

Short Communication

A Unique Academic–Government Collaboration Yields First Report of Detailed Habitat Description for *Haemaphysalis longicornis* (Ixodida: Ixodidae) in Madison County, KY

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Subject Editor: Holly Gaff

Received 2 February 2021; Editorial decision 9 March 2021

Abstract

Haemaphysalis longicornis Neumann, Asian longhorned tick, was collected in Madison County, Kentucky, United States as part of an ongoing collaborative-tick surveillance project. This is the first collection of this invasive tick that includes ancillary data on habitat and landscape features derived from the USDA Forest Service, Forest Inventory and Analysis program.

Key words: *Haemaphysalis longicornis*, Asian longhorned tick, distribution, habitat description, zoonosis

Haemaphysalis longicornis Neumann, Asian longhorned tick, is a vector of many pathogens in its endemic range (Beard et al. 2018) and *Theileria orientalis* Ikeda type in North America (Dinkel et al. 2021). Since the initial detection of *H. longicornis* in the fall of 2017 in New Jersey (Rainey et al. 2018), this invasive and now arguably endemic tick species has been reported in 14 states east of the Mississippi river (U.S. Department of Agriculture [USDA] 2021). Identifying novel infestation sites for invasive and emerging tick species is important, but identifying these sites is prohibitive due to costs and limited resources associated with preventative public health and surveillance (Eisen and Paddock 2020). Thus, most surveillance systems are reliant on passive surveillance and citizen science with the public identifying a problem (Eisen and Paddock 2020, Mader et al. 2020). Knowing tick surveillance provides information on tick presence, encounter frequencies, and (with frequent monitoring and pathogen screening) entomological risk, we established a collaborative-tick surveillance program to monitor sites every 5 yr for ticks and their pathogens (Trout Fryxell and Vogt 2019). Here,

we report a detailed habitat description of a new site where a USDA crew encountered several *H. longicornis*.

Materials and Methods

The USDA Forest Service, Forest Inventory and Analysis (FIA) program is an ongoing, strategic survey of forest conditions across all land ownerships in the United States and its territories. Permanent plots consisting of four 0.04-acre (0.017 ha) subplots are installed across the landscape, one per approximately 6,000 acres (24 km²), and visited every 5, 7, or 10 yr (Bechtold and Patterson 2005). For approximately 6.5 yr, opportunistic sampling of ticks across the southeastern United States has taken place as part of a unique government–academia partnership (Trout Fryxell and Vogt 2019). This partnership continues to yield valuable information on tick abundance, distribution, pathogen presence, and habitat. Actual plot locations are confidential to protect landowner privacy and are not presented herein.

On July 15, 2020, an FIA crew encountered and collected several ticks on a FIA plot near College Hill, Kentucky. Briefly, FIA crews are instructed to do routine tick checks to prevent tick bites and if any ticks are encountered, those ticks are to be placed in provided vials of 80% ethanol and properly labeled. Importantly, none of the ticks provided to us from this site bit the crew. The 20 FIA-encountered ticks were sent to the University of Tennessee for identification using dichotomous keys (Keirans and Durden 1998, Egizi et al. 2019).

To describe characteristics of the plot and surrounding area, aerial imagery was obtained from 2018 National Agriculture Imagery Program (NAIP) imagery (<https://earthexplorer.usgs.gov/>; accessed 11/2/2020). The image was taken in October 2018. We used the interactive supervised classification tool in ArcMap 10.3 (<https://desktop.arcgis.com/en/documentation/>; accessed 11/2/2020) to create a 'trees' layer by designating training polygons for trees, pastures, roads, ponds, planted areas, and bare soil then combining non-tree layers to yield 'trees' and 'other'. Estimates of tree cover were compiled for circular plots centered on the FIA plot and ranging from 37 m dia. (0.43 ha) (slightly smaller than the sampled area of an FIA plot) to 148 m dia. (6.88 ha); this provided information on the conditions on and surrounding the plot location. Data were also compiled for concentric rings 37 m in width radiating out from the plot center to illustrate changes in tree cover moving away from the plot.

Results

Tick identifications from the collection described above consisted of *Amblyomma americanum* (seven females, three males, and three nymphs) and *H. longicornis* (five females and two nymphs). This is a new county record for *H. longicornis* in Madison County, Kentucky and was reported to the USDA Animal Plant Health Inspection Service as a taxonomic identification (USDA 2021). It also represents one of the westernmost collections to date east of the Mississippi river. The collection took place approximately 8 miles from Bluegrass Stockyards in Richmond, Kentucky. The plot is within a large, high-fence animal enclosure grazed by cattle and containing an unknown number of coyotes used to train hunting dogs.

Percent tree cover estimates indicate greater tree cover on the plot than the surrounding area and decreasing tree cover moving away from the plot (Table 1). The plot is in a forested area approximately 23 ha in size, bordering on approximately 10 and 5 ha of open field to the west and east, respectively, and a narrow strip of open area approximately 2 ha in size to the north. Further west land

use is primarily larger agricultural fields, and further east is mixed residential and forested land with several ponds. Access to this plot was denied during the prior FIA survey (2012) due to hunting activity, so we could not attempt to detect any changes from prior surveys; however, stand age at this plot was estimated to be 45 yr.

Two conditions were observed on the plot, mixed upland hardwood (three subplots) and Eastern red cedar (*Juniperus virginiana*) (one subplot), with canopy cover of 70 and 63%, respectively, in good agreement with our estimates based on tree classification. Both conditions were estimated to be 80% forested. Tree composition (all trees on all subplots ≥ 5 inches dbh) was 62% Eastern red cedar, 14% American elm (*Ulmus americana*), 8% sassafras (*Sassafras albidum*), and 5% sycamore (*Platanus occidentalis*), with one each of green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), red mulberry (*Morus rubra*), and black oak (*Quercus velutina*). Slope ranged from 12 to 34 degrees. Measured tree density was 223 trees per acre (551 trees/ha). The crew noted a heavy infestation of the exotic invasive plant *Microstegium vimineum* (Japanese stiltgrass) ranging from 25 to 90% coverage of the forest floor. The nearest dwelling from the plot was 230 m and the nearest road was 270 m.

Discussion

The potential for human contact with *H. longicornis* in this landscape appears to be significant due to human activity directly on the plot and residential areas nearby. Proximity to Bluegrass Stockyards in Richmond, Kentucky highlights potential risk to livestock in the area or potentially a mode of introduction to the area. This represents the first collection and report of *H. longicornis* accompanied by the extensive plot data collected by FIA. Detailed forest inventory described within contributes to a predictive description of the habitat for *H. longicornis*. It is important to note that we make no assumptions regarding absence data in other FIA plots, as our collections rely on tick encounters and not intensive sampling. Previously, suitable habitat included sites with unmowed lawns or taller grassy habitats which include Dallas grass (*Paspalum dilatatum*) and rushes (*Jucus* species) as well as habitat with mixed hardwoods, pine, and grasses (Medlock et al. 2008, Heath 2016, Rainey et al. 2018, Tufts et al. 2019, White et al. 2020). As tick specimens are encountered and reported by FIA crews, these detailed analyses can be replicated and evaluated not only for *H. longicornis*, but for additional tick species as well. As *H. longicornis* distribution continues to expand in the United States, this cooperative-tick surveillance program will likely yield additional new county records as well as useful information on habitat- and landscape-level characteristics related to tick presence and abundance.

Table 1. Tree cover estimates centered on Forest Inventory and Analysis plot of interest

| Sampling method | Area, ha | Distance from plot, m | No. pixels | | Percent tree cover |
|-----------------|----------|-----------------------|------------|--------|--------------------|
| | | | Trees | Other | |
| Circle | 0.43 | – | 7,554 | 4,426 | 63 |
| Circle | 1.72 | – | 25,246 | 22,536 | 53 |
| Circle | 3.87 | – | 52,538 | 55,697 | 49 |
| Circle | 6.88 | – | 94,427 | 96,824 | 49 |
| Ring | – | 0–37 | 7,554 | 4,426 | 63 |
| Ring | – | 37–74 | 17,692 | 18,110 | 49 |
| Ring | – | 74–111 | 27,292 | 33,161 | 45 |
| Ring | – | 111–148 | 41,889 | 41,127 | 50 |

Circle estimates are tree cover for the entire area indicated, and ring estimates are for 37-m-wide concentric rings on and surrounding plot.

Acknowledgments

We gratefully acknowledge the efforts of the many federal and state Forest Inventory and Analysis cruisers participating in this project. Funding was provided by USDA Forest Service, Southern Research Station.

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