Tick-Borne Infections Council of North Carolina, Inc.

NEWSLETTER 2022, Volume 2

Quote: "One thing the U.S. has done right is the creation of five Vector-Borne Disease Regional Centers of Excellence in 2017 to assist academic researchers who are developing new and improved methods for monitoring populations of disease-causing arthropods and state health departments that are directing the day-to-day surveillance work. It's a great policy mechanism that bridges the academic and public worlds, noting that a five-year grant originally funded the Centers of Excellence through 2021, and new money will continue the program through 2027.
--- Leslie Mertz, PhD, in "U.S. Policy Leaves Country Vulnerable to Arthropod-Borne Diseases," (click to see more information). To learn what the US is not doing well, read the scientific paper, "Riding the Wave: Reactive Vector-Borne Disease Policy Renders the United States Vulnerable to Outbreaks and Insecticide Resistance," Journal of Medical Entomology, tjab219, https://doi.org/10.1093/jme/tjab219, 22 January 2022.

Highlights…

- **The Original Scientific Description of the Lone Star Tick**
- **Isolation of Heartland Virus from Lone Star Ticks, Georgia, USA, 2019**
- **Even the tigers and lions in zoos have tick-borne diseases**
- **Asian Longhorned Tick Marches into 17 States**
- **Asian Longhorned Ticks Transmit Heartland Virus in the Lab**
- **Areas of Alaska may soon be suitable for the Pacific blacklegged tick**
- **Risk of tick-borne diseases twice as high for forestry workers in NY state as indoor comparison group**

- **Basil essential oil with rock dust appears effective as a tick repellent**
- **The underbelly of the Lyme disease diagnostic world- one example**
- **Spotted fever caused by *Rickettsia parkeri* in Brazil**

Special notice:

COVID-19 vs. Tick-Borne Diseases: How to Tell the Difference

People are getting outside more due to the pandemic. The link below is to an article from New York but is pertinent to NC. We would add that here ticks are active all year, so even in the winter on a warmer day it is possible to contract a tick-borne infection (TBI).

Knowledge or evidence of a tick bite is not as easy as this article would imply. Many people that contract a TBI have no knowledge or physical evidence of a tick bite that is noticeable. Also, respiratory symptoms in Covid may not always occur quickly so no respiratory symptoms can't necessarily be used to distinguish TBIs from Covid at the onset of illness. Sometimes, respiratory symptoms with Covid may be minimal.

There are cases now reported in the medical literature of late treatment for TBIs due to this confusion. We at TIC-NC are aware of several such cases. (Comments by the newsletter editor M. Herman-Giddens)

There are no state Vector-borne Disease Working Group meeting dates for 2022. Check with us for future dates if they occur.

Location when held:
Office of the Chief Medical Examiner Photo ID required.
4312 District Drive
Raleigh, NC 27607

Link to Notice to Medical Providers from the State Department of Public Health on Lyme Disease and Rickettsial Diseases: "Annual Update on Diagnosis and Surveillance for Tickborne Diseases".

The state issues one letter yearly on the reported tick-borne infections and related issues. Please see the homepage of our website to access. www.tic-nc.org.

To look at the (state) NCDHHS's tick data, go to epi.dph.ncdhhs.gov/cd/diseases/ticks.html.

From the CDC

Where To Find CDC Case Definitions and their Statement that the Surveillance Case Definitions Are "not to be used as the sole criteria for establishing critical diagnosis"

Case Definition and Report Forms

The surveillance definition of Lyme disease was revised in January 2022.

See https://www.cste.org/resource/resmgr/ps/ps2021/21-ID-05_Lyme_Disease.pdf for the rationale behind the changes.

- ndc.services.cdc.gov/case-definitions/lyme-disease-2022/
- www.cdc.gov/lyme/resources/lymediseasecasereportform.pdf (for public health officials' use)

The surveillance definition of Rocky Mountain spotted fever/spotted fever rickettsiosis was revised in 2020.

- ndc.services.cdc.gov/case-definitions/spotted-fever-rickettsiosis-2020/

Note: Surveillance case definitions establish uniform criteria for disease reporting and should not be used as the sole criteria for establishing clinical diagnoses, determining the standard of care necessary for a particular patient, setting guidelines for quality assurance, or providing standards for reimbursement.

Accessed and copied 14 September 2019.

Note: By the *former* CDC definition, six counties had confirmed cases of Lyme disease in two persons who had not traveled out of the county for 30 days after their tick exposure. **Therefore, these counties were endemic for Lyme disease by the former CDC definition: Wake, Guilford, Haywood, Alleghany, Buncombe, and Wilkes.** Counties with one case of locally acquired Lyme disease were: Cleveland (2008), Wilson (2009), Pitt (2009), Carteret (2009), Gates (2011), Perquimans (2011), Rowan (2013), Union (2013), Caldwell (2013), Franklin (2014), Stanley (2014), Duplin 2014.

TIC-NC Talks and Materials Distributed

Brochures/booklets:
Our Asheville volunteer has mailed many booklets out to NC's school superintendents and some mayors.

Consulting: Assisted Head Start regional office with tick safely information for their manual.

Proclamation: Lyme Disease Awareness, Asheville, NC

Radio: Speaker for show on ticks and TBIs, West Jefferson, NC. WKSK 580

Report from the State or Vectorborne Disease Work Group meeting

None. Earlier reports are available online and in our prior newsletters.

From North Carolina: State tick research and/or reports

The 2020 tick-borne disease surveillance summaries are now complete.

NC Surveillance Summary Reports

- Ehrlichiosis Surveillance Summary: 2020 (105 cases confirmed & probable)
- Spotted Fever Group Rickettsiosis Surveillance Summary: 2020 (190 cases confirmed & probable)
- Lyme Disease Surveillance Summary: 2020 (272 cases confirmed & probable)
- Tick Borne Disease Surveillance Summaries: 2019 (PDF, 1MB)

NC TBIs 2020 final probable/confirmed, NC reported cases

Ehrlichiosis	105
Spotted Fever Rickettsiosis	190*
Lyme disease	272

**Note: the new definition of SFR is stricter, hence the lower numbers than NC has had in the past.*

TIC-NC Activities

Employee Wellness Day at UNC, March 18

After almost 3 years it was strange and exciting to once again have a booth and interact with people who have had trouble with ticks and those who wanted to keep that from happening. We got some new members, gave away products Insect Shield generously donated to us as prizes, talked to many people, and handed out a lot of booklets and other materials.

TIC-NC volunteers Marcia E. Herman-Giddens and McGregor Bell

Below: Seen on the door of the Jordan Lake Visitor Center off of H'way64 https://www.ncparks.gov/jordan-lake-state-recreation-area/home.

North Carolina and South

The Original Scientific Description of the Lone Star Tick (Amblyomma americanum, Acari: Ixodidae) and Implications for the Species' Past and Future Geographic Distributions

Amblyomma americanum L. is an important vector in North America originally described by Linnaeus based on Pehr Kalm's 1754 report. While Kalm's 'Travels into North America' is well known, his 1754 report remains obscure. Some authors were skeptical that Kalm referred to A. americanum because he encountered them at sites farther north outside of the species' range. However, the details in the 1754 report leave no doubt that Kalm described lone star ticks. In this historical review, we provide support for Kalm's identification using a modern translation of his 1754 report and other sources. We also delineate distributional changes of lone star ticks from the pre-colonization era to the present and interpret them in the context of large-scale anthropogenic changes in the landscape. In this framework, the lone star tick's current northward expansion is a recolonization of their former range. Extensive deforestation and extirpation of their principal host species, white-tailed deer, led to A. americanum's disappearance from the northern parts of its range by the 20th century. Subsequent recolonization by second-growth forest and increases in white-tailed deer populations by the mid-20th century is now allowing A. americanum to reclaim its former range. These changes in the land appear to be the driving force behind A. americanum's present expansion. Understanding this species' history and the factors contributing to its current expansion will enable better predictions about its future distribution and potential to transmit human pathogens. Rochlin I, et al. *Journal of Medical Entomology*, 59, 2, pp 412–420, https://doi.org/10.1093/jme/tjab215.

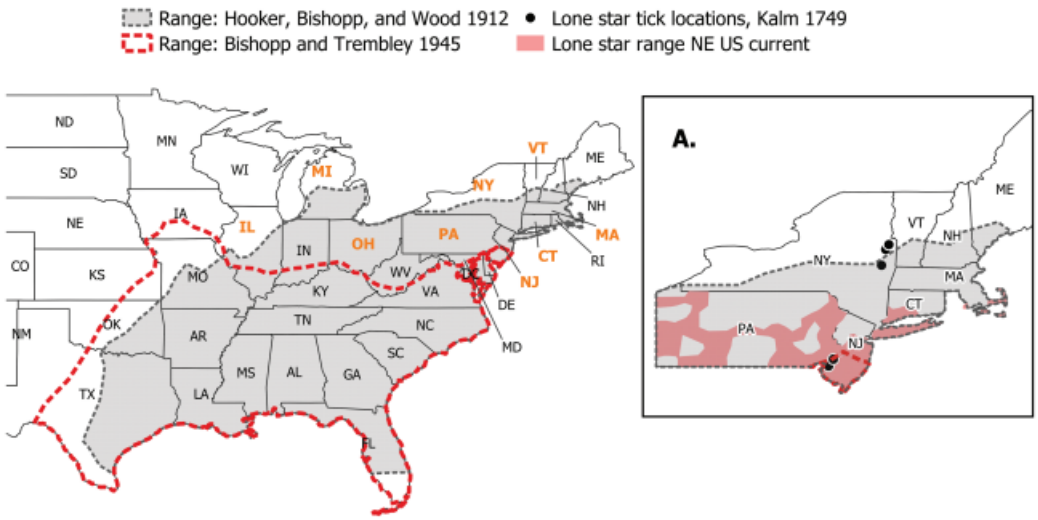


Fig. 1. Historical range of lone star (A. americanum) ticks in the US. Maps for the 1912 range (grey background) and the 1945 range (red dashed line) were georeferenced and digitized from the respective publications (Hooker et al. 1912, Bishopp and Trembley 1945). Northern states with A. americanum records from 18th to early 20th centuries are indicated with bold orange text. Inset A. Current distribution (1990–2020) of A. americanum in northeastern US (pink background). Georeferenced and digitized from (Schulze et al. 2011, Molaei et al. 2019, Pak et al. 2019). Kalm's locations (black dots) and the historical ranges are also indicated. All data were processed using QGIS v. 3.10.8. Cartographic state boundary files were downloaded from US Census Bureau (www.census.gov).

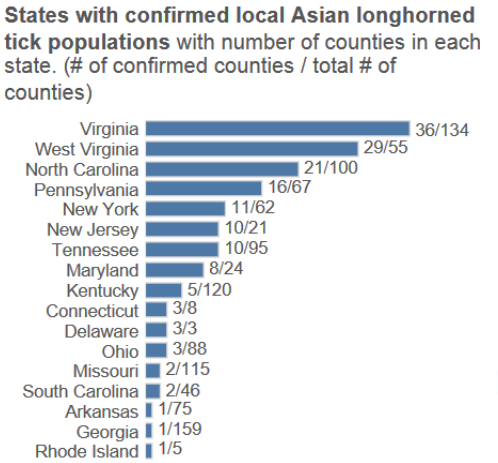
Asian Longhorned Tick Marches into 17 States

By RHONDA BROOKS February 10, 2022

What kind of pest can move into a country and sweep across a third of it in only four years? The Asian longhorned tick (ALT), for one.

A native of southeast Asia, the tick's presence was formally recognized in the U.S. in 2017 in New Jersey. The tick was found on an imported Icelandic sheep and confirmed by the Rutgers Center for Vector Biology.

By last September, the U.S. Centers for Disease Control (CDC) had confirmed the tick (Haemaphysalis longicornis) is now present in at least 17 states: Arkansas, Connecticut, Delaware, Georgia, Kentucky, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia.



Many Tick Species

Ticks are a growing concern for public health officials. There are about 90 different tick species in the U.S., and tick bites and tick-borne diseases more than tripled here between 2004 and 2016, according to the CDC. There were more than 70,000 cases of diseases spread by ticks in the U.S. in 2016 alone.

So how concerning is the ALT, relative to other tick species in the U.S.?

Researchers are unsure because the tick is relatively new here. The good news is while the ALT can carry a virus that does contribute to human hemorrhagic fever in eastern Asia, there have been no pathogens associated with ALT in the U.S., according to researchers at John Hopkins Medicine.

Two ticks in their nymphal stage. At left, the longhorned tick, native to Asia and a recent arrival in the U.S. At right, the lone star tick, found in the eastern United States and in Mexico.
Graham Hickling, Center for Wildlife Health, University of Tennessee

However, the ALT can be a parasitic problem in birds, wildlife, livestock and even dogs and cats. While the ALT has been found in limited numbers on horses, pigs, sheep, goats and chickens, it can cause economic losses via the disease, T. orientalis, in dairy and beef cattle, according to Kevin Lahmers, a veterinary pathologist at Virginia Tech. It also is often present on pasture in large numbers. "It's called hyperendemic. There can be hundreds of ticks on a person 30 to 60 seconds after they get off their ATV after they drive through a field," Lahmers says. "You can find a density of 10 per blade of grass. That's just a little weird, in my opinion, to think about that number of ticks," he adds.

Common Characteristics
Research shows the Ikeda strain of T. orientalis can lead to severe clinical signs and death of up to 5% of affected animals, according to Drs. Kelcey D. Dinkel and David R. Herndon, respectfully, Department of Veterinary Microbiology & Pathology, Washington State University. They reported their findings in a March 2021 article published in Parasites & Vectors.

Common symptoms of T. orientalis in cattle are similar to anaplasmosis and include fever, anemia, jaundice and lethargy, Lahmers reports. However, the majority of cattle that contract the disease appear to be asymptomatic or minimally affected.

“We know that because whenever we find clinical cases, we sometimes see that 75% to 100% of the herd is positive at the time of the first detection of a clinical animal,” he reports. “So, some herds can have it without anyone knowing it.”

Once cattle are infected by the parasite, they often carry a large ALT load.
“The Asian longhorned tick has some things about it that make it challenging to address,” Lahmers says.
One, it reproduces by parthenogenesis, meaning it doesn’t need a mate.

“All of the ticks that have been observed in the United States so far are female. Because it doesn’t have to find a mate to reproduce, it can spread faster,” he says.

High Population Numbers
A single female ALT can create a large population of ticks. It produces 1,000 to 2,000 eggs at one time, according to the USDA Animal and Plant Health Inspection Service (APHIS).

Also, because the ticks reproduce asexually, it appears there's a shortened life cycle rather than a year-long life cycle. “We can see multiple stages – the larva, nymph, and adult – all at the same time on the same animal,” Lahmers explains.

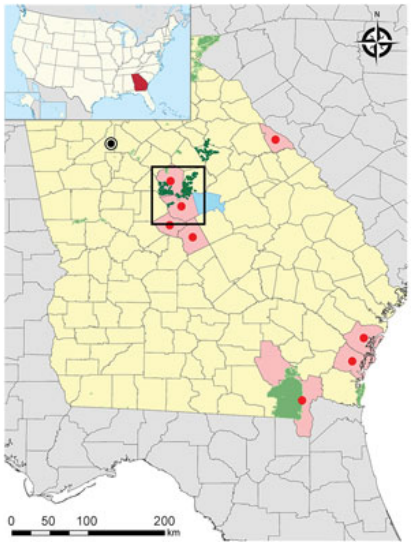

An infestation of Asian Longhorn Ticks. Photo by Joe Deal, North Carolina State University

And then there’s the issue of the sheer number of ticks that Lahmers and veterinarians sometimes see on an animal or in a pasture. The ticks can remain infected on a pasture for up to two years under favorable conditions

There is no effective treatment other than supportive care for clinically ill animals. Tick control, pasture management, and maintaining a good plane of nutrition are important preventive measures that can be implemented, Lahmers says. Currently a PCR test is available on blood or by submitting the spleen of necropsied animals to differentiate the disease from anaplasmosis. If veterinarians or producers suspect the disease in their area, they are encouraged to let their state department of agriculture know.
www.agweb.com/news/livestock/beef/asian-longhorned-tick-marches-17-states

Isolation of Heartland Virus from Lone Star Ticks, Georgia, USA, 2019

Report of a human death and exposure of white-tailed deer to Heartland virus (HRTV) in Georgia, USA, prompted the sampling of questing ticks during 2018–2019 in 26 sites near where seropositive deer were captured and the residence of the human case-patient. We processed 9,294 *Amblyomma americanum* ticks in pools by virus isolation in Vero E6 cells and reverse transcription PCR. Positive pools underwent whole-genome sequencing.



Three pools were positive for HRTV (minimum infection rate 0.46/1,000 ticks) and none for Bourbon virus. Cell cultures confirmed HRTV presence in 2 pools. Genome sequencing, achieved for the 3 HRTV isolates, showed high similarity among samples but marked differences with previously sequenced HRTV isolates.

The isolation and genomic characterization of HRTV from *A. americanum* ticks in Georgia confirm virus presence in the state. Clinicians and public health professionals should be aware of this emerging tick borne pathogen. Romer Y, et al. Emerg Infect Dis. 2022, https://doi.org/10.3201/eid2804.211540.

Ed. note: From Newsweek 3.16.2022: In Georgia there has been one confirmed case that was discovered retrospectively. A patient had died from a mystery infection in 2005. Subsequent analysis showed he had died from the virus, with serum samples showing deer in the region had been exposed since at least 2001. www.newsweek.com/georgia-lone-star-tick-heartland-virus-disease-deadly-1688666.

National Section

Transovarial Transmission of Heartland Virus by Invasive Asian Longhorned Ticks under Laboratory Conditions

The Asian longhorned tick, *Haemaphysalis longicornis*, is an ixodid tick native to Southeast Asia that was reported in the United States during 2017 and has since been found in 17 states. In its native range, this tick is the main vector of Dabie bandavirus (formerly severe fever with thrombocytopenia syndrome virus), the agent that causes severe human illnesses characterized by high fever, thrombocytopenia, leukopenia, and multiorgan dysfunction.

Dabie bandavirus is closely related genetically to Heartland bandavirus (HRTV), an emerging North American virus reported during 2012 after 2 men in Missouri, USA, showed febrile illness with fatigue, thrombocytopenia, and leukopenia after exposure to ticks. Because the current geographic range and the predicted range expansion of invasive *H. longicornis* ticks overlap considerably with human cases of HRTV, including Missouri, this study was designed to assess the ability of this invasive tick species to maintain and transmit HRTV. Raney WR Perry, et al. *Emerging Infectious Diseases*, *28*(3), 726-729. https://doi.org/10.3201/eid2803.210973.

Even the tigers and lions at zoos get tick borne diseases: *Cytauxzoon felis, Ehrlichia ewingii and more*

DETECTION OF VECTOR-BORNE INFECTIONS IN LIONS AND TIGERS AT TWO ZOOS IN TENNESSEE AND OKLAHOMA, USA

Protozoal and bacterial vector-borne infections are frequently diagnosed in domestic felids. However, with the exception of *Mycoplasma haemofelis* and *Cytauxzoon felis*, their occurrence in managed nondomestic felids housed in the United States is largely unknown. Following a case in February 2020 of fulminant cytauxzoonosis in an African lion (*Panthera leo*), EDTA–whole blood samples were collected opportunistically from February 2020 through June 2020 from 34 adult tigers (*Panthera tigris*) and eight adult African lions from the same sanctuary in eastern Tennessee as well as 14 adult tigers from a zoo in southern Oklahoma. Samples were analyzed for *Cytauxzoon felis*, *Bartonella* spp., hemotropic *Mycoplasma*, *Rickettsia* spp., *Anaplasma* spp., *Ehrlichia* spp., *Babesia* spp., and *Hepatozoon* spp. DNA by PCR amplification. All animals were asymptomatic at the time of collection.

None of the Oklahoma animals were positive for vector-borne organisms, but these pathogens were detected in tigers at the Tennessee facility, including *Cytauxzoon felis* (11.8%), "*Candidatus Mycoplasma haemominutum*" (5.9%), and *Ehrlichia ewingii* (2.9%). During the study period, two animals developed clinical signs of cytauxzoonosis and were assessed for vector-borne infections as part of their diagnostic evaluation. This study documents the presence of tick-borne diseases in managed nondomestic felids in the southeastern United States and underscores that ectoparasite control measures should be practiced to minimize exposure of carnivores in managed care. Cerreta AJ, et al. *Journal of Zoo and Wildlife Medicine* 53(1), 50-59, doi.org/10.1638/2020-0199.

Study finds a high diversity of tick-borne bacteria and protozoa across an expanding urban area in the U.S. Great Plains

Effect of Urbanization on Presence, Abundance, and Coinfection of Bacteria and Protozoa in Ticks in the US Great Plains

Urbanization alters components of natural ecosystems which can affect tick abundance and tick-borne disease prevalence. Likely due to these changes, tick-borne pathogen prevalence has increased in many U.S. urban areas. Despite the growing public health importance of tick-borne diseases, little is known about how they are influenced by urbanization in North America, especially in the central U.S. where several pathogens occur at or near their highest levels of incidence nationally.

To determine whether urban development influences tick infection with bacteria and protozoa, we collected ticks at 16 parks across a gradient of urbanization intensity in Oklahoma City, Oklahoma, USA and tested them using a variety of PCR assays. Adult ticks tested positive for *Rickettsia parkeri*, *R. amblyommatis*, *R. rhiphicephali*, '*Candidatus* R. andeanae', *Ehrlichia*

chaffeensis, *E. ewingii*, Panola Mountain Ehrlichia, '*Borrelia lonestari*', *Theileria cervi*, *Babesia* spp. Coco, and *Cytauxzoon felis*. These results indicate the presence of a high diversity of tick-borne bacteria and protozoa across an expanding urban area in the U.S. Great Plains.

Although there appeared to be some risk of encountering tick-borne microorganisms across the entire urbanization gradient, *E. chaffeensis*, *E. ewingii*, and *T. cervi*-infected ticks and microbe diversity decreased with increasing urbanization intensity. We identified a low rate of coinfection between different microorganisms, with coinfected ticks mainly collected from sites in the least-urbanized areas. This study suggests the need for awareness of tick-borne disease risk throughout urban areas in the central U.S. and highlights a need for studies of tick host habitat use and movement in cities. Noden at al. *Journal of Medical Entomology*, tjab228, https://doi.org/10.1093/jme/tjab228.

Risk of tick-borne diseases twice as high for forestry workers in NY state as indoor comparison group

Tick magnets: The occupational risk of tick-borne disease exposure in forestry workers in New York

Outdoor workers, such as forestry workers, are at an increased risk for contracting tick-borne diseases due to their prolonged time spent in tick habitats. Although well studied in Europe, no studies have been conducted with forestry workers in the Northeastern United States since 1990s.

Full-time forestry workers and two comparison groups (volunteer firefighter/first responders and indoor/healthcare workers) within New York State Department of Environmental Conservation Regions 3, 4, 5, 6, and 7 were recruited for this cross-sectional seroprevalence study. Blood draws were conducted to test for antibodies to Lyme, anaplasmosis, babesiosis, and ehrlichiosis. Surveys were administered to determine personal risk factors and protective behaviors.Between November 2020 and May 2021, 256 (105 forestry, 101 firefighter/first responder, and 50 indoor/healthcare) workers participated in this study. Forestry workers had a probability of testing positive nearly twice as high for any tick-borne disease (14%) compared to firefighter/first responders (8%) and to indoor workers (6%); however, this difference was not statistically significant ($P = .140$). Forestry workers were more likely to find embedded ticks on themselves ($f = 33.26$, $P < .0001$ vs both comparison groups) and to have been previously diagnosed with a tick-borne disease ($P = .001$ vs firefighter/first responders, $P = .090$ vs indoor/healthcare workers).

TABLE 2. Number and percentage of study sample testing positive for antibodies to Lyme, Anaplasma, Ehrlichia, Babesia, or any Tick-Borne Disease (TBD)

Tick-Borne disease	Forestry (FOR) (n = 104)	Firefighter/first responder (FF) (n = 101)	Indoor/healthcare (HCW) (n = 49)	Overall *P* value	Pairwise comparison *P* values		
					FOR vs FF	FOR vs HCW	FF vs HCW
Lyme (%)	3 (2.9)	1 (1.0)	1 (2.0)[a]	.8435	.6216	.999	.999
Anaplasma (%)	9 (8.7)	7 (6.9)	0 (0.0)	.1192	.6605	.0578	.0965
Ehrlichia (%)	1 (1.0)	1 (1.0)	0 (0.0)	.999	.999	.999	.999
Babesia (%)	3 (2.9)	0 (0.0)	2 (4.1)[b]	.1434	.2466	.6555	.1067
Lyme, Anaplasma, Ehrlichia (%)	12[c] (11.5)	8 (7.9)	1 (2.0)	.136	.3828	.063	.2723
Any TBD	15 (14.4)[c]	8 (7.9)[d]	3 (6.1)	.176	.140	.137	.999

This pilot study suggests a higher proportion of tick-borne disease risk among forestry workers compared to firefighters/first responders and indoor/healthcare workers with lesser exposure. A larger study to confirm or refute this pilot data could help optimize mitigation/prevention strategies. Roome A, et al. Health Science Reports 2022, doi.org/10.1002/hsr2.509.

Knowledge, attitudes, and behaviors regarding tick-borne disease prevention in Lyme disease-endemic areas of the Upper Midwest, United States

Lyme disease and other tick-borne diseases are a major public health threat in the upper midwestern United States, including Michigan, Minnesota, and Wisconsin…
We conducted a population-based survey in summer 2019 in 48 high-risk counties (those having a five-year 49 average (2013-2017) Lyme disease incidence of ≥ 10 cases per 100,000 persons per year), in Michigan, Minnesota, and Wisconsin.
2,713 surveys were analyzed
98% of the population had heard of Lyme disease
91% perceived it as very or extremely serious
25% perceived tick-borne diseases as very common in their community
68% check themselves thoroughly for ticks most of the time or always
43% use bug repellent on skin or clothing most of the time or always
13% had ever treated their property with a pesticide to kill ticks
3% had ever used devices to apply pesticide to rodents on their property

Willingness to practice tick bite prevention behaviors, however, was estimated to be much higher… Tick checks were more likely to be practiced among participants who perceived tick-borne diseases to be highly prevalent in their community… Participants who had seen information from state health departments were also more likely to practice preventive measures. The most common reported barriers to using any of these methods were forgetfulness, safety concerns, and lack of awareness. Our survey findings shed light on how residents from these Upper Midwest states may adopt tick control and tick bite prevention measures and how public health outreach may be most effective for this population. Beck et al. Ticks and Tick-borne Diseases, https://doi.org/10.1016/j.ttbdis.2022.101925.

Modeling geographic uncertainty in current and future habitat for potential populations of Ixodes pacificus in Alaska

Ixodes pacific (Acari: Ixodidae) is the primary vector of Lyme disease spirochetes to humans in the western United States. Although not native to Alaska, this tick species has recently been found on domestic animals in the state. I. pacificus has a known native range within the western contiguous United States and southwest Canada; therefore, it is not clear if introduced individuals can successfully survive and reproduce in the high latitude climate of Alaska.

To identify areas of suitable habitat within Alaska for I. pacificus, we used model parameters from two existing sets of ensemble habitat distribution models calibrated in the contiguous United States. To match the model input covariates, we calculated climatic and land cover

covariates for the present (1980-2014) and future (2070-2100) climatologies in Alaska. The present-day habitat suitability maps suggest that the climate and land cover in Southeast Alaska and portions of Southcentral Alaska could support the establishment of I. pacificus populations. Future forecasts suggest an increase in suitable habitat with considerable uncertainty for many areas of the state.

Repeated introductions of this non-native tick to Alaska increase the likelihood that resident populations could become established. Witmer FD, et al. Department of Computer Science & Engineering University of Alaska Anchorage Timm W. Nawrocki Alaska Center for Conservation Science University of Alaska Anchorage Micah Hahn Institute for Circumpolar Health Studies University of Alaska, Anchorage, academic.oup.com/jme/advance-article-abstract/doi/10.1093/jme/tjac001/6520869.

How companies will make more money from testing for Lyme disease in the future

Lyme Disease Diagnostics Market is Projected to Expand at a CAGR of 4% from 2021 to 2031

By Transparency Market Research, Published March 2, 2022

Lyme Disease Diagnostics Market: Introduction

According to the report, the global Lyme disease diagnostics market was valued at ~US$ 2 Bn in 2020 and is projected to expand at a CAGR of 4% from 2021 to 2031. Lyme disease, commonly known as Lyme borreliosis, is an infectious disease caused by the Borrelia bacteria and carried by ticks. The most common indication of infection is spreading red rash, known as erythema migrans, which emerges around a week after tick bite.

Different diagnostic tests are used in the diagnosis of Lyme disease such as serological test, polymerase chain reaction (PCR) testing, immunofluorescence (IFA), lymphocyte transformation test, urine antigen testing, and others. The growth of the global Lyme disease diagnostics market can be ascribed to increase in incidence and rise in prevalence of Lyme disease, and surge in funding from government organizations and large corporates for developing Lyme disease diagnostic kits.

Request Brochure of Report –
https://www.transparencymarketresearch.com/sample/sample.php?flag=B&rep_id=1658

And, the article continues. See link for the rest:
www.digitaljournal.com/pr/lyme-disease-diagnostics-market-is-projected-to-expand-at-a-cagr-of-4-from-2021-to-2031.

International & General Section

Research suggests that dead fragments of the Lyme disease bacteria may remain in the body and cause inflammation in the nervous systems even after treatment

Neuropathogenicity of non-viable *Borrelia burgdorferi* ex vivo

Even after appropriate treatment, a proportion of Lyme disease patients suffer from a constellation of symptoms, collectively called Post-Treatment Lyme Disease Syndrome (PTLDS). Brain PET scan of patients with PTLDS have demonstrated likely glial activation indicating persistent neuroinflammatory processes. It is possible that unresolved bacterial remnants can continue to cause neuroinflammation. In previous studies, we have shown that non-viable *Borrelia burgdorferi* can induce neuroinflammation and apoptosis in an oligodendrocyte cell line.

In this follow-up study, we analyze the effect of sonicated remnants of *B. burgdorferi* on primary rhesus frontal cortex (FC) and dorsal root ganglion (DRG) explants. Five FC and three DRG tissue fragments from rhesus macaques were exposed to sonicated *B. burgdorferi* and analyzed for 26 inflammatory mediators. Live bacteria and medium alone served as positive and negative control, respectively. Tissues were also analyzed for cell types mediating inflammation and overall apoptotic changes.

Non-viable *B. burgdorferi* induced significant levels of several inflammatory mediators in both FC and DRG, similar to live bacteria. However, the levels induced by non-viable *B. burgdorferi* was often (several fold) higher than those induced by live ones, especially for IL-6, CXCL8 and CCL2. This effect was also more profound in the FC than in the DRG. Although the levels often differed, both live and dead fragments induced the same mediators, with significant overlap between FC and DRG. In the FC, immunohistochemical staining for several inflammatory mediators showed the presence of multiple mediators in astrocytes, followed by microglia and oligodendrocytes, in response to bacterial remnants. Staining was also seen in endothelial cells. In the DRG, chemokine/cytokine staining was predominantly seen in S100 positive (glial) cells. *B. burgdorferi* remnants also induced significant levels of apoptosis in both the FC and DRG. Apoptosis was confined to S100 + cells in the DRG while distinct neuronal apoptosis was also detected in most FC tissues in response to sonicated bacteria.

Non-viable *B. burgdorferi* can continue to be neuropathogenic to both CNS and PNS tissues with effects likely more profound in the former. Persistence of remnant-induced neuroinflammatory processes can lead to long term health consequences. Parthasarathy G & Gadila SK. *Sci Rep* 12, 688 (2022). https://doi.org/10.1038/s41598-021-03837-0.

Tick ecology and Lyme borreliosis prevention: A regional survey of pharmacists' knowledge in Auvergne-Rhône-Alpes, France: Ticks and tick-borne Disease

The most prevalent vector-borne diseases in Europe are caused by tick-borne pathogens, such as bacteria of the genus Borrelia that cause Lyme borreliosis. In this context, retail pharmacists are frequently the first medical source of information in the event of a tick bite.

The objective of this study was to assess pharmacy professionals' knowledge about both tick ecology and the appropriate measures for tick bites and Lyme borreliosis prevention. It was based on an online survey of 364 pharmacists and pharmacy assistants located in the Auvergne-Rhône-Alpes region of France.

The results showed solid knowledge about preventive measures for tick bite and Lyme borreliosis, but weaker knowledge about tick biology (hosts, suitable habitats, favorable conditions for tick activity, etc.). Several stereotypes were observed in the responses of the pharmacy professionals. These appear to result from a social construction of the knowledge on ticks and tick-borne diseases previously shown to the general population in the region. The results highlight the need for continuous training about ticks and tick-borne diseases for healthcare professionals serving local populations that live in endemic areas. Bord S, et al. Ticks and Tick-borne Diseases, https://doi.org/10.1016/j.ttbdis.2022.101932.

Basil essential oil with rock dust appears effective as a tick repellent

Repellent and acaricidal activities of basil (*Ocimum basilicum*) essential oils and rock dust against *Ixodes scapularis* and *Dermacentor variabilis* ticks

Repellent and acaricidal activity of essential oils extracted from three varieties of basil (*Ocimum basilicum* L.) were evaluated on blacklegged ticks (*Ixodes scapularis* Say) and American dog ticks (*Dermacentor variabilis* Say) in laboratory conditions. Essential oils were extracted and characterized through gas chromatography-mass spectrometry and tested at different concentrations for long-term repellent activity using horizontal bioassays. In addition, basil essential oils were combined with an inert material (i.e., granite rock dust) with known insecticidal and miticidal properties to assess acaricidal activities against adult ticks.

Among the tested basil varieties, var. Jolina essential oil at 15% vol/vol concentration repelled 96% of tested ticks up to 2 h post-treatment. The EC_{50} for *I. scapularis* nymphs was 4.65% vol/vol (95% confidence interval: 4.73–4.57). In acaricidal tests, the combination of essential oil from var. Aroma 2 at 10% wt/wt with rock dust resulted in 100% tick mortality after only 24 h post-exposure, with a LD_{50} of 3.48% wt/wt (95% CI 4.05–2.91) for freshly prepared treatment tested on *I. scapularis* adults. The most common compounds detected in basil essential oils by GC–MS were linalool (52.2% in var. Nu Far, 48.2% in Aroma 2, 43.9% in Jolina), sabinene (6.71% in Nu Far, 8.99% in Aroma 2, 8.11% in Jolina), eugenol (11.2% in Jolina, 8.71% in Aroma 2), and estragole (18.2% in Nu Far).

The use of essential oils alone and in combination with rock dust provides an innovative and environmentally friendly approach for managing ticks and inhibiting vector-borne disease transmission. Wang et al. *Experimental and Applied Acarology*, doi.org/10.1007/s10493-022-00705-y.

A new focus of spotted fever caused by *Rickettsia parkeri* in Brazil

Spotted fever (SF) is a tick-borne zoonosis caused by bacteria of the genus *Rickettsia* . The disease varies in severity from mild clinical forms to severe cases. In Brazil, *Rickettsia rickettsii* SF is the most serious rickettsiosis and can result in death if not diagnosed and treated at the onset of symptoms.

The SF mild form is caused by *Rickettsia parkeri* strain Atlantic Rainforest, and this etiological agent has been reported in the South, Southeast and Northeast regions of the country, in areas of preserved or little anthropized Atlantic Rainforest. *Amblyomma ovale* is the proven vector and dogs are the hosts associated with the bioagent cycle. During a SF case investigation in Paraty municipality, Rio de Janeiro State, an Atlantic Rainforest biome area in Southeastern Brazil, the human pathogen *R. parkeri* strain Atlantic Rainforest was detected by PCR in a sample of human skin inoculation eschar and in a female *A. ovale* tick collected from a dog.

These results expand the known area of occurrence of this mild form rickettsiosis in Brazil. In addition, the results of the present study indicate the importance of implementing programs to control canine ectoparasites and to raise awareness of the risks of infection, signs and symptoms of SF caused by *R. parkeri* strain Atlantic Rainforest. de Moura Martiniano NO, et al. Rev. Inst. Med. trop. S. Paulo 64 • 2022 • https://doi.org/10.1590/S1678-9946202264022.

☼☼☼

TIC-NC is grateful for the financial contributions of Insect Shield International, LLC.

insect shield®
repellent apparel

About Insect Shield Technology:
Insect Shield's EPA-registered technology converts clothing and gear into effective and convenient insect protection. The repellency is long-lasting and appropriate for use by the entire family with no restrictions for use.

Quick Facts:

- Repellency is in the clothing and gear – not on your skin
- Lasts through 70 launderings
- EPA-registered
- No restrictions for use
- Appropriate for the entire family
- No need to re-apply

- Repels mosquitoes, ticks, ants, flies, chigger and midges including those that can cause Lyme disease, malaria and other dangerous insect-borne diseases

www.insectshield.com

Get your own clothes treated: **Insect Shield Your Own Clothes**
https://www.insectshield.com/IS-Your-Own-Clothes-P338.aspx

☼☼☼

Tick-Borne Infections Council of North Carolina is a non-profit 501(c)3 organization formed to improve the recognition, treatment, control, and understanding of tick-borne diseases in North Carolina. We are all-volunteer and appreciate donations.

Disclaimer

TIC-NC's newsletter content, including text, graphics, images and information is for general informational purposes only. The contents are not intended to be a substitute for professional medical advice, diagnosis or treatment.

Any contact information is provided for you to learn about tick borne illnesses and related issues. Our organization is not responsible for the content of other material or for actions as a result of opinions or information expressed which may appear from time to time.

It is the responsibility of you as an individual to evaluate the usefulness, completeness or accuracy of any information you read and to seek the services of a competent medical professional of your choosing if you need medical care.

This organization is not a representative, program, affiliate of any other organization, unless specifically stated. Contact us at info@tic-nc.org or 919-542-5573

You have received this newsletter because you are on our membership list. If you want to be taken off at any time, just reply with 'unsubscribe' in the subject box.