Utah Department of Health and Human Services

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Tick surveillance annual report 2023

Introduction

The Utah Department of Health and Human Services (DHHS) conducts tick surveillance to better understand the distribution of tick species across the state, seasonal tick trends, and potential tickborne diseases that can be acquired in Utah. All these data help identify areas of risk for certain tickborne diseases across the state.

The tick surveillance project began in summer 2020 and tick identification at the Utah Public Health Lab (UPHL) began in summer 2022. Along with DHHS and UPHL, these surveillance efforts have been conducted with help from several other partners, including the local health departments (LHDs) throughout Utah, Division of Wildlife Resources (DWR), the Rickettsial Zoonoses Branch at the Centers for Disease Control and Prevention (CDC), various camp facilities throughout the state, and Utah residents who submit tick specimens to UPHL.

This annual report summarizes the tick surveillance efforts during the 2023 season, including locations where tick drag events occurred, which tick specimens were found, pathogens that were identified, and tick surveillance expansion and improvement efforts.

Dermacentor andersoni female under the microscope at UPHL.

Background

Tickborne disease incidence in people in Utah is low. The most common disease carried by ticks in Utah is Colorado tick fever (CTF), followed by Rocky Mountain spotted fever (RMSF). On average, 1–2 CTF cases are reported annually and an average of 1 RMSF case is reported every 5 years in the state. Both diseases can be transmitted by the Rocky Mountain wood tick (*Dermacentor andersoni)*, which is the most common tick found in Utah.

Lyme disease is the most common tickborne illness in Utah. However, most human Lyme disease cases reported in Utah traveled to Lyme-endemic areas in the Midwest and along the east coast. While the vector for Lyme disease, the western black-legged tick (*Ixodes pacificus),* is found in Utah, none have tested positive for the bacteria that causes Lyme disease and there is no current evidence of tickborne Lyme disease transmission in the state. But, a handful of Lyme disease cases have been reported to DHHS with no out-of-state travel history. Further investigation on Lyme disease risk in Utah is needed.

DHHS tick surveillance efforts are conducted to learn more about Lyme disease risk in Utah. We also want to identify which tick species are present in Utah on a county level, what pathogens they carry, and which seasons of the year these tick species are active.

Utah's tick surveillance efforts have expanded to include tick drags performed by LHDs, animal surveillance conducted by representatives at DWR, and passive surveillance by volunteer partners as well as public submissions through a citizen submission program.

Surveillance protocols

Tick surveillance at DHHS is an ongoing and evolving program and, therefore, year-to-year protocols may change based on goals and objectives for that current season. To understand the 2022 tick surveillance program and protocols, please see the 2022 report here: https://epi.utah.gov/wp-content/uploads/DHHS_TickSurveillanceReport_FINAL.pdf

DHHS tick drags

The spring tick drag schedule is determined by the temperature and snow melt, and start dates change on an annual basis. Once temperatures are above freezing for a week and there is no snow on the ground at a specific site of interest, the spring tick drags can begin. Two to 5 DHHS employees visit a drag site, use a tick flag (a white cloth with a broom stick attached as a handle), walk for 30-minute increments to try to collect any ticks in the area. Flags are checked every 25 steps to make sure any captured ticks do not fall off of the cloth. Ticks are collected from the flag and placed in labeled tubes for further analysis at UPHL.

The tick drag season ends when temperatures drop below freezing for more than 3 days in a row, and an area gets snow (usually in mid to late October).

Tickborne disease case follow-up

DHHS performs follow-up tick drags at or near areas of known exposure for reported human tickborne disease cases. When a tickborne disease case is reported to DHHS in the electronic disease surveillance reporting system, the DHHS team reaches out to the appropriate LHD to get any relevant exposure information for cases who report a known tick bite in Utah. Within 2 weeks, the DHHS team goes to the general area where the tick bite was reported to conduct a tick drag using the same protocol as the active tick drag protocol above. If ticks are found, the team continues to survey the area for ticks for another 30 minutes. Collected ticks are then sent to UPHL for identification and pathogen testing. The follow-up tick surveillance protocol was created and implemented for the first time in 2023. **DHHS followed up on one Colorado tick fever case with a known tick exposure in Utah.**

LHD tick drags

DHHS started training interested LHDs on tick surveillance and tick drag protocols during the fall 2022 tick drag season. We also provided tick drag supplies. LHD tick drags follow the same protocol as DHHS tick drags. **One LHD partner conducted tick drags and sent ticks to UPHL for identification and pathogen testing in 2023.**

Passive partner surveillance

Passive surveillance includes tick submissions from established state partners. Ticks found (on a person or pet, or in the environment) are collected and sent to UPHL for analysis. If an organization wants to become a tick surveillance partner with DHHS, vector-borne epidemiologists at DHHS provide training and tick collection supplies including vials with ethanol, vial labels, and a Google spreadsheet to document tick specimens collected. Tick specimens may be transported to UPHL by DHHS staff or the UPHL courier system. Past partners have included mosquito abatement districts and youth camp facilities. **One established partner submitted ticks for analysis in 2023.**

Citizen submission program

DHHS started their citizen tick submission program in 2023 to diversify the species of ticks and tick locations collected throughout the state, as well as to increase tick collection numbers. Ticks that test positive for a pathogen of interest and submitted through this

program can help in targeted active tick drags in the area the submitted tick was originally found. DHHS created a RedCAP survey (https://pubredcap.health.utah.gov/surveys/?s=4P9WXFRWT9D9LAXL) posted on our website for anyone to fill out and submit with a tick specimen they find. Tick specimens should be double bagged and dropped off at the closest local health department to be shipped to UPHL for tick identification and pathogen testing. Identification information will be provided to the submitter if an email address is listed on the form. Pathogen testing results are for internal use only and are not provided to the submitter since tick pathogen results should not be used for diagnostic purposes.

Animal surveillance

Animal surveillance gives us the chance to collect higher numbers of ticks at one site and helps us understand the species of ticks found in Utah at a county level. Many tick species are host-specific and will likely not be found during tick drag events, so animal surveillance is a more efficient way to capture tick count data for various tick species. Tick collection can take place during trapping events, game checkpoint events, and other already scheduled pathogen testing or animal encounter events to reduce added work for those who participate in animal surveillance. DHHS provides vials pre-filled with ethanol and vial labels for tick collection along with a Google sheet to document tick specimens. Tick specimens will either be picked up by DHHS or the UPHL courier system will be used to transport samples to UPHL for further analysis**. No animal surveillance was performed during the 2023 tick surveillance season.**

Tick identification protocol

Tick identification is performed under a microscope using dichotomous keys (Brinton et al., 1965) provided by the Rickettsial Zoonoses Branch at the CDC. Larval ticks and any ticks difficult to identify by microscopy (due to damage), are sequenced for identification.

Tick pathogen testing protocol

UPHL tests all viable adult ticks for pathogens of interest. Currently, UPHL tests for *Rickettsia ricketsii*, Colorado Tick Fever virus (CTFv), and *Borrelia burgdorferi*. These tests are decided based on the species of tick submitted.

DHHS Tick drag locations summary

The main goals for tick surveillance in 2023 were to increase tick collection numbers to test for pathogens and to assess which seasons the ticks in Utah are active. Therefore, tick drag efforts were focused at a handful of sites that were revisited on a monthly basis. DHHS conducted 50 tick drags throughout the 2023 season, which included visits to 16 unique sites. Active tick surveillance started late due to a long and wet winter and spring season. The first tick drag of the year occurred on May 4, 2023 (compared to April 8 in 2022) in Salt Lake County, and the last tick drag of the year occurred on October 24, 2023 in Summit County. Table 1 summarizes the tick drags completed during 2023 by county.

Table 1. Tick drag events by county, 2023

County	Number of tick drags
Salt Lake	19
Summit	20
Tooele	2
Wasatch	9
Total	50

Tick specimen summary

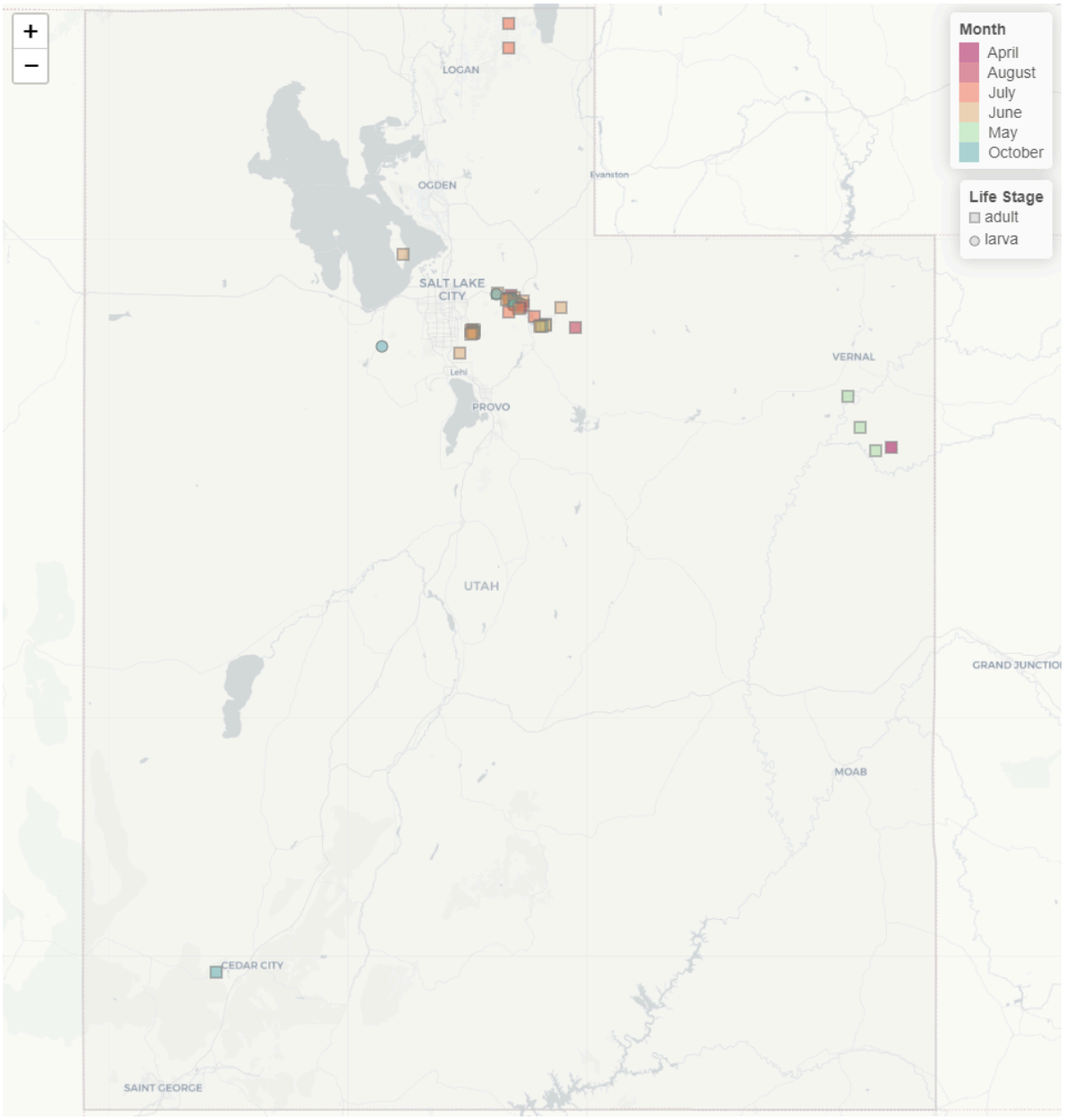
We collected **229 adults, 2 nymph, 128 larval ticks, and more than 100 tick eggs in 2023** (Table 2). The year before (2022), we collected 80 adults, 1 nymph, and 215 larval ticks. The ticks came from DHHS tick drags, partner tick drags, and passive collection through the DHHS public submission program. Figure 1 shows the locations where adults, nymphs, and larvae were collected throughout Utah in 2023.

Table 2. Collected adult ticks by sex, 2023

Sex	Tick count
Male	103
Female	126
Total	229

Note: Sex was not determined for larval and nymph ticks.

Figure 1. Locations where adults, nymphs, and larvae were collected in Utah, 2023



Interactive tick surveillance map link

Of the 229 adult ticks collected, 55% (n=126) were female (Table 2). In 2023, DHHS identified 6 species among the adult ticks collected: *Dermacentor andersoni, Dermacentor albipictus, Dermacentor similis, Dermacentor variabilis, Ixodes pacificus,* and *Rhiphicephalus sanguineus*. The nymphs found were identified as *R. sanguineus*, and the larval ticks collected were identified as *D. andersoni or D. albipictus.* Table 3 describes count data for tick species and life stage found in 2023.

Table 3. Tick species counts by life stage, 2023

Species	Life stage			
	Adult	Nymph	Larvae	Total
D. albipictus	4		127	131
D. andersoni	208		1	209
D. similis	2			2
D. variabilis	2			2
R. sanguineus	10	2		12
I. pacificus	2			2
Total	228	2	128	358

Note: D. similis and D. variabilis ticks were submitted through the citizen submission program by a Utah resident but came from outside of Utah.

Tick habitat

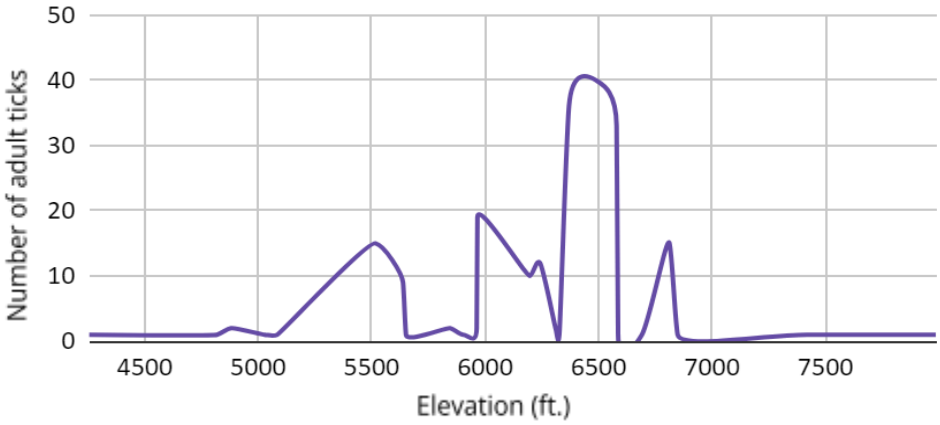
Ticks collected during DHHS tick drags were found in areas with mixed grasses and shrubs (Figures 2-4). Habitat details for most submitted ticks are not available. Ticks collected in 2023 were found at elevations ranging between 4,254 feet and 7,987 feet (note: 23 submitted ticks did not have specific location information and were excluded from elevation data summaries). Figure 5 shows the elevation distribution of the ticks collected during the 2023 season. Additional collections are needed to better understand elevation preferences of different tick species.

Figure 2. Sage brush and mixed green grass habitat where *D. andersoni* adults were found in the spring months

Figure 3. Grass patches where ticks were found

Figure 4. Close up of tick questing on a piece of grass

Figure 5. Elevation range of adult ticks collected in 2023



Note: Figure 5 shows the elevation range of the sites where DHHS tick drags were done, as well as where the passive surveillance partners collected ticks. This figure does not necessarily show the preferred elevation of ticks

Seasonality of ticks

In general, ticks are most active in the spring/early summer months after the snow melts and in the fall months once the weather cools down, before the first snow. DHHS focused on looking at the seasonality of Utah ticks in 2023 to see if Utah sees the same general tick seasonality trend. Ticks were first collected at the end of April from a partner submission. The first tick found during DHHS active surveillance was found at the start of May during the first tick drag of the season. Tick numbers from drag events peaked in June and submitted ticks peaked in June and September. The submitted ticks in September were mostly from the southern regions of Utah. Table 4 summarizes the locations of the adult ticks found in 2023 by month for each collection method (drag and submission). Figure 6 outlines the number of adult and nymph ticks found by all methods on a biweekly basis and Figure 7 outlines the number of tick larvae found on a biweekly basis. Larval ticks were found in May (n=1) as well as in October (n=127), and 2 nymph ticks were found in September.

Table 4. Count of adult ticks collected by month per county

County	Month							
	April	May	June	July	August	September	October	Grand total
Box Elder		**1**						**1**
Drag								
Submission		1						
Cache				**3**				**3**
Drag								
Submission				3				
Davis			**1**					**1**
Drag								
Submission			1					
Iron							**2**	**2**
Drag								
Submission							2	
Salt Lake		**4**	**38**	**2**				**44**
Drag		4	38	2				
Submission								
Summit		**33**	**65**	**33**	**3**			**134**
Drag		33	61	30	2			
Submission			4	3	1			
Uintah	**1**	**4**						**5**
Drag								
Submission	1	4						
Wasatch		**16**	**7**					**24**
Drag		16	6					
Submission			1					
Washington						**10**		**10**
Drag								
Submission						10		
Unknown county		**1**		**1**				**2**
Drag								
Submission		1		1				
Grand total	**1**	**59**	**111**	**39**	**3**	**10**	**2**	**226**

Note: "Drag" = tick drags performed by DHHS; "Submission" = ticks found and submitted by partners or through the public submission program

Figure 6. Date of adult and nymph tick collection—biweekly, 2023

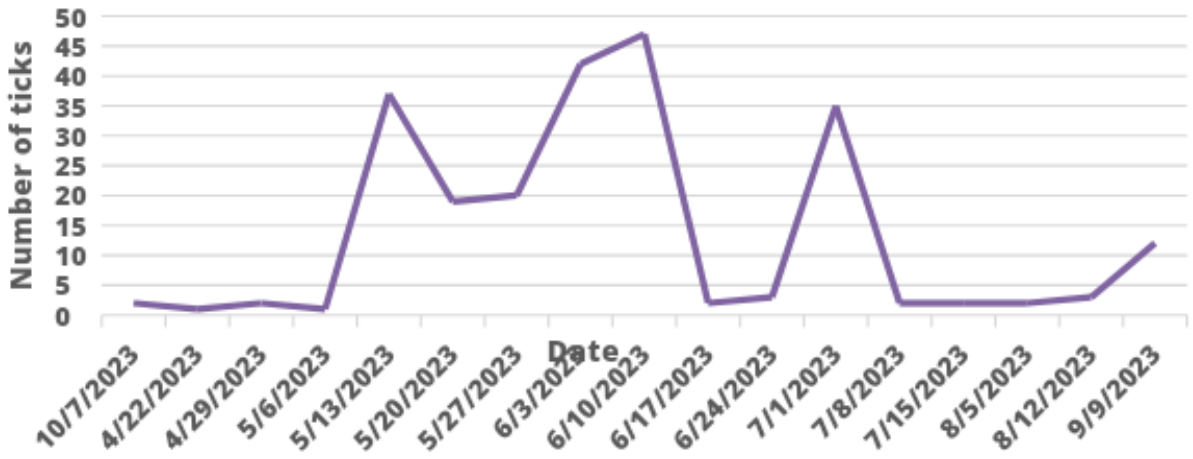
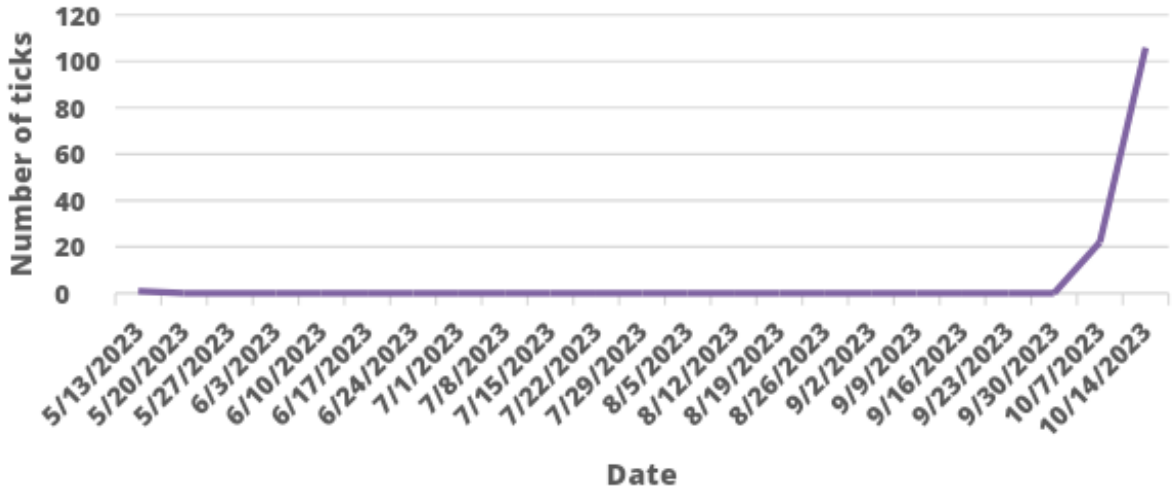


Figure 7. Date of larval tick collection, 2023



Pathogen testing

UPHL onboarded CTFv tick testing in 2023 along with the already established *Rickettsia rickettsii* and *Borrelia burgdorferi* assays. As of January 2024, UPHL has tested 221 out of the 230 adult and nymph ticks collected throughout 2023. *R. rickettsii* testing was performed on *Dermacentor* spp. and *R. sanguenius* ticks. CTFv testing was performed on *Dermacentor* spp. ticks. *B. burgdorferi* testing was performed on *I. pacificus* ticks. 217 ticks were tested for *R. rickettsii*, 179 ticks were tested for CTFv, and the 2 *I. pacificus* found this year were tested for *B. burgdorferi*. Table 5 summarizes the pathogen testing results.

Table 5. Pathogen testing results from 2024 collected ticks

Pathogen tested	# Positive	# Negative	# Inconclusive
R. rickettsii	0 (0%)	217 (100%)	0 (0%)
CTFv	13 (7.3%)	161 (89.9%)	5 (2.8%)
B. burgdorferi	0 (0%)	2 (100%)	0 (0%)

Tickborne disease counts

The most common tickborne diseases that are reportable in Utah include Colorado Tick Fever (CTF), Lyme disease, Rocky Mountain spotted fever (RMSF), and Tickborne Relapsing Fever (TBRF). There were 2 confirmed/probable human CTF cases reported in 2023. Both cases had known tick bites in Utah. There were 16 confirmed/probable Lyme cases reported in 2023. Most of those cases (14) had known travel history and 2 cases had unknown travel and exposure history information. There were 0 confirmed/probable Utah cases of RMSF and TBRF reported in 2023. However, there was an out-of-state resident who developed TBRF after a Utah travel exposure. Table 6. summarizes tickborne case counts compared to the 5- and 10-year averages.

Table 6. 2023 human tickborne disease case counts vs. 5- and 10-year averages

Disease	2023	5-year average	10-year average
CTF	2	1.6	0.9
Lyme disease	16	18.8	18.2
RMSF	0	4	5.3
TBRF	0	0.4	0.6

Resources

Utah pest fact sheet: Ticks and tickborne diseases of Utah (Utah State University)

Lyme disease DHHS disease plan (2022)

Colorado Tick Fever DHHS disease plan (2018)

Spotted fever rickettsiosis DHHS disease plan (2019)

CDC tick surveillance and tick drag protocol (2020)

CDC tick website

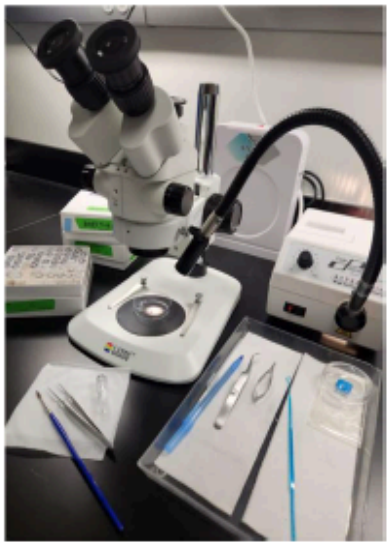
CDC tickborne disease reference manual for providers (Sixth Edition, 2022)

BYU *Dermacentor* identification Dichotomous keys

Tick surveillance 2023 photo album

First tick of the season collected, May 2023

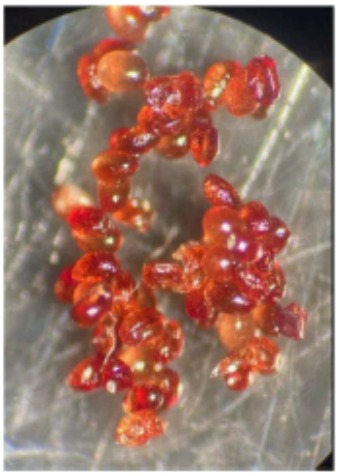
Vial of *D. andersoni* ticks found on our Colorado Tick Fever case follow-up drag



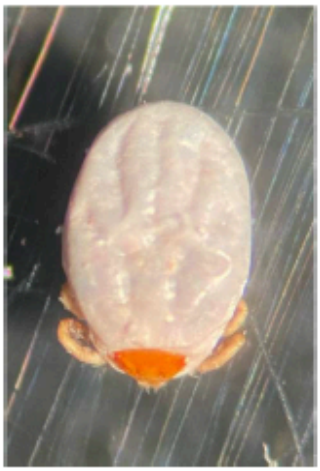
Tick identification set-up at the Utah state lab

Grass patches on the side of a popular recreation trail where several ticks were found

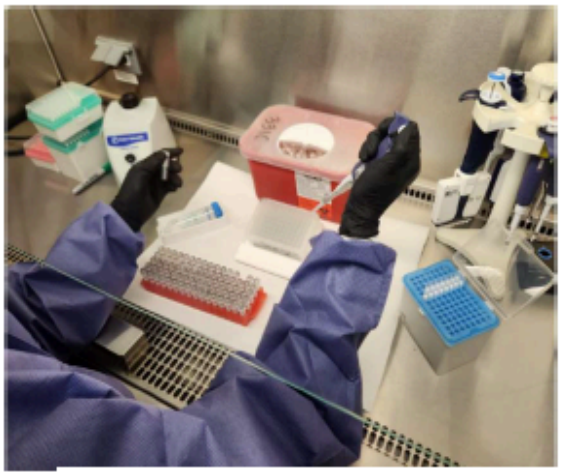
Active tick drag surveillance performed by DHHS team



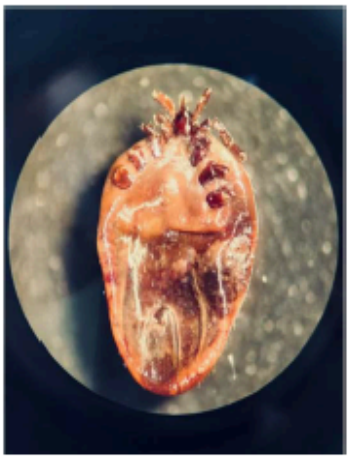
R. sanguineus eggs found in a dog's ear



Dorsal view of *R. sanguineus* larva found by a vet in a dog's ear



DNA/RNA extraction for tick pathogen testing



Ventral view of the first *I. pacificus* tick found during DHHS tick surveillance efforts