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First confirmed record of *Ochlerotatus mariae* (Sergent & Sergent, 1903) in the Balearic Islands (Spain) and its significance in local mosquito control programmes

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Abstract

The first confirmed presence of *Ochlerotatus mariae* in Majorca (Balearic Islands, Spain) is presented. Given that this species can frequently cause biting nuisance in rocky coastal Mediterranean areas, it is essential to understand its distribution in this tourist area in order to conduct efficient mosquito control.

Key words: *Ochlerotatus mariae*, halophilic culicid, coastal mosquito, rock-pool mosquito, first record, Balearic Islands, Spain.

Introduction

Ochlerotatus mariae (Sergent & Sergent, 1903) is one of the three allopatric members of Mariae Complex, which also includes *Oc. zammitii* (Theobald, 1903) and *Oc. phoeniciae* (Coluzzi & Sabatini, 1968). Each may be separated by several morphological features and by molecular characters (Coluzzi & Sabatini, 1968; Coluzzi & Bullini, 1971; Coluzzi *et al*., 1971; Coluzzi *et al*., 1976; Schaffner *et al*., 2001; Becker *et al*., 2003). All freely attack humans, domestic stock and wildlife and are major biting pests wherever they occur.

These three specialised species breed exclusively in unshaded coastal rock pools created and maintained within the range of spray from the tideless Mediterranean. Pool size, water temperature and salinity usually vary considerably within the time taken for single broods to complete their aquatic life stages.

Oclerotatus mariae is restricted to the Western Mediterranean, (Coluzzi *et al*., 1975); except for two isolated and widely separated records from the Atlantic coast of the Iberian Peninsula (Encinas Grandes, 1982). It is found as far east as the Tyrrhenian coasts of Italy and Sicily). *Ochlerotatus zammitii* occurs along the Adriatic coasts of Italy and the Balkans, the Eastern coasts of Sicily and Malta, the Ionian and Aegean coasts and the western part of the Mediterranean coast of Turkey (Labuda, 1969; Regner, 1969; Coluzzi *et al*., 1976). The more restricted distribution of *Oc. phoeniciae* extends along the eastern half of the south coast of Turkey and the rocky coast of Syria, Lebanon, Israel and Cyprus (Coluzzi *et al*., 1974).

Records of *Oc. mariae* are scanty in Spain, and in addition to the puzzling records from the Atlantic Provinces of Huelva and Santander (Encinas Grandes, 1982), are limited to the Mediterranean Provinces of Girona, Barcelona, Tarragona and Murcia. Following the criteria of Eritja *et al*. (2001), Spanish reports of *Oc. zammitii* (Gil Collado, 1932, 1935; Nájera, 1943; Clavero, 1946), should be attributed to *Oc. mariae.* Information on the presence of the species in the Balearic Islands is confusing. According to Torres Cañamares (1979), citing Margalef (1949), there is only one report (in 1926) of the captured of *Oc. mariae* in Majorca Island. However, this record seems to be doubtful, because this species is absent from later checklists compiled by several authors (Encinas Grandes, 1982; Eritja *et al*., 2002; MOTAX, 2011). Furthermore, recent mosquito surveys carried out in the Balearic Islands could not confirm the presence of *Oc. mariae* (Melero-Alcíbar *et al*., 2006a, 2006b).

Materials and methods

The coast of Ses Salines in the south of Majorca Island (N 39°15'55.4'' / E 3°03'04.7'') was selected as the study area due to the abundance of rocky biotopes along the sea shore (Figure 1). Surveys of aquatic habitats were carried out during March 2011. Rocky larval sites were sampled using the standard dipping method (Service, 1993), but in small rock holes sampling was also performed by pipetting. Mosquitoes collected were identified according to the taxonomic criteria of Schaffner *et al*. (2001) and Becker *et al*. (2003).

Results

All of the culicids collected in coastal rock pools were *Oc. mariae* (Figure 2). In addition, females of *Oc. mariae* were also captured while attempting to bite. All the mosquitoes collected were transferred to the Entomological Collection of the University of Valencia (ENV) and related biogeographic information was presented to the Global Biodiversity Information Facility (GBIF).

Discussion

This is the first confirmed record of *Oc. mariae* in the Balearic Islands. Our findings probably correspond to a first annual generation, since this multivoltine species usually develops in Mediterranean coasts from March to October (Becker, 2003). The strong anthropophilic behaviour of *Oc. mariae* described in the surroundings of their larval biotopes (Schaffner *et al*., 2001) was also evidenced. From a veterinary point viewpoint, the possible transmission of the avian parasite *Plasmodium relictum* by *Oc. mariae* should be noted (Gutsevich *et al*., 1974).

Consequently the distribution and phenology of *Oc. mariae* should be further investigated in order to apply the most efficient mosquito control programmes. It is important to note that in last few years there have been numerous episodes of concern on the Majorca Island due to the nuisances provoked by mosquito proliferation. The peculiarity of rock pools as larval development sites means that often *Oc. mariae* is overlooked by mosquito

control agencies. As the island of Majorca has many miles of rocky coast, the need to include *Oc. mariae* in mosquito control programmes is evident. Moreover larval control of *Oc. mariae* can be occasionally complicated and expensive. Although very few studies have explored the effect of salinity on the efficacy of microbial larvicides, several researches indicate that increasing salinity levels reduce the efficiency of *Bacillus*-based larvicides (Nayar *et al*., 1999; Osborn *et al*., 2007). Other studies have revealed that salinity concentrations of 10, 20, and 30% seawater did not affect the *Bacillus* spore dormancy (Yousten *et al*., 1992). Nevertheless there is a high variability in the dose-mortality response between different bacterial products, mosquito species and even for populations within species. Regarding seawater concentration it is relevant that larvae of *Oc. mariae* are able to tolerate salt concentration of 20% (Rioux, 1958).

On the other hand the surveillance of exotic vectors should be a priority in the Balearic Islands. Besides the high levels of tourism from different European countries, it should be noted that air and sea traffic from the Spanish mainland is common. In certain areas such as Catalonia, *Stegomyia albopica* (Skuse, 1894) is abundant (Aranda *et al*., 2006; Bueno Marí & Jiménez Peydró, 2010a).

In conclusion the establishment of a permanent vector surveillance network is a necessary goal for the Spanish Public Health since current globalization has provoked an increase n the presence of several imported arboviruses in recent years (Bueno Marí & Jiménez Peydró, 2010b, 2010c).

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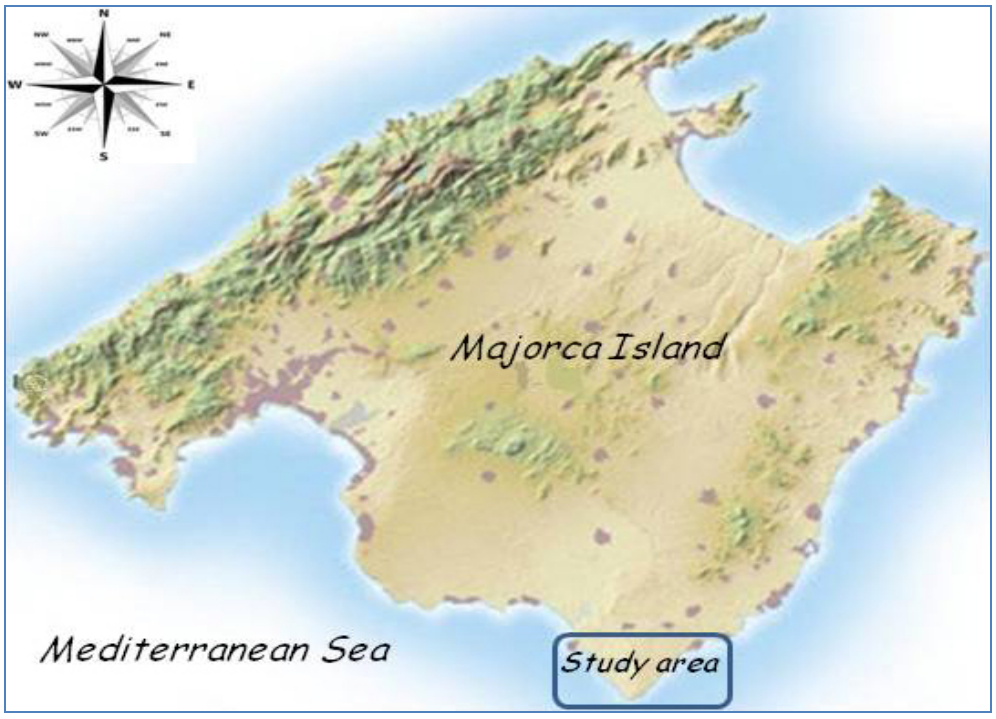

Figure 1. Location of the study area.

Figure 2. Examples of coastal rock pools sampled.