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Source: Journal of Wildlife Diseases, 14(2) : 165-169

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-14.2.165>

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ORAL PAPILLOMATOSIS IN COYOTES (*Canis latrans*) AND WOLVES (*Canis lupus*) OF ALBERTA

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Abstract: Twelve cases of oral papillomatosis were detected in wild carnivores of Alberta, ten in coyotes (*Canis latrans*) and two in wolves (*Canis lupus*). Lesions ranged from mild with a few small papillomas to severe with much of the surface of the lips, tongue and buccal cavity covered with papillomas. Three of five coyotes with severe papillomatosis were in obvious poor health. The gross and histologic lesions are described and the significance of this disease in wild carnivores is discussed.

INTRODUCTION

Coyotes (*Canis latrans*) are found throughout Alberta, although they probably are beyond their pristine geographic range in central and northern regions.⁷ Wolves (*C. lupus*) are found in the forested regions of northern and western Alberta.⁶ Studies of diseases of these animals are meagre, at least in Alberta, although sarcoptic mange may be an important mortality factor (Samuel, unpub.). Incidental to research on sarcoptic mange of coyotes and wolves was the discovery of oral neoplasms in several animals. This report summarizes cases of oral papillomatosis in coyotes and wolves of Alberta from 1971 to 1976.

Oral papillomatosis has not been reported from wolves and only infrequently from coyotes. Six cases are known from coyotes of Texas,⁸ one from each of Saskatchewan¹ and Manitoba,⁴ and six from Alberta.^{1,5} Published data have dealt with case reports,^{1,8} electron microscopy,⁴ and the prevalence of the disease.⁵ Data presented in this paper are similar to that of the cited literature, but include the first reported cases of papillomatosis in wolves, information on prevalence of the infection and reported

transmission of coyote papillomatosis to dogs.

Gross Lesions

Ten coyotes and two wolves from divergent areas of Alberta, and infected with oral papillomatosis, were submitted to various provincial laboratories from February, 1971, to December, 1976 (Table 1). The following criteria were used to make the various diagnoses: gross and microscopic appearance, transmission experiments, and the electron microscopic demonstration of a papova virus. Five cases, all in coyotes, were considered severe (Figs. 1 and 2), two were moderate, and five, including two in wolves, were mild (Fig. 3).

Papillomas were broad-based, occurring singly and in clusters and varied in diameter from 1 to 10 mm (confluent masses up to 300 mm) and in height from 1 to 8 mm (Figs. 1, 2, and 3). Grossly, the smaller (< 1 mm) tumors appeared smooth, whereas those of 2 to 3 mm diameters had a finely nodular appearance. Masses larger than 3 mm had a distinct papillomatous appearance, with numerous fine, somewhat pointed, fingerlike projections. All were non-pigmented, often in distinct contrast to

TABLE 1. Recent cases of oral papillomatosis in coyotes and wolves of Alberta, 1971-1976.

Host Species	COLLECTION			ASSESSMENT OF:	
	Date	Location	Method	Infection	Host Condition
Coyote:					
1	Feb. 1971	Edson (~ 53.35°N, 116.20°W)	Shot*	Severe	Good (small in stature)
2	Winter 1971-72	Rochester (~ 54.25°N, 113.25°W)	Trapped	Severe	Poor (severe mange)
3	Winter 1971-72	Morrin (~ 51.45°N, 112.50°W)	Shot*	Moderate	Good
4	Jan. 1974	Cardston (~ 49.10°N, 113.20°W)	Shot*	Severe	Good (small in stature)
5	Jan. 1974	Cardston (~ 49.10°N, 113.20°W)	Shot*	Mild	Good
6	Jan. 1974	St. Albert (~ 53.25°N, 113.35°W)	Shot*	Mild	Good
7	Mar. 1976	Legal (~ 53.55°N, 113.35°W)	Shot*	Moderate	Good (mild mange)
8	Mar. 1976	Legal (~ 53.55°N, 113.35°W)	Shot*	Mild	Good
9	Mar. 1976	Edmonton (~ 53.25°N, 113.25°W)	Observed	Severe	Poor
10	Dec. 1976	Lac La Biche (~ 54.45°N, 112°W)	Shot	Severe	Poor (severe mange)
Wolf:					
1	Nov. 1975	Peace River (~ 56.15°N, 117.15°W)	Found dead**	Mild	Good
2	Nov. 1975	Peace River (~ 56.15°N, 117.15°W)	Found dead**	Mild	Good

*Coyote hunter.

**Near poisoned bait station.



FIGURE 1. Severe involvement of the lips (Coyote #1).



FIGURE 3. Mild involvement of the lips (Coyote #5).



FIGURE 2. Severe involvement of the lips, tongue, and oral mucosa (Coyote #1).

the adjoining normal epithelium of the lips.

Coyotes or wolves with mild and moderate infections had fewer than 20 and approximately 50 papillomas, re-

spectively (Table 2). Several of the mild cases were detected only because individuals who submitted coyotes with severe cases became interested in the infection and hence, scrutinized carcasses more closely. (Coyotes numbered 6 to 9 were observed or submitted by one individual as were coyotes #4 and #5 and the two wolves.) The two infected wolves were male pups found dead together near a poisoned bait station on 25 November 1975. Only portions of the lips were submitted. Papillomas were few and small (none over 8 mm in diameter). Viral particles observed were indistinguishable from those seen in coyotes (Yamamoto, pers. comm.).

It was not possible to count or measure all growths on coyotes with severe infections, as some were confluent masses (Figs. 1 and 2, Table 2). Coyote #10 had 119 papillomas between the teeth and gums and on the margins of the lips, 28 on the palate, 7 on the dorsal pad, 20 on the dorsal surface of the tongue, and 12 on the frenulum and ventral surface of the tongue.

Three of five coyotes with severe infections were emaciated and in poor body condition. Unfortunately, no body weights were recorded. Two had severe cases of sarcoptic mange. Two others with severe infections were small in

TABLE 2. Summary of location, number, and size of oral papillomas from coyotes and wolves.

Assessment of Infection	Papillomas		
	Location	Number	Size*
Mild	Margin of lip	<20	<10
Moderate	Margin of lip	~ 50	4-15
Severe	Varied**	Many	up to 300

*Diameter (mm).

**Neoplasms were found on the tip of the nose, palate and dental pad (most behind the incisiform teeth), margin of the lips, glottis epiglottis, and the tongue.

stature, but appeared to be in good health. None of the coyotes was aged.

Histopathology

Tumors were removed, fixed in formalin, trimmed, processed routinely, mounted in paraffin, cut at 6 μ m and stained with hematoxylin and eosin and in some cases, Gomori's trichrome. Histologically, tumors from both coyotes and wolves were similar in appearance. A low-power view (25 \times) of most masses revealed much hyperplastic, hyperkeratinized epithelium thrown into papilliform projections containing thin, sometimes arborizing connective tissue cores. On high power (400 \times), widespread mitotic activity was seen in the basal cell layer; nuclei contained finely stippled chromatin and 1 to 2 nucleoli. Many cells of the prickly cell layer were ballooned and much more eosinophilic than those of the basal cell layer. Nuclei tended to be round or oval with a clear central area, giving these cells a distinct vesicular appearance. Nuclear chromatin was clumped and usually one nucleolus was present. Intercellular bridges were prominent. The granular layer usually contained many cytoplasmic keratohyalin granules, with occasional large aggregations of this material. Squamous epithelial cells were vesicular in appearance, with finely granular, pale,

eosinophilic-staining cytoplasm. Nuclei contained one or more distinct, large amorphous basophilic inclusions, with margination of the chromatin. The keratinized layer contained much keratohyalin material and ghostlike remnants of ballooned epithelial cells, the nuclei of which contained usually one dense basophilic inclusion body.

DISCUSSION

According to Trainer *et al.*⁸ naturally-occurring canine oral papillomatosis is known only from dogs and coyotes. One obvious, unresolved question is whether or not the viruses from these hosts are identical. Recent progress has been made; it is apparent that the virus and/or the disease are macroscopically, histologically and ultrastructurally similar.^{1,2,3,4,8} In addition, oral papillomatosis of Alberta coyote origin was produced in two beagle pups following inoculation of a 10% solution by scarification (Thomsen, pers. comm.).⁵ An important unanswered question is whether or not canine oral papilloma virus produced tumors in coyotes.

Recent evidence suggests that (1) obvious lesions are rare in coyotes and (2) the body condition of infected coyotes is variable. Nellis⁵ found "oral papilloma-

⁵ Thomsen, J.J. Personal communication. 1973. Fred Hutchinson Cancer Research Center, Seattle, Washington 98104, USA.

like lesions" on tongues or lips of five of 225 dead and 54 live (= trapped) coyotes; cases varied in severity from mild to severe, and no animal was obviously impaired by the disease. Broughton *et al.*¹ reported that two infected animals were in apparent good health whereas one animal was extremely emaciated. Three coyotes of the present study were in obvious poor health, but the most severely affected coyote (#1), although small, was in good condition and had eaten a ruffed grouse (*Bonasa umbellus*) just prior to death.

To obtain information on the prevalence of this disease in wild canids of Alberta, the following question was submitted to 1800 agricultural field men, registered trappers, and National Park

wardens in 1973: "Have you observed large and/or numerous warts around or in the mouths of coyotes?" Only 23 (4.9%) of 473 respondents who saw coyotes often replied affirmatively. At least two cases submitted to our laboratory were referred to independently by respondents to the questionnaire, suggesting that at least some of the positive responses were dealing with oral papillomatosis. Comments from others, such as "blackish warts on lips", "cauliflower clusters", "fairly large warts on the inside of the lower lip" were equally suggestive of papillomatosis. One severe case in a wolf with mange was noted also. These data, those of Nellis,⁵ and the few reports in the literature, suggest that grossly obvious lesions are rare in coyotes.

Acknowledgements

T. Yamamoto, Department of Microbiology, University of Alberta, kindly identified the virus. The assistance of personnel of the Alberta Departments of Recreation, Parks and Wildlife and Agriculture, and several hunters, particularly O. Coil, in obtaining infected animals is appreciated. This study was supported in part by the National Research Council of Canada (Operating Grant A-6603), Alberta Fish and Wildlife Division and the Alberta Department of Agriculture.

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Received for publication 11 May 1977