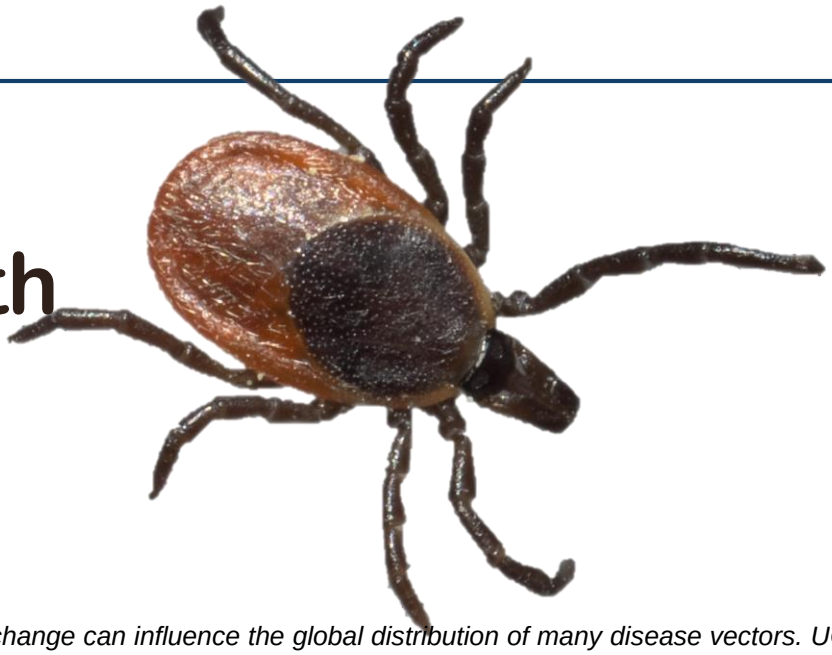
The Truth about Ticks



Climate and environmental change can influence the global distribution of many disease vectors. UCD One Health researcher Annetta Zintl, investigates the distribution of ticks and tick-borne pathogens in Ireland, and their importance for human and animal health.

Ticks have been very much in the public eye lately. One of the reasons is that climate change is facilitating the spread of certain tick species into areas where they were previously absent, for example some North African and Asian ticks are becoming established in Central and Northern Europe. This is worrying because, apart from the obvious unpleasantness of finding a tick on yourself or your pet, ticks are notorious vectors of disease. And the list of pathogens that can potentially be transmitted by ticks is steadily growing as increasingly sensitive methods are employed to look for them.

These developments are worrying. However, it is important to remember a few basic facts about ticks. The tick species that are the main vectors of disease only feed three times in their lives, once as larvae, once as nymphs and once as adults. In between feeds they spend long periods of time (12 months or more) in the environment, digesting their blood meal and moulting to the next life cycle stage. This together with the fact that ticks have very specific humidity and temperature requirements means that their distribution is largely determined by climate. While it is well documented that many areas have become more suitable for certain tick species as a result of anthropogenic climate change, other areas have apparently become less so.

However, in contrast to new site reports it is much more difficult to record sites where ticks have disappeared as there are no agreed standards as to how much sampling effort has to be expended before a site can be declared free of a particular tick species. Another important fact is that the pathogenic agent is often highly specific to certain tick species, much more so than their association with the vertebrate host. Therefore, as the distribution of specific tick species is governed by climate and geography so are the risks of contracting specific tick-borne diseases.

While this distinction is obvious to most people in Ireland with regard to tick-borne pathogens that are prevalent in central Europe (such as tick-borne encephalitis), it is often overlooked in relation to new and emerging tick-borne pathogens reported from the USA and Canada. It appears that the high level of cultural exchange and people movement between North America and Ireland gives rise to the (frequently erroneous) assumption that what is of clinical concern over there must also be present here. Interestingly this is true for tick-borne diseases that affect both humans and companion animals.

Every year numerous students and interns help to collect ticks on farms, in parks and woodland. Clockwise from top left: Fiona McKiernan and Taher Zaid (both postgraduate students at the UCD School of Veterinary Medicine), Atiyah Bagha (undergraduate student at the UCD Vet School), Aurore de Maqueville (Agricultural School, Bordeaux), Anne Pettilon-Pronk, Emmanuel Coulange, Tiphaine Dubourdieu (all undergraduate students from Paul Sabatier University, Toulouse), Sorcha Brosnan (undergraduate student at the UCD Vet School)

Since 2016, numerous undergraduate and postgraduate students and interns have helped to collect data on ticks and tick-borne diseases in Ireland. Every spring and summer teams have gone out to sample parks, forests and farms for the presence of ticks.

Sampling is done by dragging white cotton blankets across the vegetation. Hungry ticks that have positioned themselves on the top of bushes and grasses in search of a new host (a behaviour known as 'questing') are stimulated by the vibration and CO_2 emitted by the approaching 'target' to hold on to the blanket as it passes over them.

All ticks collected in a defined area (approx. 175m^2 per site) are enumerated and returned to the lab where, on the basis of size and morphology, they are identified to life cycle stage (larva, nymph or adult), sex and species. They are then analysed for the presence of pathogens using DNA-based methods. The rationale behind this approach is that only organisms that have survived since the last feed (which is likely to have occurred more than 12 months ago) will be detectable at this stage, while any other organisms that are not equipped to be tick-transmitted, will have been degraded and digested.

Results to date suggest that no new tick species have appeared in Ireland in the last 20 years as the species we have found have all previously been reported here. By far the most common and widespread species and probably the only one that parasitizes humans in Ireland is *Ixodes ricinus* (*Ixodes hexagonus* is also present in Ireland but rarely feeds on humans).

Many people associate the presence of deer with a risk of Lyme borreliosis. However, while they serve as hosts for large numbers of ticks and contribute significantly to the vector population deer are not considered competent reservoirs for the pathogen.

I. ricinus also occurs throughout continental Europe where it serves as a vector for several important viral, bacterial and protozoal pathogens. In Ireland *I. ricinus* is known to transmit four Borrelia species (three of which can cause Lyme borreliosis in humans), the rickettsial agent, *Anaplasma phagocytophilum*, the protozoan parasite *Babesia divergens* and Louping ill virus.

There are obviously a lot of concerns about Lyme borreliosis. However, so far we have found no evidence that infected ticks are on the increase or that new *Borrelia* species have been brought into Ireland. *A. phagocytophilum* has never been properly researched in Ireland. Anecdotal clinical evidence suggests that the strains that cause tick-borne fever in sheep and cattle may be quite common, while the subtypes that infect humans and companion animals are rare or absent.

B. divergens, the cause of redwater fever in cattle was long the scourge of cattle farmers in Ireland. The disease saw a sudden drastic decline in the late 1990's which has continued until now, however, isolated foci of high disease incidence remain.

Louping ill chiefly affects sheep in the west and north west of Ireland where it causes isolated cases of clinical disease although many animals are seropositive.

Based on PCR analysis of ticks and questionnaire surveys of farmers, veterinarians and pet owners we have found no evidence to date that any new exotic tick-borne pathogens have made their way into Ireland. However, with ongoing changes in climate, continuing large scale movement of livestock and people and new environmental legislation and policies that will affect the availability of suitable tick habitat continued monitoring of ticks and tick-borne pathogens is clearly warranted.

This work is done in collaboration with numerous tick experts in Ireland and abroad including (from left) Jeremy Gray, Professor Emeritus from what was then the School of Biology and Environmental Science in UCD, who worked on ticks and tick-borne diseases long before it became fashionable and has published many highly cited articles in the field; Peter Stuart, wildlife disease ecologist at Trinity College Dublin, with an interest in longitudinal studies of rodent pathogen dynamics, including their ticks and tick-borne diseases; Robert Shiel and Sinead Devine, colleagues in the UCD School of Veterinary Medicine, who are investigating whether there are cases of tick-borne disease in companion animals that currently go undetected and Theo De Waal, with an interest in the tick species that infest dogs in Ireland.

Annetta Zintl, Lecturer in Veterinary Parasitology and Immunology at UCD School of Veterinary Sciences, who leads several projects focused on the distribution and prevalence of ticks and tick-borne pathogens in Ireland.

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