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Integrative early-warning modelling of West Nile virus transmission in Germany

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Driven by globalisation and climate change, mosquito-borne viruses have emerged in Europe over the last decades, with West Nile virus (WNV) transmission detected in Germany in 2018. *Culex pipiens* is considered the primary vector, but the sister species *Cx. torrentium* also plays a role in WNV transmission, especially in Central Europe where both species occur in sympatry. Assessing WNV transmission risk often relies on mechanistic or correlative models, but approaches that integrate both streams for more informative results are lacking in the literature. Moreover, most models use static data, limiting their suitability for real-time predictions. This study developed a "hybrid" model in which estimates of mosquito abundance refine a mechanistic R0 model based on temperature-dependent transmission parameters. Mosquito abundance was derived from real-time surveillance data collected from traps across Germany, allowing a vector-to-host ratio parameter to be incorporated in the model. Hourly updated nation-wide climate data was used as input to yield short-term forecasts presented as risk maps, serving as a tool for risk assessment. The findings suggest that the role of *Cx. torrentium* in WNV transmission was underestimated, as its high vector competence for WNV generated high R0 values. Integrative models that take advantage of regularly updated climate and mosquito surveillance data could greatly enhance decision-making regarding surveillance plans and preventive measures.

Keywords

West Nile virus, modelling, early warning systems, Culex torrentium, mosquito-borne diseases

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Professional Status of the Speaker

PhD Student

Junior Scientist Status

Yes, I am a Junior Scientist.

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