



TICK DISTRIBUTION AND TICK-BORNE PATHOGENS IN FINLAND - THE TICK PROJECT OF THE UNIVERSITY OF TURKU

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Ticks and tick-borne diseases constitute a growing problem in northern Europe and Russia. Surveys conducted in Russia, Sweden and Norway have revealed a northwards shift in distribution and an increase in tick abundance over the past few decades. In contrast, ecological data of Finnish tick populations are scarce. The last nationwide mapping of the geographical distribution of *Ixodes ricinus* in Finland is over five decades old. Regarding the distribution of the *Ixodes persulcatus*, no nationwide survey has ever been made.

The tick project of the University of Turku was started in 2012, with the objective of producing novel data on tick abundance, ecology and tick-borne pathogen diversity in Finland. However, we also wanted to update old data on the geographical distribution of ticks. To accomplish this, we organized two citizen science campaigns: a national tick sighting survey in 2014 (Map 1) and a national tick collection campaign in 2015 (Map 2).

Field surveys

Blanket dragging has been conducted at many locations around southwestern Finland since 2012 to survey tick abundance and seasonal questing activity (Map 3; Figure 1).

Similar surveillance sites were established at several university research stations in 2015 (Map 4).



Map 3. Field survey locations

A long-term surveillance site for tracking annual changes in tick abundance, seasonal questing activity patterns and pathogen diversity was established on Seili island (near Turku) in 2012.

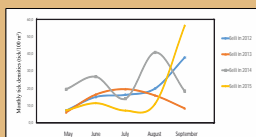


Figure 1. Seasonal questing activity observed for ticks in Seili during 2012-2015.



Map 4. Research stations

National tick collection campaign

We also wanted to produce nationwide data on the geographical distribution of the two currently known disease-transmitting tick species in Finland, *I. ricinus* and *I. persulcatus*. To accomplish this, we organized a national tick collection campaign in 2015, where we asked citizens to send ticks to us.

The campaign was a success with nearly 7000 letters received, containing approximately 20 000 individual ticks from all around Finland.



Pathogen analyses

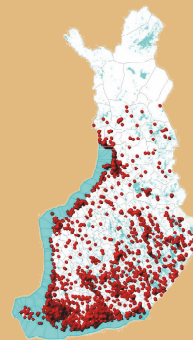
Ticks collected from southwestern Finland have been screened for several tick-borne pathogens (Table 1). *Borrelia burgdorferi* s.l. are the most common pathogens detected, with an overall prevalence of 23.5% for adults and 18.5% for nymphs. During screening, *Borrelia miyamotoi* has been detected from three novel localities in the Archipelago Sea (previously only reported from the Åland Islands in Finland).

Table 1. List of pathogens screened from tick samples collected from southwestern Finland.

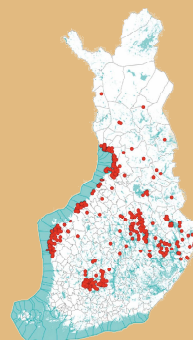
List of screened pathogens	n (%)		
	Adults	Nymphs	Larvae
<i>Borrelia burgdorferi</i> sensu lato	142	16/72	32/95
<i>B. burgdorferi</i> sensu stricto			
<i>B. sensu lato</i>			
<i>B. burgdorferi</i>			
<i>B. burgdorferi</i> sensu stricto	142	16/72	32/95
<i>Borrelia burgdorferi</i> sensu stricto	44	6/29	13/66
<i>Borrelia burgdorferi</i> sensu stricto	98	11/52	19/99
<i>Borrelia burgdorferi</i> sensu stricto	98	11/52	19/99
<i>Borrelia burgdorferi</i> sensu stricto	46	6/29	13/66
<i>Borrelia burgdorferi</i> sensu stricto	98	11/52	19/99
<i>Borrelia burgdorferi</i> sensu stricto	98	11/52	19/99

Legend:
■ Detected from samples (total number of ticks analysed)
■ Not detected from samples (total number of ticks analysed)

Distribution maps



Map 1. Distribution of *Ixodes* spp. based on the national questionnaire survey in 2014.



Map 2. Distribution of *I. persulcatus*. The situation in 2.10.2015 based on the samples we received in summer 2015.



Future remarks and goals

Tracking of tick abundance, seasonal questing activity and pathogen diversity continues at university research stations.

The geographical distribution of *Ixodes ricinus* and *Ixodes persulcatus* in Finland will be determined from national collection campaign data.

Laboratory analyses for national tick collection campaign samples to

- determine the prevalence of several tick-borne pathogens in different parts of Finland.
- assess the differences between *I. ricinus* and *I. persulcatus* pathogen prevalence and diversity.

Utilizing next-generation sequencing to

- determine the most common host animals and differences in host animal utilization for *I. ricinus* and *I. persulcatus*.
- assess the bacterial, viral and fungal species diversity found within ticks.

Publications:

Sormunen J.J., Klemola T., Vesterinen E.J., Vuorinen I., Hytönen J., Hänninen J., Ruohomäki K., Sääksjärvi I., Tontti E., Penttinen R. Assessing the abundance, seasonal questing activity, and *Borrelia* and tick-borne encephalitis virus (TBEV) prevalence of *Ixodes ricinus* ticks in a Lyme borreliosis endemic area in Southwestern Finland. *Ticks and Tick-borne Diseases*. 2016;7(1):208-15.

Sormunen J.J., Penttinen R., Klemola T., Hänninen J., Vuorinen I., Laaksonen M., Sääksjärvi I.E., Ruohomäki K., Vesterinen E.J. Tick-borne bacterial pathogens in southwestern Finland. Under review, 2016.

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