Boumerdes (N) |
| <i>Ochlerotatus coluzzii</i> Rioux, Guilvard & Pasteur, 1998 | 21 | - | Tipaza (N) |
| <i>Ochlerotatus detritus</i> Halyday, 1833 | 68 | - | Tipaza (N) |
| <i>Ochlerotatus dorsalis</i> Meigen, 1830 | 19 | - | Ghardaïa (S) |
| <i>Uranotaenia unguiculata</i> Edwards 1913 | - | 2 | Algiers, Blida (N) |

Guilvard & Pasteur, 1998, *O. detritus* Haliday, 1833, *O. dorsalis* Meigen, 1830, *O. flavescens* Muller, 1764, *O. geniculatus* Olivier, 1791 and *Uranotaenia unguiculata* Edwards, 1913. *Culex pipiens* and *Culiseta longiareolata* were the most dominant species. In the urban sites, the total richness was high, with 8 species. The rural sites also mark an important total richness, with 6 species. In contrast, only 3 species were observed in salt marsh sites. We note the first record of *Cx. territans* in Algeria, at an altitude of 1750 m. We note also the second record in Algeria (and the Maghreb) of *Ae. albopictus*, which was found at Illoula Oumalou (Tizi Ouzou), 48 Km from its first capture at Larabaa Nath Irathen (IZRI *et al.*, 2011), situated in the same department.

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Discussion

Results from the present study, combined with information from the literature on the culicid fauna of Algeria, highlight a number of points that deserve further attention. As usual in entomological field surveys, providing final species names for certain mosquitoes is a challenge, particularly for females from which cuticular scales and setae have been abraded in traps. Based on more than thirty years of fieldwork, SENEVET & ANDARELLI (1960) identified 27 species of Culicidae in Algiers, belonging to the subfamilies Anophelinae and Culicinae. This diversity is explained by the climate and the diversity of natural and urban habitats available for the development of Culicidae. In the region of Constantine, BERCHI (2000) noted the presence of seven species belonging to the subfamilies Anophelinae and Culicinae: *Cx. pipiens*, *Cx. mimeticus*, *Cx. theileri*, *Cx. hortensis*, *C. longiareolata*, *An. labranchiae* and *U. unguiculata*. According to HASSAINE (2002), the Culicid fauna of Mediterranean Africa consists of 67 species, belonging to two subfamilies and seven genera. In the western region of Algeria (Tlemcen), 20 species of Culicidae are recorded. This relatively high number of species can be explained by the large number of samples taken in this area, as well as the long period of sampling that lasted two years. According to FAURE *et al.* (1980), the number of species inventoried is in accordance with the number of individuals collected. In the Mila region, MESSAI *et al.* (2010) noted the presence of 12 species of Culicidae belonging to two subfamilies: *Cx. pipiens*, *Cx. modestus*, *Cx. theileri*, *Cx. hortensis*, *Cx. antennatus*, *Cx. laticinctus*, *Cx. deserticola*, *Cx. sp.*, *C. longiareolata*, *An. labranchiae*, *An. pharoensis* and *U. unguiculata*. From the results obtained in our study (Table 1), the genus *Culex* is the most abundant, it is represented by five species, with *Cx. pipiens* as the most frequent species. The second position is occupied by the genus *Culiseta*, with *C. longiareolata* being the most abundant and most frequently collected species at the different houses surveyed. The genus *Culex* was represented by 5 species: *Cx. pipiens*, *Cx. theileri*, *Cx. deserticola*, *Cx. territans* and *Cx. hortensis* of which *Cx. pipiens* was the most abundant, with 1365 larvae and 823 adults, captured both in urban and rural sites, due to its high ecological elasticity and ability to colonize different environments. This species is typically characterized as urban, being very common in towns. These results are consistent with many recent studies. In the region of Mila, MESSAI *et al.* (2011) noted the presence of 12 species, eight of these belonging to the genus *Culex* (*Cx. pipiens*, *Cx. modestus*, *Cx. antennatus*, *Cx. hortensis*, *Cx. deserticola*, *Cx. theileri*, *Cx. laticinctus* and *Culex* sp.). In the region of Biskra, MERABTI & OUAKID (2008) recorded 22 species, six of which belonging to *Culex* (*Cx. hortensis*, *Cx. pipiens*, *Cx. modestus*, *Cx. theileri*, *Cx. laticinctus* and *Cx. torentium*). In the region of Tebessa, BOUABIDA *et al.* (2012) recorded nine species, including five of *Culex* (*Cx. pipiens*, *Cx. theileri*, *Cx. hortensis*, *Cx. perexiguus* and *Cx. laticinctus*). A recent study confirms that *Cx. pipiens* from the Maghreb is an efficient experimental vector for the transmission of West Nile Virus and Rift Valley Fever Virus (AMRAOUI *et al.*, 2012).

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Aedes albopictus is a recent invasive species in the Mediterranean region (ADHAMI *et al.*, 1998) and is known to have the potential for vertical transmission of viruses from the infected female to their eggs, confirmed for *Aedes albopictus*, *Aedes aegypti* and *Culex* (BAQAR *et al.*, 1993). Amazingly, in the last two decades, *Ae. albopictus* has attained an almost global distribution, presently being found in the United States, Central and South America, Africa, Europe and the Middle East. Several factors contributed to the rapid spread of this mosquito species, among the most important of which are the resistance of its desiccated, dormant eggs and their efficient passive transport around the world, often in used tires (TATEM *et al.*, 2006). The ability of *Aedes albopictus* to serve as a vector for transmitting disease has been experimentally demonstrated for 26 arboviruses (GRATZ, 2004). It should be noted that we captured two females of this dreadful mosquito in the same department as that of the first capture in Algeria and the Maghreb was made (IZRI *et al.*, 2011).

Conclusions

This study, which is a complement to other mosquito surveys performed, adds to our knowledge of the distribution in Algeria of medically important species. Among the 17 species of Culicidae found, most are potential or proven vectors of pathogens that cause diseases in humans and domestic animals in various areas of the world. The results obtained should be useful for developing a control program to direct operations and to assess its efficiency. Future studies should address the possible relations between richness and diversity of populations of disease vectors and the risk of human infection.

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