

FOCUS ON

The Asian Longhorned Tick: Assessing Public Health Implications for Ontario



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Introduction

The Asian longhorned tick (*Haemaphysalis longicornis*) is native to eastern Asia. In 2017, the first Asian longhorned tick population in North America was reported from a farm (ticks collected from sheep and the environment) in Hunterdon County, New Jersey, United States (US).¹⁻³

Through examination of archived specimens, Asian longhorned ticks were detected in the USA in 2010 (West Virginia, tick collected from a white-tailed deer) and 2013 (New Jersey, from a dog).¹⁻³

Presumably, Asian longhorned ticks arrived in the US through animal importation, such as importation of infested horses in California (1983 and 1985) and New Jersey (1969).⁴⁻⁷

Current Situation and Objectives

As of August 1, 2019, there are no reports of Asian longhorned ticks in Canada. The closest area to Ontario that Asian longhorned ticks have been detected is central Pennsylvania.³

The primary objectives of this report are to:

- raise awareness of invasive Asian longhorned ticks
- assess the public health implications of Asian longhorned ticks for Ontario

Methods

A Focus On is a document that provides an overview of a public health topic without systematically reviewing the literature on that topic. Public Health Ontario (PHO) reviewed the literature (PubMed) relating to Asian longhorned ticks, including applicable grey literature (up to January 16, 2019), to prepare this Focus On. We initially screened titles and abstracts for relevant information (e.g., hosts, pathogens, distribution); full text articles were reviewed and relevant information extracted from each article.

Results: Distribution

Asian longhorned ticks are native to China, Japan, South Korea, North Korea and Far Eastern Russia (Primorsky Krai Region).⁸

By the early 1900s, Asian longhorned ticks spread to Australia and New Zealand through the cattle trade with Japan.⁸ In addition, these ticks inhabit New Caledonia, Fiji and possibly other Western Pacific islands.

Asian longhorned ticks occur primarily in temperate regions, but also occur in subtropical and tropical climates. These ticks can adapt to cold environments, with 50% mortality at -15°C for nymphs and -14°C for adults; however, their cold-hardiness varies by population.⁹⁻¹¹

Asian longhorned ticks do not tolerate arid conditions.⁹ Throughout its distribution, these ticks commonly occupy coastal regions with higher relative humidity; e.g., in Australia, they are restricted to coastal temperate and subtropical regions.^{8,12}

North America Distribution - Current

Asian longhorned ticks were first discovered in New Jersey in 2017; since this time, additional ticks have been found in Arkansas, Connecticut, Delaware, Kentucky, Maryland, New York, North Carolina, Pennsylvania, Tennessee, Virginia and West Virginia.³ The distribution of these ticks in the US is likely

much wider, given that tick surveillance efforts vary by state and county. To date, the Asian longhorned tick has not been detected in Canada.

North America Distribution - Predicted

Using climatological, ecological and tick presence data throughout its distribution, modelling indicates much of eastern North America is suitable for Asian longhorned ticks.¹³ The probability of tick presence was highest in areas with:

- mean annual temperature $\approx 12^{\circ}\text{C}$ (high probability range: $0^{\circ}\text{--}20^{\circ}\text{C}$)
- maximum temperature of the warmest month $\approx 22^{\circ}\text{C}$ (high probability range: $18^{\circ}\text{--}35^{\circ}\text{C}$)
- annual precipitation just above 1,000 mm (high probability range: 500–3,000 mm)
- temperate and subtropical deciduous forests¹³

Rochlin (2018)¹³ noted that habitats most suitable for Asian longhorned ticks are in southwestern and eastern portions of Ontario. In the Eastern Hemisphere, these ticks occur up to 45°N ; in Canada, that latitude would include most of southern Ontario, south of Ottawa.^{5,8}

Hosts: What Do Asian Longhorned Ticks Feed On?

Asian longhorned ticks are three-host ticks, with larvae, nymphs and adults each requiring a blood meal. These ticks are generalists, feeding primarily on what is most abundant in the environment.¹⁴ Larvae and nymphs parasitize birds and small mammals and adults parasitize large animals, such as cattle and horses. In the US, surveillance has detected Asian longhorned ticks on:

- companion animals (i.e., dog, cat, horse)
- livestock (i.e., cattle, goat, sheep)
- wildlife (e.g., coyote, gray fox, groundhog, white-tailed deer, raccoon, Virginia opossum)
- humans³

Asian longhorned ticks can adapt rapidly to the local fauna, contributing to their ability to survive and spread quickly. Infestation of hosts with wide geographic ranges, such as birds, means these ticks have the opportunity to spread rapidly over long distances. In New Zealand, Asian longhorned ticks have been detected on wild and domestic birds (e.g., mynas, domestic and wild ducks, kiwis and house sparrows).^{15,16} In South Korea, there are records of these ticks from migratory birds (e.g., thrushes and kingfishers);¹⁷ whereas house sparrows and Australian magpies are hosts in Australia and geese and doves are hosts in China.^{18,19} In 2018, it was reported through [media](#) that wildlife rehabilitators collected Asian longhorned ticks from a red-tailed hawk in Virginia.

Seasonal Activity

In temperate populations, each female adult Asian longhorned tick lays approximately 2,000 eggs in a grassy field during the early summer, where larvae emerge and develop in the late summer, climbing the grass to await passing hosts. Blood-fed larvae will fall off the host and develop into nymphs in the fall. Nymphs will spend the winter in leaf litter, blood-feed on hosts and develop into adults in the spring.²⁰

In temperate areas outside of North America, Asian longhorned ticks survive the winter as nymphs in leaf litter or as adults in leaf litter or on hosts.^{9,21} In temperate North America, it is postulated that these ticks overwinter as unfed nymphs; however, the overwintering strategy is yet to be confirmed. The timing and length of activity for different development stages vary depending on temperature, humidity, host availability and day length;⁹ activity periods are shortened in cooler, temperate regions compared to tropical and sub-tropical regions (for life cycle variations, see Fonseca et al. (2018)).²⁰

A Unique Reproductive Strategy among Ticks

Asian longhorned ticks are capable of parthenogenesis (asexual reproduction), enabling females to produce eggs without fertilization from males.

Without the need for mating, female Asian longhorned ticks can spread rapidly and reach high densities. In asexual populations, males are rare (e.g., 1 in 400 ticks being male in Australia) or absent (e.g., New Zealand).²² In New Jersey, there was a single male specimen detected among the more than 1,100 ticks collected from the index farm, meaning this invasive population is parthenogenetic.¹ Sexual reproduction also occurs in populations of eastern Asia.²³

Identifying Asian Longhorned Ticks

Asian longhorned ticks are reddish-brown. Adult females are 2.7–3.4 mm long and 1.4–2.0 mm wide, whereas nymphs are 1.8 × 1.0 mm and larvae are 0.6 × 0.5 mm ([Figure 1](#)).⁸ These ticks lack patent markings or coloration patterns. When completely blood fed, adult females measure up to 10 mm long.

Two other tick species closely related to Asian longhorned ticks (*H. longicornis*) occur in North America; the rabbit tick (*Haemaphysalis leporispalustris*) and the bird tick (*Haemaphysalis chordeilis*).²⁴ *H. leporispalustris* parasitizes rabbits (e.g., eastern cottontail rabbits) and hares (e.g., snowshoe hares), but will also parasitize ground-dwelling birds. *H. chordeilis* normally parasitizes birds (e.g., grouse). Both species are widely distributed in Ontario and are uncommon ectoparasites of humans.

Any *Haemaphysalis* tick collected from a host other than a rabbit or hare or bird should be considered an Asian longhorned tick until expertly identified.

From 2000 through 2015, the Ontario public have submitted approximately 30,000 ticks to PHO and 10 have been identified as *H. leporispalustris*; no *H. chordeilis* have been identified.

Haemaphysalis juxtakochi is the only other *Haemaphysalis* tick found in the Americas, occurring from Mexico to Argentina. *H. juxtakochi* are rare in the United States and, to our knowledge, have never been reported in Canada. Researchers found *H. juxtakochi* on a white-tailed deer in Ohio (1993) and on migratory birds (e.g., thrushes, warblers) in Louisiana (2009–2010).²⁵⁻²⁷

For additional information on identification of *Haemaphysalis* ticks, including the Asian longhorned tick, in the Western Hemisphere, please refer to Egizi et al. (2019).²⁸

Figure 1. Dorsal view of an Asian longhorned tick nymph and adult female



Assessing Public Health Threats in Humans

No pathogens of public health significance have been detected in Asian longhorned ticks collected in the US to date; however, these ticks are known vectors of severe fever with thrombocytopenia syndrome virus (SFTSV), which has infected humans in eastern Asia ([Table 1C](#)).^{29,30} SFTSV is an emerging, hemorrhagic, tick-borne pathogen in eastern Asia, where case fatality rates range from 6%–30%.³¹⁻³³ The

distribution of SFTSV cases is correlated with bird migratory routes in China, Japan and South Korea, showing that birds transport these ticks over long distances.³⁴

The capability of Asian longhorned ticks to transmit North American pathogens (e.g., species of *Anaplasma*, *Babesia*, *Borrelia* and *Ehrlichia*) to either humans or animals has not been demonstrated.

Anaplasma phagocytophilum, *Borrelia afzelii*, *Ehrlichia chaffeensis* and *Rickettsia japonica* have been detected in field-collected Asian longhorned ticks throughout eastern Asia, but demonstration of the tick as a vector is lacking (Table 1A).³⁵⁻³⁸ Similarly in China, Asian longhorned ticks harbour several *Rickettsia* species (e.g., *Rickettsia heilongjiangensis*), with no existing evidence of transmission to humans.³⁹

Conversely, Thogoto virus (THOV) was recently isolated from an Asian longhorned tick in Japan, with further studies demonstrating the tick as a vector of THOV (Table 1C).⁴⁰ THOV is primarily a pathogen of cattle and sheep, but humans can be accidental hosts.^{41,42} In addition, research in Japan indicates these ticks are a cause of galactose- α -1,3-galactose (α -gal) or a red meat allergy.⁴³

Aside from STFSV and THOV, Asian longhorned ticks have not been demonstrated as a vector of any other human pathogens to date.

Table 1A. Selected bacterial pathogens detected in field-collected Asian longhorned ticks outside of North America

Pathogens*	Asian longhorned tick collection locale	Representative susceptible hosts	Demonstrated as a vector?***	Selected references
<i>Anaplasma bovis</i>	China, N. Korea, S. Korea	Cattle, deer	No	35,39,44
<i>Anaplasma capra</i> ***	China	Goats, humans (rare), sheep	No	45
<i>Anaplasma central</i>	China, Japan, S. Korea	Cattle	No	39,44,46
<i>Anaplasma marginale</i>	Australia, Japan	Cattle	No	46
<i>Anaplasma ovis</i>	China	Goats, sheep	No	47
<i>Anaplasma phagocytophilum</i>	China, Japan, N. Korea, S. Korea	Humans, multiple mammals	No	36,44,48
<i>Anaplasma platys</i>	S. Korea	Dogs	No	49

Pathogens*	Asian longhorned tick collection locale	Representative susceptible hosts	Demonstrated as a vector?***	Selected references
<i>Bartonella grahamii</i>	N. Korea	Humans (rare), rodents	No	35
<i>Bartonella henselae</i>	N. Korea	Cats, humans	No	35
<i>Borrelia afzelii</i>	China, S. Korea	Humans	No	51,52
<i>Borrelia garinii</i>	China	Humans	No	51
<i>Ehrlichia canis</i>	China, S. Korea	Dogs	No	49
<i>Ehrlichia chaffeensis</i>	China, S. Korea	Humans, multiple mammals	No	38
<i>Ehrlichia ewingii</i>	S. Korea	Humans	No	49
<i>Rickettsia heilongjiangensis</i>	China	Humans	No	39
<i>Rickettsia japonica</i>	Japan, S. Korea	Humans	No	37,50
<i>Rickettsia raoultii</i>	China	Humans	No	39
<i>Rickettsia rickettsii</i>	China, S. Korea	Dogs, humans	No	37,39

* This is not an exhaustive list of pathogens detected in Asian longhorned ticks.

** Denotes whether or not researchers have demonstrated that these ticks are vectors of this pathogen during transmission studies and pathogen detected in field-collected ticks.

*** Provisional name

Table 1B. Selected apicomplexan (single-celled parasites) pathogens detected in field-collected Asian longhorned ticks outside of North America

Pathogens*	Asian longhorned tick collection locale	Representative susceptible hosts	Demonstrated as a vector?***	Selected references
<i>Babesia bigemina</i>	China	Cattle	No	53
<i>Babesia bovis</i>	China	Cattle	No	46
<i>Babesia canis vogeli</i>	China	Dogs	No	54
<i>Babesia divergens</i>	China	Cattle, humans (rare)	No	48
<i>Babesia gibsoni</i>	China, Japan	Dogs	Yes	54,55

Pathogens*	Asian longhorned tick collection locale	Representative susceptible hosts	Demonstrated as a vector? **	Selected references
<i>Babesia major</i>	China	Cattle	Yes	46
<i>Babesia microti</i>	China	Humans, multiple mammals	No	54
<i>Babesia motosi</i>	China	Sheep	No	56
<i>Babesia ovata</i>	China, Japan	Cattle	Yes	57
<i>Babesia</i> sp. BQ1 (Lintan)	China	Goats, sheep	Yes	58,59
<i>Hepatozoon canis</i>	Japan	Dogs	No	60
<i>Theileria annulata</i>	China	Camels, cattle	No	56
<i>Theileria luwenshuni</i>	China	Deer, goats, sheep	Yes	56,61
<i>Theileria orientalis</i> (includes <i>T. sergenti</i> and <i>T. buffeli</i>)	Australia, China, Japan, New Zealand, S. Korea	Cattle	No	56,62,63
<i>Theileria uilenbergi</i>	China	Goats, sheep, deer	No	64
<i>Theileria sinensis</i>	China	Goats, sheep	No	56

* This is not an exhaustive list of pathogens detected in Asian longhorned ticks.

** Denotes whether or not researchers have demonstrated that these ticks are vectors of this pathogen during transmission studies and pathogen detected in field-collected ticks.

Table 1C. Selected viral pathogens detected in field-collected Asian longhorned ticks outside of North America

Pathogens*	Asian longhorned tick collection locale	Representative susceptible hosts	Demonstrated as a vector? **	Selected references
Huaiyangshan virus (HYSV)	China	Humans	No	68
Khasan virus (KHAV)	Russia	Unknown	No	69
Powassan virus (POWV)	Russia	Humans	No	65
Severe fever with thrombocytopenia syndrome virus (SFTSV)	China, Japan, S. Korea	Humans	Yes	30,34,39,70

Pathogens*	Asian longhorned tick collection locale	Representative susceptible hosts	Demonstrated as a vector?***	Selected references
Thogoto virus (THOV)	Japan	Cattle, goats, humans (rare), sheep	Yes	40,67
Tick-borne encephalitis virus (TBEV)	S. Korea	Humans	No	66

* This is not an exhaustive list of pathogens detected in Asian longhorned ticks.

** Denotes whether or not researchers have demonstrated that these ticks are vectors of this pathogen during transmission studies and pathogen detected in field-collected ticks.

Assessing Veterinary Health Threats

No pathogens of veterinary health significance have been detected in Asian longhorned ticks collected in the United States to date. Nonetheless, these ticks are a serious biting pest, especially for livestock and wildlife. Tick burden on livestock can reach high densities on animals, causing blood loss, anemia, weight loss, weakness and death. In addition, infestations can lead to reduced milk production and hide damage in cattle and poor quality wool in sheep.^{8,9,71,72} Asian longhorned ticks are considered the primary tick species associated with companion animals in Japan and South Korea.⁷³⁻⁷⁵

Species of *Anaplasma*, *Babesia*, *Bartonella*, *Ehrlichia* and *Theileria* have been detected in field-collected Asian longhorned ticks throughout eastern Asia, but demonstration of the tick as a vector is lacking (Table 1A, 1B). These ticks are demonstrated vectors of pathogens to animals, specifically several species of *Babesia*, *Theileria luwenshuni* and THOV (Table 1B, 1C). Asian longhorned ticks, while not confirmed vectors of *T. orientalis*, are considered a vector in New Zealand since this is the only tick associated with *T. orientalis*-infected cattle in the country.^{9,76}

Monitoring for Asian Longhorned Ticks in Ontario

Since Asian longhorned ticks have not been detected in Canada and no human pathogens have been reported from tick populations in the US, there are no immediate risks to public health in Ontario. The public health importance of these ticks may evolve as the tick's range expands, altering existing vector-pathogen-host dynamics. Ontario has a robust active and passive tick surveillance program, with the means to detect Asian longhorned ticks. Continued tick surveillance in Ontario is key to assessing the future risks posed by Asian longhorned ticks.

Public Health Ontario, along with public health units (PHUs), will continue to monitor for Asian longhorned ticks through passive and active surveillance.

PHO monitors ticks submitted through the province's passive tick surveillance program, including adventive or invasive species (e.g., lone star tick, *Amblyomma americanum*).⁷⁷ Ticks from human sources can be submitted by the public through their physician or respective PHU (depending on PHU of residence).^{78,79} In addition, Asian longhorned ticks can be detected through the blacklegged tick (*Ixodes scapularis*) active surveillance program, where tick dragging is performed to collect ticks from the environment in the spring and fall.⁸⁰ Ontario's tick surveillance program will allow for quick detection of Asian longhorned tick incursions, making it easier to assess and mitigate public health threats. Additionally, the public can submit digital images of ticks to the web-based tick identification platform called [eTick](#).

Given that Asian longhorned ticks have the potential to have a substantial impact on Ontario's companion animals, livestock and wildlife if eventually established in Ontario, PHO will work with its veterinary health partners (e.g., Ontario Veterinary College, University of Guelph) to continue to monitor for these ticks.

For more information on PHO's active and passive tick surveillance, please refer to: [Technical report: Update on Lyme disease prevention and control](#), [Tick dragging: standard operating procedure](#) and [Blacklegged tick surveillance in Ontario: a systematic review](#). There are preventive measures that can be taken to protect the public from Asian longhorned tick bites.

Protecting Yourself from Tick Bites

Preventive measures can be taken to protect yourself from tick bites, including bites from Asian longhorned ticks. This includes covering up during outdoor activities, wearing an appropriate repellent (e.g., products containing DEET), inspecting yourself for ticks after outdoor activity and drying clothes on high heat. For further advice on personal protection, please see the [Ministry of Health and Ministry of Long-Term Care website](#).

People concerned about Asian longhorned ticks on their companion animals or livestock should contact their veterinarian.

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