Look Out for the Lone Star Tick

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On March 28th of this year, the Morbidity and Mortality Weekly Report (MMWR) of the Center for Disease Control and Prevention (CDC) announced the recent discovery of a new tick-borne disease, Heartland virus disease. The vector is the Lone Star tick, *Amblyomma americanum* (Fig. 1). The Lone Star tick has been identified as a probable or confirmed vector of 6 infectious diseases that affect humans and/or animals of the United States: tularemia (*Francisella tularensis*), human monocytic ehrlichiosis (*Ehrlichia chaffeensis*), canine granulocytic ehrlichiosis (*E. ewingii*), Panola Mountain Ehrlichia, Cytauxzoonosis (*Cytauxzoon felis*) and Heartland Disease (Heartland Disease virus) (Table 1). Four of the agents cause zoonotic disease: *Francisella tularensis*, *Ehrlichia chaffeensis*, *E. ewingii*, and Panola Mountain Ehrlichia. At this time, Heartland Disease virus is only known to cause disease in humans. Cytauxzoonosis (*Cytauxzoon felis*) only causes illness in cats.

Table 1. Infectious Diseases Transmitted by *Amblyomma americanum*, “Lone Star Tick,” in the United States

<table>
<thead>
<tr>
<th>Disease Agent</th>
<th>Reservoir Animals</th>
<th>Susceptible Hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ehrlichia chaffeensis</em></td>
<td>white-tailed deer, coyote, domestic dog, domestic goat?</td>
<td>human, domestic dog</td>
</tr>
<tr>
<td><em>Ehrlichia ewingii</em></td>
<td>domestic dog, coyote?</td>
<td>human, domestic dog</td>
</tr>
<tr>
<td>Panola Mountain Ehrlichia</td>
<td>domestic goat?, white-tailed deer?</td>
<td>human, domestic dog</td>
</tr>
<tr>
<td><em>Cytauxzoon felis</em></td>
<td>bobcat, domestic cat?, Florida panther?</td>
<td>domestic cat, captive wild cats</td>
</tr>
<tr>
<td><em>Francisella tularensis</em></td>
<td>multiple animals, particularly rabbits/hares and rodents</td>
<td>human, many animals including domestic dog and cat, horses, livestock</td>
</tr>
<tr>
<td>Heartland virus</td>
<td>??</td>
<td>human</td>
</tr>
<tr>
<td>STARI*</td>
<td>??</td>
<td>human</td>
</tr>
</tbody>
</table>

*STARI = Southern Tick Associated Rash Illness – the infectious agent for this disease has not been identified.

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Francisella tularensis was the first discovered as early as 1911, followed by C. felis in 1976 and E. chaffeensis in 1986, E. ewingii in 1992, STARI disease in the early 1990s, Panola Mountain Ehrlichia in 2006, and Heartland virus in 2012. Although the discovery of Cytaxzoa felis occurred in 1976 it was not until 2010 that the Lone Star tick was proven to be its primary vector. Prior to 2010 the American Dog tick, Dermacentor variabilis, was incriminated as the most important vector tick for C. felis. With the increasing number of human/zoonotic infectious diseases transmitted by Amblyomma americanum, there is now a strong interest in understanding this tick and identifying its range and habits.

Human and animal risks for the diseases transmitted by the Lone Star tick are increasing because the abundance of A. americanum is increasing within many areas of its long established range and its range is currently expanding. Until recent years, the Lone Star tick had been considered a tick of only southern and southeastern states (Fig. 5). In July 2011, the CDC's distribution map of the Lone Star tick showed the tick is now as far north as Maine (Fig. 6).

Amblyomma americanum is a 3-host hard tick. Phylogenetically, it lies in the family Ixodidae (hard ticks), which includes Ixodes, Dermacentor, and Rhipicephalus ticks (Fig. 2). Hard ticks have a scutum – the scutum of the male tick covers almost the entire body and prevents the male from becoming very swollen when feeding - the scutums of the female and nymphal ticks only partially cover their bodies (mouth parts region) and female and nymphal ticks become very swollen (engorged) with blood during feeding. An adult female A. americanum tick can be easily identified by the single white spot on its back (“Lone Star Tick”), which is still visible in the engorged tick (Fig. 3). The nymph and adult male ticks have variegated patterns on their backs and adult male and nymphal ticks might be difficult for the inexperienced viewer to differentiate from nymphal and male ticks of the Dermacentor or Rhipicephalus genera (Fig. 4).

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As a 3-host tick, each stage (larva, nymph, or adult) of the Lone Star tick feeds and then falls off of its host (Fig.4). The fed larval and nympha stages molt to their next stage while on the ground. After molting, they find a new host for feeding again. It typically takes 2 years and sometimes 3 years for an *A. americanum* tick to complete its life cycle from egg to fed adult and most of its life is spent on the ground molting, inactive, or questing for a host. *Amblyomma americanum* is considered a nondiscriminate feeder and each of its stages, larva, nymph or adult, feeds on many different animal species from small birds to large mammals. The tick is an aggressive host quester and considered a real nuisance to people. The bites of *A. americanum* adults result in painful wounds inflicted by the ticks' long mouth parts (Figs. 1 through 4). Adding insult to injury, if the bite does not transmit an infectious disease, a component of the tick’s saliva can cause an allergic reaction to consumed red meat in some people.

Lone Star ticks are most commonly found in 2nd growth woodland with dense undergrowth (e.g., newly reforesting areas), frequently at the interface of grassland/meadow with forest. Surveillance studies performed in southern states and in Nebraska have found that the adult and nymph ticks quest for food most actively April through June. During the hot summer months their activity decreases. But, it is possible in southern states to find questing adult and nymphaal ticks all year long, but with fewer found during the hot summer months and during the coldest winter months. The larvae of *A. americanum* begin feeding during the summer months and continue feeding into autumn. The feeding and questing activities of all species of ticks are influenced by climate and outdoor temperature and thus the active questing periods of *A. americanum* residing in the northern states of its range may be different than those of ticks in southern states. As yet, no studies have reported the questing behavior of this tick in northern states. Winter survival occurs with fed larvae, unfed or fed nymphs, and unfed adults - these ticks emerge in the spring to continue their life cycles. Adult males die soon after mating and adult females die after laying eggs.

The primary factors attributed to the increasing abundance and the geographic dispersion of the Lone Star tick are the white-tailed deer, the coyote, and the wild turkey. Each of these animal species is a common host for *A. americanum* ticks. All three species have multiplied and spread across the Unites States in the last half of the 20th century. The white-tailed deer is incriminated as the most important cause and the deer prefer the same newly forested habitat as *A. americanum*. White-tailed deer, coyotes, and wild turkeys have not only been spreading across the country, they are increasingly present in suburban and urban environments. Before the 1920s, white-tailed deer and turkey populations dropped precipitously in northeastern and southern states due to commercial and sustenance hunting. Population management practices initiated in the 1930s and 1940s returned deer and wild turkey populations back to and beyond their original sizes, respectively. Between 1973 and 1993, the number of white-tailed deer increased 3-7 fold in southern and southeastern states. White-tailed deer and wild turkeys have been spreading westward and northward throughout the country as they repopulate. Coyotes originally were native only to western prairie states, but are now found throughout (Continued on page 4)
the United States. Coyotes were not seen in southern states east of the Mississippi River until after the 1960s. The first coyote reporting in New York was not until 1925.

As would be expected, the geographic distribution of *A. americanum* is expanding in a similar pattern to the range expansions of white-tailed deer, coyotes, and wild turkeys. The current CDC map of the distribution of the Lone Star tick in the United States was made in July 2011 (Fig. 6). Prior to this map, the CDC’s mapped distribution of *A. americanum* in the United States.
States restricted the tick to southeastern/southern United States westward to Oklahoma. The tick was not shown to be established in Iowa, Ohio, mid and northern New York and Pennsylvania, mid and northern Illinois and Indiana, or the far northeastern Atlantic coastal states (Fig. 5). The CDC’s July 2011 map indicates the Lone Star tick has moved northward and westward and is now established all through the states of the Atlantic coast including Maine, and is present in the Midwest as far north as Iowa and touching the southern border of Wisconsin. Recent evidence shows *A. americanum*’s range is expanding northward from Midwestern states into southern North Central states. The Michigan State University Extension website states that *A. americanum* is “known to occur throughout southern Michigan”. In Minnesota and Wisconsin, the numbers of reported adult and nymph Lone Star ticks increases each year. Minnesota and Wisconsin Lone Star ticks previously have always been considered to have fallen off of migrating birds from southern states and not from established tick colonies. But, in southern Wisconsin, questing adult and nymph ticks have now been found by “flagging” for ticks in Dane County. It is not known if *A. americanum* is truly established in any of these 3 northern states because no larvae have yet been found and larvae are needed to confirm the presence of an established colony. As reports of these ticks are becoming more numerous each year, particularly from southern Wisconsin it is speculated that *A. americanum*’s range has expanded northward into southern Wisconsin. It is expected the tick will be able to survive in Minnesota and Wisconsin because it is surviving in northeastern states.

The distributions of the infectious diseases transmitted by the Lone Star tick will not necessarily parallel the tick’s range. Other factors also influence disease prevalence, e.g., abundance/presence of animal reservoirs, presence of susceptible hosts. The geographic distribution of human monocytic ehrlichiosis likely will mimic that of *A. americanum*’s range because the white-tailed deer is a reservoir host for *Ehrlichia chaffeensis*. In fact, *E. chaffeensis*, which is endemic in southern states and Missouri, does appear to be spreading northward with *A. americanum. Amblyomma americanum* adult ticks PCR-positive for *E. chaffeensis* have been found in Connecticut and Rhode Island. In 2012, of 18 confirmed human cases of *E. chaffeensis* infections in Wisconsin, there were several patients that had no travel history outside of the state. It is possible these several patients were infected in Wisconsin. There is currently no documented evidence that other infectious pathogens transmitted by the Lone Star tick are spreading outside their known endemic areas. However, it should not be surprising if this does occur because the reservoir animals for each of these diseases are widespread throughout the United States, except for possibly the bobcat reservoir for *C. felis*, which is believed to be of low density in the agricultural areas of the Midwest and southern Minnesota and Wisconsin.

The Lone Star tick, *Amblyomma americanum* is a proven vector for a number of human and veterinary infectious diseases in the United States. The latest identified disease, Heartland Disease, was just described in 2012. The tick’s range is expanding northward into northern Midwestern states, into north central states and into far northeastern Atlantic states. White-tailed deer, coyotes, and wild turkeys are considered responsible for spread of the Lone Star tick. It is suspected the infectious diseases transmitted by *Amblyomma americanum* will be seen in future years with increasing frequency outside the tick’s well known distribution in southern and southeastern states.

**Selected Bibliography**


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Website April 2014 – Lone Star tick (*Amblyomma americanum*)/Insects and Arthropods/ Diagnostic Services at Michigan State University