

The invasive vector mosquito *Aedes japonicus* in Europe: Still no end in sight!

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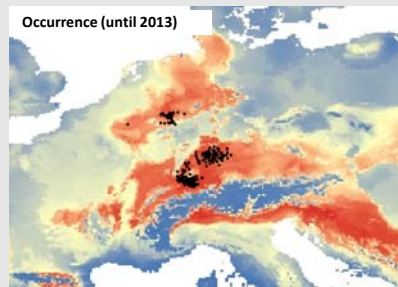
Background

Aedes (Finlaya) japonicus japonicus (Theobald, 1901) is a highly ranked listed invasive culicid species and originates from East Asia and the Far East. At present it is established in the European countries Switzerland, Germany, Austria, Slovenia, Croatia, France, Belgium and the Netherlands as well as in America throughout the northeastern states of the USA crossing the border to the south of Canada, Hawaii, Washington and Oregon.

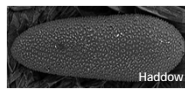
It is known to transmit the West Nile virus and Japanese Encephalitis virus under field conditions and is a potential vector for Dengue, Chikungunya, LaCrosse, Eastern Equine Encephalitis, St. Louis Encephalitis, and Rift Valley Virus.

Results: Areas at risk for an further establishment of *Aedes japonicus*

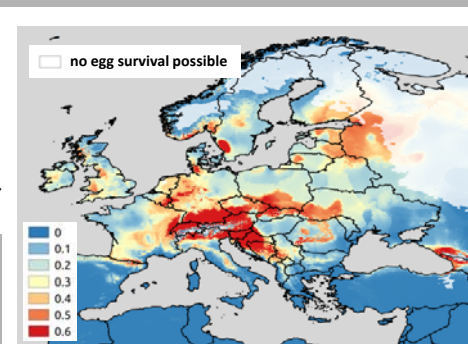
Aedes japonicus - current



Climatic Variables	Explanation
Bio6	Min Temperature of Coldest Month
Bio9	Mean Temperature of Driest Quarter
Bio10	Mean Temperature of Warmest Quarter
Bio14	Precipitation of Warmest Month
Bio18	Precipitation of Warmest Quarter

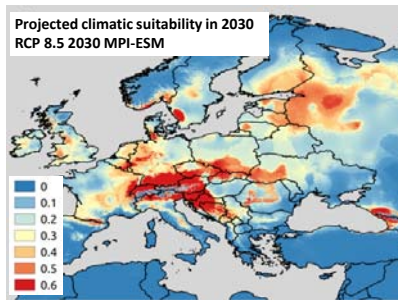


The climatic suitability for *Aedes japonicus* in Europe is intersected with the lower temperature threshold at which mosquito egg survival is not possible anymore depending on the ambient temperature. Long-term establishments in Northern Europe and Russia can be excluded.



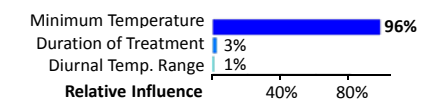
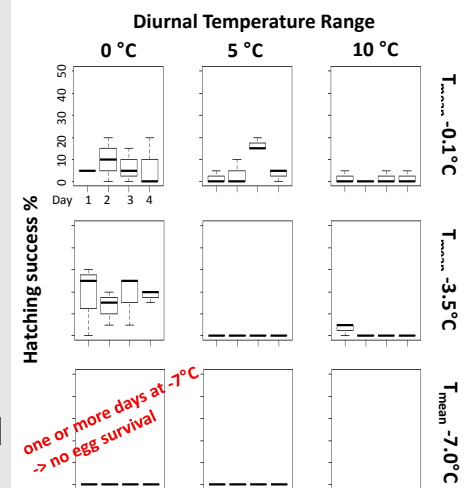
The combination of correlative species distribution models with special expert knowledge on the ecology of a species, here an invasive disease vector mosquito, can strongly improve the risk assessment regarding future areas at risk for an establishment of the species.

Aedes japonicus - future

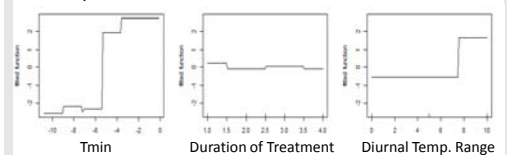


Large parts of Central and Eastern Europe will be climatically suitable

Climate Chamber Experiments: Egg Survival at Low Temperatures



BRTs explained variance: cv correlation = 0.62



Methods

- Correlative species distribution model SDMs: Ensemble Modelling approach as implemented in biomod2 R-package
 - Bioclimatic variables of Worldclim (5' resolution, global scale), Generalized Linear Model (GLM), Generalized Boosting Model (GBM), Random Forest (RF), Maximum Entropy (MAXENT)
 - Future projections 2030, 2050 and 2070 for five climate models (cesm1_bgc, fio_esm, giss_e2_r, inm_cm4, mpi_esm_lr) and two IPCC-5 scenarios (rcp4.5, rcp8.5)
- Climate chamber experiment: Detection of low temperature thresholds for mosquito egg survival under three different diurnal temperature range treatments and Combination of the outcome with SDMs to substantially improve risk maps by considering areas where an establishment of *Aedes japonicus* is unlikely due to winter conditions
- See also the talk of Anja Jaeschke SAT 14:30 CT2.7, H 21, RW II and the poster of Nils Tjaden P2.50

Further References

- Thomas, Beierkuhnlein (2013) Predicting ectotherm disease vector spread—benefits from multidisciplinary approaches and directions forward. *Naturwissenschaften* 100:395-405
- Kampen, Werner (2014) Out of the bush: the Asian bush mosquito *Aedes japonicus japonicus* (Theobald, 1901) (Diptera, Culicidae) becomes invasive. *Parasites & Vectors* 7:59
- Thomas, Obermayr et al. (2012) Low-temperature threshold for egg survival of a post-diapause and non-diapause European aedine strain, *Aedes albopictus* (Diptera: Culicidae). *Parasites & Vectors* 5:100
- Fischer, Thomas et al. (2011) Projection of climatic suitability for *Aedes albopictus* Skuse (Culicidae) in Europe under climate change conditions. *Global Planetary Change* 78:54-64

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