

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number:

STSM title: Vector role of mosquitoes (Diptera: Culicidae) in the Mediterranean region: identification and field monitoring methods of native and AIM species in urban, rural and natural areas

STSM start and end date: 02/09/2021 to 16/09/2021

Grantee name: Maria Bourquia

PURPOSE OF THE STSM:

The current pandemic related to the coronavirus-2019 disease dramatically illustrates the ability of infectious agents to cross species barriers or adapt to new transmission conditions, causing emergences with potentially devastating consequences - the quarantine measures and travel restrictions implemented to fight this virus are reminiscent of the fight against medieval plagues. Among these emerging diseases, there are many of vector-borne one.

The Mediterranean region is favourable to the study of these emergences, as a crossroads of trade and a mobility zone between sub-Saharan Africa, the Middle East and Europe. The impact of global changes is particularly important and the diversity of climates and ecosystems facilitates the study of the evolution of ecological gradients. Finally, the Mediterranean region is already experiencing multiple emergences or resurgences of vector-borne diseases, particularly transmitted by mosquitoes. We can mention West Nile fever, whose introduction of a new lineage of virus (through migratory birds) has led to an intensification of transmission throughout the Mediterranean basin and an extension of its distribution in Europe. The Rift Valley fever, whose presence in the Mediterranean was previously sporadic and limited to the Nile Delta, and whose recent arrival in Libya, through animal movements from Sudan, due to the political instability of the area, raises fears of an emergence in the entire Mediterranean basin.

Knowledge in terms of taxonomy and bio-ecology of vectors is important to understanding vector transmission phenomena and to be able to consider adequate control methods.

The aim of the Aim cost mission was to allow Maria Bourquia as an early stage career to develop and consolidate her skills on advanced training in morphological identification of mosquito vectors in the Mediterranean region (a discipline particularly concerned by the breakdown of intergenerational transmission); training of field monitoring methods of native and AIM species in urban, rural and natural areas of the Balearic Islands; and to promote future medical and veterinary entomology research exchanges and opportunities among ZAP-UIB and the Institut Agronomique et Vétérinaire Hassan II Mediterranean Basin area.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

1- Training of field monitoring methods of native and AIM species and other vector insects in urban, rural and natural areas

a/ Study areas

A total of six rural areas with integrated production farms (cattle, sheep, goats and horses) were visited during two weeks, in order to collect samples. The selected farms were belonging to different municipalities and/or separated by 10 to 50 km in order to cover a larger area of the island and avoid the collection of insects from the same population species.

In addition, a total of two natural and semi-natural areas close to rural areas were sampled. These areas include wetlands or reservoirs where the population of vector is higher (Salobrar de Campos, Albufera d'Alcúdia).

b/Collection of the samples

i/Traps for collects Culicidae and Phlebotominae:

- Mini-CDC trap with CO₂ : Mosquito trap that consists of catching mosquitoes inside a collector and a 6 V battery. As a attractant, CO₂ is used with a pressure regulator that is responsible for expelling around 1,5 kg of CO₂ per night of sampling.

- Light trap: for catching sandflies, its consists of a small incandescent light bulb connected to a 12 V battery.

- BG-Sentinel trap : for catching mosquitoes of the genus *Aedes*. It consists of a 12 V battery and an attractant composed of lactic acid (BG-lure). This trap is placed directly on the ground and preferably in shaded areas.

ii/Trap for catching insects of the genus *Culicoides*: Onderstepoort trap. It consists of an UV light tube and a 12 V battery.

c/ Methodology

At each sampling, one mini-CDC, light trap, Onderstepoort trap and BG-Sentinel were placed. The mini-CDC trap and the light trap were placed in the late afternoon and were picked up in the morning, while the other traps were remain in place for 24 hours (Figure 1a). The samples collected were transported to the laboratory of Zoology at UIB. Once there, the insects were determined at the species level by identification keys (Becker et al, 2020 ; Gunay et al, 2020) (Figure 1b). The determination was performed on a cold plate (BioQuip chill table) in order to maintain the cold chain, conserve the insect and prevent degradation of DNA and RNA. They then were stored in 1.5 ml tubes at -80°C for further molecular analysis.



Figure 1a : Setting the light trap



Figure 1b : Identification of collected samples

d/ Molecular detection of vector pathogens (not realized)

The search for pathogens in the different groups of dipterans studied will be performed using specific conventional PCR. In the case of the positive pool, each individual will be re-analyzed individually and will be sequenced.

2- Advanced training in morphological identification of mosquito vectors in the Mediterranean region

Morphological identification of Culicidae of medical and veterinary interest was performed using two main identification keys (Becker et al, 2020; Gunay et al, 2020). This identification was carried out on the different samples collected in the field during the STSM period (see part 1) but also on collections of Culicidae from the Palearctic region available at the laboratory of Zoology-UIB.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

1-Training of field monitoring methods of native and AIM species and other vector insects in urban, rural and natural areas

Culicidae species identified in the livestock farms and natural parks (Table1): *Aedes albopictus*, *aedes caspius*, *Culex pipiens s.l.*

Other insects vectors : Phlebotominae, Ceratopogonidae (*Culicoides*)

Table 1 : Identification of collected samples in two Natural parks

Zone	Trap	Date	Family/subfamily	Species	Females	Males	Engorged female	total
Albufera (Alcudia)	BG sentinel+lure	09/09/21	Culicidae	<i>Cx. pipiens s.l.</i>	2	0	0	2
Albufera (Alcudia)	BG sentinel + lure	09/09/21	Culicidae	<i>Aedes caspius</i>	6	0	0	6
Albufera (Alcudia)	CDC+CO2	09/09/21	Culicidae	<i>Cx. pipiens s.l.</i>	24	0	0	24
Albufera (Alcudia)	CDC+CO2	09/09/21	Culicidae	<i>Aedes caspius</i>	16	0	0	16
Albufera (Alcudia)	Light trap	09/09/21	Culicidae	<i>Cx. pipiens s.l.</i>	7	6	0	13
Albufera (Alcudia)	Light trap	09/09/21	Culicidae	<i>Aedes caspius</i>	19	112	0	131
Albufera (Alcudia)	Light trap	09/09/21	Phlebotominae	-	3	0	0	3
Albufera (Alcudia)	Light trap	09/09/21	Ceratopogonidae	Pending	12	0	0	12
Salobar de campos	BG sentinel + lure	10/09/21	No captures	-	-	-	-	-
Salobar de campos	CDC+CO2	10/09/21	Culicidae	<i>Cx. pipiens s.l.</i>	3	0	0	3
Salobar de campos	CDC+CO2	10/09/21	Ceratopogonidae	pending	4	0	0	4

2- Advanced training in morphological identification of mosquito vectors in the Mediterranean region

From the samples collected during our field work: *Aedes caspius*, *Aedes albopictus*, *Culex pipiens s.l.*
From the collections of Culicidae from the Palearctic region available in the Zoology laboratory of UIB : *Aedes caspius*, *Aedes albopictus*, *Culex theileri*, *Culex algeriensis*, *Culiseta annulata*, *Culiseta longiareolata*, *Culex pipiens s.l.*

FUTURE COLLABORATIONS (if applicable)

This STSM allowed to establish a partnership between the Applied Zoology and Animal Conservation Research Group 'ZAP) of the University of Balearic Islands (UIB) and the Unit of Parasitology and Parasitic diseases of the Institut Agronomique et Vétérinaire Hassan II (IAV Hassan II). Commun activities will be initiated, in particular by the concretization of reflections around answers to calls for tender.

This STSM gave me the push to develop research and training activities in the field of mosquito-borne diseases in our Unit of Parasitology and Parasitic diseases, where skills are insufficient, by strengthening conceptual and practical skills, especially for the identification of native and invasive vectors and field monitoring.

We also discuss the possibility for asking for a grant from the UIB to invite researchers from IAV Hassan II in order to consolidate the collaboration between the two teams and exchange informations about mosquito taxonomy and surveillance.

The STSM grantee

Maria Bourquia
Institut Agronomique et Vétérinaire Hassan II, Rabat, Maroc
Date: 17/09/2021

Signature



Confirmation by the host institution of the successful execution of the STSM

I confirm that Maria Bourquia's STSM, entitled "Vector role of mosquitoes (Diptera: Culicidae) in the Mediterranean region: identification and field monitoring methods of native and AIM species in urban, rural and natural areas" has been organized at the University of Balearic Islands, Applied zoology group, within the activities of the WG1 AIM COST Action, from 02 to 16 September 2021, and it was concluded with success.

Maria Bourquia closely worked with myself and with the colleagues from the Applied Zoology and Animal Conservation Research Group on different activities included the identification and field monitoring of mosquito.

The STSM has been an opportunity for planning possible joint research activities and further successful collaboration under the umbrella of AIM COST Action.

For the Host Institution

Dr Miguel Angel Miranda Chueca
University of Balearic Islands,
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Date: 17/09/2021