1. Influence of temperature and photoperiod on the egg-hatching rate of *Aedes koreicus*

Aedes koreicus, a mosquito species native to East Asia, has been gaining increasing attention due to its potential impact on public health. The species is native to East Asia, including countries like South Korea, Japan, and China. In recent years, it has been spreading beyond its native range and establishing populations in parts of Europe, including Italy, Germany, and Switzerland.

One of the most concerning aspects of *Ae. koreicus* is its role as a potential vector for various diseases. It is closely related to *Ae. albopictus*, the Asian tiger mosquito, which is known to transmit several viruses like dengue, chikungunya, and Zika. While *Ae. koreicus* has not been definitively linked to the transmission of these diseases, its close genetic relationship to *Ae. albopictus* raises concerns about its vector competence.

The ecology and biological determinants of the species are however not fully understood, as presently only a handful of scientific studies have been published.
Taking advantage of data collected from field and laboratory experiments, the student will investigate the influence of temperature and photoperiod on the egg-hatching rate of *Ae. koreicus*.

Objectives

1. A better understanding of the biology of the species
2. A better understating of the survival rate of different types of eggs (normal and diapausing) under low-temperature regimes
3. Implement these observations into a quantitative modelling framework

Intended Learning Outcomes:

- Mosquito physiology
- Thermal biology
- Statistical/empirical modelling.
- Mechanistic/theoretical modelling

Contacts:

YOUR UNIVERSITY
Dr. Daniele Da Re, Edmund Mach Foundation (daniele.dare@fmach.it)
Dr. Giovanni Marini, Edmund Mach Foundation (giovanni.marini@fmach.it)

2. Laboratory Experiment on Temperature-Dependent Life History Traits of Two Invasive Asian Mosquitoes: *Aedes albopictus* and *Aedes koreicus*

The Trentino area is one of the few regions in Italy where the invasive Asian mosquitoes *Aedes albopictus* (Asian tiger mosquito) and *Aedes koreicus* coexist. These species are of growing concern due to their ability to transmit pathogens such as dengue, chikungunya, and Zika viruses (*Aedes albopictus*), as well as the adaptability and potential vector competence of *Aedes koreicus*.

Recent reviews have highlighted significant gaps in our understanding of the life history traits of these mosquitoes, particularly under conditions that mimic natural environmental variability. This thesis addresses these gaps by utilizing state-of-the-art climatic chambers programmed with fluctuating temperature regimes. This novel experimental approach replicates natural conditions more accurately than constant-temperature studies, providing valuable insights into how environmental variability influences the biology of these invasive vectors.

Laboratory experiments will focus on examining key temperature-dependent life history traits, including development time, survival rates, and reproduction, with the aim of generating high-quality data specific to the populations of these species adapted to colder climates.

Objectives:

1. Investigate the effects of fluctuating temperature regimes on the development, survival, and reproduction of *Aedes albopictus* and *Aedes koreicus*.
2. Address key gaps in the knowledge of life history traits highlighted in recent scientific reviews.
3. Provide ecologically relevant data for improving predictive models of population dynamics.

Intended Learning Outcomes:

- Hands-on experience with climatic chambers and fluctuating temperature experiments.
- Understanding of how temperature variability impacts mosquito life history traits.
- Experimental design and data analysis techniques in mosquito thermal biology.
- Contribution to filling critical knowledge gaps on invasive mosquito species.
- Insights into the ecological adaptations and public health implications of *Aedes albopictus* and *Aedes koreicus*.

Contacts:

YOUR UNIVERSITY
Dr. Daniele Da Re, Edmund Mach Foundation (daniele.dare@fmach.it)

3. Database Management and modelling of Parasitic Vector Species in the Trentino area

Parasitic vector species, including *Aedes albopictus* (Asian tiger mosquito), *Culex pipiens* (common house mosquito), and the tick *Ixodes ricinus*, play a crucial role in the transmission of various pathogens affecting humans and animals. These vectors are responsible for spreading diseases such as dengue, chikungunya, West Nile virus, Lyme disease, and tick-borne encephalitis. Monitoring and analysing the distribution of these species is essential for understanding their epidemiological impact and informing public health strategies.

This thesis aims to create a comprehensive database for managing data on parasitic vector species, specifically focusing on the Trentino region. The student will actively participate in fieldwork during the summer of 2025 to sample mosquitoes and ticks, contributing to an up-to-date and reliable dataset. The curated data will then be analysed using statistical models to identify correlations between environmental factors, vector distribution, and population dynamics.

Objectives:

1. Development and curation of a database for parasitic vector species.
2. Statistical analysis using correlative models to investigate environmental influences on vector populations.
3. Optional: Conducting field samplings of *Aedes albopictus*, *Culex pipiens*, and *Ixodes ricinus* in Trentino.

Intended Learning Outcomes:

- Database management and data curation techniques.
- Statistical analysis with correlative models.
- Understanding the ecology and epidemiological significance of parasitic vectors in the Trentino region.
- Optional: Field sampling methods for parasitic vectors (mosquitoes and ticks).

Contacts:

YOUR UNIVERSITY
Dr. Daniele Da Re, Edmund Mach Foundation (daniele.dare@fmach.it)
Dr. Valentina Tagliapietra, Edmund Mach Foundation (valentina.tagliapietra@fmach.it)
Dr. Francesca Dagostin, Edmund Mach Foundation (francesca.dagostin@fmach.it)
Dr. Giovanni Marini, Edmund Mach Foundation (giovanni.marini@fmach.it)

4. Time-Series Analysis of 17 Years of Longitudinal Sampling of the Winter Oviposition Activity of Aedes albopictus in Emilia-Romagna

Aedes albopictus (Asian tiger mosquito) is a globally invasive species known for its adaptability and role as a vector for diseases such as dengue, chikungunya, and Zika viruses. In the Emilia-Romagna region, *Ae. albopictus* has been responsible for several outbreaks of dengue and chikungunya over the past 15 years, underscoring its significant public health impact. While most research focuses on its activity during warmer months, *Ae. albopictus* has shown a remarkable ability to adapt its oviposition behaviour to cooler temperatures, including during the winter. This adaptation has critical implications for its population dynamics, range expansion, and potential for year-round disease transmission.

This thesis will analyze a unique 15-year dataset from longitudinal sampling of *Ae. albopictus* oviposition activity during the winter in the Emilia-Romagna region. The dataset provides an exceptional opportunity to study long-term trends, seasonal variability, and the environmental factors influencing winter oviposition behaviour. Advanced time-series analysis techniques will be applied to uncover patterns, correlations, and potential drivers of this behaviour.

Objectives:

1. Conduct a comprehensive time-series analysis of 17 years of winter oviposition data for *Aedes albopictus* in the Emilia-Romagna region.
2. Identify trends and seasonal patterns in winter oviposition activity.
3. Investigate correlations between environmental variables (e.g., temperature, precipitation) and oviposition rates.
4. Provide insights into the ecological and epidemiological implications of winter oviposition in *Ae. albopictus*.

Intended Learning Outcomes:

- Mastery of time-series analysis techniques and their application to ecological data.
- Insights into long-term population dynamics and seasonal adaptations of invasive mosquito species.
- Experience in handling and analyzing extensive datasets.
- Understanding the ecological and public health significance of *Ae. albopictus*' winter activity in Emilia-Romagna.

Contacts:

YOUR UNIVERSITY
Dr. Daniele Da Re, Edmund Mach Foundation (daniele.dare@fmach.it)
Paola Angelini, Regione Emilia Romagna (Paola.Angelini@regione.emilia-romagna.it)
Alessandro Albieri, Centro Agricoltura Ambiente (aalbieri@caa.it)
Dr. Giovanni Marini, Edmund Mach Foundation (giovanni.marini@fmach.it)