

DISCUSSIONS ON THE INVASIVE LONGHORNED TICK, *HAEMAPHYSALIS LONGICORNIS*



Webinar Question & Answer Session November 19, 2018

Are there active management programs that could have also affected (perhaps limited) distribution in New Zealand?

- (Dr. Heath)** If we had known about the tick and how readily it would have dispersed in the very early days, I mean, we found it in 1911 and it had probably been here since about 1894. Now, when we did find we had the tick, compulsory dipping was set up in certain parts of the north island. There was a tick control or tick border area where we dipped all the cattle. But by then, to use another cliché, the horse had bolted, unfortunately, and it was a little bit late to prevent the tick moving beyond its initial establishment area. But, if we'd had the chemicals – we didn't have persistent chemicals in 1911, but that was the time when we probably could have done something about it – we may well have been able to prevent it moving outside of its original area. But, that is about the only way I think it possibly could be done. I hope that answers that particular question because you have to be aware, as I said before, that there are so many other hosts than cattle and sheep and horses. That larger mammals are not the only ones, and there is not a lot you can do about hares or coyotes or birds.

It seems the geothermal parts of the north island [New Zealand] have not seen the tick. Is it because it is drier and because of the geothermal activity?

- (Dr. Heath)** The geothermal area has an altitude of around 370m, 69 frost days annually and a total rainfall of 960mm annually; summers are hot and winters cool with a winter mean temperature of 7°C and a mean annual temperature of around 10°C. Soils are poor and there is little in the way of livestock farming, although there are wild horses, wild deer and hares. The median March vapor pressure is 8-12mm Hg, compared with 14-16 mmHg in areas where the tick is common. Taken together these factors mean the region is too cool and too dry for sustained tick survival. Temperatures that slow tick development expose the tick to sustained water loss which, if there is no opportunity to redress water balance, becomes fatal. There are records of the tick being found in scattered pockets on the fringe of the volcanic plateau, but that is all. Below ground geothermal activity is unlikely to influence tick survival, whereas where hot springs and geysers occur there is no farming and if ticks are around they would be on wildlife and there is little in direct contact with geothermal activity.

For Dr. Heath: Does soil pH seem to affect tick spread?

- (Dr. Heath)** We have never measured that, so I cannot answer. Sorry.

Question to Dr. Heath: Has this species been found in urban/suburban areas in New Zealand?

- (Dr. Heath)** Yes. It is found mostly in rural areas, but it turns up occasionally in urban ones. In fact, more recent expansions of its range have been found in an urban area in the south island near a city called Christchurch. In fact, and in listening to Rich's presentation, it is very interesting that dog walkers in particular are either disseminating the tick or are picking it up. It seems to be that with more and more dogs, particularly in New Zealand, and more and more people walking them further afield, that perhaps they are helping distribute the tick beyond its rural confines.
- (Dr. Falco)** I should also mention that we are finding *H. longicornis* in large numbers on utility right-of-ways, which are the sort of short grass transects similar to the walking trail we surveilled in Westchester County, NY.

Has acquired resistance to Asian longhorned tick bites been reported in New Zealand? If so, how frequently is this reported?

- (Dr. Heath)** It has not been recorded. All I know from personal observations – and no one has done any studies or surveys on this – there are always some animals that seem to have fewer ticks than others. But, you cannot always tell whether it may in fact just be that they have encountered fewer ticks while they have been pastured. But, from what I have read and what I know of tick infestations in other countries, particularly in Australia, when it comes to the cattle tick *Boophilus*, there are animals that are more resistant, and there are actually breeds of animals, such as the Indus breeds, which you can use as a stock unit that can be run in areas where tick levels are very, very high. So, in answer, I would say that there are some that are more resistant to the tick and you can use a breeding program to select those, but we do not have any information in New Zealand that would be of any use beyond that point.

Have Asian longhorned ticks exhibited Flumethrin resistance?

- (Dr. Heath)** No. I know of studies done in Japan with something like five years of acaricide application to cattle and to pasture, and they have shown no signs of pyrethroid resistance. With respect to that, somebody once tried in New Zealand to take up a helicopter and spray pasture with pyrethroids from a helicopter. I would not recommend it, as an environmental issue, but that particular person seemed to think it worked well. The problem with aerial application of insecticides is that they do not always reach the soil surface.

Since the tick is parthenogenic, it would probably be even more vulnerable to a targeted control, correct? Has there been any word of a biological or otherwise targeted control for the tick?

- (Dr. Heath)** I am not really sure I understand your argument, unless you are implying that parthenogenesis would make genetically-based control more effective, because it would be through the female line alone and thus you would be, in effect, attacking a clone rather than the variability inherent in panmixia? You may also be referring to *Wolbachia* and its potential for sterilizing male ticks. I am unaware of any targeted control methods currently in use, although a colleague here in New Zealand has found a fungus that appears to attack different stadia of the tick, especially in damp, poorly drained localities; but, the work is subject to commercial confidentiality and I cannot say more. There are some moves I am aware of to seek a vaccine against *H. longicornis*. However, as it is a 3-host tick, this could be tricky to implement. A vaccine against a one-host tick in Australia was only partially effective and still needed to be supplemented with acaricide use.

Are there any protocols or guidance documents regarding the full body wash/acaricide application to livestock?

- **(Dr. Heath)** In New Zealand, we have a very limited number of ectoparasiticides available for application to livestock. We have been under considerable pressure because of insecticide residue concerns in both meat, and wool and pelts. The current protocols are that there are a large number of low-volume applications, or so-called pour-ons. They are the usual ones that are applied. A farmer goes to a veterinarian or agricultural supply person, picks up a can of whatever acaricide he wants to use, and applies it to the animal. He is supposed to read the labels on the can, but they do not always, so the protocols, no matter how detailed and how carefully prepared, are not always followed.
- **(Audience Member)** You can go to the veterinaryentomology.org website, and on there for some select states that have veterinary entomologists, you can go to VetPestX and it will tell you what products are registered for different types of animals. I have created a list for my producers here in Tennessee to help them control things before it gets out of hand, potentially next year or the year after. The other thing is that you can go to the [Tick Eradication Program](#) out of Texas, and they have a lot of great information there on where to get protocols on how to control and treat animals.

For Dr. Heath: Is there an increase in likelihood that a person that handles livestock would be bitten?

- **(Dr. Heath)** Humans do get infested with *H. longicornis*, but it is not a common event. People handling livestock are encountering animals with ticks already attached and feeding, and these ticks do not preferentially leave one animal to attach to another. The risk to humans would more likely be from walking through tick infested pasture and encountering questing (unfed) ticks. Walking through long pasture (at least above ankle height) in tick-infested paddocks has a higher risk of humans becoming infested than in any other environment. Sitting down for a prolonged period (or standing in one place while working) in tick-infested grass increases the risk markedly, as ticks are attracted to increased CO₂ levels from breath. Larvae (early autumn mostly) seem to be more assiduous in getting onto a host, although nymphs are keen feeders too, especially in late winter/early spring after their winter diapause.

How much do these ticks infest dogs in New Zealand?

- **(Dr. Heath)** They are actually fairly common on dogs. Farmers are frequently telling me about their dogs being infested. Cats as well. So, any animal that runs out into pasture will have ticks attached to it eventually.

Besides rabbits, what other small mammals are present in New Zealand that are potential hosts? Are there any small mammals on which *H. longicornis* have not been found?

- **(Dr. Heath)** The problem with that is that, once again, no one has done a nationwide survey. But, it has been found on the European hedgehog. I mentioned the rabbit, and the hare; the European hare is a particularly good host. We do not have a lot of small mammals here, actually. There are ferrets, there are stoats, and there are weasels, and I do not have any records of *H. longicornis* being taken off those particular animals. One of the rather strange hosts is our kiwi, our flightless endemic bird, which, when let loose on pasture with ticks on it, actually carries quite a few ticks. Not the adults, but quite a few larvae and nymphs. Anything that walks and stalks amongst tick-infested pasture, whether mammal or bird, will get infested.

Does this species feed on field mice? Any comparison with rats?

- (Dr. Heath)** I have tried to feed it on mice and rats in the past, and it will feed on them. It is just that for a mouse, they are so small they are probably unlikely to pick up more than a few larvae. I guess I can say that, without a good, data-based opinion, those two mammals would be hosts, but I do not know to what extent.

Do the larvae occur in masses like lone star ticks?

- (Dr. Falco)** Yes, they do seem to occur in clumps and masses.
- (Dr. Egizi)** Yes, I would agree.
- (Dr. Heath)** That's right, yes.

How far (laterally) do the ticks move?

- (Dr. Heath)** We found probably two to three meters, at most, for a female, and hardly any movement at all for a larva. They just tend to stay clustered around the eggs that they have climbed out of, and then just wait and climb up the vegetation. And the nymphs themselves do not seem to move very far. But, the female might go two to three meters to find a sheltered spot to lay her eggs.

Are there data on the overwintering ability of these ticks?

- (Dr. Heath)** Yes, there is. As shown in the presentation, they overwinter quite happily in New Zealand. They overwinter mostly as unfed nymphs. Although, we have found unfed larvae and unfed females in small numbers, compared with the numbers of nymphs. It is a behavioral diapause, and they just happily sit there. They are found in Japan under snow, and are quite happy under snow. So, they have a very good adaptation as far as overwintering conditions are concerned.

Can they survive sub-zero Fahrenheit temperatures?

- (Dr. Heath)** *Haemaphysalis longicornis* survives under snow in Japan, indicating that it can withstand subzero temperatures. Having said that, *H. longicornis* is freeze susceptible (Yu *et al.* 2014; *Parasites and Vectors*, <https://doi.org/10.1186/1756-3305-7-346>). Gradual exposure to low temperatures can enhance its cold hardiness, while the possible formation of cryoprotective proteins is suggested, but not proven.

I found roughly 2,000 larvae in a deer bed in a Westchester [NY] park on October 31, 2018, and November 1, 2018. Is this anomalous for this time of year?

- (Dr. Heath)** If I have my seasonal patterns for the Northern hemisphere correct, you are referring to autumn. In New Zealand, autumn is the time when larvae are most apparent and they arise from eggs deposited by females in late summer. Those larvae, once fed, will give rise to unfed nymphs, which will overwinter, ready to attack stock in late winter/early spring.

Have any pathogens of concern been isolated from *H. longicornis* in New Zealand?

In New Zealand, is any testing conducted for particular pathogens possibly vectored by this tick?

Have any of these ticks been tested for pathogens? If so, what ones?

- (Dr. Heath)** Theileriosis is a big deal in New Zealand, but no other organisms have been isolated from the tick. We have had *Theileria orientalis* serotypes Ikeda, Chitose, and Buffeli in New Zealand, and they were recently discovered in about 2012 with an Australian origin.
- (Dr. Falco)** They are being tested now in New York for the pathogens we have routinely in *Ixodes scapularis*, plus for exotics as well.
- (Dr. Egizi & Dr. Seraphin of USDA-APHIS)** We are up to 120 *H. longicornis* ticks from New Jersey (Hunterdon and Middlesex counties) that were tested for six pathogens: *B. burgdorferi*, *B. miyamotoi*, *A. phagocytophilum*, *B. microti*, *E. chafeensis*, and *E. ewingii*. All ticks tested negative, and are now in the process of being surveyed for *Rickettsia* pathogens. CDC has tested ca. 100 ticks sent by Rutgers University from New Jersey for Heartland virus, Bourbon virus, and SFTS virus; all tests were negative. One single tick found crawling on a person in New Jersey was ground-up for tick panel testing by a human diagnostic lab, and was negative for things tested under this tick panel (e.g., Lyme disease, Ehrlichiosis, etc.). The infested sheep in New Jersey tested negative for *Anaplasma marginale*, *Babesia bigemina*, *Babesia bovis*, *Coxiella burnetii*, and *Ehrlichia ruminantium*. Although heavily infested, the sheep did not show any signs of illness; it eventually died of old age in early 2018.

For Dr. Falco: How were the thousands of larvae found in New York State identified?

- (Dr. Falco)** Using a key under a microscope. Of course, that is why it took three days because everything had to be looked at under a microscope, and everything had to be checked off as it was counted. I, of course, do not mean we keyed out every larva; that is impossible with the numbers we were dealing with. We first observed the lint roller sheets under the microscope, looking for something other than *Haemaphysalis*, which we then focused on. It is not hard to tell the difference between *I. scapularis* and *H. longicornis* under the microscope like this. After each sheet was thoroughly examined under the microscope, we would count each tick manually. Regarding the possibility of collecting the native rabbit tick, *Haemaphysalis leporispalustris*, on our drag sheets, this tick is exceedingly rare, and we are confident that all but a few (if that many) of the thousands of larvae collected are *H. longicornis*.

How many adult males have been found in your New York collections?

- (Dr. Falco)** None.
- (Dr. Egizi)** There was a report of one male from New Jersey, but we have not been able to confirm that. I have personally looked at a few hundred adults, and they were all female.
- (Dr. Heath)** Never found a male in New Zealand. Two, I think, were found in Australia, of thousands and thousands of ticks examined.

For Dr. Falco: Did you replace the adult and nymph ticks back into the environment, or were all taken back to the lab?

- (Dr. Falco)** We took them back, yes. When we go back to the site, we are not necessarily going to the same place. You could say that since you are taking some out, it could affect your counts for the next time, but we are not sampling the exact same place again. So, we do not think that is an issue. It is just the way we do the sampling.

What 'strain' are we dealing with in the USA? Bisexual, or parthenogenetic, or both?

- (Dr. Heath)** It is most likely that the US has a parthenogenetic strain of the tick. The reason being that it is the most widespread strain, and the bisexual strain appears to be confined to southern Japan. If males are found in any quantity in the US, then I would have to revise my conclusion.

For Dr. Egizi: Do you have an idea, having done some molecular genetics, an actual origin of the tick, where it may have come from in another part of the world? Also, perhaps, how it may have entered?

- (Dr. Egizi)** Right now we are working with what is available in GenBank, and there are only sequences from a few locations in China and from Victoria in Australia available. That is what I have been comparing it with. I did find all of the US haplotypes represented in those locations. One of them is in both, one of them is only in China, and one of them is only in Australia. I caution that these are a limited number of samples from a limited number of locations, and it could be there is another population in another country, or even another region in those countries, that has not been sampled yet that would have all three. So, it is a little too early to be making determinations based on the genetics whether it is a single or multiple introductions. What we can say is that there were at least three females introduced. We do not know if they came at the same time or not.

Dr. Heath: Any ideas how the tick got to the USA?

- (Dr. Heath)** I would blame tourists, myself. Or perhaps US citizens returning from Australia or East Asia. We frequently find these ticks on humans. In fact, we have looked at the number of species that have come into New Zealand, and more than half of them that have been intercepted at our border are on human beings, either on their luggage or attached to their persons. The remainder are usually on companion animals, and mostly dogs. So, I would not discount any particular vehicle of entry, but I would probably sit a little more heavily toward humans. Either their personal possessions or their persons.

If *H. longicornis* travel with dogs into new areas, what is the panel's assessment with respect to introductions into other regions of the world (Europe)?

- (Dr. Heath)** Good question, actually. There have been a couple of species of *Haemaphysalis*, one in particular, *H. punctata*, that has been found in Europe currently and it is slowly spreading. If biosecurity measures are not good, then there is no reason why *H. longicornis* could not spread elsewhere. It seems to have, as I said before, a considerable bioclimatic plasticity and ability to reside just about anywhere. If you look at its current distribution in East Asia, there must be numerous places about the world where it would happily establish.

Are wildlife doomed?

- (Dr. Heath)** In short: no. Ticks have been around since the time of dinosaurs and have evolved with mammals. Mammal (or bird) extinctions are more likely to be at the hand of humans than at the mouthparts of ticks. Although *Haemaphysalis longicornis* has a wide host range, it seems to be very rare that it causes death. Usually, a short term appetite loss and transient anemia, but vertebrates bounce back by producing new blood cells quickly and regaining appetite. Where deaths occur with this tick, it is usually because an animal has encountered a large number of ticks all at once and suffers an anaphylactic shock. Most animals adapt over time and develop a degree of immunity to ticks, although this is usually not generalized, but occurs more at previous bite sites where inflammatory reactions reduce blood flow or induce scarring. Remember that the USA has a large tick fauna and much wildlife still.