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Revealing the necessity of winter diapause for temperate populations of *Aedes albopictus* (Diptera: Culicidae) by field tests and modeling

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The Asian tiger mosquito is a widely spread invasive and vector species native from tropical South-East Asia. For the last decades, the species has colonized temperate regions of the northern hemisphere. This outstanding acclimation to temperate climates is notably attributed to its capacity of egg winter survival through diapause. Our aim in this study is to demonstrate why the diapause is a necessary process to survive the mild winter of southern France.

Firstly we investigated the ability of *Aedes albopictus* to overwinter was investigated by exposing eggs to winter environment from November 2012 to mid-March 2013. Diapause-induced temperate eggs, Non-diapause-induced temperate eggs, and tropical eggs unable of diapause were studied. Egg batches were kept outside during the winter, sheltered from rainfall and predation. They were brought back and kept in the laboratory and every fortnight for 2 months were stimulated to hatch. In the temperate strain egg survival rate was not significantly improved by diapause, but was higher than in the tropical strain. Activation of the diapause process did not change wing size or shape in the temperate strain. The essential function of the diapause is to avoid precocious egg hatching during mild periods of winter.

Secondly, these data were integrated to a rainfall- and temperature-driven abundance model to improve overwintering simulations. The generated simulations were correlated to recorded field data and were used as the reference model for *Ae. albopictus* dynamics. In order to demonstrate the importance of the diapause for mosquito abundance, a simulation knocking-out the diapause ability was compared to the reference model. It resulted in the continued hatching of mosquito eggs up to December instead of October, with host seeking females active up to the beginning of December. Mosquito population did not become extinct through time but persisted at a very low density, and with a 3 months delay of the beginning of the population density increase. We conclude that diapause tremendously increases the survival ability of *Ae. albopictus* in the French Mediterranean area. These results are discussed in terms of control strategies and in terms of history of invasive mosquito species' establishment in Europe.