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Asian Longhorned Tick and Theileria Orientalis Ikeda: Current Thoughts and Understandings

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Asian Longhorned Tick

The Asian longhorned tick (fig. 1), *Haemaphysalis longicornis (Acari: Ixodidae)*, was first detected in the United States in 2017. It was first identified on a sheep in New Jersey and has since been identified in 19 states (USDA 2021): Arkansas, Connecticut, Delaware, Georgia, Indiana, Kentucky, Massachusetts, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia (fig. 2).

The Asian longhorned tick (ALT) is a small tick (3-4 millimeters as adults) that can reproduce by parthenogenesis, or asexual reproduction, meaning that only females are required to reproduce. females can lay up to 3,000 eggs at a time.

Figure 1. Asian longhorned tick (Photo courtesy of Alex Crumble, Eastwood Laboratory, Virginia Tech.)

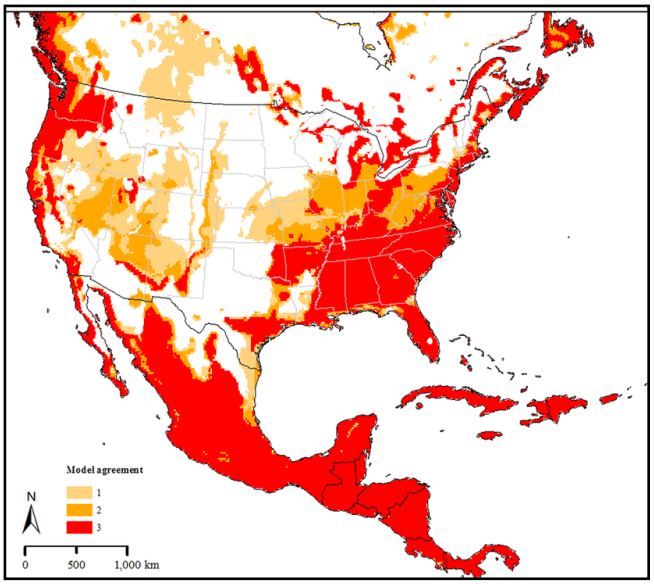

Figure 2. Potential spatial distribution of the newly introduced longhorned tick, *Haemaphysalis longicornis* in North America. (Reprinted from Raghavan [2019].)

Asian Longhorned Tick Environment

Within its geographic distribution of North America, ALT is found in specific microenvironments in epically large numbers. ALT favors low-lying swampy areas, wooded areas, and taller grass (fig. 3). Fields where these factors come together tend to have enormous numbers of this tick. During periods of high tick activity, one's lower pants legs can become covered with ticks after simply walking through the pasture. The tick has been found on different species of hosts, including

sheep, goats, dogs, cats, horses, cattle, chickens, black bears, red and grey foxes, groundhogs, striped skunks, white-tailed deer, elk, opossums, raccoons, Canada geese, barred owls, great horned owls, brown boobies, mice, and red-tailed hawks (USDA 2021).

Figure 3. Ticks on the head of fescue grass. (Photo courtesy of Eastwood Laboratory, Virginia Tech.)

Asian Longhorned Tick on Cattle

ALT infestations on cattle can be dramatic. Figure 4 shows the ear of a yearling calf that is heavily infested with ALT. This photo shows that all stages of the life cycle of the tick can be present on a single animal at a given time. Large numbers of ALT can be found in the ears, groin, and vaginal areas of infested animals. Not all cattle will have such striking infestations, and within herds some cattle are more heavily infested than others. Tick burdens on the animals seem to be directly correlated to the number of ticks on the pasture that the cattle currently inhabit.

Figure 4. Yearling with ALT infestation.

Current research at Virginia Tech is exploring the impact of ALT on cattle production and measurable production losses. In most cases, cattle infested with ALT do not appear to suffer significant clinical disease. Cattle infested with ALT may look unthrifty, cows and bulls may have reduced body condition, or calves may have decreased weight gains, but these issues may not be attributable solely to ALT. In these cases, the herds are likely suffering from a concurrent problem such as sub-optimal nutrition, simultaneous parasitism, or disease. However, ALT problems can occur in well-managed herds with no other concurrent issues. In very rare cases, infestation of ALT may be heavy enough to cause a primary problem, such as anemia. If you have cattle that are noticeably unwell, it is unlikely that ALT is the only problem present. Cattle producers should work closely with their veterinarian to rule out other possible health issues affecting their herd.

Diagnosis and Treatment

Proper identification of tick species can help pinpoint health issues in a cattle herd. Ticks can be collected from animals and placed in alcohol for preservation, and these samples can be submitted for identification. Cooperative Extension services, state departments of agriculture, and agriculture departments at land-grant universities can all help identify tick species.

Tick Control: ALT appears to be susceptible to most of the chemical products commonly used to treat other species of ticks on cattle. Some products containing Macrocyclic lactones and organophosphates are both labeled for other species of ticks. Pyrethroids have also been recommended to treat cattle that are parasitized with ALT. Macrocyclic lactones are a class of endectocides that consist of Dectomax®, Eprinex®, Cydectin®, LongRange®, and Ivomec®. Dectomax®, Eprinex®, and Cydectin® pour-ons are all effective in treating animals with ticks. Organophosphates come as concentrates that can be mixed up in sprays or applied to backrubbers. Pyrethroid pour-ons like CyLence®, Saber®, Ultra Boss®, and StandGuard® are not labeled for tick control but can be used to treat the ticks. A limitation of the mentioned pour-on treatments is that they may not reach high enough concentrations in the areas that the tick clusters, such as the ears and groin. Many fly tags containing macrocyclic lactones, organophosphates, or pyrethroids are labeled for ticks and appear effective against ALT.

If cattle continue to graze pastures that are heavily infested, they may become reinfected as drug levels provided by treatment drop off. The length of time that any of these products will keep cattle from becoming reinfected is not currently known but will likely vary based on the particular product and the level of ticks on the pasture.

Treatment of pastures is possible but not generally recommended. Carbaryl (Sevin®) is one example of a product approved to treat pastures for ticks. Before treating pastures, you should consult an expert in your area and only treat those areas with the densest tick populations.

Other helpful recommendations for controlling ticks are to fence cattle away from swampy areas and woods and keep pastures clipped short. Unfortunately, these recommendations can negatively impact beef cattle production and may outweigh the benefits of tick control. Furthermore, wildlife can drop ticks off as they pass through pastures, reintroducing ticks into previously treated and/or fenced areas. Successful treatment and control programs for ALT will require an integrated approach. A single application of any of these products is unlikely to provide complete control of ALT.

ALT and *Theileria Orientalis*

The most important impact of ALT on cattle herds is its role in the spread of the blood protozoan parasite *Theileria orientalis*. Theileriosis is a relatively new disease in the U.S. Due to the emerging nature of the disease, information is rapidly changing, and myths abound. The following information represents the best understanding of the disease at this time. Theileriosis was first recognized in the U.S. in 2018. The disease had previously been identified in numerous Pacific Rim countries. Japan, Korea, China, Vietnam, New Zealand, and Australia all had theileriosis diagnosed in their cattle herds prior to its identification in the U.S.

Theileria orientalis genotype Ikeda is the *Theileria* organism of importance in the U.S. There have been other species of *Theileria* present in the U.S. for years. Chief among these species is *Theileria orientalis* genotype Chitose. While the other genotypes of *Theileria orientalis* can infect cattle, they do not cause any clinical signs of disease. *Theileria orientalis* Ikeda is the first Theileria species in the U.S. recognized to cause clinical disease in cattle.

Theileria has been diagnosed in nine states: Virginia, West Virginia, North Carolina, Tennessee, Kentucky, Pennsylvania, Maryland, New York, and Kansas. *Theileria* is spreading rapidly in the eastern U.S. and will likely continue to spread. The spread of *Theileria* and ALT are very closely related, and ALT is assumed to be the most important route of transmission from one bovine animal to another.

Both *Theileria orientalis* Ikeda and the bacterium *Anaplasma marginale* cause infectious bovine anemia. Both tick-borne organisms are red blood cell parasites that lead to the destruction of the cell, causing anemia in clinically diseased animals. The clinical signs of theileriosis are the same as for anaplasmosis. It is impossible to distinguish between the two diseases based solely on clinical signs, and a laboratory diagnosis is required. Just like anaplasmosis, most of the cattle that test positive are asymptomatic carriers that do not show clinical signs of disease. It is possible that animals may be infected with both anaplasmosis and theileriosis concurrently. Only a small number of animals that are infected with *Theileria orientalis* Ikeda will ever show clinical signs of disease.

Diagnosis and Clinical Signs

Clinical signs associated with theileriosis are caused by anemia. Affected cattle are slow, depressed, exercise intolerant, and may have labored breathing. Most commonly, a cow is found off by itself and is reluctant to move very much. If animals are not checked often, the producer may find dead cows without having noticed clinical signs (fig. 5). Many of these clinical signs are not unique to theileriosis. Cattle suffering from clinical theileriosis will have pale (white) or jaundiced (yellow) mucous membranes.

Diagnosis of theileriosis can be made with a polymerase chain reaction (PCR) blood test. To determine if a bovine should be tested for *Theileria*, a blood sample should first be collected and checked to see if the animal is truly anemic. This can be done by a veterinarian in their office by running a packed cell volume (PCV). If the animal is anemic (PCV<= 20), then blood can be submitted to a lab to test for *Theileria* and *Anaplasma*. Once established in a herd, *Theileria* often spreads through most of the cattle in the herd. Most of these animals will never develop clinical theilerosis or become sick from *Theileria*. It is important to correctly determine which animals to test and correctly interpret those test results. There are three possible interpretations of a positive test result:

1. Cow is infected with *Theileria* but is perfectly normal.
2. Cow is infected with *Theileria* but suffering from another disease.
3. Cow is infected with *Theileria* and is suffering from theileriosis.

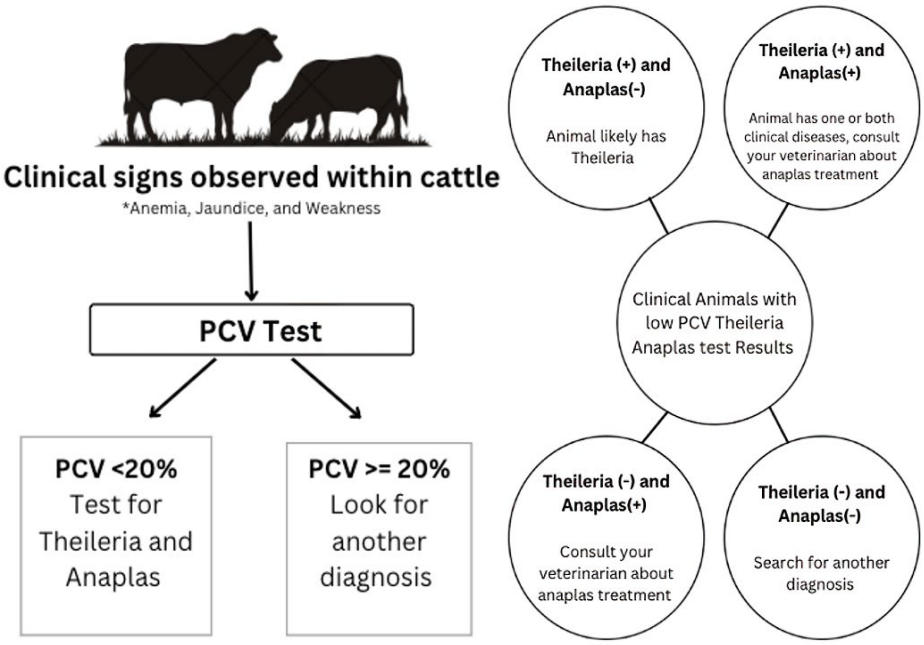

Figure 5. Clinical signs observed within cattle and the next testing steps.

Many herds infected with *Theileria orientalis* Ikeda never suffer any clinical signs. For herds that do have animals with clinical theileriosis, the most common presentation is 1%-5% of the cows show clinical signs over a 2-3 week period. After this initial outbreak, there are not often long-term problems. In very rare cases, a higher percentage of cattle will be affected. Thus far, almost all the animals diagnosed with theileriosis have been adult cows, with calves being rarely clinical. Almost all the cases that have been documented have been in beef cattle, though clinical cases have been reported in dairy cattle. This probably has to do with the percentage of dairy cattle to beef cattle on pasture in the areas *Theileria* has been reported. Dairy cattle have been affected in other countries.

Treatment

There is no drug approved for treatment of *Theileria orientalis* Ikeda in the United States. There is an approved drug in New Zealand, but it has a 180-day slaughter withdrawal. This drug is currently being evaluated for potential approval in the U.S. With the lack of an approved drug, many treatments have been tried but there is no evidence that any of them has a direct impact on the disease. Currently, the best recommendation to deal with cattle affected with clinical theilerosis is to provide supportive care. For animals with severe, acute anemia, the supportive care includes gentle handling, providing easy access to feed, water and shade, and perhaps utilizing adjunct products such as vitamin and mineral antioxidant supplements. If applicable or identified by the owner as fully needed, transfusions can be attempted under the supervision of a veterinarian. Producers should consult their veterinarian for individual treatment recommendations.

There are limited data conducted in Virginia on the effects of infection with *Theileria* on production (Guynn et al.). The data that are available do not suggest that subclinical infection with *Theileria* has any impact on production measures. Table 1 shows the average daily weight gain of yearlings that were either PCR-positive or PCR-negative for *Theileria*. These yearlings were in a large dry lot being fed a total mixed ration (TMR) with a desired rate of gain of 3-3.5 pounds per day. None of the animals showed any signs of sickness due to *Theileria* during the 125 days they were monitored.

Table 1. The average daily weight gain (ADG) of yearlings based on positive or negative PCR test results of *Theileria*.

Effect of subclinical infection of *Theileria* on ADG in yearling cattle p=0.506	
Theileria test status	ADG (pounds per day)
Theileria + (n=37)	3.08
Theileria – (n=169)	3.13

Prevention

Preventing Infection of a Herd

The rapid, wide distribution of *Theileria* through the eastern U.S. demonstrates the difficulty in preventing the spread of *Theileria* into beef herds. Many producers have herds that are already infected with *Theileria* and are unaware of it. Prevention of *Theileria* in a herd should be centered around controlling ticks and avoiding the purchase of test-positive cattle. ALT is the most likely cause of introduction of *Theileria* into a herd. Despite implementation of preventive measures, it is still very possible for a herd to become infected with *Theileria*. Table 2 shows the infection level in a Virginia herd in 2019 and again in 2022. This herd consisted of approximately 200 spring calving cows and 200 fall calving cows. During this time, the herd was closed, except for the addition of breeding bulls, and needles were changed between cows when administering injections.

Table 2: Infection level in a Virginia herd in 2019 and 2022.

Year	Test results
2019	0% positive (0/112 positive)
2022	>90% positive (all adult cows tested)

Preventing Spread of Infection Within a Herd

To try to stop the spread of *Theileria*, every effort must be made to prevent the spread of blood between cattle. Once again, ALT is likely the most common cause of the spread from animal-to-animal. With the high level of infestation of ALT in many herds, controlling ticks well enough to prevent the spread of *Theileria* is difficult. In herds with lower levels of ALT infestation, adequate tick control may be possible and may help prevent the spread of *Theileria*. Utilizing clean needles and disinfecting surgical instruments will limit transmission within the herd and may mitigate the spread of other bloodborne diseases as well.

Producers should discuss *Theileria* with their herd health veterinarian. The priority that *Theileria* and ALT management should take in herd health should be determined so that appropriate management steps can be considered.

Conclusion

Theileriosis is a new, emerging disease spreading rapidly in the eastern United States. Producers should be aware of *Theileria*, but neither producers nor consumers should be alarmed by it. Most cattle that are infected with *Theileria* will not show any signs of clinical diseases. Some producers will experience deaths of 2-5 cows. Rarely will there be a severe clinical disease with 10-25 cattle affected. Research suggests that once cattle are infected with *Theileria*, cattle will be infected for life. Only a small percentage of producers will lose cattle to theileriosis. Currently, there is no approved drug for the treatment of theileriosis, and treatment consists of supportive care.

The Asian longhorned tick is rapidly spreading through much of the East Coast of the United States. These ticks have a strong presence in some pastures. There may be a heavy ALT infestation on cattle, although these ticks may rarely be involved with the clinical disease in cattle. Treatment of cattle includes external parasiticide usage, which is typically effective, but cattle may become reinfected when treatment wears off. The primary importance of ALT in cattle is its role in the spread of *Theileria*.

References

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