Crowdsourced Photos Show Expanding Ranges for Ticks

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In a new study published in May in the *Journal of Medical Entomology*, researchers analyzing tick photos submitted to the TickSpotters program at the University of Rhode Island find that three tick species—such as the blacklegged tick (*Ixodes scapularis*)—that transmit Lyme and other human diseases are present in

hundreds of U.S. counties where previous surveillance had not yet documented them. (Photo by David Cappaert (https://www.inaturalist.org/photos/55729174), via iNaturalist, CC BY-NC 4.0 (https://creativecommons.org/licenses/by-nc/4.0/))

By John P. Roche, Ph.D.

Seventy-five percent of arthropod-borne human disease in the U.S. is spread by ticks, and cases doubled in the U.S. between 2004 and 2016. With such significant rates of infection, information on the ranges of ticks that spread disease is essential.

In a study published in May in the *Journal of Medical Entomology* (https://doi.org/10.1093/jme/tjab082), Heather Kopsco, Ph.D., Roland Duhaime, and Thomas Mather, Ph.D., used photos submitted to their TickSpotters (https://web.uri.edu/tickencounter/tickspotters/submit/) surveillance program at the University of Rhode Island to document the geographic ranges of three medically important U.S. tick species, including two that spread Lyme disease.

Because of ticks' medical importance, surveillance of their abundance and distribution is important to public health and education. Active surveillance of tick species is sometimes conducted by entomologists in specific areas, but active surveillance is expensive and limited in geographic scope. In contrast, passive surveillance, in which the public submits data, is inexpensive and can sample the whole country. Passive surveillance is sometimes conducted by having citizens send in physical tick samples through the mail. This method can provide data on whether ticks are infected with pathogens, but it is slow. An alternative approach is to have people with tick encounters submit photos electronically to a crowdsourced site run by entomologists, after which they receive back a report on the tick species and the probability of infection based on how long the tick had been attached. This method is fast, easy, and inexpensive, and it can provide rapid feedback to citizens. A previous study by Kopsco and Mather and colleagues, covered in an August 2020 *Entomology Today* article (https://entomologytoday.org/2020/08/20/crowdsourced-surveillance-program-public-understanding-tickborne-diseases/), found that this style of photo surveillance could identify tick species with more than 98 percent accuracy.

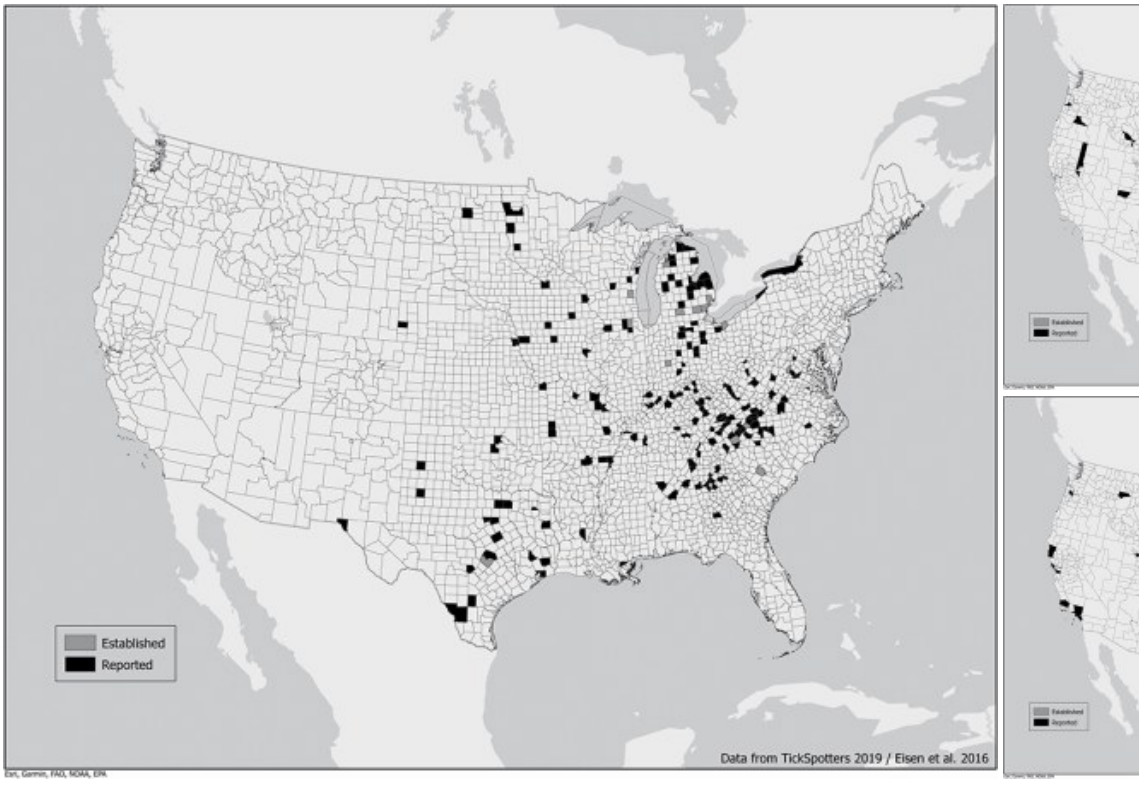
In their new study, Kopsco, Duhaime, and Mather compared data from photos submitted to TickSpotters to published, county-based data on distributions of three medically important tick species:

1. the blacklegged tick (*Ixodes scapularis*), which spreads Lyme disease in the eastern and midwestern U.S.
2. the Western blacklegged tick (*Ixodes pacificus*), which spreads Lyme disease in parts of the western U.S.

3. the lone star tick (*Amblyomma americanum*), which spreads the bacterial disease ehrlichiosis.

The investigators wanted to see the extent to which the data from TickSpotters were consistent with the county data and if the TickSpotters data could fill in any gaps in the county data.

In their study, the investigators examined photographs submitted to TickSpotters from 2014 to 2019. Presence of a species was categorized as either “reported” (a single report of any life stage) or “established” (reports of two life stages or six individuals of any life stage).



For the blacklegged tick, they received 9,532 photograph reports from 900 counties, 187 of which had no previous record of blacklegged ticks. The largest increases in this species were found in Michigan and Texas. Large increases were also found in Indiana, Kentucky, Tennessee, Virginia, North Carolina, and Georgia.

For the Western blacklegged tick, TickSpotters received 692 photograph reports from 90 counties. Nine of those counties had no previous record of the Western blacklegged tick. Increases in the range of this species were seen in Nevada, Utah, Colorado, Oregon, and Idaho.

More than 5,000 photograph reports of the lone star tick were receivedfrom 1,035 counties. Of those, 341 counties did not have a previous record of lone star ticks. The

largest expansion of the lone star tick was seen in Illinois, Indiana, Kentucky, and Ohio.

In sum, TickSpotters identified hundreds of counties around the country with new incidences of members of these three tick species. Furthermore, they observed that the tick species appeared to be increasing their seasonal activity periods. These findings can be used to identify regions where public information on risk-reduction would be most valuable.

So, why are the ranges of these tick species expanding? “The causative drivers of these upturns are complex,” Kopsco says, “but have a lot to do with increased host availability, warming temperatures, and moisture availability. It’s of course important to note that increases in reports can also be due in part to improved awareness and reporting efforts. Whereas these tick species have upper limits of temperatures and dryness that they can handle, the short-term trends support general expansion of these three species beyond their current ranges.”

One range expansion that Kopsco and colleagues found particularly surprising was that of the lone star tick. “We received reports of lone star ticks from six California counties and other counties on the west coast,” Kopsco says, “which is far beyond its general range in the middle and eastern parts of the country.”

In their paper, the researchers explained that there were no reports sent into TickSpotters from numerous counties in Texas, Tennessee, and Virginia where the tick species are known to exist. Kopsco attributes this potentially to dynamics in what drives submissions. “In areas of new tick invasion, where people are unfamiliar with tick encounters, they may be more likely to report their encounter. In locations where people are far more used to encountering ticks, they may not deem it worthy of sending in a report,” she says.

The data collected by TickSpotters are invaluable in adding to our understanding of tick ranges, but the program’s public education role is equally important. “TickSpotters and the TickEncounter Resource Center (https://web.uri.edu/tickencounter/) continue to innovate new ways of helping people protect themselves and their pets against tick bites,” Kopsco says. “Recently, they released a Google Calendar for updates on key preventative actions in response to seasonal tick activity (https://web.uri.edu/tickencounter/ticksmart/ticksmart-google-calendar/). They release new content regularly to empower people to take on the outdoors with confidence.”

The ecology of tick distributions, and the nuances of how human behavior affects disease transmission from these species, are tremendously complex. The distribution data and human-encounter data collected by TickSpotters, and the public education

information distributed by the program, can help unravel and address these intriguing complexities.

Read More

"Crowdsourced Tick Image-Informed Updates to U.S. County Records of Three Medically Important Tick Species (https://doi.org/10.1093/jme/tjab082)"

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