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Authors: Muschenheim, A. L., Thome, E. T., Williams, E. S., Anderson, S. H., and Wright, F. C.

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Psoroptic Scabies in Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*) from Wyoming

A. L. Muschenheim,[1] E. T. Thorne,[2] E. S. Williams,[3] S. H. Anderson,[4] and F. C. Wright,[5] [1] Department of Zoology and Physiology, University of Wyoming, Box 3166 University Station, Laramie, Wyoming 82071, USA; [2] Wyoming Game and Fish Department, Box 3312 University Station, Laramie, Wyoming 82071, USA; [3] Department of Veterinary Sciences, University of Wyoming, 1190 Jackson, Laramie, Wyoming 82070, USA; [4] Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Box 3166 University Station, Laramie, Wyoming 82071, USA; [5] Kripling-Bushland U.S. Livestock Insects Research Laboratory, P.O. Box 232, Kerrville, Texas 78029, USA

ABSTRACT: Thirteen Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) with clinical signs of psoroptic scabies were captured in Wyoming. Signs included droopy ears, depilation on the head and neck, and exudate in the ears. Mites were identified as either *Psoroptes cervinus* or *P. equi*. Two ewes with scabies at the time of original capture had no clinical signs of mite infection 1 and 2 yr later.

Key words: Scabies, *Psoroptes cervinus*, *Psoroptes equi*, *Psoroptes ovis*, Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*, case reports.

Psoroptes ovis and *P. cervinus* were a major factor in the decline of bighorn sheep (*Ovis canadensis*) populations in the United States (Ward, 1915; Wright et al., 1933; Bailey, 1936; Seton, 1937; Packard, 1946). Scabies was present in bighorn sheep herds across Wyoming (USA) in the late 1800's and was thought to be responsible for epizootics southwest of Cody and in the Bighorn Mountains (Honess and Frost, 1942) and the Wind River Mountains (Seton, 1937). Honess and Frost (1942) reported there had been no authenticated reports of scabies in bighorn sheep in Wyoming for many years prior to 1942. No cases were documented again until 1963 (Hepworth, 1963). Similarly, until the last few decades there were few reports of scabies in bighorn sheep since the early epizootics. More recently, scabies due to *P. ovis* was associated with population declines of desert bighorn sheep (*O. canadensis mexicana*) and (*O. canadensis nelsoni*) on the San Andres National Wildlife Refuge, New Mexico (Lange et al., 1980), in northwestern Arizona (Welsh and Bunch, 1983), and on the Desert National Wildlife Range in Nevada (Decker, 1970). Mites taken from Rocky Mountain bighorn sheep (*O. canadensis canadensis*) transplanted from Idaho to Oregon in 1984 (Foreyt et al., 1985) were identified as *Psoroptes ovis*.

Three herds of Rocky Mountain bighorn sheep in Wyoming are currently known to be infested; the herds that winter on the North Fork and the South Fork of the Shoshone River in the Absaroka Mountains (Howe and Hepworth, 1964; Thorne and Walthall, 1982) and the Camp Creek herd south of Jackson (Thorne et al., 1984). Seven of 18 sheep examined from the Shoshone River herds in 1983 and 1984 were infected (Irwin and Hurley, 1985). Many other bighorns in these herds have been observed with clinical signs of scabies including droopy ears, alopecia on the head, neck and back, and exudate in the ears.

During February and March 1986 and 1987, 11 ewes and two young rams exhibiting clinical signs of scabies were captured approximately 64 km southwest of Cody, Wyoming (USA) on the South Fork of the Shoshone River (44°12′N, 109°35′W). Sagebrush/wheatgrass and sagebrush/wheatgrass/juniper vegetation types exist in the lower areas where the bighorn sheep graze. Bighorn sheep were immobilized with 320 mg ketamine hydrochloride (Ketaset, Veterinary Products, Bristol Laboratories, Syracuse, New York 13201, USA) and 260 to 340 mg xylazine hydrochloride (Rompun, Haver-Lockhart, Bayvet Division, Cutter Laboratories, Inc., Shawnee, Kansas 66201, USA), or 3 mg carfentanil citrate (Wildnil, Wildlife Laboratories,

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Inc., Fort Collins, Colorado 80525, USA) and 15 mg xylazine hydrochloride administered by projectile syringe. Yohimbine hydrochloride (Antagonil, Wildlife Laboratories, Inc., Fort Collins, Colorado 80525, USA) was used to reverse ketamine and xylazine immobilization. Carfentanil and xylazine immobilization was antagonized with naloxone hydrochloride (Naloxone, Wildlife Laboratories, Inc., Fort Collins, Colorado 80525, USA), diprenorphine (M50-50, D-M Pharmaceuticals, Inc., Rockville, Maryland 20850, USA) or naltrexone hydrochloride (Naltrexone, Wildlife Laboratories, Inc., Fort Collins, Colorado 80525, USA). Antibiotics (Dual-Pen, penicillin G benzathine and penicillin G procaine, Tech America Group, Inc., Elwood, Kansas 66024, USA) were given to all animals.

Drawings and photographs were made of the areas with lesions and physical appearance. Four skin scrapings were taken from the peripheral region of the most encrusted lesions at the junction with normal skin on each individual. For some samples hair over areas to be scraped was clipped to increase ease of locating mites. Mineral oil was applied to each location and, using a fresh scalpel blade, a scraping approximately 1.5 by 1.5 cm was taken until blood showed. Scrapings were stored in plastic bags. Swabs were taken from both ears with cotton tipped swabs, and stored in glass tubes with rubber stoppers. When present, scabs of exudate and debris were removed from the ears and stored in plastic bags. All mite samples were refrigerated. Skin scrapings and ear swabs were examined under a dissecting microscope (100×) for the presence of psoroptic mites within 48 hr of collection.

Most lesions occurred in the ears or on the face and head. Lesions on the ears were present from the external auditory meatus to the outer surface and were characterized by scabs of yellowish white dried serous exudate, exfoliated epidermis containing loosened hairs and off-white mites. When this crusty layer was removed the epidermis underneath was red and raw with serous exudate. In some cases the meatus was blocked with a solid plug. Lesions on other areas were similar but generally less severe or extensive.

Mites were observed in ear swab samples from five of seven bighorn sheep in 1986 and four of six in 1987. Mites were present in scrapings from the skin of ears of several animals but from the body on only one individual. Mites from skin scraping and ear swab samples were identified as either *P. cervinus* (F. C. Wright, Knipling-Bushland U.S. Livestock Insects Research Laboratory, USDA, Agricultural Research Service, Kerrville, Texas 78029, USA) or *P. equi* (R. L. Smiley, Biosystematics and Beneficial Insects Institute, USDA, Agricultural Research Service, Beltsville, Maryland 20705, USA). The outer opisthosomal setae (OOS) measurements ($\bar{x}$ = 182 μm, range 107 to 314 μm n = 42 from 31 mites) were longer than those reported for *P. ovis* from domestic sheep ($\bar{x}$ = 122 μm, Sweatman, 1958; $\bar{x}$ = 131 μm, Wright et al., 1983) and bighorn sheep from New Mexico, Arizona, and Idaho ($\bar{x}$ = 134–140 μm, Wright et al., 1984).

The taxonomy of the genus *Psoroptes* is controversial. Prior to 1958, nine species or varieties were described. With the exception of *P. natalensis* all were considered to be so similar that specific identification was difficult. Although there is little morphological difference, it was believed that species were host specific indicating physiological differences. Sweatman (1958) suggested a simplified nomenclature based on morphometric measurements of the outer opisthosomal setae (OOS) on adult male mites and location of lesions on the host. This system is currently widely used. However, recent data comparing psoroptic mites from a variety of hosts indicate that the system is inadequate and alternate methods need to be developed (Wright et al., 1981, 1983, 1984). Sweatman (1958) indicates there is overlap in morphometric measurements of *P. ovis* and *P. cervinus* making these species very difficult to iden-

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tify; he suggested that these species may be closely related.

Although bighorn sheep in Wyoming have been observed dead or dying with extensive scabies lesions on the head and body, morbidity and mortality has not been as high (Irwin and Hurley, 1985; Thorne et al., 1985; Anderson et al., 1987) as described with *P. ovis* infection of desert bighorn sheep in New Mexico (Lange et al., 1980) and Arizona (Welsh and Bunch, 1983), or in historic accounts of scabies epizootics in bighorns throughout the western North America. The disease in herds from Wyoming is not necessarily progressive as two previously infested ewes were observed by spotting scope within 100 m, 1 and 2 yr after capture without gross signs of scabies. Damage to the ears caused by infestation is visible by spotting scope at 200 meters.

Reports of scabies in bighorn sheep are increasing. Considering the impact scabies had on wild sheep populations historically this should be cause for concern. Preliminary studies using ivermectin to control psoroptic scabies in desert bighorn sheep had encouraging results (Kinzer et al., 1983). Further research is needed on the epizootiology and control of scabies in wild sheep.

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