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Letters to the Editor

Multiply Infected Vectors

Wielinga et al. (10) provide an important reminder that ticks and other insect vectors are sometimes microbial "zoos" rather than single-pathogen vehicles. A single tick may simultaneously transmit *Borrelia* and *Babesia* species (7) or, perhaps, coinfect humans with *Borrelia*, *Babesia*, and *Ehrlichia* species (1, 3).

Wielinga et al. report that the frequency of *Ixodes ricinus* ticks coinfected with *Borrelia* and *Ehrlichia* or *Anaplasma* species is higher than would be expected on the basis of independence between the pathogens, that this frequency increases with tick age, and that the degree of the statistical surplus of coinfections varies with habitat type. Given that the striking surpluses over the 2 to 3 years in the park, forest, and heather habitats ($P < 0.01$ for each by χ^2 and Fisher's exact tests) appeared to be absent over the 5 years in the dune habitat ($P > 0.1$), might these differences between the habitats have been mediated by differences between the years in the age structures of the tick populations in the field or the assay samples? Since an individual vector rarely clears an infection, infections accumulate with age, and in a vector population, frequencies of multiply infected vectors typically track seasonal and other environmental influences on age structure (4, 5).

Wielinga et al. also point out that pathogens sharing a vector may interact within that vector. Among mosquito-borne pathogens, for instance, transmission of the Rift Valley fever and eastern equine encephalitis viruses by *Aedes* mosquitos coinfected with *Brugia* species is enhanced (8, 9); *Plasmodium* and *Wuchereria* species coinfect *Anopheles punctulatus* at higher-than-expected frequencies (2) but suppress each other's development in *Anopheles gambiae* (6). Wielinga et al. have drawn attention to an important but neglected set of topics for research, the results of which should improve our understanding and control of vector-borne diseases.

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