

## PSOROPTIC SCABIES IN BIGHORN SHEEP IN WASHINGTON AND OREGON

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**Abstract:** In 1988, clinical scabies (Psoroptes ovis) was observed in populations of Rocky Mountain bighorn sheep (Ovis canadensis canadensis) in northeast Oregon and southeast Washington, and in California bighorn sheep (Ovis canadensis californiana) in southeast Washington. Based on observations of wild sheep in the field and diagnosis of P. ovis from skin scrapings from captured sheep, prevalence of infestation was over 50%, but was most severe in the California bighorns. In the 2 herds of Rocky Mountain bighorns, lesions were less severe, and mortality was not observed. In the California bighorns, lesions were extensive, and about 50 of 80 sheep died. Source of the outbreak may have been Rocky Mountain bighorns transplanted from Idaho to Oregon in 1984.

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Scabies in bighorn sheep is caused by a surface feeding mite, Psoroptes ovis. Lesions are characterized by an exudative dermatitis with scab formation, and result from chronic irritation of the skin caused by mouthparts of the mites, and possibly from an immune response to proteins from the feeding mites. Layers of epidermis with serum, slough from the skin, and the scaly, scab-like lesions are often diagnostic of infection. Lesions consisting of layers of sloughed epithelium within ears usually develop first, and ear canals are often completely filled with debris. Advanced cases of scabies can cause mortality and jeopardize survival of bighorn populations (Lange et al. 1980, Welsh and Bunch 1983). The purpose of this paper is to document the occurrence and prevalence of P. ovis in bighorn sheep in Oregon and Washington.

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## HISTORY AND METHODS OF EXAMINATION

California bighorn sheep were reintroduced into Oregon and Washington in 1951 and 1957, respectively. Rocky Mountain bighorn sheep were reintroduced into both states in 1971. Psoroptes ovis, or lesions compatible with scabies were not identified in bighorns in Oregon or Washington until December 28, 1984, when 27 Rocky Mountain bighorns were transported from the mouth of Cove Creek along the Salmon River in Lemhi County, Idaho to the Wenaha herd in Wallowa County,

Oregon (Foreyt et al. 1985). At release, crusty lesions were noted in the ears of 2 sheep, and a scraping was made from the ear of 1, a 3 1/2-year-old ewe. About 75 larvae, nymphs, and adult *P. ovis* were recovered from the scraping. All sheep were treated with ivermectin at 0.2 mg/kg of body weight intramuscularly before release, but the potential for spread was noted (Foreyt et al. 1985), because the Wenaha herd of Rocky Mountain bighorns is within 16 km of a herd of California bighorns in Cottonwood Creek, Washington, and less than 30 km from a herd of Rocky Mountain bighorns at Joseph Creek (Black Butte), Washington (Fig. 1). Collared sheep have traveled between these populations.

On March 9, 1988, a dead California bighorn ewe, at least 4 years old, was found in the Oregon Wenaha herd near the Washington border (Fig. 1), and was examined at Washington State University (WSU). Approximately 50% of the hair on the head was missing, and crusty scabs were noted on most of the head including the ears, and on the front shoulders and rear legs (Figs. 2-4). Ear canals were blocked with crusty exudative debris. About 25,000-35,000 mites were present on the head where mites were in large, clearly visible clusters (Fig. 4). Mites were identified as *Psoroptes* sp. based on morphology of the jointed pedicels on the legs (Fig. 5). Representative mites were sent to Dr. Fred Wright, U.S. Livestock Insects Laboratory, Kerville, Texas, who identified them as *P. ovis*, based on lengths of 58 outer opisthosomal setae (OOS) from 33 adult males (Wright et al. 1984). Mean length of the OOS was  $147.4 \mu\text{m} \pm 23.31$  (S).

Between 1988 and 1990, sheep in the 2 herds of Rocky Mountain bighorns (Wenaha herd in Washington and Oregon, and Joseph Creek herd in Washington), and the herd of California bighorns in Cottonwood Creek were observed by air or on foot for lesions compatible with scabies. Dead sheep were examined for mites and lesions, and 4 sheep were immobilized for examination.

#### Wenaha Herd

In 1988 the Wenaha herd in Oregon and Washington included about 60 Rocky Mountain bighorns. Scabies related mortality had not been observed. In March, 5 of 35 (14%) observed sheep had obvious lesions compatible with scabies, including alopecia and scabs on the ears, head, neck, or shoulders. In March 1989, 5 of 21 (24%) had lesions, and in March-May, 1990, at least 50% of the sheep had observable lesions. In most cases, only the ears were affected. In April-May, 1990, about 80 sheep were in the Wenaha population, and 4 sheep (2 ram lambs, 1 ewe lamb, and a 3-year-old ram) were immobilized in Oregon with xylazine in a Palmer capture dart, and examined. Lesions were similar on all 4 and consisted of crusty debris in the ears. Live *Psoroptes* sp. were isolated from all sheep.

#### Cottonwood Creek Herd

In 1988, this California bighorn herd decreased from about 80 to 30, presumably due to scabies, and poor range conditions resulting from drought. In March 1988, obvious lesions were observed in 13 of 49 (26%) sheep. In January, 1989, 2 sheep were euthanized for examination. Each sheep had lesions on ears, face, neck, and shoulders, and about 400-500 live *Psoroptes* sp. were isolated from the ears of each.

#### Joseph Creek Herd

In 1990, 2 sheep, an adult ram and an adult ewe were euthanized and examined. Both sheep were emaciated and weak. Crusty scabs were present in the ears. Seven psoroptes sp were detected from a scaping from the ram, and over 2,000 were detected from ear scrapings from the ewe. This herd is growing rapidly and includes about 160 sheep in 1990. No mortality due to scabies has been detected.

#### EXPERIMENTAL TRANSFER TO DOMESTIC SHEEP AND A BIGHORN SHEEP

Mites from the 2 California bighorns collected from the Cottonwood Creek herd were transferred to 2 domestic sheep and a Rocky Mountain bighorn ram lamb to test transmissibility. The domestic wether sheep were housed together in a 5 x 8 m indoor room at WSU and the bighorn was housed in a similar room. All sheep were fed alfalfa hay free choice, and had access to mineralized salt and fresh water at all times. Approximately 50 mites mixed in crusty material from the wild bighorns were placed deep in the ear canals of each sheep (25 per ear) with a cotton tipped swab. Thirty days after inoculation, ears were examined with an otoscope, and cotton tipped swabs were rotated within the ear canals and withdrawn and examined for mites under a dissecting microscope (40x). The domestic sheep were maintained for 90 days. The bighorn lamb was maintained for almost 1 year after inoculation, and examined at about 2-month intervals. Mites were not recovered from the domestic sheep, but were recovered at each sampling from the bighorn. Over the one 1-period scaly lesions were present in the ears only. Ears were completely filled with concentric debris, but lesions did not spread to the body.

#### DISCUSSION

It is likely that the scabies outbreak in Oregon and Washington originated from the transplant to Oregon from Idaho in December, 1984 (Foreyt et al. 1985). Scabies had not been identified in Oregon or Washington before this time, and the initial cases in 1988 were near the 1984 release. Scabies is now present in 3 herds, Wenaha, Joseph Creek, and Cottonwood Creek (Fig. 1), but has significantly impacted only the Cottonwood Creek herd where over 50% of the sheep died in 1988, and very few lambs were observed in 1989. Mortality in these California bighorns was likely due to poor habitat conditions resulting from severe drought, compounded by scabies. Similar observations occurred in Arizona where an increased prevalence of scabies followed a 2-year drought (Welsh and Bunch 1983). Therefore, the impact of scabies may be related to habitat, nutrition, and immunocompetence of infected bighorns. An alternative explanation is that California bighorns are more susceptible than Rocky Mountain bighorns to the effects of scabies. Mortality was not observed in the Wenaha or Joseph Creek herds of Rocky Mountain bighorns, and lesions were generally restricted to the ears. Further evaluation is necessary to determine if there is a difference between subspecies in susceptibility to scabies.

Because scabies can cause significant mortality in bighorns, it is an important management consideration. Management options include: 1) monitor populations to determine infestation rates and mite intensities; 2) treat infected populations with ivermectin by injection

or feed formulation at 0.5-1.0 mg/kg of body weight to minimize impacts of infestation; 3) exclude sheep with scabies from transplant programs; 4) treat all transplanted sheep with ivermectin subcutaneously at 0.5-1.0 mg/kg of body weight to minimize the probability of transplanting sheep with live mites; and 5) take no action and endure the consequences of infections.

Ivermectin at a dosage of 0.5-1.0 mg/kg of body weight has been effective against P. ovis in desert bighorn sheep (Ovis canadensis mexicana) in New Mexico (Kinzer et al. 1983a). In cattle treated subcutaneously with ivermectin at 0.2 mg/kg of body weight, live mites could be found on treated animals for up to 20 days after treatment (Wright and Guillot 1984a), and live mites from cattle treated with the same dosage of ivermectin were capable of reproducing on recipient cattle for up to 9 days after treatment (Wright and Guillot 1984b). Residual activity of ivermectin at a subcutaneous dosage of 0.2 mg/kg is approximately 3 weeks (Meleney et al. 1982), with the mean maximum serum concentration of 29 ng of ivermectin per ml at 48 hours after injection (Guillot et al. 1986). Therefore, when treated with ivermectin at 0.2 mg/kg or more of body weight, animals should be separated from noninfected animals for at least 20 days. Also, cattle that have been treated and cured of scabies are just as susceptible to infection as naive cattle after a 2-5 month latent period (Guillot 1987). Therefore, long-term resistance to scabies is not likely to occur after treatment.

Based on reports by Wright et al. (1981), Kinzer et al. (1983g), and on our results, it appears that P. ovis of bighorn sheep are biologically distinct mites, that normally are unlikely to infect domestic sheep or cattle. While transmission to livestock is unlikely, potential transmission to other wild ruminants is unknown.

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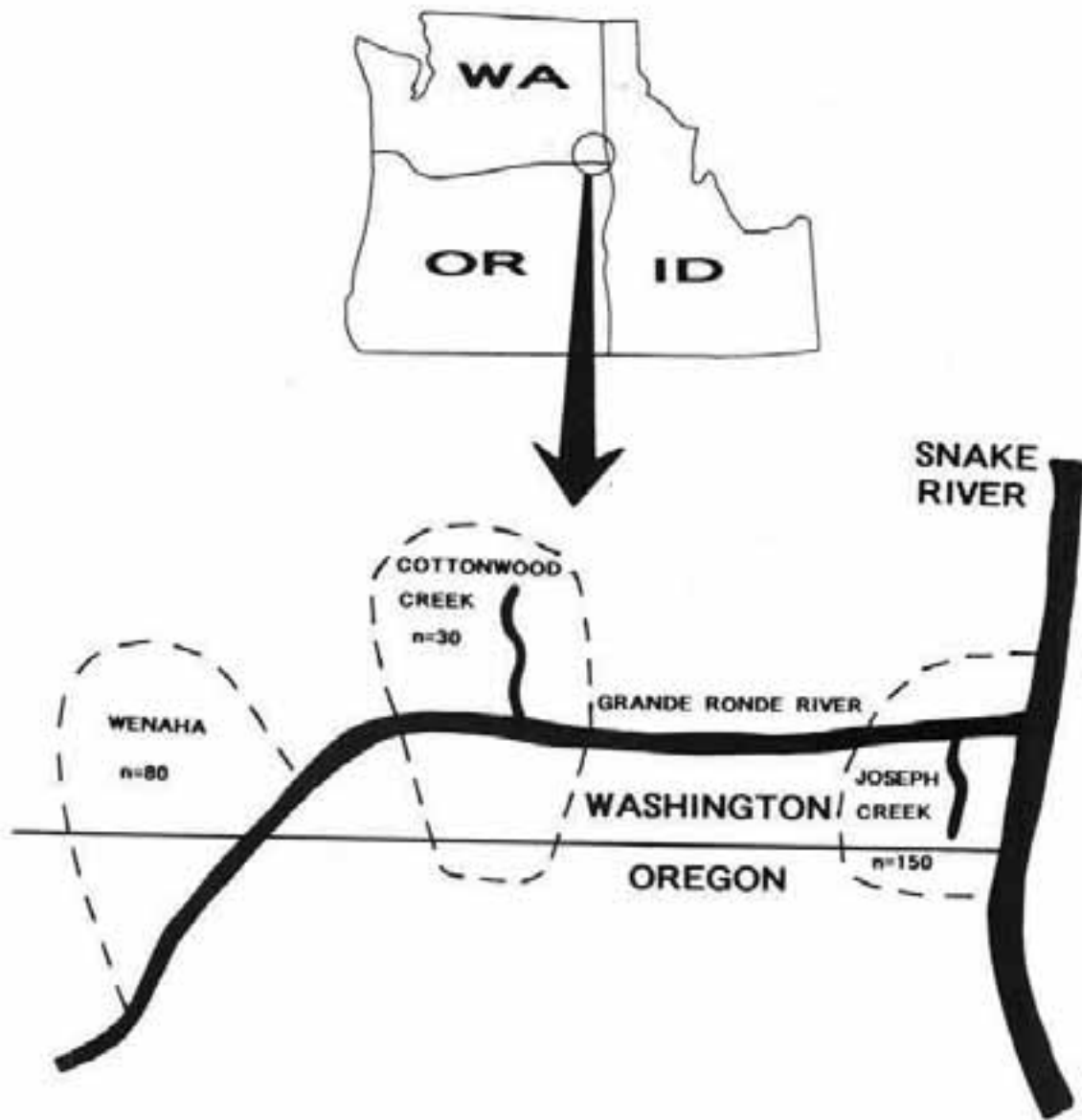


Fig. 1. Location of scabies in 3 populations of bighorn sheep in Oregon and Washington.



Fig. 2. Bighorn sheep with scabies from the Wenaha herd in Washington illustrating generalized alopecia of the ear, muzzle, and around the eye, with excoriations and crust formation.



Fig. 3. Posterior part of the head of bighorn sheep with scabies from the Wenaha herd in Washington illustrating alopecia, excoriations, and crust formation.



Fig. 4. Closeup view of Fig. 3 illustrating alopecia, excoriations, and crust formation with thousands of Psoroptes ovis visible in clusters (arrows).



Fig. 5. Psoroptes ovis from a bighorn sheep. Note the jointed pedicels on the front legs (arrows).