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***Streptococcus equisimilis* Infection in Striped Skunks (*Mephitis mephitis*) in Saskatchewan**

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ABSTRACT: Three radio-collared striped skunks (*Mephitis mephitis*) found dead during a field study of winter ecology of striped skunks near Willowbrook, Saskatchewan, Canada were examined. *Streptococcus equisimilis* was identified as the primary agent causing necrotizing purulent pneumonia in one skunk and suppurative meningoencephalitis in another. Both *Streptococcus equisimilis* and *Streptococcus canis* were isolated from lesions of purulent myocarditis and pyothorax in the third skunk. These are apparently the first reported cases of *S. equisimilis* infection in striped skunks and suggest that this opportunistic pathogen may be a significant cause of mortality under some conditions.

Key words: Case report, disease, *Mephitis mephitis*, *Streptococcus equisimilis*, striped skunk.

Streptococci are common bacterial pathogens of domestic animals and human. Streptococcal diseases are characterized by fever associated with septicemia (Scanlan, 1989). Foci of infection exhibit suppurative inflammation and abscesses where drainage is prevented (Scanlan, 1989). Streptococci also are occasionally associated with pneumonia. Each species or group of streptococci has a preferential site and host species (Barnum, 1988). Swine and horses are commonly infected by *Streptococcus equisimilis*, whereas humans and dogs rarely are infected (Biberstein and Hirsh, 1999). In swine, *S. equisimilis* causes suppurative, proliferative, and erosive arthritis in young pigs (Scanlan, 1989). In horses and other domestic animals, *S. equisimilis* causes suppurative conditions (Biberstein and Hirsh, 1999). *Streptococcus equisimilis* is associated with pharyngitis and a variety of localized and systemic suppurative infections in humans

(Turner et al., 1997). The bacteria can be carried on the skin, mucous membranes, and in lymphoid tissues of healthy individuals (Greenstein et al., 1994). Many infections are probably endogenous and stress-related (Biberstein and Hirsh, 1999). The organisms are opportunists and usually gain entry to body through injuries. Pathogenic streptococci do not survive long outside the animal body, so transmission is believed to be through direct contact or from aerosols (Barnum, 1988). Herein we report *S. equisimilis* infection in three striped skunks (*Mephitis mephitis*).

Three wild adult male striped skunks (#29, #72, and #113) that had been fitted with radio-collars were found dead during a field study of winter ecology of striped skunks near Willowbrook, Saskatchewan, Canada (51°12'N, 103°49'W). On 5 November 1999, 37 days after capture and fitting with radio-collar, skunk #72 was found dead under a grain shed in an occupied farmstead. Skunk #29 was found dead on 15 November 1999, 57 days after capture and fitting with radio-collar, lying near a vacant beaver (*Castor canadensis*) bank den that it had occupied. On 21 October 2000, 28 days after capture and fitting with radio-collar, skunk #113 was found dead in an underground burrow at the edge of woodland in a hayfield. The animals were brought to the Canadian Cooperative Wildlife Health Centre, Western College of Veterinary Medicine in Saskatoon, Saskatchewan for necropsy because rabies had been detected in skunks from the area.

Skunk #72 was in moderate body condition (weight 2.5 kg). It had a draining

subcutaneous abscess near the angle of the jaw. The pleural cavity contained >120 ml of thick, turbid red-tan fluid. There were two 1.5 cm diameter masses containing similar fluid within the right lung. Skunk #29 had abundant body fat (weight 5.0 kg). The lungs were diffusely dark red and consolidated, with multiple pale foci. The meninges were cloudy and contained purulent exudate. Skunk #113 was in an excellent body condition (weight 3.6 kg) with abundant body fat. The lung was dark grey-purple and was consolidated. A 2–4 mm pale raised focus was present on the surface of the left ventricle, extending approximately 2 mm into the myocardium. The thoracic cavity contained 5 ml of blood-tinged fluid with variably sized clumps of fibrin. Pleural fluid, material from the abscess, and spleen from #72, lung tissue and a swab from the meninges of #29, and heart, lung, and spleen from #113 were collected for bacterial culture. Selected tissues from each animal were fixed in 10% neutral buffered formalin, dehydrated in graded alcohol and xylene, embedded in paraffin, sectioned at 5 μ m, and stained with hematoxylin and eosin (Luna, 1968).

Samples were cultured at 37 C on 5% sheep blood and MacConkey agars. Bacteria were identified as streptococci on the basis of colonial morphology and Gram stain, and as *S. equisimilis* on the basis of β hemolysis and fermentation of trehalose, but not sorbitol or lactose (Farrow and Collins, 1984; Facklam and Carey, 1985; Hardie, 1986). Brain tissue was sent for rabies examination to the Animal Disease Research Institute (Canadian Food Inspection Agency, Lethbridge, Alberta, Canada) where they were examined using a fluorescent antibody test (Webster and Casey, 1988). Paraffin-embedded lung tissue from each animal was examined for canine distemper virus antigen by immunohistochemistry using an avidin-biotin immunoperoxidase technique by Prairie Diagnostic Service (Saskatoon, Saskatchewan, Canada). An antibody against the nu-

cleoprotein of measles virus, known to cross-react with canine distemper virus was used as primary antibody.

Streptococcus equisimilis was isolated from all tissues cultured, except the spleen of animal #72. A few *Bacillus*, *Enterobacter*, *Staphylococcus*, and *Acinetobacter* spp. isolated from some of the tissues were considered to be contaminants. Limited histopathologic examination confirmed the presence of necrotizing purulent pneumonia in #72, and severe suppurative meningoencephalitis in animal #29. Both animals had unidentified nematodes in the lung. Animal #29 had chronic interstitial pneumonia of unknown etiology, as well as severe alveolar hemorrhage and edema that appeared to be acute. Skunk #113 had purulent myocarditis and acute pyothorax. *Streptococcus equisimilis* and *Streptococcus canis* were isolated from the lesions. All of the animals tested negative for rabies and canine distemper viral antigens.

It is not known if *S. equisimilis* is an inhabitant of the pharynx or other tissues of normal skunks or if it can be transmitted between skunks. Striped skunks are often intimately associated with human dwellings such as farmsteads with domestic livestock (Verts, 1967; Larivière and Messier, 1998); hence transmission to skunks from domestic sources is possible. Skunks may have contracted *S. equisimilis* from horses in nearby farms. However, it is unknown how long or if the bacteria survive in feces. Also, there was no record of *S. equisimilis* infection in horses in the study area.

The skunks were radio-located from capture until they were found dead; none of them had shared dens. Skunks #29 and #72 were more than 2 km apart when they were found dead in 1999. In 2000, the second year of the study, skunk #113 was found dead more than a few km from the vicinity of the previous two cases. It is unlikely that they had transmitted the bacterium from one to the other. In the autumn, skunks forage extensively to store enough body reserve to remain inactive for

the winter season (Gunson and Bjorge, 1979). Also, males fight with each other to gain access to winter dens. Male skunks probably suffer from minor skin abrasion, trauma, and environmental stress thus increasing their probability of infection with *S. equisimilis*. *Streptococcus equisimilis* is an opportunistic pathogen and lesions may have developed when these individuals were stressed. We are not aware of any previous report of *S. equisimilis* infection in a wild mustelid. With the expansion of agriculture and the associated fragmentation of habitats in the prairies, the contact rate of striped skunks with domestic livestock has likely increased, which may have consequences for transmission of disease to and from domestic animals and humans. However, the importance of *S. equisimilis* as a mortality agent for skunks remains unknown.

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