Medical Xpress

High levels of co-infection with pathogens and symbionts in ticks from the Ardennes

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Ticks are small blood-feeding arachnids that can transmit diseases amongst animals and humans. Researchers from the French National Institute for Agricultural research, INRA studied pathogen species and bacterial symbionts in tick species *Ixodes ricinus*. Publishing in *PLOS Neglected Tropical Diseases*, their findings showed all ticks contained symbiotic bacterial species and over half were infected with pathogens. The high level of co-infection with multiple pathogens and symbionts has important implications for diagnosis and treatment of tick-borne diseases.

The researchers collected 267 adult female ticks between May and August 2012 from an 80 km transect in the French Ardennes. Samples were taken from 6 forested areas and 3 with hedge networks. RNA and DNA were extracted from all ticks and high-throughput screening carried out for identification of both pathogens and symbionts. The researchers looked for the presence of DNA from 37 different species of bacteria, parasites and viruses and four bacterial symbionts (*Wolbachia* sp, *Midichloria mitochondrii*, *Spiroplasma* spp. and *Acinetobacter* spp.)

Of the 267 individually analyzed female ticks 45% were infected with at least 1 pathogen. A further 45% of these (54 ticks) were infected with more than one species. Of the 255 specimens analyzed for symbiotic bacterial species 100% contained DNA from M. mitochondrii, with 76%, 65% and 20% containing DNA from Spiroplasma, Acinetobacter and Wolbachia respectively. When both pathogens and symbionts were

taken into account, some ticks contained up to 8 micro-organisms.

A statistical analysis for associations between co-infected bacteria suggested strong associations between infection with the species Borrelia garinii and Borrelia afzelii. No significant associations were found between symbionts and pathogen infections. The researchers studied only adult ticks in order to maximize co-infection rates to study associations, and acknowledge that further study of the nymph and larval stage may reveal more information about the levels of co-infection.

"This work highlights the co-infection phenomenon in ticks, which may have important implications for human and animal health." Says Dr Vayssier-Taussat from the National Institute for Agricultural Research (INRA). "The high co-occurrence of symbionts and pathogens in ticks reveals the necessity to account for these interactions in the development of new alternative strategies to control ticks and tick-borne diseases.

The high prevalence of co-infection means that diagnostic tools need to be able to match the range and variety of all pathogens over the geographical area where the tick is found. Co-infection of tick borne diseases can alter patient symptoms, producing more severe or different symptom patterns. The possibility of co-infection has implications for treatment strategies, e.g antibiotics which may clear a bacterial infection will not help with a co-infected virus.

The study raises awareness of the issue of co-infection of tick-borne diseases. The high level of co-infection should be a consideration for public health measures, and the interaction between symbionts and pathogens inside the tick is an important area for continued biological study.

More information: *PLOS Neglected Tropical Diseases*, dx.plos.org/10.1371/journal.pntd.0004539