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Inventory of Culicidae (Diptera: Nematocera) in the region of Collo (North-East Algeria)

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ABSTRACT

A mosquito's survey was conducted in the region of Collo (North-East of Algeria) between November 2011 and October 2012 where the collection of specimens was performed twice a month in urban and rural sites. Species were identified using the software of Schaffner et al., (2001). Thirteen species representing five genus were identified: *Uranotaenia unguiculata*, Edwards, 1913; *Orthopodomyia pulcripalpis*, Rodani, 1872; *Culex pipiens*, Linnaeus, 1758; *Culex Laticinctus*, Edwards, 1913; *Culex impudicus*, Ficalbi, 1890, *Culex pusillus*, Macquart, 1850; *Culex hortensis*, Ficalbi, 1889; *Culex theileri*, Theobald 1903; *Culiseta annulata*, Schrank 1776; *Culiseta ochroptera*, Peus, 1935; *Culiseta glaphyroptera*, Schiner, 1864; *Culiseta longiareolata*, Macquart, 1838; and *Anopheles maculipennis sacharovi*, Favre, 1903. Ecological parameters such as diversity, richness indices and centesimal frequency were calculated to analyze changes in diversity, similarity, and dominance of species for each site: *Culex pipiens* was dominant in both urban and rural sites with 52, 38% and 51% respectively.

Keywords: Inventory, Culicidae, systematic, Biodiversity, Collo, Algeria.

INTRODUCTION

The family of Culicidae is a diverse group of largely haematophagous insects. A number of species are vectors of viruses, nematodes, and protozoa. Due to their large geographical distribution, abundance and harmfulness, mosquitoes transmitted various diseases to humans and animals like malaria, lymphatic filariasis and the West Nile [1-2- 3]. For all these pathogenic reasons, regular campaigns are aiming both at the eradication of these diseases and reducing the noise in the urban and touristic centers. This control cannot be effective without a better knowledge of the bio-ecology and the distribution of these insects, in space and time [4]; [5]. Recent studies are interested on the Culicidae fauna of Algeria, especially the systematic, biochemistry, morphometry, chemical and biological control [5- 13]. This work has been devoted to the systematic identification of Culicidae species collected from different sites in the region of Collo according to the software of [14]. We also proceeded to determine the ecological indices and to specify the relative abundance of the inventoried species.

MATERIALS AND METHODS

Presentation of the study region

Collo is located in the North-East of Algeria, between 37 ° 00'51 " N latitudes and 6 ° 33'2" E longitudes with an area of more than 228, 28 km². It is 71 km from the West of the province of Skikda, and 108 km far from the province of Constantine. It is bordered by the Mediterranean Sea from the North and Nord-Est, Jijel province from the West and by Tamalous town from the south. It includes three communes. It has a subtropical climate (Figure 1). Mosquitoes sampling was carried out during 2010-2011. The study area contained an urban and a rural site. Each site is divided into stations: the different cities represent our urban stations. Two rural sites were selected in the

peripheral areas of the city: in the North Telezza which is 3 km far from the town and contained two stations. In the East Bni zid situated in 13 km far from the town and contained three stations. They were mainly wells, freshwater stagnations and temporary stagnations of rainwater

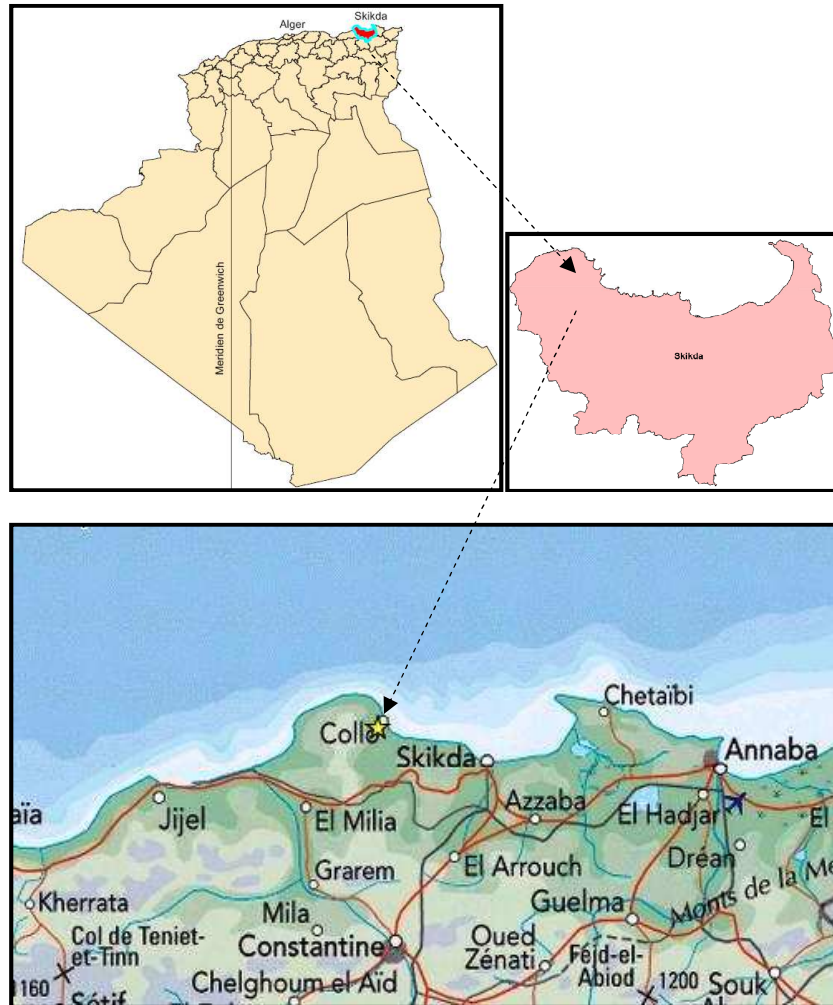


Figure 1: Geographic location of the region of Collo [15].

Sampling method

Specimens collected from different stations were harvested at the larval and adult stages. Mosquito's larvae were collected using the technique of "Dipping". This method consists to dip a ladle in several places of water. For shelter, we used a bucket with a capacity of 5 liters and a rope. The capture of adults was carried out at the buildings, using a glass tube that is placed delicately on the mosquito at rest, which wins the bottom of the tube, then put them in cubic cages [4].

Mounting and identification of specimens

The mosquitoes were reported to the laboratory, the larvae are preserved in 5% NaOH (for 3 days), rinsing with distilled water (3 baths 2 to 5 minutes), and made mounting between a slide and a cover slip in a drop of glycerin. The determination of specimens was realized using the key [14].

Ecological indexes

Ecological indices are used to analysis the population of Culicidae: total and mean richness [16], the Shannon-Weaver index [17], the index of equitability [18] and the frequency or relative abundance [19].

RESULTS AND DISCUSSION

Inventory

A total number of 1591 mosquito specimens representing 13 species were collected in the region of Collo during the survey and identified with the software of [14]. These species belonging to two subfamilies: Culicinae and

Anophelinae). This identification revealed the presence of five genus *Uranotaenia*; *Orthopodomyia*; *Culex*; *Culiseta* et *Anopheles* and 13 species: *Uranotaenia unguiculata*, Edwards, 1913; *Orthopodomyia pulcripalpis*, Rodani, 1872; *Culex pipiens*, Linnaeus, 1758; *Culex laticinctus*, Edwards, 1913; *Culex impudicus*, Ficalbi, 1890, *Culex pusillus*, Macquart, 1850; *Culex hortensis*, Ficalbi, 1889; *Culex theileri*, Theobald 1903; *Culiseta annulata*, Schrank 1776; *Culiseta ochroptera*, Peus, 1935; *Culiseta glaphyroptera*, Schiner, 1864; *Culiseta longiareolata*, Macquart, 1838; and *Anopheles maculipennis sacharovi*, Favre, 1903. *Culex pipiens* and *Orthopodomyia pulcripalpis* and *Cs. glaphyroptera* were found along the survey and *Cx. Pusillus*, *Cs.annulata* present a few number. The month of August marks the maximum values with 192 individuals divided into 9 species while the month of January has the minimum values with 57 separate individuals in 6 species (Table 1).

Ecological analysis

Total and mean Richness, diversity index and equitability

In the urban site, the total richness was important with 9 species, and abundance of 1115 individuals. The diversity index of Shannon-Weaver showed values ranging from 1 station 8 to 2,08 at the station 2, the second value shows a population rich in species (8 species). Concerning the equitability, in the 2^d station, these values tend to 1 which explains the balance between populations (Table 2, 3).

The rural site marks a total richness with 8 species, and abundance of 504 individuals. The diversity index of Shannon-Weaver showed values ranging from 0,35 in station 5 to 1,35 at station 2. The second value shows a population rich in species (6 species). Concerning the equitability, in the 2^d station, the 1st values tend to 0 which explains that the populations are not balanced and all staff is focused on one species, (Table 4, 5).

Centesimal Frequency or relative abundance

In both urban and rural sites of the study area, *Culex pipiens* is the most common species with 55, 38%, 51% respectively and found in more than 50% of sampling. Other species are uncommon because they present less than 25% of sampling (Figure 2, 3).

The genus of *Culex* was presented by 6 species *Culex pipiens*, *Culex theileri*, *Culex laticinctus*, *Culex pusillus*, *Culex impudicus* and *Culex hortensis*. *Culex pipiens* was the abundant species in the urban site with 602 individuals and 258 individuals in the rural site because of its high ecological elasticity and its ability to colonize different environments. This species is typically called urban, very common in towns. These results are consistent with many recent works: In the region of Mila [8] that noted the presence of 12 species, 8 belonging to the genus of *Culex* (*Culex pipiens*, *Culex modestus*, *Culex antennatus*, *Culex hortensis*, *Culex deserticola*, *Culex theileri*, *Culex laticinctus* et *Culex sp*). And that of [20], in the region of Biskra, 22 species, 6 belonging to the genus of *Culex* (*Culex hortensis*, *Culex pipiens*, *Culex modestus*, *Culex theileri*, *Culex laticitus*, *Culex torentium*). In the region of Tebessa, [13] revealed the presence of 9 species, 5 belong to the genera of *Culex* (*Culex pipiens*, *Culex theileri*, *Culex hortensis*, *Culex perexiguus* et *Culex laticinctus*).

Table 1: Total monthly Richness of Culicidae in the region of Collo, during a year (2011-2012).

Mois Espèce	Nov.	Dec.	Janv	Fev	Mar.	Avr.	Mai	Juin	Juit.	Aout	Sep.	Oct.
<i>U. unguiculata</i> (Edwards, 1913)	4	2	/	3	12	6	/	8	1	12	1	6
<i>Or. pulcripalpis</i> (Rodani, 1872)	11	7	2	14	6	15	6	5	1	20	12	16
<i>Cx. pipiens</i> (Linnaeus, 1758)	56	39	34	58	81	87	91	100	89	107	65	54
<i>Cx. laticinctus</i> (Edwards, 1913)		9	2	8	14	11	23	9	18	13	13	21
<i>Cx. impudicus</i> (Ficalbi, 1890)	3	2	/	2	2	3	12	3	15	7	12	/
<i>Cx. pusillus</i> (Macquart, 1850)	/	1	/	/	/	/	2	1	/	4	/	/
<i>Culex hortensis</i> (Ficalbi, 1889)	/	1	/	/	/	/		14	7	/	2	
<i>Culex theileri</i> (Theobald 1903)	9	8	5	7	5	17	16	7	8	/	21	8
<i>Cs. annulata</i> (Schrank 1776)	/	/	/	/	2	/	/	/	/	/	/	/
<i>Cs. ochroptera</i> (Peus, 1935)	1	5	/	2	/	/	2	/	13	16	4	3
<i>Cs. Glaphyroptera</i> (Schiner, 1864)	8	14	1	7	21	3	10	4	20	9	7	12
<i>Cs. longiareolata</i> (Macquart, 1838)	5	3	13	6	6	7	2	/	1	4	2	7
<i>Anopheles maculipennis sacharovi</i> (Favre, 1903)	/	/	/	/	/	/	/	7	/	/	20	/
N. total d'individus	97	91	57	107	147	149	162	158	173	192	159	127

U.: *Uranotaenia*; Or. : *Orthopodomyia*; Cx.: *Culex*; Cs.: *Culiseta*; /: absent.

Table 2: Abundance of Culicidae in the urban site of Collo(S: station).

Station Species	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈
<i>U. unguiculata</i>	10	30	3	2	2	3	5	0
<i>Or. pulcripalpis</i>	23	28	10	15	12	8	9	12
<i>Cx. pipiens</i>	117	50	64	67	79	73	65	87
<i>Cx. laticinctus</i>	15	17	8	13	0	15	3	13
<i>Cx. impudicus</i>	13	10	16	12	0	9	6	0
<i>Cx. Pusillus</i>	4	0	0	0	3	0	0	0
<i>Cs. ochroptera</i>	6	15	0	4	8	0	6	0
<i>Cs. glaphyoptera</i>	17	18	12	9	14	12	11	17
<i>Cs. longiareolata</i>	2	1	0	0	4	0	0	0
Total	207	169	113	122	122	120	105	129

Table 3: Shannon – Weaver diversity index (H'), maximal diversity index (H' max) and equitability (E) of Culicidae in the urban site of Collo (S: station).

variable	S1	S2	S3	S4	S5	S6	S7	S8
Individuels / station	207	169	113	122	122	120	105	129
H' / station	1,48	2,08	1,3	1,38	1,18	1,24	1,29	1
S/ station	9	8	6	7	7	6	7	5
H' max	2,19	2,07	1,79	1,94	1,94	1,79	1,94	1,61
E / station	0,67	1	0,72	0,71	0,6	0,69	0,66	0,62
Sampling number	24	24	24	24	24	24	24	24

Table 4: Abundance of Culicidae in the rural site (Station₁:Telezza, Station₂: Bni Zid: Station₃,Station₄, Station₅) of Collo.

Station Species	S1	S2	S3	S4	S5
<i>Culex pipiens</i>	76	69	50	34	29
<i>Culex laticinctus</i>	10	21	4	3	0
<i>Culex hortensis</i>	0	10	4	4	0
<i>Culex theileri</i>	48	30	17	7	2
<i>Culiseta annulata</i>	0	0	0	2	0
<i>Culiseta glaphyoptera</i>	0	2	0	0	1
<i>Culiseta longiareolata</i>	6	8	40	0	0
<i>Anopheles maculepennis sacharovi</i>	0	0	3	24	0
Total	140	140	118	74	32

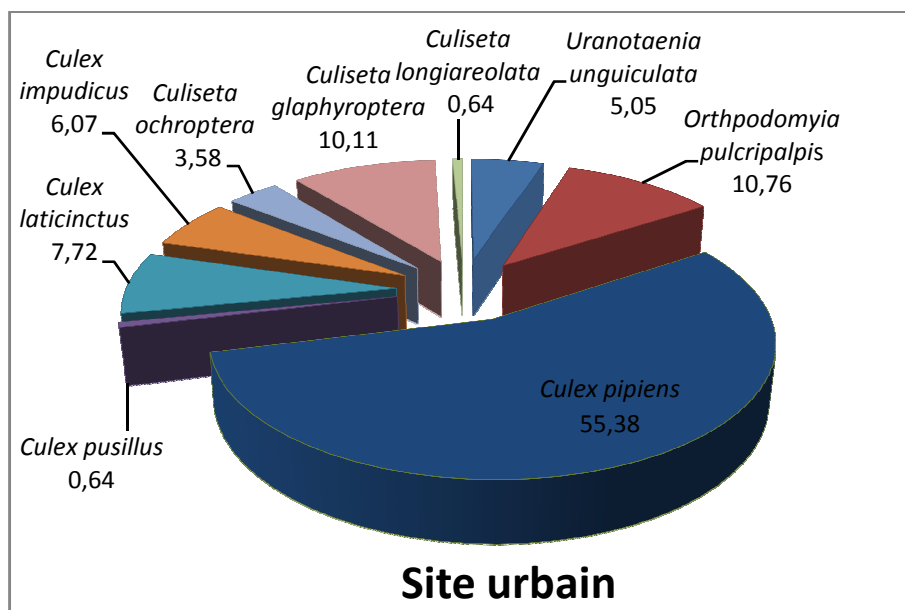


Figure 2: Centesimal Frequency (relative abundance of Culicidae species collected in the urban site of the region of Collo.

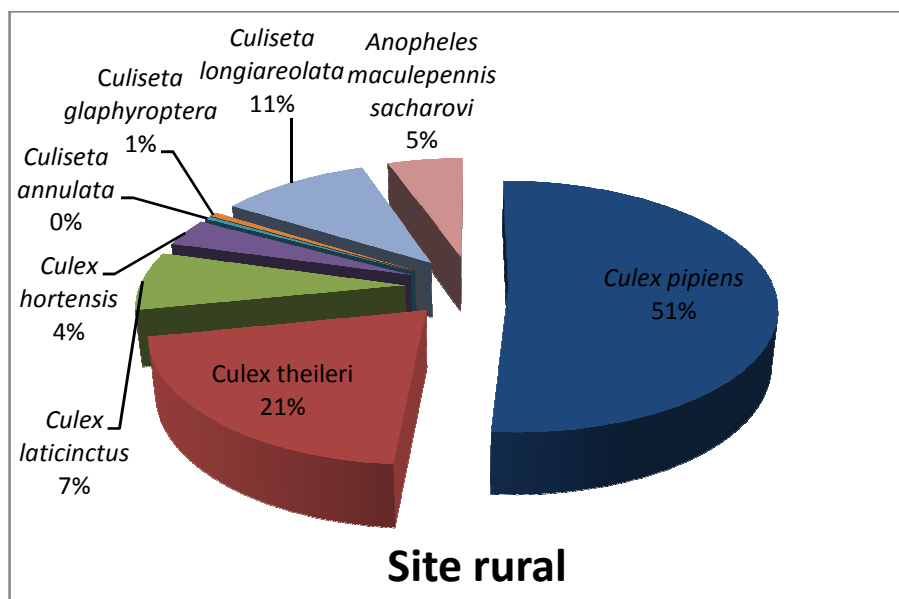


Figure 3: Centesimal Frequency (relative abundance of Culicidae species collected in the rural site of the region of Collo.

Table 5: Shannon – Weaver diversity index (H'), maximal diversity index (H' max) and equitability (E) of Culicidae in the rural site of Collo (Telezza: Station₁, Station₂; Bni Zid: Station₃, Station₄, Station₅).

variable	S ₁	S ₂	S ₃	S ₄	S ₅
Individuels / station	140	140	118	74	32
H' / station	1	1,35	1,3	1,29	0,35
S / station	4	6	6	6	3
H' max	1,38	1,79	1,79	1,79	1,38
E / station	0,72	0,75	0,72	0,72	0,25
Sampling number	24	24	24	24	24

CONCLUSION

This study, which is a complement to other published mosquito surveys realized in the North-East of Algeria, can answer many questions about the ecology of medically important species and the taxonomy of complexes species. Among the 13 species of Culicidae that were found in the region of Collo, most of them are potential or proven vectors of pathogens that cause diseases in humans and domesticated animals in various areas of the world. The results obtained are useful for developing a control program, to direct operations and to assess its efficiency. Future studies should address to the possible relations between richness and diversity of populations of disease vectors and the risk of human infection. However, Culicidae distribution can be also conditioned by the temperature and biological or chemical composition of water [21].

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