

Exotic Ticks

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Importance

Tick bites can be irritating or painful. They also provide entry points for secondary bacterial infections and some parasites, including screwworms where they are endemic. Heavy infestations can damage hides and may cause anemia, particularly when the animal is in poor condition. *Rhipicephalus appendiculatus*, the brown ear tick, damages the ears of cattle and other livestock, and some species of ticks can cause tick paralysis. However, the most important risk with the introduction of exotic ticks is that they may carry the agents of exotic diseases such as heartwater or bovine babesiosis.

Some important and widely distributed tick species identified as high risk for introduction into North America include *Amblyomma variegatum*, *A. hebraeum*, *Rhipicephalus (Boophilus) microplus* and its close relative *R. australis*, *R. (Boophilus) annulatus*, the *R. appendiculatus/R. zambeziensis complex*, and *Ixodes ricinus*. However, there are also many other ticks exotic to North America that could be problematic if introduced. A recent example is *Haemaphysalis longicornis*, the Asian longhorned tick. *H. longicornis* was first recognized on the East Coast of North America in 2017, though investigations subsequently found evidence for its presence in older archived samples, including one from West Virginia in 2010. This tick, which probably originated in Asia, was previously established in Australia, New Zealand and some Pacific islands, feeds on many domestic animals and wildlife, and has now been found in a number of U.S. states

Disease risks

Ticks can act as vectors for various bacterial, viral and protozoal pathogens. In some cases, a newly introduced tick might be an additional vector for pathogens already present in a country, potentially expanding their host range and/or increasing their prevalence. More importantly, an exotic tick may simultaneously introduce a novel pathogen. This is most likely to occur when the tick acts as a biological vector, though pathogens carried mechanically can also be transported if they survive long enough. The establishment of *A. variegatum* in the Caribbean is an example of a tick introducing a new disease. Around 1828, this tick colonized the island of Guadeloupe, probably via a shipment of infested cattle. Because these ticks carried *Ehrlichia ruminantium*, the agent of heartwater, heartwater also became established on Guadeloupe. *A. variegatum* gradually spread from one Caribbean island to another. However, heartwater only became endemic on some of these islands; others were colonized with uninfected ticks.

Even when an introduced tick does not carry any disease agents, its presence may increase the risk that a new pathogen will become established at a later time. This situation occurred in New Caledonia. *R. australis* is a vector for *B. bovis*, one of the agents of bovine babesiosis. Uninfected *R. australis* ticks became established in New Caledonia after being transported there on equids in the 1940s. However, bovine babesiosis was absent until 2007, when *B. bovis* was introduced in cattle that had been immunized with a live babesiosis vaccine, and these cattle infected the tick vector.

Species Affected and Life Cycle

Ticks vary in host specificity. Some tend to feed mainly on a few closely-related animal species, though they will occasionally infest other hosts. Others are generalists, and occur on a wide variety of wildlife and domestic animals. The ability of a tick to successfully complete its life cycle may also differ with the host. A high proportion of *R. microplus*, for example, will mature and lay fertile eggs when fed on cattle, but the number of adult females and egg-laying success are much lower when this species is placed on sheep.

Ticks are usually transported to new areas on animals. Livestock, which are commonly traded and moved around the world, have been responsible for many introductions, but pets and humans can also transport ticks. Many ticks also attach to birds, and may be transported long distances on migratory species.

Three-host ticks

Three-host ticks generally feed on a different host at each stage of their life (larva, nymph and adult), dropping to the ground between blood meals to develop to the next stage. Adult ticks also require a blood meal before sexually maturing, mating and laying



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their eggs in the environment. Although larvae and nymphs sometimes feed on the same host species as adult ticks, it is common for them to be found more often on smaller animals.

A. variegatum, *A. hebraeum*, *I. ricinus* and *R. appendiculatus* are examples of 3-host ticks. These ticks have life cycles of varying lengths. *A. variegatum*, *A. hebraeum* and *I. ricinus* usually take more than a year, and up to a few years, from larva to egg laying. *R. appendiculatus* can produce one to three generations of ticks in a year, depending on the environment, and high tick burdens may build up on an animal in a relatively short time. *Haemaphysalis longicornis*, which is also a 3-host tick, has both parthenogenetically and sexually reproducing populations. This tick can, thus, develop a new population of ticks from a single fed female tick. Parthenogenetic populations of *H. longicornis* appear to reproduce faster.

One-host ticks

One-host ticks usually spend all three stages of their life on a single animal. Female ticks deposit their eggs in the environment. The hatched larva locates a host and feeds, then molts to become a nymph and an adult on the same animal, unless it is involuntarily removed. Adults also feed and mate on the animal before the female tick drops off for egg laying. Questing larvae of one-host ticks, like the larvae of some three-host ticks, may survive long periods in the environment without feeding; however, larvae that do not find a host eventually die of starvation. *R. microplus* and *R. annulatus*, which are one host-ticks, can complete a life cycle in 3 to 4 weeks, which can result in heavy tick burdens on some animals.

Geographic Distribution

Exotic ticks may be either widespread or limited in their distribution. Very widely distributed ticks, such as *R. microplus*, have a higher probability of being introduced, simply due to their prevalence. Some exotic ticks, such as *A. variegatum*, *A. hebraeum*, *R. annulatus*, *R. microplus* and *R. appendiculatus*, are adapted to the tropics and subtropics. In contrast, *I. ricinus* is restricted to cool, relatively humid, shrubby or wooded areas. Whether an introduced tick becomes established only temporarily in a location or persists long term depends not only on whether it finds suitable host(s), but whether the new location has a suitable climate. For example, a tick species adapted to the tropics might survive and feed on animals in a northern area for a time, but it is likely to persist only until the arrival of winter.

Two of the ticks at high risk for (re)introduction to the U.S. are *R. annulatus* and *R. microplus*, which were eradicated from this location by a program to eliminate bovine babesiosis. They both still exist in Mexico and South America, and would be expected to successfully reestablish themselves in the U.S. if reintroduced. Thus, there are extensive efforts to restrict them to a permanent quarantine zone in the U.S. along the Mexican border.

Identification

Some exotic ticks are more readily recognized than others. *Amblyomma variegatum* and *A. hebraeum*, for example, are large, ornate, variegated ticks. Ticks in other genera, such as *Rhipicephalus* and *Ixodes*, have no ornamentation and are less distinctive, and may be readily missed or confused with endemic tick species.

Exotic ticks may be identified at least to the genus level using tick keys. Identification to the species level can be difficult, and ticks should be submitted to an expert for identification or confirmation. Ticks that are submitted in 70% ethanol can be examined morphologically, and if necessary, tested by PCR. Both male and female ticks, and ticks from different life stages, should be submitted if they can be found.

Control

Disease reporting

Veterinarians who encounter or suspect the presence of an exotic tick should follow their national and/or local guidelines for disease reporting. In the U.S., state or federal authorities must be notified immediately.

Prevention

Measures used to exclude exotic ticks from a country include pre-export inspections to certify that animals are free of ectoparasites, quarantines upon entry, and treatment with acaricides.

Three-host ticks, which spend at least 90% of their life in the environment, can be very difficult or impossible to eradicate once they become established in an area. While programs to eradicate a 3-host tick were occasionally successful in a limited location (e.g., various *A. variegatum* eradication programs on Caribbean islands), lasting elimination of such ticks has been rare. Eradicating one-host ticks may be more feasible, especially when they display strong host specificity. However, these programs can also require considerable resources and may be constrained by the presence of alternate domestic animal or wildlife hosts. An example of a successful one-host tick eradication program was the elimination of *R. microplus* and *R. annulatus* from the U.S. in order to eliminate bovine babesiosis. This program, which took about 40 years (1906 to 1943), included acaricide treatment of both cattle and equids, and was facilitated by these ticks' preference for feeding on cattle. It was, nevertheless, expensive, as well as controversial at the time, and it was complicated in Florida by the presence of white-tailed deer as alternate tick hosts.

In endemic regions, acaricides are often used to control ticks on animals. However, they do not prevent the animal from becoming reinfested. Use of these agents can lead to the development of acaricide resistance in ticks, and may also have other adverse environmental effects, including incidental effects on other arthropods. Other control measures include pasture rotation, environmental modification to make sites less attractive to ticks, physical

removal of ticks from an animal, the use of relatively tick-resistant animal breeds, and other strategies. Tick vaccines against various species are under investigation, and two vaccines were commercialized for *B. microplus*. These two vaccines had limitations, including the need for frequent boosters, and were not a commercial success. One has now been withdrawn and the other has limited availability.

Public Health

Tick bites can be irritating or painful, and the wound may become infected. *Amblyomma* spp. cause particularly large wounds and can be difficult to remove. Exotic ticks can sometimes transmit diseases such as African tick bite fever and tick-borne encephalitis to humans.

Internet Resources

[Hard Ticks from the University of Edinburgh](#) (photographs)

[United States Department of Agriculture \(USDA\) Animal and Plant Health Inspection Service \(APHIS\)](#)

[University of Bristol. Tick Identification Key](#) (for ticks of veterinary importance).

[World Organization for Animal Health \(WOAH\)](#)

[WOAH Terrestrial Animal Health Code](#)

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