Spatial Dynamics of a Bacterial Pathogen: Sylvatic Plague in Black-tailed Prairie Dogs

by

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ABSTRACT

Black-tailed prairie dog (*Cynomys ludovicianus*) populations have declined by as much as 98% during the past 100 years. Several factors have contributed to this decline including intentional poisoning, habitat loss and sylvatic plague. During the past 60 years, plague may have been the most significant cause of decline Sylvatic plague is an exotic vector-borne disease caused by the bacterium *Yersinia pestis* and causes mortality rates approaching 100% in black-tailed prairie dog colonies. Plague epizootics in black-tailed prairie dogs are often widespread, with groups of colonies typically extirpated in a short period of time. Plague may be transmitted among prairie dog colonies via two mechanisms: (1) epizootic transmission, in which plague cycles among prairie dog colonies via the movement of infected prairie dog fleas by dispersing prairie dogs or perhaps the movement of infected fleas by predators such as coyotes, and (2) enzootic transmission, in which reservoir species such as northern grasshopper mice (*Onchomys leucogaster*) and deer mice (*Peromyscus maniculatus*), transmit infected fleas to prairie dogs. Our research aims to quantify the effects of sylvatic plague on the metapopulation structure of black-tailed prairie dog colony complexes and to determine if metapopulation structure, in turn influences the spread of plague among colonies.

We examined spatial patterns of colonies in areas with and without a history of plague to identify landscape scale effects of plague on black-tailed prairie dogs, as well as factors that influence intercolony transmission in complexes where plague was present. The presence of sylvatic plague in black-tailed prairie dog colonies significantly alters the spatial structure of colony complexes. Colony complexes with a history of plague are composed of smaller colonies with greater intercolony distances, while complexes where plague is absent are primarily composed of more large colonies in close proximity to neighboring colonies. We can conclude from this portion of the project that sylvatic plague increases the degree of colony isolation. Multistate modeling illustrated the mechanisms expected to have the most impact on intercolony transmission of plague. Colony area, distance to the nearest neighboring colony and distance to the nearest drainage, which may function as dispersal corridors, were the most important factors for predicting the probability of plague entering colonies.