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Source: Journal of Medical Entomology, 43(1):17-24. 2006.
Published By: Entomological Society of America
DOI: http://dx.doi.org/10.1603/0022-2585(2006)043[0017:DSAHOT]2.0.CO;2
URL: http://www.bioone.org/doi/full/10.1603/0022-2585%282006%29043%5B0017%3ADSAHOT%5D2.0.CO%3B2

Distribution, Seasonality, and Hosts of the Rocky Mountain Wood Tick in the United States

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J. Med. Entomol. 43(1): 17–24 (2006)

ABSTRACT *Anaplasma marginale* Theiler is a tick-borne pathogen that causes anaplasmosis in cattle. There are ≈20 tick species worldwide that are implicated as vectors of this pathogen. In the United States, *Dermacentor andersoni* Stiles and *Dermacentor variabilis* (Say) are the principal vectors. The risk of transmission of anaplasmosis to cattle has been largely based on the distribution of *D. andersoni* in the United States. We developed a centralized geographic database that incorporates collection records for *D. andersoni* from two large national databases. We reviewed the geographic records in each database and postings from MEDLINE and AGRICOLA to produce a national county-level distribution map based on a total of 5,898 records. The records spanned the period from 1903 through 2001 with the majority between 1921 to 1940. Populations of *D. andersoni* were recorded from 267 counties in 14 states and were distinguished as either established or reported. We found 180 counties with established populations of *D. andersoni* and 87 counties with reported occurrences in 14 states with the majority of established populations reported from Montana, Idaho, and Oregon. *D. andersoni* populations in the United States currently extend from the western portions of Nebraska and the Dakotas westward to the Cascade Mountains and from the northern counties of Arizona and New Mexico northward to the Canadian border. The data will be useful for identifying regions at increased risk of acquiring anaplasmosis in the United States. Based upon the database collection records, we also present a summary of recorded hosts for *D. andersoni* and comments on its seasonal occurrence.

KEY WORDS *Dermacentor andersoni*, distribution, United States

TICKS ARE IMPORTANT VECTORS of disease-causing pathogens affecting humans and animals. Disease agents transmitted to livestock, equids, and poultry by ticks can have a major impact on animal production in many regions of the world (Jongejan and Uilenberg 1994). Ticks cause not only severe toxic reactions, such as paralysis, but also may transmit bacterial, viral, and protozoal pathogens. The Rocky Mountain wood tick, *Dermacentor andersoni* Stiles, is the principal vector of *Anaplasma marginale* Theiler to cattle in the United States (Kocan 1986). Anaplasmosis can cause serious health problems to cattle with estimated losses of $300 million annually in the United States (Kocan et al. 2000). *A. marginale* is a rickettsial organism that produces progressive anemia, anorexia, resultant weight loss, reduced exercise tolerance, and even death in cattle (Schofield and Saunders 1987, Kocan 1992, Palmer et al. 2001). Geographic isolates of *A. marginale* can vary in genotype, antigenic composition, morphology, and infectivity in ticks (Ewing 1981). High infection rates of male *D. andersoni* with their intermittent feeding behavior make the males the primary method for *A. marginale* transmission to cattle in certain regions (Eriks et al. 1993, Kocan and de la Fuente 2003). The Rocky Mountain wood tick is also a vector of the agents of Rocky Mountain spotted fever, tularemia, and Q fever and can cause tick paralysis in humans and animals (Comer 1991, McLean et al. 1993, Treadwell et al. 2000, Lysyk 2003).

Numerous studies on the Rocky Mountain wood tick deal with its ecology, distribution, seasonal behavior, vector capacity, and paralyzing ability. Kocan (1986) cites its distribution as from western Nebraska and South Dakota, westward to the Cascades and Sierra Nevada Mountains, and from northern New Mexico and Arizona, northward into Canada. In Canada, *D. andersoni* has been reported from southern British Columbia eastward into Alberta and extending into Saskatchewan where it is replaced by *Dermacentor variabilis* (Say), the American dog tick (Gregson 1973). The Rocky Mountain wood tick is a three-host tick, and its life cycle is usually completed within 2 to 3 yr, depending on its geographic location, with all three life stages capable of overwintering (Wilkinson

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1968, 1979; Eads and Smith 1983). Adults usually occur as early as March, reaching a maximum abundance in April and May; nymphs typically parasitize hosts in early April, whereas, larvae usually occur in early June. All three stages usually disappear by late summer or early fall (Cooley 1932). Small mammals such as chipmunks (*Tamias* spp.), ground squirrels (*Spermophilus* spp.), woodrats (*Neotoma* spp.), and jackrabbits (*Lepus* spp.) serve as hosts for larvae and nymphs, whereas adults generally feed on larger mammals such as horses (*Equus caballus* L.), cattle (*Bos taurus* L.), mule deer [*Odocoileus hemionus* (Rafinesque)], mountain goat [*Oreaminos americanus* (Blainville)], and elk (*Cervus elaphus* L.).

Generally, infections with tick-borne disease agents are tied closely to the local prevalence of tick vectors, and specifically, the risk of *A. marginale* transmission to cattle has largely been based on studies of the distribution of *D. andersoni* (Kocan 1986). Because the United States distribution of *D. andersoni* has not been reported previously at the county level, we developed such a distribution map, using data from two large extant faunistic collections. This map provides a basis for designing better prevention strategies against anaplasmosis and other diseases associated with the Rocky Mountain wood tick.

Materials and Methods

Definitions. We used the county-level definitions of *Ixodes scapularis* Say, the blacklegged tick, populations given by Dennis et al. (1998) as a basis to describe *D. andersoni* populations. *D. andersoni* was defined as "reported" from a county if at least one specimen of any life stage had been collected, or if the number of specimens collected was not specified in that area at any time within that county. Tick populations were defined as "established" if at least six ticks of one life stage or two of the three active life stages (adults, nymphs, or larvae) were collected within that county during one collection period.

USDA Tick Geodatabase. Electronic records from the United States National Tick Collection (USNTC) database were obtained from National Museum of Natural History, the Smithsonian Institution in Washington, DC. The USNTC records for *D. andersoni* were from 1903 through 1989. Records from U.S. Department of Agriculture's (USDA) National Tick Surveillance Program database were obtained from the Pathobiology Laboratory of the National Veterinary Services Laboratories (NVSL) in Ames, IA. From NSVL database records for *D. andersoni*, we were able to extend our distribution records from 1990 to 2001. Collection records from this database were combined with the USNTC collection records for *D. andersoni* to create a single database, USDA's tick geodatabase. For counties with multiple records, if a county met the criteria for an established population during any collection period in either database, then the county was listed as established. If any records did not give county-level information, then other locality fields (e.g., cities) were used to identify the counties of record.

Literature Sources. MEDLINE (http://www.ncbi.nlm.nih.gov) and the National Agricultural Library's AGRICOLA (http://agricola.nal.usda.gov) databases were reviewed to identify articles on the distribution of the Rocky Mountain wood tick in the United States. Any county-level data identified were added to the tick geodatabase along with records from the USNTC and NVSL tick surveillance activities to produce a distribution map for *D. andersoni.* In addition, annual reports from USDA's National Tick Surveillance Program from 1962 through 1989 were reviewed for county- and state-specific information relevant to *D. andersoni*'s distribution in the United States.

The combined final database was used to produce a county-level distribution map for *D. andersoni.* Maps were created using ArcView, version 3.3 (ESRI, Redlands, CA). Counties were shaded to reflect the reported and established populations.

Results

The USNTC provided 6,256 distribution records for *D. andersoni*, including 375 records from Canada. Of the original total, 5,811 records had United States county-level information. The NVSL database provided 89 *D. andersoni* records, 87 of which had county-level information. Thus, we were able to use 5,898 records to develop a county-level-based map for the distribution of the Rocky Mountain wood tick in the United States (Fig. 1). Although the timeline of database entries extended from 1903 through 2001, the majority of the records (59%) came from 1921 to 1940. Table 1 summarizes the reported data mapped by state and county with *D. andersoni* populations characterized as established or reported. Tick populations were reported in 87 (2.8%) of the 3,141 counties in the United States and established in 180 counties (5.7%) for a total of 267 counties (8.5%) nationwide.

Table 2 summarizes the extent and level of Rocky Mountain wood tick distribution by county within each state and the contribution of each state to the total area encompassing the distribution of *D. andersoni* in the western United States. The established and reported populations of *D. andersoni* were present in 267 counties in 14 states with the largest proportions of the populations recorded from Montana (16.5%), Idaho (14.2%), and Colorado (12.4%). Wyoming had the most widespread distribution with records from 20 of 23 counties; however, MT maintained the largest number of established counties representing the overall distribution of *D. andersoni* with 20% of the total number of counties with established populations of the Rocky Mountain wood tick. Individual counties with reported populations were found in each of the 14 states with Colorado having the largest proportion (19.5%).

The *D. andersoni* records in the geodatabase resulted from flagging, dragging, CO_2 baits, and collections from small-, medium-, and large-sized animal surveys. Of the 5,898 records used to create the dis-

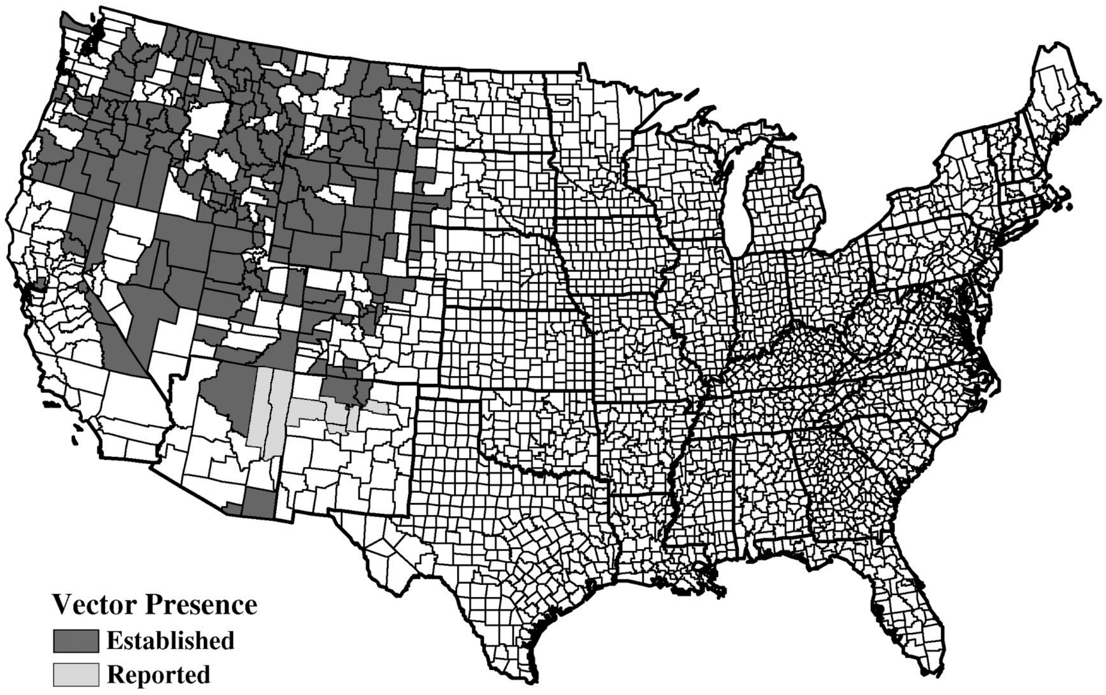

Fig. 1. Recorded distribution by county of *D. andersoni* in the United States geodatabase, 1908–2001.

tribution, 71.1% were collected from animal hosts, 24.9% from vegetation, and 3.9% had no collection methods listed. The animal-associated collections (Table 3) were collected from wildlife (53.5%) and from livestock, equids, domestic animals, or humans (17.6%).

D. andersoni adults were collected from all 267 counties; however, immatures were collected from only 258 counties. The largest numbers of adults and immatures collected were from Montana with 42,177 adults and 17,676 immatures collected from 44 counties. There were no larvae collected from Arizona, and no nymphs collected from North Dakota. North Dakota had the fewest collections, with only three adults and 40 larvae collected from four counties.

Discussion

The national map we developed for *D. andersoni* in the United States is the first county-level distribution map for this tick species since it was recognized as a vector of the agent of Rocky Mountain spotted fever to humans in 1906 (Bishopp 1911). From ≈210,000 records representing tick observations for >90 yr within both databases, we were able to find ≈6,000 *D. andersoni* records at the county level. A majority of *D. andersoni* collection records were from 1921 to 1941 in Montana. This disproportionate reporting of *D. andersoni* may have been because of extensive survey work conducted by the state of Montana and the presence of the Rocky Mountain Laboratories in Hamilton, MT, where the USNTC was housed initially (Bishopp and Trembley 1945, Durden et al. 1996). In total, 3,444 records were reported for *D. andersoni* within this 20-yr period and 3,306 (96.0%) of these records were from Montana. Between 1981 and 2001, there were only 92 records added to either database.

Distribution. Historically, only a few published works deal with the distribution of *D. andersoni* in the United States, and its known geographic range in the United States seems to have changed very little over the past 95 yr. After Dr. H. T. Ricketts determined that *D. andersoni* was the vector of the agent of Rocky Mountain spotted fever in 1906, an entomologist of the Montana Agricultural Experiment Station, R. A. Cooley, undertook the task of determining the tick's statewide distribution, and others worked with him to determine *D. andersoni*'s distribution beyond the state's border. They collected *D. andersoni* from 10 states with three localities in California, 15 in Colorado, 42 in Idaho, 72 in Montana, 11 in Nevada, two in New Mexico, 15 in Oregon, 12 in Utah, 27 in Washington, and 26 in Wyoming throughout 1909 (Bishopp 1911). In another survey from 1913 to 1932, the Entomology Board of Montana conducted various studies on *D. andersoni* and tick-transmitted diseases. *D. andersoni* was found in Arizona, California, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming. Furthermore, it was thought that *D. andersoni* would probably not extend its range beyond these 14 states because of its short feeding time on a host (Cooley 1932, 1938). Bishopp and Trembley (1945) reviewed and summarized the known geographic range of the Rocky Mountain wood tick, but their map shows a slightly smaller U.S. dis-

Table 1. Recorded geographic distribution in the Geodatabase for *D. andersoni* by state and county

Arizona	California	Colorado	Idaho	Montana	Nebraska	Nevada
Apache	**Alpine**	Adams	**Ada**	**Beaverhead**	**Dawes**	Douglas
Cochise	Eldorado	**Archuleta**	Bannock	**Big Horn**	**Scotts Bluff**	**Elko**
Coconino	Fresno	**Boulder**	Bear Lake	**Broadwater**	**Sioux**	**Eureka**
Navajo	Humboldt	Chaffee	Benewah	**Carbon**		Humboldt
Santa Cruz	**Inyo**	**Clear Creek**	Bingham	**Carter**		**Lander**
	Kern	**Conejos**	**Blaine**	Cascade		Lincoln
	Lassen	Custer	Boise	**Chouteau**		Lyon
	Los Angeles	Denver	**Bonner**	**Custer**		**Nye**
	Mendocino	Douglas	**Bonneville**	Daniels		**Washoe**
	Modoc	Eagle	**Boundary**	Dawson		**White Pine**
	Mono	El Paso	**Butte**	Fergus		Carson City
	Nevada	Fremont	**Camas**	**Flathead**		
	Plumas	**Garfield**	**Caribou**	**Gallatin**		
	Shasta	Gilpin	**Cassia**	**Garfield**		
	Siskiyou	Gunnison	**Clark**	**Glacier**		
	Solano	Jackson	**Clearwater**	**Golden Valley**		
		Jefferson	Custer	**Granite**		
		La Plata	**Elmore**	Jefferson		
		Lake	**Franklin**	**Lake**		
		Larimer	**Fremont**	**Lewis/Clark**		
		Mesa	**Gem**	**Lincoln**		
		Montezuma	Gooding	**Madison**		
		Montrose	**Jerome**	**Meagher**		
		Ouray	**Kootenai**	**Mineral**		
		Park	**Latah**	**Missoula**		
		Pitkin	**Lemhi**	**Musselshell**		
		Rio Blanco	**Lincoln**	**Park**		
		Rio Grande	**Minidoka**	**Phillips**		
		Routt	**Nez Perce**	Pondera		
		Saguache	**Oneida**	**Powell**		
		San Miguel	Owyhee	**Powder River**		
		Summit	**Payette**	**Ravalli**		
		Weld	**Power**	**Richland**		
			Shoshone	**Roosevelt**		
			Teton	**Rosebud**		
			Twin Falls	**Sanders**		
			Valley	**Silver Bow**		
			Washington	Stillwater		
				Sweet Grass		
				Teton		
				Toole		
				Treasure		
				Valley		
				Yellowstone		

New Mexico	North Dakota	Oregon	South Dakota	Utah	Washington	Wyoming
Bernalillo	Adams	**Baker**	**Butte**	Beaver	Adams	**Albany**
Los Alamos	**Bowman**	Benton	**Custer**	**Box Elder**	**Asotin**	**Big Horn**
Mckinley	Hettinger	**Clackamas**	**Fall River**	**Cache**	Benton	**Campbell**
Mora	Slope	**Columbia**	Harding	**Carbon**	**Chelan**	**Carbon**
Rio Arriba		**Crook**	Jackson	Davis	**Clallam**	**Converse**
Sandoval		**Deschutes**	**Lawrence**	Duchesne	Clark	**Fremont**
Santa Fe		**Douglas**	Meade	Emery	Columbia	Hot Springs
Taos		**Gilliam**	**Pennington**	Garfield	**Douglas**	**Johnson**
		Grant		Grand	**Ferry**	Laramie
		Harney		**Iron**	Franklin	**Lincoln**
		Hood River		**Juab**	Garfield	**Natrona**
		Jackson		**Kane**	**Grant**	**Park**
		Jefferson		**Millard**	King	**Platte**
		Josephine		**Salt Lake**	**Kittitas**	**Sheridan**
		Klamath		**San Juan**	**Klickitat**	**Sublette**
		Lake		San Pete	**Pend Oreille**	**Sweetwater**
		Lane		**Sevier**	Pierce	**Teton**
		Linn		Summit	Skamania	**Unita**
		Malheur		**Tooele**	**Spokane**	Washakie
		Marion		**Unitah**	**Stevens**	**Weston**
		Morrow		**Utah**	Walla Walla	
		Multnomah		**Wasatch**	Whatcom	
		Sherman		Washington	**Whitman**	
		Tillamook			**Yakima**	
		Umatilla				
		Union				
		Wallowa				
		Wasco				
		Wheeler				
		Yamhill				

[a] Counties in bold represent established populations.

Table 2. Numbers and percentage of U.S. counties by state with reported and established populations of the Rocky Mountain wood tick in the Geodatabase

State (no. counties)	Established	Reported	Total	% *D. a.* distribution	% state/counties
Arizona (15)	3	2	5	1.9	33.3
California (58)	7	9	16	6.0	27.6
Colorado (63)	16	17	33	12.4	52.4
Idaho (44)	29	9	38	14.2	86.4
Montana (57)	36	8	44	16.5	77.2
Nebraska (93)	3	0	3	1.1	3.2
Nevada (17)	6	5	11	4.1	64.7
New Mexico (33)	3	5	8	3.0	24.2
North Dakota (53)	1	3	4	1.5	7.5
Oregon (36)	27	3	30	11.2	83.3
South Dakota (66)	5	3	8	3.0	12.1
Utah (29)	14	9	23	8.6	79.3
Washington (39)	13	11	24	9.0	61.5
Wyoming (23)	17	3	20	7.5	87.0
Total	180	87	267		

D. a., *D. andersoni.*

tribution than that of Cooley (1938). They remarked on its abundance in rough cut-over, mountainous areas, and sage brush country near streams. By 1975, the known distribution of *D. andersoni* was confirmed over the mountainous areas of the western United States from the Dakotas, Nebraska, Colorado, and northern New Mexico westward through some of northern California to the eastern slope of the Cascades in Oregon and Washington (Easton et al. 1977). Specifically, in Oregon, *D. andersoni* nymphs were found in Baker, Douglas, Gilliam, Grant, Harney, Klamath, Lake, Malheur, Union, and Wheeler counties, and larvae were found in five of those counties: Douglas, Gilliam, Grant, Harney, and Malheur. In a small survey in California in 1981, the distribution of the Rocky Mountain wood tick was limited to Lassen and Modoc counties in association with pine (*Pinus* spp.), juniper (*Juniperus* spp.), and woodland with sagebrush scrub (Lane et al. 1981).

Our review of the distribution records of *D. andersoni* in USDA's tick geodatabase indicates that it has been reported from 267 counties in 14 states through 2001. This tick species has not extended its range into any additional states since 1932. Comparing the number of counties reporting *D. andersoni* with the total number of counties within each state, *D. andersoni* seems to be well established in Wyoming (87.0%), Idaho (86.4%), Oregon (83.3%), Utah (79.3%), and Montana (77.2%). Adults were collected from all 14 states, nymphs from 13 states with the exception of North Dakota, and larvae were collected from 13 states with the exception of Arizona. The collection of immatures from all 14 states is a good indication that established populations of *D. andersoni* exist in all of them.

Over the entire time recorded in the databases, the distribution of the Rocky Mountain wood tick only covers just >8% of the counties within the United States and all counties are in the western half of the country. This percentage translates to 26.5% of the total surface of the continental United States. Although each county within a state is completely

Table 3. Recorded animal host associations of *D. andersoni* in the United States Geodatabase

No. records	Host	State abbreviation													
		AZ	CA	CO	ID	MT	ND	NE	NM	NV	OR	SD	UT	WA	WY
1,123	Chipmunk, squirrels, and prairie dogs		*	*	*	*	*			*	*	*	*	*	*
1,053	Voles, pikas, and pocket gophers		*	*	*	*		*	*			*	*	*	*
2	Weasels			*											*
19	Bears				*	*									
6	Birds (grouse)					*									*
2	Bobcats					*									
419	Rabbits and hares	*	*	*	*	*	*	*	*	*	*		*	*	*
236	Mice and rats	*	*	*	*	*	*		*	*	*	*	*	*	*
211	Marmots, badgers, and porcupines		*	*	*	*			*		*	*	*	*	*
5	Coyotes				*	*						*	*		
82	Hoofed mammals (wildlife only)			*	*	*			*					*	*
97	Cattle	*	*	*	*					*	*		*	*	*
414	Equids	*	*	*	*	*	*	*	*	*	*	*	*		
37	Sheep	*	*	*	*	*	*	*	*	*	*				
6	Pigs		*			*									*
4	Goats					*					*				
51	Dogs		*	*	*	*		*			*		*	*	*
5	Cats (domestic)		*	*	*										
422	Human	*	*	*	*	*	*	*	*	*	*	*	*	*	*

shaded in Fig. 1, tick populations were not evenly dispersed over the entire county.

Range expansion of the Rocky Mountain wood tick may be limited by the availability of suitable habitats. This tick seems to inhabit areas in the United States that are semiarid and mountainous with vegetation including short prairie grasses, shrubs, and few trees. It has been found in association with pine, juniper, and woodland with sagebrush scrub in California (Lane et al. 1981). Moreover, Eads and Smith (1983) found *D. andersoni* to be concentrated in areas of shrub, rocky outcrops, open grassy areas, and in montane forests and ponderosa pine (*Pinus ponderosa* P.C. Lawson) in Colorado. In Canada, *D. andersoni* inhabits areas of subalpine forest, shrubby areas, ponderosa pine, bluebunch wheatgrass [*Pseudoroegneria spicata* (Pursh)], rose (*Rosa* spp.), and saskatoon shrubs (*Amelanchier alnifolia* Nutt.), *Agropyron spicatum* (Pursh) grass, and Douglas fir tree [*Pseudotsuga menziesii* (Mirbel)] zones (Hall et al. 1968, Schaalje and Wilkinson 1985). The availability of hosts, soil temperatures, humidities, aspect, and slope seem to determine the distribution of this tick species.

Seasonality. Seasonal collection records for *D. andersoni* in USDA's tick geodatabase correlated well with those in previously published studies. In our records, adults were collected on either hosts or vegetation from February through November, with nymphal collections from March through October, and larval collections as early as March and as late as October. The largest number of adults was collected from March through April, most nymphs from May to June, and most larvae from June to July.

A summary of seasonality information in the existing literature for *D. andersoni* populations among the 14 states shows good consistency with our observations. Adults were collected between January and November, with peak activity between April and June. Nymphs and larvae were collected between March and October, with peak activity from May through June. All three stages were collected contemporaneously between March and October with peak activity for all three stages in May and June; however, the seasonal activity of *D. andersoni* can vary regionally (Rotramel et al. 1976). In Oregon, adults were collected from February through October and peak activity was in May (Easton et al. 1977), whereas in Colorado adults were collected between March and October with the majority between April and June. Nymphs were collected in Colorado between March and June (Bishopp and Trembley 1945, Eads and Smith 1983). In Montana, *D. andersoni* larvae were active from June to September, and nymphs were active from June to August and as early as April (Sonenshine et al. 1976).

Hosts. Most of the *D. andersoni* collection records from wildlife in the geodatabase came from small mammals, such as chipmunks, ground squirrels, pikas (*Ochotona* spp.), pocket gophers (*Thomomys* spp.), mice, rats, marmots (*Marmota* spp.), and porcupines [*Erethizon dorsatum* (L.)] (Table 3). Also in our records, more Rocky Mountain wood tick collections came from large livestock, such as cattle and horses, than from large wildlife, such as elk or mule deer. Generally, host records in the tick geodatabase agree well with the most common published hosts for *D. andersoni.* For example, according to Cooley (1932) and Gregson (1973), small mammals serve as hosts for larvae and nymphs, and adults feed on larger mammals. All three stages can be found on porcupines, jackrabbits, and marmots (Wilkinson 1972, Gregson 1973, Rotramel et al. 1976). Small mammal hosts include ground squirrels, chipmunks, pocket gophers, marmots, woodrats, mice, pikas, and small carnivores (Sonenshine et al. 1976, Eads and Smith 1983) Larger mammal hosts include cervids, badgers [*Taxidea taxus* (Schreber)], bobcats [*Lynx rufus* (Schreber)], domestic cats (*Felis catus* L.), cattle, horses, domestic dogs (*Canis familiaris* L.), goats (*Capra hircus* L.), mountain goats, hogs (*Sus scrofa* L.), humans (*Homo sapiens* L.), bears (*Ursus* spp.), coyotes (*Canis latrans* Say), and sheep (*Ovis aries* L.) (Bishopp and Trembley 1945).

The medical and veterinary interest and importance of *D. andersoni* are exemplified by the large number of collection records from humans and livestock in both the geodatabase and the literature. Additionally, the large number of ticks removed from wildlife, particularly smaller mammals, suggests potential wildlife reservoirs of tick-borne diseases such as Colorado tick fever. For example, ecological studies carried out in Montana showed that the presence of Colorado tick fever was well correlated with not only the distribution of the Rocky Mountain wood tick but also the presence of ground squirrels, a preferred host of larval *D. andersoni* (Burgdorfer and Eklund 1959, 1960).

The national county-level distribution map for the Rocky Mountain wood tick described in this article provides a good foundation for future studies. The development of biologically based models that predict the regional distribution of American ticks can be an important element in assessing the risk of tick-borne diseases. For example, the blacklegged tick is a disease vector whose population maintenance and distribution depend on climate variation and landscape patterns (Ostfeld et al. 1996, Frank et al. 1998). Abiotic factors, such as precipitation and humidity, are important in regulating this tick's off-host survival (Needham and Teel 1991, Bertrand and Wilson 1996) and the character of local vegetation influences its occurrence (Schmidtmann et al. 1998). Our map provides an opportunity to understand some of the ecological processes that may be influencing the distribution of *D. andersoni.* A spatial model of the environmental suitability is currently under development to better assess the risk to animal health from the presence of established populations of this economically important tick species in the United States.

Acknowledgments

We thank the Centers for Epidemiology and Animal Health's GIS group within USDA–APHIS, and Veterinary Services in Fort Collins, CO, for helpful comments regarding database development and review of this manuscript. In addition, we thank the U.S. National Museum of Natural History, Smithsonian Institution, Entomology Department and Tim Merle; and the USDA, National Veterinary Services Laboratories Information Technology group in Ames, IA, and Larry Rice for help with the tick database records and interpretation.

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Received 22 June 2005; accepted 8 September 2005.