A study led by Mosquito Alert shows that citizen science is a useful and reliable tool for studying the mosquitoes driving global epidemics.

Another study quantifies the passive transport of tiger mosquitoes between Spanish provinces by car.

The use of the platform and citizen observations is promoted to launch the first pilot tests with the management portal.
INDEX

1. About the project 3
2. Results and achievements in 2017 11
   2.1. Technological platforms 11
   2.2. Citizen observations 16
   2.3. Science 19
   2.4. Management, Surveillance and control 25
   2.5. Internationalization 31
   2.6. Community building and outreach 33
3. Coordination and acknowledgements 41
Mosquito Alert is a citizen science observatory for monitoring and controlling tiger mosquitoes (*Aedes albopictus*) and yellow fever mosquitoes (*Aedes aegypti*), invasive species that are vectors of global diseases such as the dengue, chikungunya and Zika fevers.

The Mosquito Alert app enables citizen to report observations of such mosquitoes and their breeding sites. The data thus provided complement scientific work and make it possible to study the mosquitoes’ distribution.

Managers from public authorities use the Mosquito Alert platform as a new source of information for implementing monitoring and control measures. Users of the app, meanwhile, receive recommendations for keeping their homes free from the species in question.

Mosquito Alert is an effective, inexpensive early-warning system that is part of Spain’s health and research system.
The tiger mosquito and the yellow fever mosquito

The tiger mosquito has been spreading along the country’s Mediterranean coast and increasingly further inland since 2004. This is mainly due to climate change and globalization. On the other hand, the yellow fever mosquito has been added as another invasive species of interest, it is similar to the tiger mosquito specially for its behaviour and the disease transmission capacity. In December 2017, the yellow fever mosquito was found in the Canary Islands for the first time in decades in Spanish territories, in the island of Fuerteventura. After this sighting, a new surveillance actions have started to prevent the expansion of this species through the other Canary Islands and its arrival to the Iberian Peninsula.

Tiger mosquito
(Aedes albopictus)

Yellow fever mosquito
(Aedes aegypti)
Breeding sites

In urban areas, tiger and yellow fever mosquitoes breed in small receptacles containing stagnant water. Thanks to Mosquito Alert, citizens can help the authorities responsible for monitoring and controlling mosquitoes detect breeding sites, such as gutters, drains and ornamental fountains in public roads.

On private property, tiger mosquitoes breed in small receptacles containing stagnant water in yards or on balconies. As the public authorities are unable to apply treatments on such property, we raise awareness among citizens with a view to them eliminating possible breeding sites in their homes themselves.
Distribution and diseases

The dengue, chikungunya and Zika fevers are not endemic in Spain. However, their transmission cannot be ruled out because of a very high level of human mobility and the presence of the tiger mosquito in its period of greatest activity (June - October). To prevent such transmission, it is crucial to be aware of the presence of the relevant species, minimize their numbers in areas in which they have established themselves and control their spread. The tiger mosquito can currently be found along the Mediterranean coast and is widespread in Asia and South America. A total of 540 municipalities in Spain have been affected, according to data spanning 2004 and 2015 (Collantes et al. 2016). The yellow fever mosquito can be found in Africa, in countries close to the tropics and subtropics, northern Brazil and southeast Asia. It is also present in the southeast of the USA, in northern Australia, along the east coast of the Black Sea and in Madeira. In December 2017 it was found in the island of Fuerteventura.
The tiger mosquito distribution in Europe (2017)

Aedes albopictus - current known distribution: September 2017

Legend

- Established
- Introduced
- Absent
- No-data
- Unknown

Countries/Regions as visible in the main map extent:
- France
- Germany
- Italy
- Spain
- UK

The yellow fever mosquito distribution in Europe (2017)

Aedes aegypti - current known distribution: September 2017

Legend

- Established
- Introduced
- Absent
- No-data
- Unknown

Countries/Regions as visible in the main map extent:
- France
- Germany
- Italy
- Spain
- UK

Photos: Roger Eritja ©
The Mosquito Alert project, a 360-degree observatory
**Citizen observations**
Collecting data

Citizens use the Mosquito Alert app to take and share geotagged photos of tiger or yellow fever mosquitoes and their breeding sites in public areas. They also receive notifications through it.

**Expert validation**
Validating data

A team of experts validate the photos and identify the species of mosquito shown. Validation results are sent to the users involved.

**Interactive map**
Collecting data

Validated sightings are published on an interactive map, where their details can be viewed, analysed and shared.

**Science**
Using data

We use the data citizens provide to study the distribution and spread of tiger and yellow fever mosquitoes.

**Management**
Using data

We collaborate with the public administration to improve the surveillance and control of the tiger mosquitos in areas where it has been established and to detect it in new areas. We promote direct communication between managers and citizen through notifications.

**Education & community building**
Rising awareness and communication

More and more territories are applying control measures and sending in data via the app, thanks to the project’s tools for communication, information and education. We also involve schools using open schooling methodologies and the project has begun to be implemented in many other countries.
Results and achievements in 2017

2.1 Technological platforms

Website and app

New website
We have updated our brand renewing our website areas, now organised in four areas of activity: citizen participation, science, surveillance and control and education.

New features of the app

1. Direct communication: we have developed a notification system which allows scientists and mosquito managers to send information via app to participants. For instance, the validation result of the reports or the treatment actions that have been carried out.

2. User reputation: users get score according to the amount of sent reports and quality.

3. Citizen validation: participants can also validate photos from others, thus getting better score.

The app in figures

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>Acumulado 2014 - 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downloads (Android + iOS)</td>
<td>7,415</td>
<td>45,005</td>
</tr>
<tr>
<td>* Reported observations of tiger mosquitos</td>
<td>1,760</td>
<td>10,038</td>
</tr>
<tr>
<td>Reported observations of yellow fever mosquitos</td>
<td>3 (Perú)</td>
<td>6 (Perú, Pakistán, Guatemala)</td>
</tr>
<tr>
<td>Reported observations of breeding sites</td>
<td>991</td>
<td>2,354</td>
</tr>
</tbody>
</table>

* total number of reported observations before expert validation.
Examples of notifications sent during 2017 (Spanish and Catalan only)

**New notifications system**

User reputation

Citizen validation

Do you see a mosquito in this photo?

- Yes
- No
- I’m not sure
Public observations map

Validated sightings are published on Mosquito Alert’s interactive map. This interface can be used to view and analyse all such reports since 2014. In 2017, with the collaboration of Dipsalut (Girona Provincial Council’s public health body) and the work of SIGTE (Servei de Sistemes d’Informació Geogràfica i Teledetecció Espacial de la Universitat de Girona) the map has been updated with new functions to simplify viewing and exporting data from one or more areas. These new tools simplify tiger mosquito monitoring and control.

The new functionalities of the map allow:

- **Select multiple layers of different observations at the same time.**
- **Share map views through social media and URL.**
- **Export and download data in different file formats.**
- **Search and visualize observations of a determined city.**
- **Visualize data from different years, months or a determined date.**
Foto d’algún mapa o de mosquits fetes per persones? ¿

Photo: Roger Eritja ©
Citizen validation

Another goal is to obtain citizen that identifies the tiger mosquito and the yellow fever mosquito quickly and effectively, **without the need for expert validation**. Thanks to the Scifabric work and their expertise in creating crowdcrafting platforms, we have a map in which citizen validations made with the app can be showed.

The map shows all the tiger mosquito reports that have been validated by 5 participants minimum. Each photo has a fiability value according to all validations, so they have a final percent of fiability. In addition, the map shows the most active months in terms of validations and allows to visualize them in every municipality.

> Go to the map
2.2 Citizen observations

Expert validation

A team of entomologists analyzes only the observations that contain a photo. Three experts identify the species for each observation independently. One more expert checks those validation results and if they coincide with a tiger or yellow fever mosquito, he assigns “possible” or “confirmed” categories depending on the quality of the photo. The final result is published in the public map and notified to the participant with a notification. Sometimes the experts add notes together with the result.
### Results of expert validation

<table>
<thead>
<tr>
<th>Categories</th>
<th>Confirmed tiger mosquito</th>
<th>Possible tiger mosquito</th>
<th>Confirmed yellow fever mosquito</th>
<th>Possible yellow fever mosquito</th>
<th>Other species</th>
<th>Unidentifiable</th>
<th>Breeding sites</th>
<th>Without photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of reports</td>
<td>537</td>
<td>424</td>
<td>2</td>
<td>1</td>
<td>323</td>
<td>1690</td>
<td>695</td>
<td>727</td>
</tr>
<tr>
<td>Characteristics</td>
<td>White line on head and thorax identified</td>
<td>Other characteristics typical of the species identified</td>
<td>Lyre-shaped lines in thorax identified</td>
<td>Other characteristics typical of the species identified</td>
<td>Characteristics of other species of mosquito identified</td>
<td>No identifiable characteristics of any particular species</td>
<td>Not validated by an expert but the wrong ones are discarded</td>
<td>Not validated</td>
</tr>
<tr>
<td>Examples</td>
<td><img src="image1" alt="Example 1" /></td>
<td><img src="image2" alt="Example 2" /></td>
<td><img src="image3" alt="Example 3" /></td>
<td><img src="image4" alt="Example 4" /></td>
<td><img src="image5" alt="Example 5" /></td>
<td><img src="image6" alt="Example 6" /></td>
<td><img src="image7" alt="Example 7" /></td>
<td><img src="image8" alt="Example 8" /></td>
</tr>
</tbody>
</table>

### Reliability of citizen data

The photos taken by citizen are getting better every year. In 2017, the 42% of all validated reports were placed in the “confirmed tiger mosquito” category. The number of “confirmed” reports is still bigger than “possibles” although quite less than in 2016.
A selection of some of the best photos in the “confirmed tiger mosquito” category (2017)
Mosquito Alert exposes that citizen science is a useful and reliable tool for studying the mosquitoes driving global epidemics

A study led by Mosquito Alert researchers published in *Nature Communications* (Palmer et al. 2017) shows that citizen science has allowed the researchers to cover much more geographic space in comparison to traditional methods, reducing the economic cost of the two-year study eight-fold. The study has used data sent by citizen from 2014 to 2015 with the Mosquito Alert app.

The results suggest that this citizen system developed by Mosquito Alert in Spain can be scale up globally in a future and design new studies on the risk of disease transmission within the contexts of globalization, climate change, and increasing social inequality.
The passive transport of tiger mosquitoes between provinces in Spain by car has been quantified for the first time

Another relevant study published by the Mosquito Alert team in *Scientific Reports* (Eritja et al. 2017) confirms that 5 out of every 1,000 daily car trips in the Metropolitan Area of Barcelona during the summer carries a tiger mosquito. The work shows that unwitting transport of tiger mosquitoes in private vehicles is a clear mechanism for their dispersal. The researchers inspected vehicles at random in checkpoints at tollbooths and vehicle inspection stations, and also gained data from alerts made by citizens using the Mosquito Alert app. The scientists created a mathematical model with these data at its core in order to predict the movement of tiger mosquitoes between Spanish provinces and in cars. Barcelona is the greatest mosquito-exporting province, followed by Tarragona, Valencia, Alicante, and Murcia. In a future the researchers will study transportation patterns and, using the model, be able to extrapolate the predictions to any place, year, and season to have a better understanding of how this insect is dispersed and be able to propose measures to halt the invasion.

*Photos of tiger mosquito inside the cars sent by citizen using the Mosquito Alert app.*

*Figure: Eritja et al.*
Scientific articles published


Citations in third parties’ scientific works


Presentations in scientific or technical conferences

- 23/11/2017. 1st Italian Citizen Science Conference. Roma
- 6-8/9/2017. Congreso SESPAS – Ciencia para la acción. Barcelona
- 21/6/2017. XIV Congreso de Salud Ambiental organizado por la Sociedad Española de Sanidad Ambiental (SESA). Zaragoza
- 1-2/6/2017. 11as Jornadas SIG Libre UdG. Girona
- 25/5/2017. 4t dia de la ciència ciutadana. Barcelona.
- 17-20/5/2017. #CitSci2017 Conference Information. Minnesota
- 15/5/2017. Dilluns de ciència CSIC – Cómo los humanos estamos transformando la
tierra: La era del «antropoceno». CEAB-CSIC.
• 21/4/2017. Seminari Hospital General Vall d’Hebrón. Hospital Vall d’Hebrón, Barcelona.
• 13-16/3/2017. VIIIth EMCA Conference. Montenegro
• 8/2/2017. Citizen Science and Open Data: a model for Invasive Alien Species in Europe. Brussel·les
A solid research studying deeply Mosquito Alert data which includes various social aspects related to the risk of disease transmission through mosquitoes won the second prize of the contest “Falling Walls LAB-Marie Skłodowska-Curie Actions”. The contest is promoted by the Marie Skłodowska-Curie program with the aim of highlighting the best projects carried out by researchers belonging to this prestigious European program. The researcher John Palmer of Pompeu Fabra University and member of Mosquito Alert presented his scientific project highlighting the achievements thanks to citizen participation combined with scientific work. > Read more
Collaborations and agreements with the public administration and private companies

**Kit for managers**

We have developed a free kit for managers with dissemination and education material for doing prevention campaigns together with the city councils. It also includes instructions to use the map and the reports to do surveillance actions in the municipalities.

**City of Barcelona**

One more collaboration with the Public Health Agency of Barcelona (ASPB), that validates data sent from participants in the city and include this data in their surveillance and control programs since 2015. In 2017, a total of 152 incidences were sent with the app and answered by the ASPB. 139 of them were inspected and in 16 tiger mosquito activity was detected, followed by treatment actions in the breeding sites.

**City of Valencia**

The Public Health Administration of the City of Valencia supports and uses the Mosquito Alert app as an extra tool to do surveillance and control actions in the city, together with the Lokímica company.

> Read more

**First steps with “Diputació de Barcelona”**

During the prevention campaign some material of Mosquito Alert was included at the “Urban pests” of the main website for city councils of the Barcelona province.

> See website
**Girona province**

Thanks to the collaboration with Dipsalut (Girona Provincial Council’s public health body) we have developed new tools to better visualize data from the map and the private portal for managers.  
> Read more

**Collaboration agreement with ANECPLA**

The Spanish National Association for Environmental Health Businesses will contribute the knowledge of professional pest control agents to Mosquito Alert’s popular platform for citizen science and mosquito control.  
> Read more

**Government of Catalonia**

Mosquito Alert is included at the health portal “Canal Salut”. A new project “PICAT” is assigned in collaboration with ISGlobal and Vall d’Hebrón Institute of Research (VHIR).

**Community of Madrid**

Mosquito Alert is included at the Program for Entomological Surveillance and Sanitary-Environmental Control of Transmitting Vectors of Arboviruses (Dengue, Chikungunya and Zika), according to the collaboration agreement in 2016.  
> Read more
More collaborative campaigns and sensibilization

During 2017 we have offered collaborations with municipalities to do sensibilization activities related to the tiger mosquito together with the city councils. Some of them are:

- Badalona City Council
- Terrassa City Council
- Sabadell City Council
- Benalmádena City Council
- El Baix Montseny
- La Pobla de Claramunt City Council
- Vinaròs City Council
A new platform for managing promoted by Dipsalut

In May 2017, Mosquito Alert and Dipsalut (the Public Health entity for the region of Girona, Spain) unveil a new platform which will improve management of the tiger mosquito in Spain. The map is based on the public map but with new management functionalities. The new tools consist of a map which allows the combination of region-specific information with scientific and technical data, as well as citizen reports on tiger mosquito sightings and breeding sites in urban areas. Managers can send notifications to citizen to update about the treatment actions answering their incidences and remind them tips to prevent breeding sites at home. With this portal, the Mosquito Alert project continues with its work to integrate the efforts of citizens with those of public officers responsible for the environment and public health. The private portal can only be accessed through a collaboration agreement. In 2017, the first pilot tests with the private portal were done with the Public Health Agency of Barcelona, Dipsalut and the Valencia City Council with the Lokímica company. The goal is to scale up the functionalities and distribute its use among the public administrations.

> Read more
Examples of notifications

Example of an individual notification sent by ASPB in Barcelona.

Example of a notification sent to a group of users.

Example of a private portal use with territorial and management information

Cartography layers combined with the citizen reports in the Girona province.
2.5 Internationalisation and global collaboration agreements

- **Consolidation of the ECSA Task Force Group and creation of Global Mosquito Alert Consortium**

  During 2017, Mosquito Alert together with the European Citizen Science Association (ECSA) has been promoting citizen science as a research tool to fight against mosquito borne-diseases, with final aim to incorporate it in policy making, legislation and national strategies. Since April 2017, this group leads the creation of the Global Mosquito Alert Consortium with the support of UNEP and the Wilson Centre (USA) to find a global strategy that collects the interests from all the countries affected by mosquito borne-diseases. > Read more

- **New national program: NASA DEVELOP**

  It is a training program of the United States promoted by NASA to work globally with environmental data. The program uses Mosquito Alert data and data from other European citizen science projects to link satellite data with mosquito abundance and make global distribution maps.
Hong Kong works with Mosquito Alert in education projects
Thanks to the translation of the app to Chinese, the Hong Kong team uses easily this tool in their education activities and for the general public. In 2017 there were a total of 29 reports in this region.

First steps to translate the app into Italian and Greek
In a near future people from Greece will be able to use the app to control the tiger mosquito.

Participation in the Medical Entomology del Instituto Pasteur MOOC
Mosquito Alert gave some material to this online course to let students know about the app and involve them to participate.

Pilot test in Barranquilla (Colombia)
A new project starts in this region lead by a group of trained volunteers that will use the app in the districts to control the tiger and yellow fever mosquitoes.
2.6 Community building and outreach

Divulgation articles in the blog

During 2017 we have published many divulgation articles related to the tiger mosquito and the yellow fever mosquito and other content related to the project.

> Visit the blog

First museistic exhibition

The project opened a citizen science exhibition cycle at the Science and Technology Library from the Autonomous University of Barcelona (UAB).

> Visit the exhibition

Other specialized publications or divulgation works


Communication indicators

- Twitter: 1,426
- Facebook: 4,341
- Anual visits (website): 25,675
- Newsletter: started in May, with 218 subscribers until December 2017.
Activities for scholarship and general public

- December 2017 - January 2018 Exposición en la Biblioteca de Ciencia y Tecnología de la UAB. Facultad de Biociencias.
- 21/12/2017. III Encuentro de Ciencia Ciudadana, Medialab-Prado. Madrid
- 25/5/2017. 4t Dia de la Ciència Ciudadana. Barcelona
- 11-18/5/2017. Xerrada. St. Quirze V.
- 16-22/03/17. Centre Cívic Bon Pastor.

Educational programme at schools

Mosquito Alert, together with the Xatrac Environmental Association and the Spanish Foundation for Science and Technology, launches an innovative project aimed at educational centers with the aim of bringing the Mosquito Alert citizen science platform to a youth audience to encourage experimentation and to awaken scientific vocations among the young.

In Spring 2017, a first pilot test was done with schools from Lleida and Barcelona with the collaboration of the ASPB and in October started the educational project, under the name of “Mosquito Alert for young people: fostering scientific vocations based on citizen science”. The goal is to encourage participation in citizen science among young people and reach areas where there are few warnings of tiger mosquitoes or their breeding places through the Mosquito Alert app. The team visited 13 centres of Castellón, Lleida, the Balearic Islands, Huesca, Teruel and Barcelona to launch the activities organized in different sessions following the methodology of works by projects in the schools. The best works were awarded. The programme also offered training courses for teachers in Huesca and Castellón. During the educational project in October the number of breeding sites reports increased up to 200 in comparison with the previous month.

> Read more
Activity with the media

During 2017 we issued 6 press releases and 1 press conference, generating 127 mentions of the project in Spain’s and international media (radio, tv and press). Journalists reporting on tiger mosquitoes and related subjects have come to regard the project as a reliable, rigorous source of information.

> Go to the press office

Selection of appearances in the media

TELEVISION

TV series “The Crowd and The Cloud” about citizen science (April 2017)

Mosquito Alert project appears on the episode “Viral vs Virus” as an example of a citizen science project which involves society to the scientific and management progress to fight against the tiger mosquito problem. “The Crowd & The Cloud” is a 4-part public television series hosted by former NASA Chief Scientist Waleed Abdalati.
Results and achievements in 2017

PRESS (in paper)

Diario de Ibiza. (October 2017)

Una ‘app’ y la ciencia ciudadana acorralan al mosquito tigre en España

Diario de Girona. (November 2017)

Detecten intercanvi de mosquits tigre entre Girona i Barcelona pels cotxes

La Rioja. (Agost 2017)

Otro terrible enemigo que llegará a La Rioja... en coche
El Segre. (June 2017)

El mosquito tigre, a mig Lleida

La seva presència ha estat confirmada a la capital, en cinc municipis més de quatre comarques del pla i també al Solsonès. Els científics també han recordat la comuni de les obstruccions autòctones.

A l’illa de Fuerteventura

Detectat a les Canàries el mosquito del dengue

Es la primera vegada en les últimes dècades que s’observa ‘Aedes aegypti’ a Espanya.

Les autoritats diuen que la presència no significa que hi hagi transmissió.

A l’illa de Fuerteventura.

Resultats i reivindicacions en 2017

Exemple de mosquit ‘Aedes aegypti’, transmisor del dengue.

Diferències entre espècies:

- Negre amb vistes blanques
- Blanqueta negre amb taques blanques i rodones
- Més foscor negre amb taques blanques i rodones
- Absoñ, negre amb taques blanques i rodones
- Tolra i cap, negres, amb un cap central blanc.

www.mosquitoalert.com

El Periódico. (December 2017)
**La Razón (October 2017)**

*ATUSALVD*

Colaboración ciudadana contra el mosquito tigre

Mosquito Alert, una aplicación móvil desarrollada por varios centros de investigación españoles, ha permitido rastrear mosquitos portadores de enfermedades mediante la colaboración ciudadana. Con los datos obtenidos, los científicos están ahora estudiando el riesgo de brotes epidémicos de estos virus en nuestro país.

---

**El Mundo (May 2017)**

La ONU y plataformas científicas se unen contra mosquitos transmisores de enfermedades

---

**LA VANGUARDIA (July 2017)**

Madrid se pone de nuevo en guardia por el virus Zika

Una nueva fase de vigilancia ambiental para controlar la llegada de la carga del "mosquito tigre".

---

**El Periódico (December 2017)**

Detectado en Canarias el mosquito transmisor de la fiebre amarilla y el dengue

La Consejería de Salud del Gobierno canario ha informado esta mañana de la detección de una hembra de mosquito *Aedes aegypti*, el insecto transmisor del virus del dengue, la fiebre amarilla y el Zika, lo que supone la primera confirmación de su aparición en España en las últimas décadas.
The Mosquito Alert project is coordinated by the institutions CREAF, CEAB-CSIC and ICREA, and promoted by the “La Caixa” Foundation. It is jointly funded by Spain’s Ministry of the Economy and Competitiveness and the Spanish Foundation for Science and Technology (FECYT).

We are particularly grateful to all the anonymous individuals who help us by providing data via the Mosquito Alert app. Also to Irene Lapuente, Rubén Duro and Santi Escartín for offering ideas and suggestions about how it could progress, participating in activities and developing the educational programme. Likewise, we are grateful to the involvement of many public and private bodies and the support of numerous professionals. Without that help, the project would not be possible.

Finally, tanks to all the Mosquito Alert team for its effort and constant involvement in all the different areas of the project, making it bigger day after day.