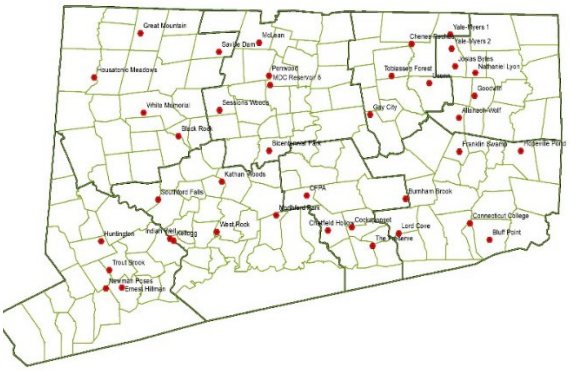
Active Tick Surveillance– Connecticut, 2019-2020

The increasing prevalence of Lyme disease (LD) and emergence of other human tick-associated diseases in the United States has become a major public health concern. The blacklegged tick, *Ixodes scapularis*, is the primary vector for at least seven pathogens that cause human disease; *Borrelia burgdorferi* (Lyme disease), *Babesia microti* (human babesiosis), *Anaplasma phagocytophilum* (human granulocytic anaplasmosis), *B. miyamotoi* (hard-tick relapsing fever), *B. mayonii* (new Lyme Borrelia spp.), the Ehrlichia muris-like agent, now *E. muris* subsp. eauclairensis (ehrlichiosis), and Powassan or deer tick virus (Powassan encephalitis). The Connecticut Agricultural Experiment Station (CAES) Tick Testing Laboratory has been conducting a passive surveillance for *B. burgdorferi* in *I. scapularis* by testing ticks submitted by the public since 1990. The testing was expanded in 2014 to include *B. microti* and *A. phagocytophilum*. However, this requires submissions from the public, which may not accurately represent tick and pathogen abundance and distribution statewide.

In 2019, CAES established a statewide active tick surveillance program. A total of 40 paired sampling sites (5 in each of CT's 8 counties) were established in 40 different municipalities in spring 2019. All locations are publicly accessible trail systems owned by land trusts, the State of Connecticut, private landowners, municipalities, and colleges/universities. Various aspects of the project are run by Drs. Kirby Stafford, Scott Williams, Megan Linske, and Douglas Brackney, with technical assistance by Duncan Cozens and Jamie Catoni.

Host-seeking nymphal and adult *I. scapularis* were prioritized and sampled at surveillance sites. Additionally, any host-seeking nymphal or adult of the newly established lone star ticks, *Amblyomma americanum*, well-established American dog ticks, *Dermacentor variabilis*, or emerging Asian longhorned ticks, *Haemaphysalis longicornis*, were sampled incidentally as well. Standard dragging techniques utilized 1 m^2 cloths to drag a total of 750 m^2 for each visit at each of the 40 locations. Ticks were transported to a laboratory for counting and identification (tick species, developmental stage). Information on tick species, life stage, and number of ticks collected, as well as weather conditions, collection site, and date were recorded. The geographic coordinates of all transects or sample plots relative were recorded using a handheld global positioning system receiver. All ticks were identified using a dissecting microscope and taxonomic keys. Tick samples were then tested for pathogens (*B. burgdorferi*, *B. miyamotoi*, *Babesia microti*, *A. phagocytophilum*, and Powassan virus) using molecular assays (PCR).

Map of Tick Collection Sites, Connecticut 2019 and 2020



2019 Active Surveillance Results

Multiple stages of *Ixodes scapularis* were documented to be established in all 8 counties.

County	Adults	Nymphs
Fairfield	**51**	**24**
Hartford	**25**	**54**
Litchfield	**69**	**70**
Middlesex	**32**	**84**
New Haven	**79**	**171**
New London	**118**	**206**
Tolland	**114**	**207**
Windham	**212**	**232**

Adult *Dermacentor variabilis* were documented in all 8 counties.

County	Adults
Fairfield	**52**
Hartford	**9**
Litchfield	**7**
Middlesex	**2**
New Haven	**7**
New London	**7**
Tolland	**8**
Windham	**92**

Amblyomma americanum were reported in New Haven and New London Counties only.

County	Adults	Nymphs
Fairfield	**0**	0
Hartford	0	0
Litchfield	0	0
Middlesex	0	0
New Haven	0	**1**

New London	2	**8**
Tolland	0	0
Windham	0	0

A total of two *Haemaphysalis longicornis* nymphs were reported from Fairfield and New London Counties.

County	Adults	Nymphs
Fairfield	0	1
Hartford	0	0
Litchfield	0	0
Middlesex	0	0
New Haven	0	0
New London	0	**1**
Tolland	0	0
Windham	0	0

Percent infection of adult female *Ixodes scapularis* with the 5 pathogens by county.

County	*Anaplasma*	*B. burgdorferi*	*B. miyamotoi*	*Babesia*	Powassan
Fairfield	9%	57%	4%	9%	0%
Hartford	0%	25%	13%	0%	0%
Litchfield	8%	53%	3%	8%	0%
Middlesex	7%	66%	0%	20%	0%
New Haven	15%	55%	5%	10%	0%
New London	6%	42%	0%	7%	0%
Tolland	11%	38%	0%	6%	0%
Windham	6%	51%	3%	11%	0%
Statewide	**8.0%**	**48.2%**	**2.3%**	**9.1%**	**0%**

Percent infection of nymphal *Ixodes scapularis* with the 5 pathogens by county.

County	*Anaplasma*	*B. burgdorferi*	*B. miyamotoi*	*Babesia*	Powassan
Fairfield	12%	6%	0%	0%	0%
Hartford	0%	31%	8%	15%	0%
Litchfield	10%	14%	0%	0%	0%
Middlesex	0%	9%	2%	18%	0%
New Haven	2%	12%	1%	4%	0%
New London	9%	24%	1%	11%	1%
Tolland	2%	26%	1%	5%	0%
Windham	2%	29%	1%	1%	1%
Statewide	**4.0%**	**20.6%**	**1.3%**	**6.4%**	**0.4%**

Density (per 100 meters^2) of adult female and nymphal *I. scapularis* across all 8 counties during their respective active seasons.

County	Female	Nymph
Fairfield	0.12	0.13
Hartford	0.04	0.29
Litchfield	0.20	0.37
Middlesex	0.08	0.45
New Haven	0.21	0.91
New London	0.39	1.10
Tolland	0.28	1.10
Windham	0.56	1.24
Statewide	**0.23**	**0.70**

Density (per 100 meters^2) of infected adult female *I. scapularis* across all 8 counties during their respective active seasons.

County	*Anaplasma*	*B. burgdorferi*	*B. miyamotoi*	*Babesia*	Powassan
Fairfield	0.01	0.07	0.01	0.01	0.00
Hartford	0.00	0.01	0.01	0.00	0.00
Litchfield	0.02	0.11	0.01	0.02	0.00
Middlesex	0.01	0.05	0.00	0.02	0.00
New Haven	0.03	0.12	0.01	0.02	0.00
New London	0.02	0.16	0.00	0.02	0.00
Tolland	0.03	0.11	0.00	0.01	0.00
Windham	0.03	0.28	0.02	0.06	0.00
Statewide	**0.02**	**0.11**	**0.01**	**0.02**	**0.00**

Density (per 100 meters^2) of infected nymphal *I. scapularis* across all 8 counties during their respective active seasons.

County	*Anaplasma*	*B. burgdorferi*	*B. miyamotoi*	*Babesia*	Powassan
Fairfield	0.01	0.01	0.00	0.00	0.00
Hartford	0.00	0.02	0.01	0.01	0.00
Litchfield	0.01	0.02	0.00	0.00	0.00
Middlesex	0.00	0.02	0.01	0.04	0.00
New Haven	0.01	0.06	0.01	0.02	0.00
New London	0.05	0.13	0.01	0.06	0.01
Tolland	0.01	0.13	0.01	0.03	0.00
Windham	0.01	0.14	0.01	0.05	0.01
Statewide	**0.01**	**0.07**	**0.004**	**0.02**	**0.00**

2020 Active Surveillance Results

Active tick surveillance for *Ixodes scapularis* and associated human pathogens: A total of 40 paired active tick surveillance sampling sites (5 in each of CT's 8 counties) were established in 40 different municipalities in spring 2019. All locations are publicly accessible trail systems owned by land trusts, the State of Connecticut, private landowners, and colleges/universities. Standard dragging techniques utilized 1 m^2 cloths to drag a total of 750 m^2 at each of the 40 locations. All 40 were sampled on 7 occasions from the end of March through the end of November 2020.

Ixodes scapularis were documented to be established in all 8 counties. All 8 counties had more than 6 adults and 6 nymphs reported.

County	Adults	Nymphs
Fairfield	61	24
Hartford	114	55
Litchfield	139	75
Middlesex	42	89
New Haven	146	175
New London	293	206
Tolland	192	239
Windham	371	256
Total	**1358**	**1119**

Adult *Dermacentor variabilis* were documented in all 8 counties.

County	Adults
Fairfield	52
Hartford	9
Litchfield	7
Middlesex	2
New Haven	8
New London	7
Tolland	8
Windham	92
Total	**185**

Amblyomma americanum were reported in Litchfield, New Haven, and New London Counties.

County	Adults	Nymphs
Fairfield	0	0
Hartford	0	0
Litchfield	1	0
Middlesex	0	0
New Haven	1	1
New London	5	8
Tolland	0	0
Windham	0	0
Total	**7**	**9**

A single *Haemaphysalis longicornis* nymph was reported from New London County and a larva confirmed from New Haven County.

County	Adults	Nymphs	Larvae
Fairfield	0	0	0
Hartford	0	0	0
Litchfield	0	0	0
Middlesex	0	0	0
New Haven	0	0	1
New London	0	1	0
Tolland	0	0	0
Windham	0	0	0
Total	**0**	**1**	**1**

All nymphal and female *Ixodes scapularis* were tested for pathogens.

Borrelia burgdorferi in *Ixodes scapularis* nymphs:

County	Tested	Positive	percent
Fairfield	24	2	8.3%

Hartford	53	12	22.6%
Litchfield	39	7	17.9%
Middlesex	47	4	8.5%
New Haven	91	11	12.1%
New London	102	24	23.5%
Tolland	96	25	26.0%
Windham	93	27	29.0%
Total-CT	**545**	**112**	**20.6%**

Borrelia miyamotoi in *Ixodes scapularis* nymphs:

County	Tested	Positive	percent
Fairfield	24	0	0.0%
Hartford	53	1	1.9%
Litchfield	39	0	0.0%
Middlesex	47	1	2.1%
New Haven	91	1	1.1%
New London	102	1	1.0%
Tolland	96	1	1.0%
Windham	93	1	1.1%
Total-CT	**545**	**6**	**1.1%**

Babesia microti in *Ixodes scapularis* nymphs:

County	Tested	Positive	percent
Fairfield	24	0	0.0%
Hartford	53	8	15.1%
Litchfield	39	0	0.0%
Middlesex	47	9	19.1%
New Haven	91	3	3.3%

New London	102	11	10.8%
Tolland	96	5	5.2%
Windham	93	1	1.1%
Total-CT	**545**	**37**	**6.8%**

Anaplasma phagocytophilum in *Ixodes scapularis* nymphs:

County	Tested	Positive	percent
Fairfield	24	3	12.5%
Hartford	53	1	1.9%
Litchfield	39	3	7.7%
Middlesex	47	0	0.0%
New Haven	91	2	2.2%
New London	102	9	8.8%
Tolland	96	2	2.1%
Windham	93	2	2.2%
Total-CT	**545**	**22**	**4.0%**

Powassan virus in *Ixodes scapularis* nymphs:

Fairfield	24	0	0.0%
Hartford	53	0	0.0%
Litchfield	39	0	0.0%
Middlesex	47	0	0.0%
New Haven	91	0	0.0%
New London	102	1	1.0%
Tolland	96	0	0.0%
Windham	93	1	1.1%
Total-CT	**545**	**2**	**0.4%**

Borrelia burgdorferi in *Ixodes scapularis* adult females:

County	Tested	Positive	percent
Fairfield	28	17	60.7%
Hartford	56	26	46.4%
Litchfield	38	20	52.6%
Middlesex	20	11	55.0%
New Haven	40	22	55.0%
New London	69	28	40.6%
Tolland	53	20	37.7%
Windham	105	53	50.5%
Total-CT	**409**	**197**	**48.2%**

Borrelia miyamotoi in *Ixodes scapularis* adult females:

County	Tested	Positive	percent
Fairfield	28	1	3.6%
Hartford	56	4	7.1%
Litchfield	38	1	2.6%
Middlesex	20	0	0.0%
New Haven	40	2	5.0%
New London	69	0	0.0%
Tolland	53	0	0.0%
Windham	105	3	2.9%
Total-CT	**409**	**11**	**2.7%**

Babesia microti in *Ixodes scapularis* adult females:

County	Tested	Positive	percent

Fairfield	28	2	7.1%
Hartford	56	5	8.9%
Litchfield	38	3	7.9%
Middlesex	20	3	15.0%
New Haven	40	4	10.0%
New London	69	5	7.2%
Tolland	53	3	5.7%
Windham	105	10	9.5%
Total-CT	**409**	**35**	**8.6%**

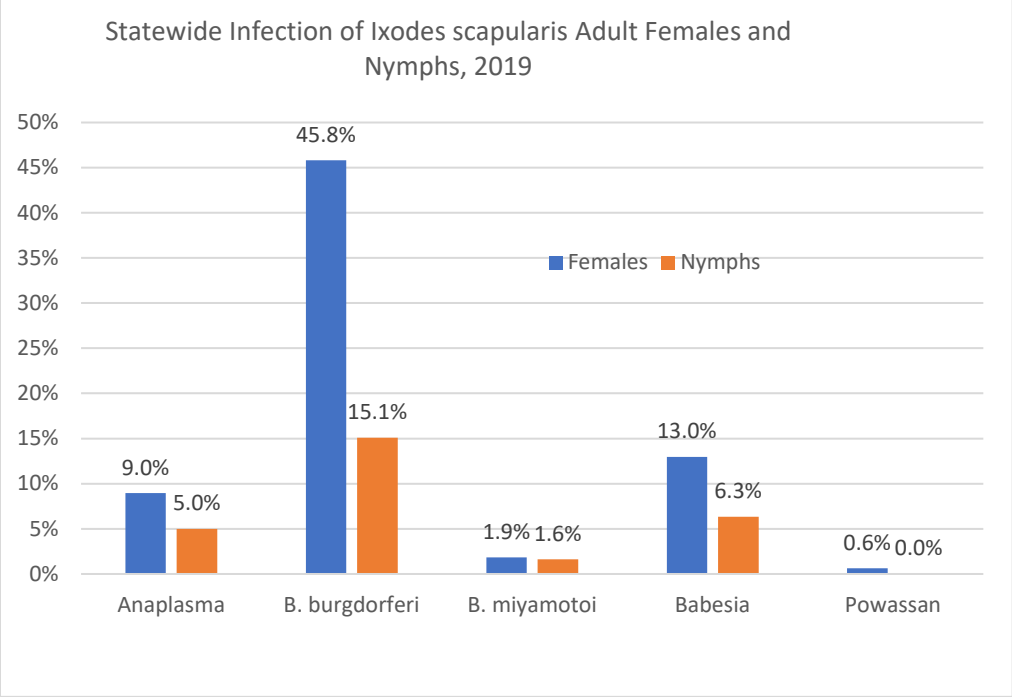
Anaplasma phagocytophilum in *Ixodes scapularis* adult females:

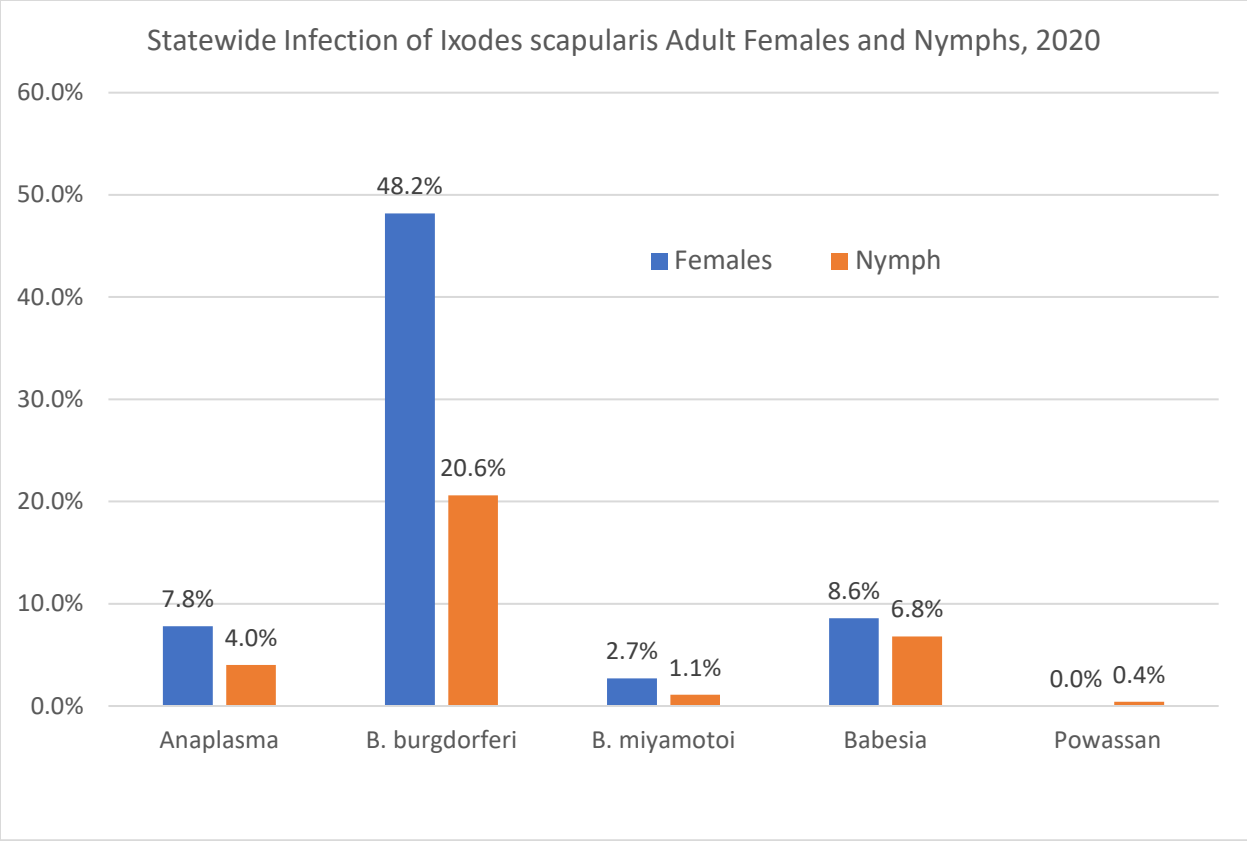
County	Tested	Positive	percent
Fairfield	28	3	10.7%
Hartford	56	5	8.9%
Litchfield	38	3	7.9%
Middlesex	20	1	5.0%
New Haven	40	6	15.0%
New London	69	4	5.8%
Tolland	53	6	11.3%
Windham	105	4	3.8%
Total-CT	**409**	**32**	**7.8%**

Powassan virus in *Ixodes scapularis* adult females:

County	Tested	Positive	percent
Fairfield	28	0	0.0%
Hartford	56	0	0.0%
Litchfield	38	0	0.0%
Middlesex	20	0	0.0%

New Haven	40	0	0.0%
New London	69	0	0.0%
Tolland	53	0	0.0%
Windham	105	0	0.0%
Total-CT	**409**	**0**	**0.0%**




Statewide Infection of Ixodes scapularis Adult Females and Nymphs, 2020
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Females
Nymph
7.8%
4.0%
48.2%
20.6%
2.7%
1.1%
8.6%
6.8%
0.0%
0.4%
Anaplasma
B. burgdorferi
B. miyamotoi
Babesia
Powassan