

Black bears could play important role in dispersal of pathogen-carrying ticks

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Hannah Tiffin, doctoral candidate in entomology, checks a sedated black bear for ticks. Credit: Taylor Miller

The spread of the blacklegged tick, the primary vector for the pathogen that causes Lyme disease, may be facilitated in Pennsylvania by animals that people rarely associate with it—black bears, according to researchers in Penn State's College of Agricultural Sciences.

In a recently published study, the researchers reported on the presence, abundance and spatial distribution of ticks on [black bears](#), with an eye toward better understanding the bears' role in [tick](#) ecology and dispersal and improving on-host surveillance techniques for ticks.

"American black bear populations in the Northeast have been rising substantially since the 1980s," said lead researcher Hannah Tiffin, dual-title doctoral degree candidate in entomology and in international agriculture and development. "Pennsylvania has seen a dramatic increase in bear numbers, with the estimated population doubling between the late 1980s and 2001 and continuing to rise in the last 20 years."

During roughly the same time frame, she noted, tick-borne diseases in humans have risen significantly, with the number of cases reported to the U.S. Centers for Disease Control and Prevention nearly tripling between 2004 and 2017. Lyme disease, which is caused by the bacterium *Borrelia burgdorferi* and is transmitted primarily by the blacklegged tick (*Ixodes scapularis*), is the most frequently reported vector-borne disease in the United States. Pennsylvania leads the nation in reported Lyme cases.

"To date, most wildlife studies of blacklegged ticks have looked at two species—the white-tailed deer and the white-footed mouse," Tiffin said. "As a result, there's a lack of research on other [animal species](#) in terms of their role in tick dispersal, their suitability as hosts and their status as reservoirs of disease pathogens."

In addition, standardized tick-surveillance methods have not been developed for host species that rarely are studied for tick burden and

parasitism, explained study co-author Erika Machtinger, assistant professor of entomology, who directs the college's Veterinary Entomology Laboratory.



Researchers find a tick feeding on a black bear. Nearly 71% of bears examined had ticks present, all of which were blacklegged ticks. Credit: Taylor Miller

"Studies of ticks on wild mammals other than white-tailed deer and white-footed mice usually consist of opportunistic tick collections," Machtinger said. "For instance, most previous studies of tick parasitism of black bears consisted of opportunistic collections on nuisance bears or

bears killed by vehicle collisions or by hunters, which limits observations to specific times of the year.

"Because black bears are known to host several species of ticks and these animals can travel long distances—particularly male bears that may travel more than 100 miles when establishing a new territory—it's important to understand their role in tick ecology and dispersal, especially in a region with high numbers of Lyme disease cases."

To assess tick presence, abundance, life stage, spatial distribution and seasonality, the research team examined 278 black bears in 21 central Pennsylvania counties—from the New York border to the Maryland line—between June 2018 and December 2019.

Researchers evaluated live, sedated black bears in cooperation with annual bear population research surveys conducted by the Pennsylvania Game Commission during the spring and summer months, as well as hunter-harvested bears brought to Game Commission check stations during the annual statewide bear-hunting season.

In addition, the scientists surveyed other black bears for tick burden as part of a concurrent study on the health status and movement of bears with sarcoptic mange, also known as scabies, which is a skin condition caused by the *Sarcoptes scabiei* mite. The goal was to investigate the association between parasitism by ticks and *S. scabiei*.

The researchers, who published their results in the *International Journal for Parasitology: Parasites and Wildlife*, found that nearly 71% of bears examined had ticks present, all of which were blacklegged ticks. Of 17 body regions surveyed, locations on the bears' head had the highest percentage of tick presence, led by the ear (39%) and muzzle (36%).



A black bear showing clinical signs of mange. Researchers found that bears with mange were less likely to be infested with ticks, possibly due to mange-induced skin conditions, grooming and hair loss. Credit: Courtesy of Hannah Tiffin

All three life stages of tick were found on bears during the study. The surveys indicated that the head and front-quarters of bears are more likely to be parasitized by adult ticks, while the legs and toes are more frequently parasitized by immature ticks—nymphs and larvae. In particular, the toes, a body area often overlooked in tick research on medium-sized and large mammals, were parasitized nearly exclusively by immature ticks.

"To our knowledge, this is the first report of larval blacklegged ticks being found on black bears," Tiffin said. "Immature blacklegged ticks typically have been thought to feed primarily on small and medium-sized mammals, but our results show that immatures of this species feed on large mammal hosts as well."

The researchers reported that the highest numbers of ticks found on bears occurred in the spring, with the next highest abundance occurring in the summer, and the lowest abundance found in the fall. "This likely relates to the blacklegged tick's life cycle in the Northeast, with nymphs most active and abundant in the spring, larvae in the summer, and adults in the fall," Machtinger said.

Of the 36 surveyed black bears showing clinical signs of mange, 20, or about 56%, had ticks present, compared to 71% of bears without mange that had ticks. The researchers noted that, although co-parasitism of sarcoptic mites and ticks on black bears had not been studied previously and further research is needed, mange can result in significant changes to the host's skin. This, they said, may prevent or reduce successful tick attachment or may prevent ticks from finding adequate attachment sites due to bears' hair loss and increased grooming when afflicted with mange.

The researchers said their findings suggest that black bears may be an important factor in tick dispersal in Pennsylvania.

"Wildlife species can be used as sentinel hosts for tick surveillance," Tiffin said. "The role of understudied tick hosts like black bears in the ecology and spread of ticks warrants additional research as human cases of Lyme disease and other tick-borne diseases continue to rise in the United States."

More information: Hannah S. Tiffin et al, Tick abundance and life-

stage segregation on the American black bear (*Ursus americanus*),
International Journal for Parasitology: Parasites and Wildlife (2021).
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