CONTAGIOUS ECTHYMA IN BIGHORN SHEEP AND MOUNTAIN GOAT IN WESTERN CANADA[1]

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Abstract: Contagious ecthyma (CE) is reported in bighorn sheep (*Ovis c. canadensis*) from several national parks in western Canada and in mountain goat (*Oreamnos americanus*) from Kootenay National Park, British Columbia. (This is the first report of CE in mountain goat.) Diagnosis was based on clinical signs, histopathology, transmission experiments and the demonstration of a poxvirus with the electron microscope. The infection was transmitted from wild to domestic goat, but not to domestic sheep.

Most infections, some of them severe, were found in lambs and kids. Clinical signs of disease were similar to those seen in domestic sheep and goats. General body condition was poor and animals had difficulty feeding normally.

All infected herds had prolonged contact with areas where salt was provided artificially (i.e., salt blocks, highways and campgrounds). Fewer infected sheep were observed annually when salt blocks were removed from Jasper National Park.

INTRODUCTION

Contagious ecthyma (CE) is a viral disease of domestic sheep and goats from many countries and is known by a variety of descriptive terms including sore mouth, contagious pustular dermatitis, scabby mouth, infectious labial dermatitis, and orf.[4] The clinical disease is characterized by proliferative, crusted and sometimes pustular lesions of the lips, muzzle and occasionally the udder, feet and vulva.[6] Little is known about CE in wild animals; it has been reported only from bighorn sheep, chamois, thar and steinbok.[5] Connell[2] and Blood[1] reviewed the history of CE to 1965 in bighorn sheep from four national parks in western Canada; no mortality was attributed directly to CE, but several cases of the disease were observed in lambs. This report summarizes recent developments concerning CE in bighorn sheep (*Ovis c. canadensis*) from western Canada and documents the disease in mountain goats (*Oreamnos americanus*).

HISTORY

CE has been observed in bighorn sheep from western Canada since 1953.[2] Sixteen infected sheep comprising 11 lambs and five ewes, were collected from Jasper, Banff, Kootenay and Waterton Lakes National Parks since 1953[1] (Stelfox, unpub.). Most animals were in debilitated condition, with severe labial lesions. Many other sheep, particularly lambs, were observed with lesions suggestive of CE.

Since 1959, 58 suspected cases which includes 49 lambs have been observed in Jasper National Park. The number of suspected cases remained low (≤ 3) each year until 1966, when 15 of 76 sheep in

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the Mile 3 band (see Fig. 1) and two other sheep from other bands were infected. In the Disaster band which has been observed closely since 1968, 51 of approximately 80 sheep were examined in February, 1968; one of 14 lambs was infected. Two of four lambs in a group of 12 were infected in September, 1970. One of eight lambs in a band of 42 sheep was infected in December, 1970. The number of presumptive cases observed annually from 1967 to June 7, 1973, in Jasper was 6, 4, 8, 4, 4, 2, and 0 respectively.

Of the 58 cases observed in Jasper National Park, 52 were seen from September to December, five from January to March and one infected lamb was observed in mid-July. None were observed in August and 10 in September.

In all cases observed in the national parks,[1] sheep have had prolonged contact with areas where salt was provided artificially (i.e., salt blocks, highways and campgrounds).

Lesions suggestive of CE have been observed in bighorn sheep east of Banff National Park,[1] in the Sheep River area in 1972 and 1973 (Horejsi, pers. comm.) (Fig. 1), and in Montana.[1] Six of 19 lambs were infected in a band of 43 sheep trapped from January to March, 1972, at Sheep River. In June-July 1972, three infected lambs were observed; during the winter, 1973, eight of 19 lambs were infected. None of the infections was considered severe (Horejsi, pers. comm.). Sheep visit artificial sources of salt between September and May of each year in the Sheep River area.

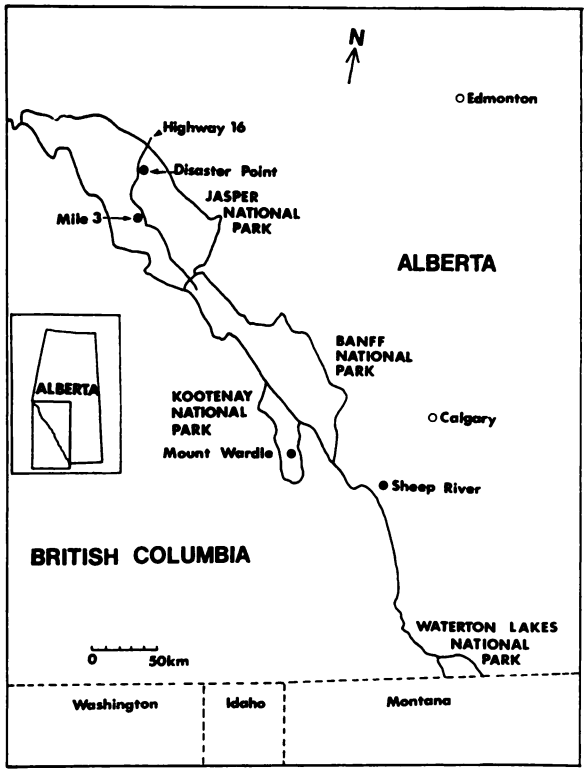

FIGURE 1. Location of western National Parks and several infected bands of bighorn sheep and mountain goat.

CE has been observed in goats from Mount Wardle since 1974 (Sime, pers. comm.). Four adults, two males and two females, were found moribund in January 1947 with severe lesions on the lips and muzzle. All animals died within 1 month of capture. Approximately 90 adults produced 18 kids on Mount Wardle in 1967, and at least six kids were observed with clinical signs of the disease (DeBock and Winkler, pers. comm.). Three of the kids with severe lesions of the lips and muzzle were found moribund in July. A 9-month old male with severe labial lesions was collected on Mount Wardle in February 1972; it weighed 12 kg. There were no reports of CE infection in 1973. Four of five mineral licks used by goats on their winter range are semi-natural.[3] No infected sheep have been observed on Mount Wardle (Stelfox, unpub.), but CE-infected sheep have been collected from other parts of Kootenay National Park.[1]

CASE REPORT — SHEEP

Two emaciated animals, a ewe and lamb, with severe lesions of the muzzle and lips, were observed and subsequently killed in Waterton Lakes National Park (Fig. 1) in April, 1971. The ewe was emaciated and weighed only 26 kg.

Gross examination of the lamb revealed numerous irregular, confluent, raised, crusted, dark brown to black lesions located along the margins of the lips including the commissures, and on the muzzle and nose. Most lesions were dry, but pustules were also present. Lesions were particularly severe in the ewe (Figs. 2-3) and were characterized by markedly thickened, edematous lips covered by reddish-brown, fissured, crusted proliferative epithelium (Fig. 2). Several pale, circumscribed, raised lesions of various diameters were observed on the dorsum of the tongue; smaller red papilloma-like proliferations, some of them perdunculated, were evident along the anterior leading edge. Numerous small pink proliferative lesions were observed clustered on the gingival mucosa at the base of the incisiform teeth (Fig. 3); blackened proliferations could also be found on the dental pad, hard palate and at the base of the molars.

FIGURE 2. Contagious ecthyma in a bighorn sheep. Lesions on the nose, lips and tongue.

FIGURE 3. Contagious ecthyma in a bighorn sheep. Lesions on the gingival mucosa.

CASE REPORT — GOAT

A severely infected moribund mountain goat kid (Fig. 4) was found by park personnel at the base of Mount Wardle in Kootenay National Park (Fig. 1) on March 1, 1972, and was transported to the University of Alberta on March 9, 1972. The kid weighed 13.4 kg on arrival and improved during its second week, following treatment for suspected nutritional myopathy. Although appetite was good, prehension and mastication were difficult and the animal's condition continued to deteriorate. At the time of death on April 3, 1972, the kid weighed 11.5 kg.

Dry, brown, proliferative lesions were prominent on the markedly edematous hyperemic lips, but diminished in severity toward the commissures (Fig.4). Lesions of the oral cavity were moist, reddish-brown and in certain sites, intensely hyperemic. A large proliferative mass on the gingiva immediately posterior to the incisiform teeth apparently interfered with the normal placement of the tongue.

Examination of the remainder of the carcass revealed numerous pulmonary abscesses along the ventral borders of the diaphragmatic lobes, with extensive fibrous adhesions to the ribs and diaphragm. As well, abscesses were observed on the pericardial sac and in the abdominal cavity, with many fibrous adhesions between the diaphragm and the rumen. Bacteriologic examinations of pulmonary abscesses yielded *Corynebacterium pyogenes* and *Pasteurella multocida*. The following helminths were found: 790 *Ostertagia occidentalis* and *Marshallagia marshalli* (abomasum); 249 *Nematodirus maculosus*, several *Thysanosoma actinioides*, many unidentified Anoplocephalidae (small intestine); 123 *Trichuris oreamnos* (caecum); and 3 *Protostrongylus rushi* (lungs).

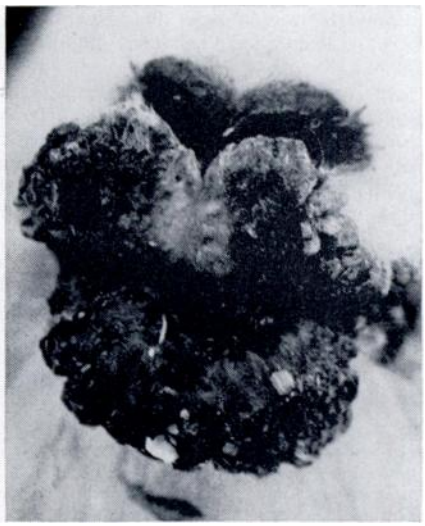

FIGURE 4. Lesions of contagious ecthyma on the lips of a mountain goat.

HISTOPATHOLOGY

Selected oral and labial lesions were trimmed to 2-3 mm thickness, fixed in 10% neutral buffered formalin, processed in several changes of ethyl alcohol, xylene and paraffin, cut at 6 μm and stained with haematoxylin and eosin (H & E).

Histopathologic lesions were similar in both the sheep and goat. Hyperplastic non-pigmented squamous epithelium, often thrown upward into folds and long spike-like projections with marked hyperkeratosis, some parakeratosis and microabscesses in the keratinized layer, characterized the lesions. Edema was prominent at the tips of epithelial folds, and in the keratinized layer, pools of serous fluid separated by thin keratin strands had a characteristic multilocular appearance. Long interconnecting rete pegs extended into the dermis, in which the proliferating connective tissue was canalized by dilated erythrocyte-filled capillaries. Inflammatory cells in the dermis consisted mainly of dense accumulations of lymphocytes, with lesser numbers of plasmacytes, neutrophils and some eosinophils.

Numerous swollen, vacuolated epithelial cells, best appreciated in the immediate vicinity of hair follicles, each contained one or more oval or round eosinophilic cytoplasmic inclusions.

VIRAL ISOLATION AND TRANSMISSION ATTEMPTS

Lesions were removed from the lip of the mountain goat and stored in refrigerated sterile buffered glycerine. Tissue was washed 3 times in saline and ground in a mortar to prepare a 10% suspension based on wet tissue weight. Transmission was attempted by spreading the suspension on a shaved, lightly scarified area of the flanks of two domestic sheep and one domestic goat. Typical vesicles and pustules characteristic of CE began to appear at the site of inoculation on the goat at 21 days. Lesions did not appear on the sheep. Typical CE viral particles[7] were demonstrated by electron microscopy, using negative staining with 2% pH 7.0 phosphotungstate, from extracts of swabs from the wild and domestic goats. The lesions on the domestic goat began to heal 30-35 days after inoculation; the inoculation site was clear by 40 days. CE has been transmitted successfully from bighorn to domestic sheep previously.[1,2]

DISCUSSION

CE has been reported rarely from animals other than domestic sheep and goat. The present data and those of Blood[1] indicate an important large focus of CE in bighorn sheep in British Columbia and Alberta. The disease is apparently restricted to certain mountain goat populations, having been reported only from Mount Wardle in Kootenay National Park, British Columbia. Many bands of uninfected goats have been observed in and near western Canadian national parks (Stelfox, Loewen, unpub., and Cowan, Hebert and others, pers. comm.).

Several sheep and goats severely infected with CE have been found dead or moribund. It is evident that prehension and mastication are altered if the lips, muzzle and buccal membranes are severely affected. These observations suggest strongly that CE, possibly in combination with high numbers of helminths (Samuel, unpub.), bacterial infections and a low plane of nutrition, is an important mortality factor in certain bands of wild sheep and goats. In animals with mild infections, mortality due to CE *per se* is probably negligible. Horejsi (pers. comm.) noted no difference between the feeding behavior of infected and uninfected lambs at Sheep River.

The role of artificial sources of salt in the epidemiology of CE is unclear. For many years, salt blocks were placed strategically in the parks to concentrate sheep and other ungulates for observaton by tourists. A dangerous zoonotic component of this policy was the observation of children breaking off and licking pieces from salt blocks used by infected bands of sheep (Stelfox, unpub.). This distribution of salt, predominately along the major road in Jasper Park, was discontinued between 1966 and 1970. However, sheep continued to return to the lick areas and eat large quantities of soil or to receive feed from tourists. Bands at Mile 3 and Disaster obtain limited quantities of salt from tourists and highway sources. At least one uninfected band of 60 sheep near the Jasper-Banff boundary has had access to block salt in the past and to heavy highway salting at the present time.

Acknowledgments

The authors wish to express their gratitude to the many park personnel and J. McGillis, Canadian Wildlife Service, who submitted observations and specimens; to T. Yamamoto, University of Alberta, for his assistance with the identification of the virus; to R. G. Christian, H. N. Vance and D. W. MacDonald, Alberta Department of Agriculture, for assistance with the necropsies. B. Horejsi, University of Calgary, kindly provided observations on the band of bighorn sheep in the Sheep River area.

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Received for publication 25 March 1974