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Incidence of spotted fever in wood ticks of Utah recreational sites

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INCIDENCE OF SPOTTED FEVER IN WOOD TICKS OF UTAH RECREATIONAL SITES[1]

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Abstract.— In 1964, 135 male and 223 female *Dermacentor andersoni* Stiles were collected at 48 national forest recreation areas in Utah. Using guinea pigs immunological tests were performed on each of 62 samples to determine the presence of the Rocky Mountain spotted fever rickettsia. Thirteen of the samples (21 percent) were positive. These 13 samples contained 35 males and 34 females yielding an infection rate of at least 3.6 percent, assuming one infected tick was in each sample.

The Rocky Mountain wood tick, *Dermacentor andersoni* Stiles, has been recognized as the principal vector of Rocky Mountain spotted fever (RMSF) in the Rocky Mountain states since shortly after the turn of the century. Much human suffering and many deaths have resulted from this disease in Utah as well as throughout the western United States. The presence of *D. andersoni* in recreational sites of the foothills, canyons, and mountains of the West offers a potential threat to the health of man. Expanding human population and increasing use of recreational facilities enhances this potential.

A previous paper (Herrin, 1968) dealt with the prevalence of *D. andersoni* adults in national forest recreational sites of Utah. This research note reports the incidence of *Rickettsia rickettsi* (Wolbach) in adult ticks collected from these recreational areas.

Using a white flannel drag, 358 adult *D. andersoni* (135 males and 223 females) were collected from 48 recreational sites during the spring and summer of 1964. Ticks from 54 collections were divided into 62 samples, rinsed several times in sterile physiological saline, and preserved in vials of sterile, nonfat skim milk at below -30 C. Subsequently, the ticks were thawed, removed from the milk, triturated, and diluted with 10 ml of sterile, nonfat skim milk. One guinea pig per sample was inoculated with 1 ml of supernatant. Guinea pigs were observed for scrotal reactions, and rectal temperatures were taken every other day for 28 days. If the guinea pig died, a second was subsequently inoculated with the original supernatant. After 28 days, blood was taken and serum was extracted from the guinea pigs. Four complement fixation (CF) screen tests were performed on each sample, followed by an additional CF test to determine the antibody titer of positive samples. As a final test, all guinea pigs were inoculated with a lethal dose of virulent *R. rickettsi* to determine if they were immune to RMSF. In this test, one guinea pig per sample was challenged, and immunity was judged solely on survival.

Abnormal temperatures in guinea pigs resulted after injections of triturated tick material from 18 samples. Seven showed abnormally

[1]This paper is taken from a master's thesis submitted to the Department of Zoology and the Graduate School of Brigham Young University (1966).

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TABLE 1. Collections of *D. andersoni* adults determined to be positive for *R. rickettsi*.

National forest Recreational site	Collection date	Number and sex in sample	Complement fixation titer	Immunity test *
Cache				
Friendship and Spring	7 July	2M, 2F	32	+
Fish Lake				
Bowery	4 June	2M, 2F	64	+
City Creek	2 June	8M	128	+
		7F	0	—
Monrovian Park	2 June	6M	128	+
		12F	0	—
Ponderosa	2 June	7M	0	—
		10F	128	+
Manti-Lasal				
Manti Community	10 July	7M	128	+
		8M	0	—
		10F	0	—
		10F	0	—
Uinta				
Altamont	25 June	2M, 4F	64	+
Aspen Grove	25 June	2M, 5F	64	—
Mutual Dell	25 June	2M, 3F	128	+
Silver Lake Flat	25 June	1M, 4F	64	—
Timpooneke	25 June	4M	128	+
		11F	0	—
Whiskey Springs	10 June	2M, 3F	128	+
Wasatch				
Sunset	7 July	1F	128	+

* Legend: + = immune; — = susceptible.

high temperatures immediately and throughout the observation period, whereas 11 had an increase in temperature after several days. None demonstrated scrotal reactions or necrosis. Eight guinea pigs died within 3 to 14 days after inoculation. Thirteen of 62 serum samples (21 percent) yielded positive CF tests (see Table 1). The titers of these samples ranged from 1:32 to 1:128, whereas controls gave titers of 1:512. Eleven of 62 guinea pigs challenged with virulent spotted fever organisms survived, indicating immunity to RMSF. These 11 correspond with 11 of the 13 serum samples yielding positive CF results. In two cases of positive CF tests, guinea pigs were susceptible to the challenge. This close correlation between results of the CF tests and the immunity tests suggests that 11, and probably 13, tick samples contained *R. rickettsi*. Three of the CF positive guinea pigs showed slightly abnormal temperatures. The remaining 15, and possibly 18, instances of abnormal temperatures are not attributable to spotted fever, since there was no correlation between samples that showed positive CF and immunity tests. Of the eight guinea pigs that died, two were from samples deemed positive by CF and immunity tests. Observations made at necropsy indicated that death was probably caused by bacterial infection.

The 13 samples of ticks positive for spotted fever represented 69 ticks (35 males and 34 females). If each positive sample yielded one tick infected with spotted fever, then 3.6 percent of all ticks collected were infected. Infected ticks were from sites in the northern half of Utah near human population centers (Provo, Salt Lake City, Ogden, and Logan). Infected ticks were collected from early June to late July and from every elevation range at which collections were made (6000 to 8800 ft). Further studies relative to incidence and virulence of *R. rickettsi* in wood ticks would help to determine the enzootic status of RMSF in Utah. Such studies should include identification of *R. rickettsi* by fluorescent antibody staining and recovery of rickettsiae in egg cultures prior to immunological tests with guinea pigs.

Literature Cited

Herrin, C. S. 1968. *Dermacentor Andersoni* in national forest recreation sites of Utah. Great Basin Nat. 28(1):30-43.