

Notes on the Ecology, the Distribution and the Life Cycle of *Ochlerotatus flavescens* (Diptera, Culicidae) in Smir Marshes (West-North of Morocco)

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Abstract: For the aim to set a clearing plan of mosquitoes of the Smir marshes (West-North of Morocco), the study of 20 shelters of mosquitoes was carried out. The regular monitoring of these shelters allowed to take a census of 14 species of Culicidae [1]. Among species of type *Ochlerotatus* newly named at the level of the site is the species *Ochlerotatus flavescens* of which datas are rare in Morocco. The present work is a contribution to the study of ecology, zoning and life cycle of this species in the Smir area.

Keywords: Culicidae, *Ochlerotatus flavescens*; Smir marshes; West-North of Morocco

1. INTRODUCTION

Ochlerotatus flavescens (Müller 1764) is a typically species of the large plains liable to flooding of the holarctic area. She was signalled in France, Spain, England, Germany, Sweden and also in North America: United States and Canada [2, 3, 4, 5]. [6] signal that species is met tritely in northern Europe and in North Africa. In Scandinavia, she is very common in Denmark and she would constitute even one of the most huge species by her aggressivity. In Western Europe, it is on the contrary a rare species.

This mosquito was not any more named in the study of [7, 8] on type *Ochlerotatus* in North Africa, while it was later treated in the study of the mosquitoes of the North Africa and of the Mediterranean basin [3, 4]. Those authors harvested species in flooded meadows, lagoons and of pools in places devoid of trees.

In Morocco, data on this species remains rare. It is only in 1991, *O. flavescens* was harvested in the larval state in Morocco in plains liable to flooding where the water is soft or salty [9], however its biology and its ecology are not still well studied. The same remark was signalled by [6] who find that the larval ecology of this species in Western Europe and notably in France is very less known. In the inventory of the mosquitoes of Morocco, [10] note that *O. flavescens* is still unpublished species. She was twice identified there by the same authors, only on the basis of larval specimens [11, 12].

2. MATERIAL AND METHODS

2.1 Study area

Smir area is a mediterranean wetland which includes a lagoon, marshes, a wadi as well as the dam of Smir. It is a low extremely north located plain of Morocco, halfway between the cities of Tetouan and Sebta and with an area about 175 hectares (Fig. 1). The climate of the zone is a mediterranean kind and his annual average of rainfall is about 982,2 mm. The hydrology of the Smir marshes results from several contributions: continental, underground, marine, wastewaters, rainfull and of streaming. These marshes contain a vegetation well diversified, counting 88 species drawn up an inventory [13, 14, 15, 16, 1, 17].



Fig. 1: Location of the study area

2.2 Methodology

On the ground

20 potential shelters were kept to follow the spatiotemporal dynamics of the mosquitoes of the Smir marshes. These shelters represent different types of ecological habitats. They were canvassed regularly twice a month during the period of study which spread out from February 2010 till January 2011, to discern well the quantitative fluctuations of culicidienne fauna within the region of study. The sampling of the larvas of mosquitoes is performed with the aid of a net fishnet with space of stitch equal to 0,1 mm for circles rather shallow (merjas and days) and with the help of a jump tied to a rope for wells. We adopted the net fishnet as means of sampling due to the fact that most stations of the study area haven't a important depth notably outside rainy season. To determine the effect of water physicochemical parametres on distribution and dynamics of mosquitoes populations in the study area, one took a sample of 1,5 l some water of every station and every season.

In the laboratory

Samples harvested faunistiques are withdrawn and put in plastic or glassy jars filled with ethyl alcohol in 70°. The identification of species was fulfilled with the aid of a binocular magnifier (Olympus) and/or of an optic microscope (Optech) and on the basis of the key of Moroccan identification [18, 19].

3. RESULTS AND DISCUSSION

3.1 Geographical distribution of *Ochlerotatus flavescens* in the Smir marshes

We harvested *Ochlerotatus flavescens* for the first time at the level of the region of Smir. She was found in six stations: St1, St6, St7, St8, St9 and St10 (that is 30 % studied stations). The similar that other species of listed *Ochlerotatus*, the larvas of this species prefer generally the salty coastal merjas of this area (Fig. 2).

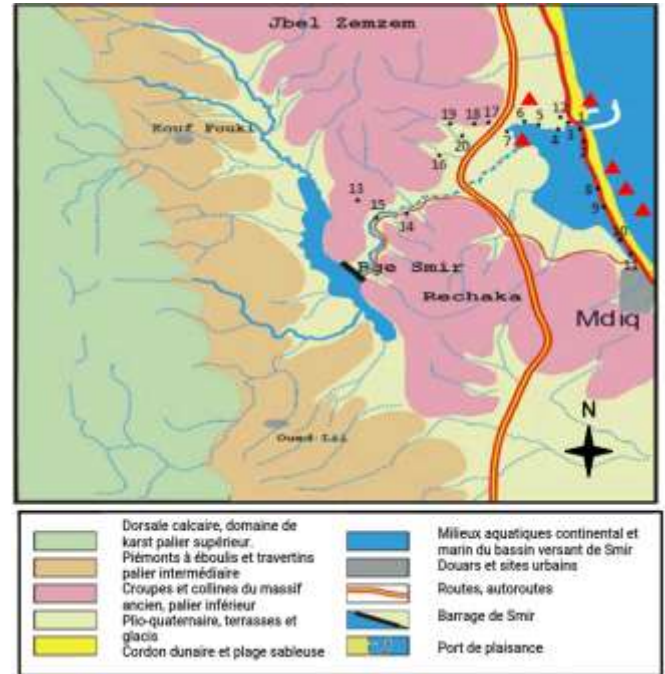


Fig. 2: Map of *Ochlerotatus flavescens* distribution in the Smir area [15]

3.2 Relating abundance and physicochemical parametres

Ochlerotatus flavescens is modestly presente in the Smir marshes. His larvas live together the same watering places as other species of *Ochlerotatus* and notably *Ochlerotatus caspius*. His relating abundance is 11,7 %, 1,2 %, 14,3 %, 7 %, 3,2 % and 3 % in stations St1, St6, St7, St8, St9 and St10 respectively. She seems to prefer not much oxygenated salty waters and can support high concentration in dissolved salts. The stations where this mosquito finds his maximum of abundance (St1, St7 and St8) are merjas where the saltiness of waters varies between 3,8 g/l and 46,7 g/l, TDS (rate of dissolved salts) wobbles between 249 mg/l and 38525 mg/l and the conductivity of the water is between 507 ms/cm and 86500 ms/cm. The rate of oxygen dissolved at the level of these stations varies between 2.89 mg/l and 6.48 mg/l and the temperature of the water wobble between 13 °C and 28 °C.

The settlement of the Smir area by new species of *Ochlerotatus* seems strongly linked the concentration of waters in dissolved salts [1]. In fact, the increase of the rate of the saltiness of waters of the site during two last decades was shown by several studies [20, 21, 22].

3.3 Life cycle of *Ochlerotatus flavescens* of the Smir marshes

The fortnightly samples of the *Ochlerotatus flavescens* larvas allowed to follow the succession of the generations of mosquitoes species in the studied stations. We tried to

estimate the periods of development of the larval generations, even though in certain cases, this estimate was very difficult notably during summer period. We treat the development cycle of of this species in the stations where it is represented well.

This new species of mosquitoes for the Smir marshes is harvested only in places of permanent water. The stages of hatching noticed for this species in the station St1 date the end of February, the 1st week of April (about 5 weeks) and 2nd week of May (5 weeks). In June, July and August, one and very merged L4 took a sample of the larvas L1, L2, L3, where it is difficult to make a difference between the successive generations. In September, we found only the larvas L3 and L4 in the shelter and since the beginning of October, we did not find the larvas of *O. flavescens* (Fig. 3). In the cas of stations St8 and St9, the last larvas was harvested in the end of August, meanwhile in the station St1, the harvesting of larvas was hold until the end of September. Also, the larvas of this species were harvested in February in the station St1, while in stations St8 and St9, one took a census more late (at the end of March).

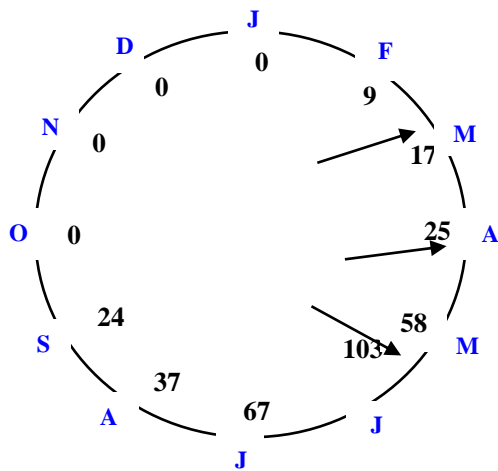


Fig. 3 : *Ochlerotatus flavescens* life cycle in Smir marshes
 → Hatching phase

Ochlerotatus flavescens is generally present in the Smir marshes since the end of the winter till the end of the summer with a maximum of abundance in full summer. [23] relate that the larvas of this species are present of the end of the winter in the middle of the spring, but retarded hatchings can appear at the beginning of the summer. However, [24] signal that habitually *O. flavescens* develop only the annual single generation.

4. CONCLUSION

The present study brings data on distribution, ecology and life cycle of *Ochlerotatus flavescens* in the Smir marshes (west north of Morocco) where it is newly named. This mosquito populates 30 % of studied stations and seems to prefer the coastal shelters of the study area. She colonizes the

permanent water, rich on dissolved salts and with low contents of oxygen. Its life cycle is constituted of at least 3 stages of hatching there before middle is jointly occupied larvas of all stadiums (notably in June, July and August).

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