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## AN EPIZOOTIC OF CONTAGIOUS ECTHYMA IN ROCKY MOUNTAIN BIGHORN SHEEP IN COLORADO

W. LANCE,<sup>1</sup> W. ADRIAN<sup>2</sup> and B. WIDHALM<sup>3</sup>

**Abstract:** Seven of 20 adult male bighorn sheep (*Ovis canadensis canadensis*) ranging from 3 to 7 years of age, from the Saguache, Colorado Area, had active lesions of contagious ecthyma. Diagnosis was confirmed by histopathology, animal inoculation, and electron microscopy. This is the first documentation of this disease in bighorn sheep of Colorado.

### INTRODUCTION

Contagious ecthyma (CE) is a well documented disease of domestic sheep<sup>1</sup> caused by a large epitheliotrophic DNA virus of the parapox group. It has been recognized in domestic sheep for over 200 years, and is commonly seen in commercial sheep operations of the intermountain region of western North America. Stockmen term this disease "soremouth" or "scabby mouth." In humans CE virus produces painful, persistent, localized skin lesions called "orf" or "ecthyma contagiosum."<sup>6</sup>

The first case of CE documented in North American bighorn sheep was in Banff National Park, Canada in 1952.<sup>1</sup> Later reports from western Alberta and eastern British Columbia indicated that the disease was capable of producing mortality in bighorn sheep, primarily in the younger age class.<sup>7</sup> CE also has been documented in Dall sheep (*Ovis dalli dalli*) in Alaska<sup>8</sup> and desert bighorn sheep (*Ovis canadensis mexicana*) in southern New Mexico (R.E. Lange, pers. comm.).

### STUDY AREA

The Saguache bighorn sheep herd located in the San Luis Valley unquestionably has been the most successful of the transplanted bighorn sheep herds in Colorado. The original group of 15 sheep, introduced in 1951 into this atypical, low elevation (2100 m to 2400 m) ponderosa-pinyon-bunchgrass habitat interspersed with cliffs and rocky bluffs, has grown into a herd of over 500 that cover two distinct home ranges (Rutherford, pers. comm., 1980). These sheep are easily observed and have been intensively studied since 1972, when a long-range lungworm research-management program was initiated.

Although domestic sheep have been pastured in the lower part of the San Luis Valley, no large herds have been on the bighorn sheep range since the mid to late 1950's. A small band of less than 20 domestic sheep were reported on the edge of the bighorn range by a local cattle rancher during part of 1976. The rancher stated that oral lesions were not seen in these sheep.

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## CASE HISTORIES

CE was first suspected in August, 1978 during a mandatory inspection of bighorn sheep taken by hunters. The wildlife conservation officer (B.W.) observed several large, wart-like areas over the muzzle and the oral mucosa of a 4 year old ram. He also noted several elevated areas around the base of the horns. The skinned head, plus samples of the wart-like lesions from the muzzle, were sent to the Wild Animal Disease Center, Colorado State University for evaluation.

Examination of the oral region revealed numerous small (4 to 8 mm) irregular shaped ulcerated lesions of the hard palate which had dark reddish bases and rounded edges. The dorsum of the tongue had a large 1 cm  $\times$  2.5 cm depressed ulcer with a dark, roughened floor and rounded edges. This ulcer penetrated the submucosa and extended into the muscle layers of the tongue for a distance of 1 cm. The buccal mucosa lateral to the lower molars contained several small, well-delineated, light cream, elevated, papillomatous growths up to 5 mm in diameter. Six additional rams ranging from 3 to 7 years of age, with similar lesions, were examined in the following 6 weeks.

Histologically, these papilloma-type growths were characterized by an epithelium with a highly proliferative basal cell layer producing epithelial pegs extending into the dermis, and a zone of acanthosis containing cells undergoing balloon degeneration. The dermis contained congested vessels and moderate infiltrations of mononuclear cells, predominantly lymphocytes. Cytoplasmic inclusion bodies were not present.

A 10% suspension of scab material prepared in sterile phosphate buffered saline was used to expose a 1 cm square area of scarified oral mucosa of a mature 3/4 bighorn  $\times$  1/4 mouflon hybrid ram. Ten days post exposure, the area contained large (1 cm  $\times$  2 cm), elevated

proliferative lesions. Smaller, circular, scab-covered lesions developed upon the oral mucocutaneous junction. Electron microscopy of the signal case lesion material and lesion material from the exposed hybrid ram revealed a large virus morphologically compatible with the virus of CE.

## DISCUSSION

The abrupt appearance of CE in the bighorn sheep herd at Saguache, Colorado area raises several questions: (a) what is the source of virus in this herd; (b) was it recently introduced or has it been dormant in this bighorn range for the past 25 years; (c) if this agent has been present in the range, what factors changed to allow it to become clinically active in the population?

The original source of virus in this case is open to question. Due to the presence of domestic sheep in the vicinity during 1976, the possibility that it was introduced by the band of 20 ewes must be considered. Examination of 40 bighorn sheep sera collected from this herd in 1977 by complement fixation did not reveal any serological titers to CE, suggesting that CE was not introduced into the population until sometime later. Controlled pen studies of the epizootiology of CE in bighorn sheep indicates that morbidity in susceptible bighorn sheep is 100% once the virus is introduced (Lance, unpubl.). If the small band of domestic sheep introduced the CE virus into the Saguache bighorn sheep herd in 1976, it would indicate that when a susceptible bighorn sheep population is challenged with this virus it produces visible clinical disease. The fact that disease was seen initially in mature rams of the 3 to 7 year age group, suggests that these animals had not had prior exposure to the virus as lambs or young adults. This is assuming that CE in bighorn sheep confers immunity for 2 years or more similar to that documented

for domestic sheep.<sup>5</sup> The serological and epizootiologic evidence indicates that the virus has not been clinically active in the population for the past 7 years.

If, on the contrary, CE virus has been historically present within the Saguache bighorn sheep range, some factor or group of factors must have been altered to initiate the clinical disease in the population. A contributing factor may have been the unusually dry range con-

ditions two years prior to the epizootic. Drought conditions have been suggested to increase oral abrasions and exposure to environment-associated virus due to close grazing. This herd is at a high population density and the concentration of animals and resultant intraspecific stress factors combined with environmental conditions may have played a primary role in triggering this epizootic.

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