Relationships between landscape structure, host community and the prevalence of tick-borne pathogens (Anaplasma phagocytophilum and Borrelia burgdorferi) in small mammals

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Abstract

Land use changes, by reshaping hosts and vectors communities and their dispersal, can modify the circulation of vector-borne pathogens. Understanding how the landscape structure influences the circulation of these pathogens is therefore useful to create vector-borne diseases risk maps and for developing preventive measures.
Small mammals can be important hosts for larval *I. ricinus* ticks, the main vector tick species in Europe. Because small mammals are also reservoirs of tick-borne infectious agents, identifying the main drivers of their prevalence in small mammals is a key issue in understanding the ecology of these infectious agents. In this aim, we investigated the prevalence of two tick-borne infectious agents in small mammals and assessed their relationships with landscape structure and host community.

During two years (2012 and 2013), we trapped small mammals in 24 sites situated in different landscape contexts (in forest, and in agricultural landscapes woodland patches and hedgerows, with various surrounding land covers and hedgerow network densities). We trapped 608 indivuals in which *Anaplasma phagocytophilum* and *Borrelia burgdorferi* sensu lato were searched by real-time PCR methods. We used graph theory and least cost paths analyses applied on each studied species in order to compute appropriate landscape connectivity measures. We also computed landscape composition and configuration variables at various scales (from 50 m to 500 m radius buffers around sampling sites).
The prevalence of *A. phagocytophilum* was positively associated with the proportion of wooded habitats in the landscape, whereas the prevalence of *B. burgdorferi* s.l. was positively associated with samplings at forest-pasture ecotones. The small mammal community

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species richness explained a substantial part of the prevalence of *A. phagocytophilum*, but not that of *B. burgdorferi* s.l.. The importance of the life history traits of infectious agents and host-vector meta-communities in relation with landscape structure, and some research perspectives, will be discussed.