

Emerging Risk Notice

January 2021

Theileria orientalis Ikeda

Key Points

- *Theileria orientalis* is a tickborne protozoon that infects red and white blood cells and causes bovine infectious anemia. Clinical signs of theileriosis are similar to anaplasmosis in cattle and include anemia, jaundice, and weakness. Native genotypes of *T. orientalis* in the United States are usually nonpathogenic; however, the virulent *Theileria orientalis* Ikeda genotype was identified in the United States.³
- The last documented theileriosis case in the United States was a beef herd in Missouri infected by *T. buffeli* in 2000.^{7,13}
- In August 2017, seven cattle from a herd in Albemarle County, Virginia died after showing signs of illness including severe lethargy and weakness. The cattle ranged in age from 3 months to 13 years and included bulls, cows, and steers.³
- In September 2017, an additional cow from the same herd was examined for weakness, icterus, and anemia. Anaplasmosis was suspected, however, testing revealed an infection with *T. orientalis*, which prompted quarantine of the affected farm and further investigation including a foreign animal disease investigation initiated in December 2017.³
- During the investigation, Virginia-Maryland College of Veterinary Medicine (CMCVM) identified the blood-borne parasite as the virulent *T. orientalis* Ikeda genotype.¹⁵
- A recently published study reported that *Haemaphysalis longicornis* ticks, also known as the Asian longhorned tick (ALHT), were found in all sampled habitat types and were the most abundant of ticks collected from the environment at the *T. orientalis* index farm in Virginia. A relatively high percentage (~13%)

of questing *H. longicornis* nymphs from this site were positive for *T. orientalis* Ikeda, further implicating this tick in the pathogen transmission on the index farm.¹¹

- A recent preliminary report of an experimental transmission trial performed by USDA's Agricultural Research Service (ARS) in conjunction with the Virginia Tech Animal Laboratory Services (ViTALS) laboratory has confirmed vector competence of *H. longicornis* for *T. orientalis* Ikeda in the United States.¹⁶
- *T. orientalis* Ikeda has been documented in cattle since September 2017 in at least 28 counties in Virginia and three counties in West Virginia.^{14,15} The National Veterinary Services Laboratories (NVSL) confirmed the initial two cases in Virginia. The remaining cases have been confirmed by blood smears and polymerase chain reaction (PCR) along with sequence and phylogenetic analyses at Kansas State Veterinary Diagnostic laboratory, Virginia-Maryland College of Veterinary Medicine, and the ViTALS laboratory.³
- Some species of *Theileria* (*T. parva* and *T. annulate*) are reportable to the World Organisation for Animal Health (OIE); however, *T. orientalis* is currently not reportable to the OIE.¹⁷
- There are no known risks to human health.

Potential Economic Concerns

- *T. orientalis* Ikeda has caused major economic losses in Asia, New Zealand, and Australia primarily as a result of deaths or illness in beef and dairy cattle and ongoing milk losses.³
- An analysis of one dairy affected by *T. orientalis* in New Zealand in 2014 estimated the loss at more than \$400 per cow.¹⁹

Epidemiology

- *Theileriae* are obligate intracellular protozoan parasites that infect wild and domestic animals in the Bovidae family worldwide. They are transmitted by ixodid ticks.¹

- *T. orientalis* has a global distribution, but countries impacted by clinical oriental theileriosis (OT) are Australia, New Zealand, Japan, Korea, China, and Vietnam.²
- *T. orientalis* has 11 genotypes identified (named: Chitose or type 1, Ikeda or type 2, buffeli or type 3, types 4 to 8, and N1 to N3). Genotypes Chitose and Ikeda are associated with severe disease.²
- *T. orientalis* Ikeda infections have been reported to cause mortality in up to 5% of infected cattle. Pregnant heifers and calves are particularly susceptible to the infection.⁷
- Additional factors, such as breed or age, may increase disease susceptibility in cattle. In Japan, beef cattle of the Wagyu breed have been reported to be less susceptible to clinical infections. However, the effect of age has not been well studied.⁷
- Clinical findings include weakness, reluctance to walk, and abortion. Physical examination may reveal mucosal pallor, pyrexia, and elevated heart and respiratory rates.^{1,2,8}
- Cattle that recover from *Theileria* infections usually become carriers.²
- In Asia, Australia, and New Zealand, the primary tick vector for *T. orientalis* Ikeda is *H. longicornis*.³ The ALHT is native to eastern Asia and has spread to Australia, New Zealand, and several Pacific islands.^{4,5,9}
- ALHT are three-host ticks, with larvae, nymphs, and adults feeding on a wide range of wild and domestic species, including birds, white-tailed deer, companion animals, livestock, equines, and humans. Once introduced into suitable habitats, ALHT populations can increase rapidly, partly due to exhibition of multiple genetic types including being parthenogenetic and bisexual.^{4,12,9}
- As of August 2020, ALHT has been identified in 15 States (Arkansas, Connecticut, Delaware, Kentucky, Maryland, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia). USDA keeps a publicly accessible website that maintains information on ALHT and maps of the current tick distribution in the U.S.¹²

Transmission

- Cattle are thought to become infected within 3 weeks of being placed on pasture containing infected tick vectors. Disease is seen more frequently when naïve animals are introduced into an endemic area or when infected animals are introduced to a herd where a competent vector is present.²
- *Theileria* sporozoites (the infective stage) are transmitted to susceptible animals during tick feeding through the tick's saliva.²
- When a *T. orientalis* parasite infects a nymphal tick feeding on a naïve cow, the cow can become infective to ticks in 10 days.²
- *Theileria* mature within the tick after it has been attached to the host for 48-72 hours. If environmental temperatures are high, infective sporozoites can develop in ticks on the ground (off host) and may enter the host within hours of tick attachment.²
- Ticks can remain infected on a pasture for up to 2 years under favorable conditions.²

Diagnostic Testing

- *T. orientalis* can be diagnosed by various methods such as microscopy, serology, molecular techniques, and xenodiagnosis. PCR, the gold standard, can detect infection in cattle up to 2 weeks before the infected erythrocytes can be observed under a light microscope. To identify the Ikeda genotype, more advanced molecular diagnostics like real time semi-quantitative and quantitative PCR assays designed to detect that genotype need to be used.⁷
- Serological tests (i.e., immunofluorescence assay [IFA] and enzyme-linked immunosorbent

assay [ELISA]) are available for detection of *T. orientalis*; however, these assays are currently not genotype-specific and may also cross-react with other *Theileria* species.^{1,7}

Treatment

- Currently, there is no approved treatment for *T. orientalis* infection.

Prevention

- Virginia Cooperative Extension has produced a document titled “Managing the Asian Longhorned Tick: Checklist for Best Management Practices for Cattle Producers.” The document can be accessed at: <https://www.pubs.ext.vt.edu/ENTO/ENTO-382/ENTO-382.htm>¹⁸
- Vector control and herd management is important to reduce the rapid spread of *T. orientalis* outbreaks. Management practices such as keeping grasses short, regularly inspecting cattle for ticks, using pesticide-impregnated ear tags, and keeping cattle out of wooded areas can reduce disease spread.^{9, 18, 19}
- Control of this tick species with acaricides alone is challenging due to a limited host attachment period, as the ticks spend most of their time in the environment and not on their biological host.⁷
- Restriction of grazing cattle movements may assist in reducing exposure to infected *H. longicornis*.⁷ Amidines, organophosphates, and synthetic pyrethroids may be effective in controlling this tick species in the field over a limited time period.⁶
- No available acaricides in the U.S. contain a label claim against *H. longicornis*.¹⁰ Isoxazolines and macrocyclic lactones ectoparasiticides that are approved in the U.S. for similar ectoparasites are also approved in other *H. longicornis* endemic countries with an indication for that tick species.¹⁰
- Any FDA-approved drug products not labeled for *H. longicornis* are considered extra-label use.¹⁰

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