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Plague in Free-ranging Mammals in Western North Dakota

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ABSTRACT: From July through October of 1996, 48 blood samples were collected from coyotes (*Canis latrans*), badgers (*Taxidea taxus*), and raccoons (*Procyon lotor*) in western North Dakota (USA) for the purposes of determining antibody titers to the plague bacterium, *Yersinia pestis.* The passive hemagglutination paper-strip blood-sampling technique was utilized with hemagglutination inhibition controls. Two positive samples were obtained from McKenzie county, one from a coyote with a titer of 1:64 and one from a badger with a titer of 1:256. Considering coyote and badger population dynamics, this study documents plague in western North Dakota.

Key words: Badger, *Canis latrans,* coyote, plague, *Taxidea taxus, Yersinia pestis,* survey.

Each decade since the mid-1940's has seen an increase in the number of reported cases of human plague in the United States and in the number of states reporting these cases. From 1944 to 1953, nine human cases of plague were reported from California, New Mexico, and Arizona. In sharp contrast, from 1984 to 1993, 125 cases of human plague were reported and these originated from all states west of the Mississippi except North Dakota, South Dakota, Nebraska, and Kansas (Centers for Disease Control and Prevention, 1994). While some of this increase may be explained by improved surveillance methods and better diagnostic techniques, there is an apparent mounting risk to humans in the Great Plains and western states. This study documents serologic evidence of *Yersinia pestis* in free-ranging mammals in western North Dakota.

Animals from 11 counties in western North Dakota were sampled (47° to 49°N, 101° to 104°W). This area is characteristic of the rolling grasslands of the northern Great Plains and includes the rugged terrain of Theodore Roosevelt National Park and the Little Missouri National Grassland. From July through October of 1996, five United States Department of Agriculture, Animal and Plant Health Inspection Service, Animal Damage Control (USDA/APHIS/ADC, Bismarck, North Dakota, USA) specialists were supplied with Nobuto paper strips (Toyo Roshi Kaisha, Ltd., Tokyo, Japan) by the Centers for Disease Control and Prevention (CDC, Fort Collins, Colorado, USA), for the purpose of obtaining blood samples to determine *Y. pestis* titers in harvested animals. Once dipped in the animal's blood and air dried, the strip was sealed in a labeled envelope and mailed to the North Dakota State University Veterinary Diagnostic Laboratory (NDSU-VDL, Fargo, North Dakota, USA) at the end of each week. There the samples were held in a conventional freezer and mailed in groups of ≥10 to CDC. Serology for antibody to *Y. pestis* was determined by the passive hemagglutination paper-strip blood-sampling technique as previously described (Wolff and Hudson, 1974). Briefly, a small section of the blood saturated strip was extracted overnight at 4 C (0.4 ml of borate buffer at pH 8.0). The buffer and strip were then complement inactivated at 56 C for 30 min. The extract was adsorbed to washed sheep red blood cells (1:10, vol/vol) for 20 min at room temperature. Supernatants were tested for antibody to the water-soluble fraction 1A envelope protein of *Y. pestis* following centrifugation. Passive hemagglutination tests and hemagglutination inhibition controls were those recommended in the protocol described by the World Health Organization (WHO, 1970). A minimal provable titer for whole blood was 1:128. This titer was determined using deletions for extraction, passive hemagglutination microtechniques, and passive hem-

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agglutination inhibition controls. The generally accepted diagnostic titer is 1:16.

Forty coyotes (*Canis latrans*), five badgers (*Taxidea taxus*), and three raccoons (*Procyon lotor*) were sampled. Of the 40 coyotes, 14 were juvenile and eight were adults. Two animals, ages unknown, were seropositive; a coyote with a titer of 1:64 and a badger with a titer of 1:256. These were collected in McKenzie county, (North Dakota, 103° to 104°W, 47°30′ to 48°N). Identification of seropositive animals in one county on the North Dakota/Montana border is a strong indication that *Y. pestis* is present in western North Dakota. The primary reservoir may be black-tailed prairie dogs (*Cynomys ludovicianus*) located on both state and private lands in the area. Both white-tailed prairie dogs (*Cynomys leucurus*) (Ubico et al., 1988), and Gunnison's prairie dogs (*Cynomys gunnisoni*) (Cully et al., 1997) are reported sylvatic reservoirs for *Y. pestis*, experiencing sporadic epizootics in which significant die-offs may nearly decimate large colonies. Predatory species such as coyote and badger, which may hunt or simply visit plague affected colonies very likely become infected by the organism if infested by carrier fleas or when feeding on infected prey. While clinical disease associated with *Y. pestis* is well known in domestic cats (Raflo et al., 1986; Eidson et al., 1991), and reported in dogs (Orloski and Eidson, 1995), serologic studies of wild populations, such as the coyote and badger, indicate that certain species seroconvert in the absence of clinical disease (Clover et al., 1989). Both badgers (Messick et al., 1983) and coyotes (Thomas and Hughes, 1992) have been identified as sentinels for plague in previous studies. The seropositive coyote and badger from McKenzie county were apparently clinically normal at the time of harvesting by USDA/APHIS/ADC specialists.

The seropositive animals were taken within 1.6 km of each other in the east central portion of McKenzie county about 80 km east of the Montana border. Studies indicate coyote home ranges vary from 3.2 to 34 km^2 (Andelt and Gipson, 1979, Gese et al., 1988). Similar studies on badgers estimate home ranges from 1.6 to 20.8 km^2 (Lindzey, 1971; Messick and Hornocker, 1981). Considering these ranges and the distance of the collection site from the Montana border, the coyote and badger were probably North Dakota residents and exposed to the bacteria within the confines of the state.

Trappers, wildlife biologists, and hunters should be aware of the presence of *Y. pestis* in the West, and handle wildlife accordingly. This is the first documentation of seropositive animals in North Dakota and while the state has had no reported cases of human plague, serologic evidence of the organism within resident wild populations makes such an occurrence possible.

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