

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

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

Action number: CA17108 - Aedes Invasive Mosquitoes
STSM title: Standardization and Implementation of Mosquito Alert Italy
STSM start and end date: 13/09/2021 to 17/09/2021
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PURPOSE OF THE STSM:

During the Short Term Scientific Mission (STSM) the first objective was to learn from Frederic Bartumeus and his team how to improve, standardize and implement Mosquito Alert Italy project. More in detail, the short visit mission has focused on:

- i) Sustainability of Mosquito alert Italy project.
- ii) Standardize methodology on Entolab and how to use the expert validation Platform (eg filtering, validation methodology, comparison between experts validation).
- iii) Develop and improve a Mosquito Alert protocol for vector control.
- iv) Develop a methodology and statistical framework on how to compare photos/number of bites data obtained from the app and field traps data obtained in the frame of surveillance of alien species. This discussion has taken advantage from experience already developed by previous app developed in Italy specifically on bite activity (ie Zanzamapp) and from the data analyses ongoing in the Frederic Bartumeus's lab for the city of Barcellona and Girona.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

During the first days (13-15/9/2021) I have learned and discussed with Frederic Bartumeus's team the following:

- 1) progresses of the Italian project including partners, the expert validation system of Italian teams; how to improve working groups of the five institutions involved in the Mosquito Alert Italy (experts involved as medical entomologist and modellers).
- 2) We discuss how to improve: a) "Entolab platform" (eg national and super-expert relationship) and "new modules" (ie mailing with Mosquito Alert app mosquito specimens to the lab); b) data extrapolation from Mosquito Alert server including Zenodo open source platform; c) visualization of the data include how to include in an Italian web site the public map of observations/bites/breeding sites

During the next days I learned the:

- 3) I had been trained (14-15/9/2021) on activities and tools already developed by Mosquito Alert Spain teams for vector control. I had been trained on: i) tools implemented in Mosquito Alert private portal to include data of vector control such as treated breeding sites or map of imported cases; ii) tools develop in Mosquito Alert web-map to extrapolate documents and reports;

4) I had been trained (14 & 17/9/2021) on: i) data extrapolation from Mosquito Alert server and Zenodo platform; ii) format and characteristic of data obtained by entolab and geo-localization of users; iii) Bayesian framework model in order to predict by statistical analysis mosquito alert data to calculate by: the propensity score; sampling effort; the human-mosquito encounters from the probability of reports; iv) mathematical model to estimate probability sending reports (ie propensity score) during time. On 16/9/2021, I participate at Mosquito Alert conference where teams of entomologist, modellers and data management discussed about: entolab system and how to implement the entomological validations.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

During my STSM I believe that I have accomplished the main goal of my Short-Term Scientific Mission, which was to get familiar with Mosquito Alert reports, the track geo-localization of the participants, the Entolab expert validation platform, the statistical mathematical models to calculate the main results from Mosquito Alert, as well as discussed with Frederic Bartemeus's team on ongoing Mosquito Alert Italy and how to improve it.

More in particular we had carried out:

- 1) a list of activities to be implement on Mosquito Alert Italy: increase of teams involved as national expert in Expert, numbers of institutions participate in Protocol Agreement of Mosquito Alert Italy, a protocol agreement to use and have Mosquito Alert Italy data from Mosquito Alert project and server.
- 2) a calendar activity for pending report validation for Italy, a new methodology for expert validation platform, a new relationship between Euro group and National Expert, a regionalization system for some European countries.
- 3) documents of Italian reports on Public web map from Mosquito Alert, a framework and methodology to use Mosquito Alert reports and data for mosquito vector control; a new real-time dataset displayed in private platform to experts, stakeholders and decision-maker in charge of mosquito surveillance and control or public health.
- 4) a first database of records and geo-localizations for Italy, a descriptive statistical analysis of Italian reports (photos, bites and breeding sites), a research activities and Bayesian model to perform statistical analysis for x days in a sampling cell the relationship between counts of tiger mosquito eggs at ovitraps placed and mosquito alert.

FUTURE COLLABORATIONS (if applicable)

During the last days of my STMS we have discussed future analysis to be implemented using Italian reports.

The main objectives of these future collaborations will be:

- i) develop a way to have a raw mosquito alert data for future collaborations.
- ii) explore the propensity score of Italian users and compare it with those obtained by Spain one. First, we will model reporting activity as function of time elapsed since the participant first downloaded the app and registered with the project and intrinsic motivation following the approach in Palmer et al., 2017; calculate sampling effort in Italian grids using data from: a) propensity score in function of time obtain Italy (see model described above) and b) the sum of participant sighting in the sampling cell during time weighted by participants reporting propensity score at the time of sighting.
- iii) Implement model using Italian reports from Mosquito Alert app and eggs counted in ovitraps. This model will aim to predict the probability of at least one reliable (confirmed or probable *Aedes albopictus*) report sent from sampling cell during the time as function of the counts of eggs per trap/days. We will obtain ovitraps data from several monitoring surveillance going in 2021 in Italy: 1) the monitoring database obtained in the frame of AIM cost surveillance in Roma; 2) several other databases obtained during surveillance of alien mosquito in different regions/sites in Italy from collaborators of University of Rome Sapienza. We will develop a Bayesian multilevel logistic regression to estimate what we term "alert probability", the probability of at least reliable tiger mosquito report being sent through mosquito alert from a given geographic cell during a time period conditional on sampling effort. Controlling for sampling will be crucial to making sense of reporting data and sampling effort is itself modelled as a function of time elapsed since the participant downloaded the app as well as intrinsic participant motivation (modelled as random intercept).