

# Rabies in Western Canada, 1978-1984

L. PRINS AND W.D.G. YATES

*Agriculture Canada, Animal Diseases Research Institute, P.O. Box 640, Lethbridge, Alberta T1J 3Z4*

## ABSTRACT

The results of laboratory examination of 22,503 specimens for the diagnosis of rabies by the standard fluorescent antibody and mouse inoculation tests over a seven year period are presented. Specimens were received from British Columbia, Alberta, Saskatchewan, the Yukon and Northwest Territories. Of the 1,445 positive cases, 10.50% involved human contact. The main reservoirs of rabies were skunks, bats and foxes. The reliability of the fluorescent antibody test for the diagnosis of rabies was reaffirmed by agreement with the mouse inoculation test in over 99% of cases.

**Key words:** Rabies diagnosis, zoonosis, western Canada.

## RÉSUMÉ

### La rage dans l'Ouest canadien, de 1978 à 1984

Cet article présente les résultats de l'examen de 22,503 échantillons suspects de rage, par l'immunofluorescence directe et l'inoculation de souris, pour une période de sept ans. Ces échantillons provenaient de la Colombie-Britannique, de l'Alberta, de la Saskatchewan, du Yukon et des Territoires du Nord-Ouest. Des 1,445 cas positifs, 10,5% s'accompagnaient de contact humain. Les mouffettes, les chauves-souris et les renards représentaient les principaux vecteurs. L'efficacité de la technique d'immunofluorescence pour le diagnostic de la rage se trouve confirmée une fois de plus, puisque ses résultats correspondaient à ceux de l'inoculation de souris, dans au delà de 99% des cas.

**Mots clés :** diagnostic de la rage, zoonose, Ouest canadien.

## INTRODUCTION

Rabies is designated as a "reportable" disease under the Animal Disease and Protection Act of Canada. The field investigation and submission of specimens for laboratory diagnosis is the responsibility of the Veterinary Inspection Directorate of the Food Production and Inspection Branch of Agriculture Canada, and the laboratory diagnosis of rabies is performed by the Animal Pathology Division of that Branch.

Diagnostic tests are performed at three laboratories in Canada: the Animal Pathology Laboratory, Sackville, New Brunswick, serving the Atlantic region; the Animal Diseases Research Institute (ADRI), Nepean, Ontario, serving Ontario, Quebec, the eastern Northwest Territories (NWT) and Manitoba (until 1984); and the Animal Diseases Research Institute (ADRI), Lethbridge, Alberta, serving Saskatchewan, Alberta, British Columbia, Yukon Territory, and the western NWT. A previously published account presented the diagnostic results of specimens submitted over a ten year period (1968 to 1977) to ADRI Lethbridge (1). Since 1984, specimens for the diagnosis of rabies from the province of Manitoba have been processed at ADRI Lethbridge instead of ADRI Nepean. However, this report presents the results of submissions to the Lethbridge laboratory between 1978 and 1984, inclusive, from the same area as the previous report (1), namely western Canada with the exception of Manitoba.

## MATERIALS AND METHODS

A total of 22,503 specimens were received from British Columbia, Alberta, Saskatchewan, the Yukon

and NWT, including 12,303 diagnostic and 10,094 survey submissions. One hundred and six of these were unfit for testing.

Most of the diagnostic specimens were submitted by the veterinarians and staff of the Food Production and Inspection Branch. Small numbers were submitted by public health officials, the Royal Canadian Mounted Police, provincial Fish and Wildlife officers, provincial veterinary laboratories and other miscellaneous sources.

The survey submissions consisted of two major groups. The first included 5,207 trapped skunks (*Mephitis mephitis*), 1,017 bats (various species), and 388 other specimens of various other species that were caught in traps set for skunks in the Alberta rabies vector control program (2). This program is carried out under the auspices of the Alberta Central Rabies Control Committee, representing federal, provincial and municipal agencies. The second group included 3,361 arctic foxes (*Alopex lagopus*), 111 lemmings (*Dicrostonyx* sp. and *Lemmus* sp.) and ten red foxes (*Vulpes vulpes*) from an ongoing survey to determine the prevalence of rabies in trapped arctic foxes from areas north of the tree line from the Beaufort Sea to the Gulf of Boothia in the NWT (3).

Specimens were processed and examined using the fluorescent antibody (FA) technique and mouse inoculation (MI) tests for rabies diagnosis as prescribed by the World Health Organization (4-6). Mouse inoculation examination was performed only on specimens which were negative by FA but which had a history of human exposure to the suspect animal, as a back-up to the FA test.

Present address of Dr. Yates: Agriculture Canada, Animal Pathology Laboratory, 116 Veterinary Road, Saskatoon, Saskatchewan S7N 2R3.

TABLE I  
RABIES SUBMISSIONS PER YEAR TO THE ANIMAL DISEASES RESEARCH INSTITUTE (LETHBRIDGE)  
1978-1984

	Submissions	Positive	% Positive
1978	2,065	178	8.66
1979	2,111	128	6.06
1980	3,163	202	6.39
1981	3,377	293	8.68
1982	3,839	238	6.20
1983	3,964	192	4.84
1984	3,878	214	5.52
Total	22,397	1,445	6.45

One hundred and six of the specimens received were unfit for testing due to decomposition, desiccation or gunshot wounds to the head.

#### RESULTS AND DISCUSSION

##### *Submissions from Western Canada as a Whole*

Table I shows the annual submissions and positive cases for the years 1978 to 1984, inclusive. Unfit specimens are excluded.

The results of 22,397 specimens examined during this seven year period are summarized by species in Table II. Negative results in the human contact column indicate a negative result both to the FA and MI tests whereas positive results were by FA test only, with the exception of the 17 specimens listed in Table VIII.

Only slight changes from year to year were observed in the actual number of positive rabies submissions

in western Canada in this and the previous (1) report. There was, however, a substantial increase observed over time in the total number of submissions examined (2,345 per year from 1971 to 1977 compared to 3,215 per year from 1978 to 1984). The percentage positive for the common vectors in western Canada decreased slightly from the previous report, bats from 5.7% to 4.8%, skunks from 36.4% to 34.0% and foxes from 25.9% to 19.5% (Table II).

Domestic animals made up 5,072 or approximately 40% of the diagnostic submissions and rabies was diagnosed in 127 (0.3%) of these. The majority of the positive domestic animals were cattle, dogs and cats.

Human involvement was indicated in 153 of 1,205 (12.7%) positive cases, of which 84 were domestic animals. The actual number of people involved was not known, but the number was probably higher than 153 since multiple exposure could be assumed in some cases. Fortunately, no human deaths occurred as a result of these

TABLE II  
RESULTS OF ALL RABIES EXAMINATIONS BY SPECIES 1978-1984  
(WESTERN CANADA)

Species	Human Contact		No Human Contact		Total	% Pos	1968-77 % Pos <sup>a</sup>
	Neg	Pos	Neg	Pos			
Badger	3	0	40	1	44	2.27	0.00
Bat	234	30	2207	93	2564	4.80	5.69
Caribou	1	1	0	1	3	66.66	100.00
Cat	1320	19	613	3	1955	1.13	2.67
Cattle	417	33	280	23	753	7.44	8.32
Coyote	102	0	399	1	502	0.20	2.10
Dog	1598	23	549	12	2182	1.60	2.78
Fox	72	3	114	42	231	19.48	25.83
Horse	68	8	32	1	109	8.26	2.27
Muskrat	50	1	167	0	218	0.46	0.00
Pig	10	1	12	4	27	18.52	21.89
Raccoon	50	0	145	1	196	0.51	2.50
Sheep	18	0	12	0	30	0.00	4.35
Skunk	117	32	1639	869	2657	33.91	36.41
Weasel	9	0	32	0	41	0.00	9.52
Wolf	7	2	17	1	27	11.11	5.71
Others	514	0	250	0	764	0.00	0.00
Subtotal	4590	153	6508	1052	12303	9.79	10.74
Arctic Fox <sup>b</sup>			3270	91	3361	2.71	4.90
Bat <sup>b</sup>			1017	0	1017	0.00	1.70
Skunk <sup>b</sup>			5058	149	5207	2.86	1.02
Others <sup>b</sup>			509	0	509	0.00	0.00
Total	4590	153	16362	1292	22397	6.45	8.62

<sup>a</sup>Bradley JA (1)

<sup>b</sup>Survey specimens

exposures. In Canada the total recorded number of human deaths from rabies is 20. The most recent cases were one in Saskatchewan in 1970, another in Nova Scotia in 1977 and the last recorded death was in 1984. This 1984 fatality was a man bitten by a dog in the Dominican Republic in July of that year who subsequently died in Quebec City a month later (7).

The survey and depopulation program of the Alberta Central Rabies Control Committee was intensified in the winter of 1979/1980 as a result of the diagnosis of rabies in three of five skunks found on two neighboring farms in southern Alberta. Approximately 1,000 specimens were tested for rabies per year from 1980 to 1984 inclusive. These specimens included 388 other species made up mainly of feral cats. All of this latter group proved to be negative for rabies by the FA test despite a

number of cases in which cats were found to be cohabitants in winter dens with skunks later shown to be positive. The number of positive skunks in the survey program varied from year to year. In 1980, 50 skunks were diagnosed positive while in 1984 the number was only seven. Details of some aspects of the seasonal patterns of occurrence and of habitat aspects have been reported by Rosatte (2).

Bat survey specimens were collected throughout Alberta. Samples were collected from colonies where rabies had been diagnosed in the past (1, 8) and from farmsteads with bat colonies where skunks had been diagnosed positive. All survey bats tested were negative for rabies despite the fact that small numbers of diagnostic specimens are found to be positive in Alberta each year.

The ongoing survey of trapped arctic foxes has to date shown inconclusive results. The annual

percentage positive in the submitted samples over the last seven years varied from 0% to 10%. A difference was observed between sampled areas, ranging from 0% to 21.9% in a given trapping season (3). All 111 lemmings and ten red foxes proved negative for rabies by the FA test [included in the "others" category of the survey specimens (Table II)].

#### *Submissions by Region Within Western Canada*

The regional distribution of the results is provided in Tables III to VII. Survey specimens have been discussed above and are not included in these tables.

*British Columbia* — A horse was diagnosed positive for rabies by the FA test and confirmed by the MI test in 1984 (Table III). From the time the FA test became the standard diagnostic test in 1968 until the above

TABLE III  
RESULTS OF RABIES EXAMINATIONS 1978-1984  
(BRITISH COLUMBIA)

Species	Human Contact		No Human Contact		Total
	Neg	Pos	Neg	Pos	
Bat	58	7	452	39	556
Cat	124	0	48	0	172
Cattle	6	0	6	0	12
Coyote	12	0	14	0	26
Dog	173	0	75	0	248
Fox	1	0	2	0	3
Horse	3	1	5	0	9
Skunk	9	0	18	0	27
Others	163	0	112	0	275
Total	549	8 (1.44%)	732	39 (5.06%)	1328

TABLE IV  
RESULTS OF RABIES EXAMINATIONS 1978-1984  
(ALBERTA)

Species	Human Contact		No Human Contact		Total
	Neg	Pos	Neg	Pos	
Bat	110	12	1183	42	1347
Cat	466	4	179	0	649
Cattle	101	0	95	0	196
Coyote	46	0	229	0	275
Dog	608	1	232	1	842
Fox	11	0	14	0	25
Horse	32	1	12	0	45
Pig	1	0	1	0	2
Skunk	34	5	640	10	689
Wolf	1	0	3	0	4
Others	192	0	187	0	379
Total	1602	23 (1.42%)	2775	53 (1.87%)	4453

diagnosis in the horse, the only species with positive test results from British Columbia were one cat from Vancouver Island in 1969 and several bats varying in number and location from year to year. Monoclonal antibody tests performed at ADRI Nepean, Ontario showed that the rabies virus isolated from the horse was similar to a strain found in bats in British Columbia, Alberta, Saskatchewan and Ontario. This strain is different from the strain found in terrestrial mammals from Manitoba through Alberta. Bats in which rabies had been diagnosed in previous years occurred in the general area where the horse had lived its entire life.

*Alberta* — The positive horse in Alberta (Table IV) was imported from Texas in April 1982. In July of that year the animal was euthanized on a tentative diagnosis of western equine encephalitis. Skunks and bats trapped

subsequently in the area were negative for rabies.

Two positive dogs and two positive cats were submitted from the intensive skunk survey and depopulation area of approximately 7500 km<sup>2</sup> in the southern part of the province which included all of the positive skunks. A rabid skunk was found 2 km from one of the cats. The other cat and the dogs were up to 7 km from any laboratory-confirmed rabid skunk.

The two other positive cats were isolated cases from northern Alberta. One stray cat was found in the city of Edmonton and the other originated from approximately 50 km northwest of Lloydminster. Followup survey samples in both cases were all negative for rabies. The positive bats were submitted over the years from throughout settled areas of the province.

*Saskatchewan* — Most of the

positive cases submitted over the period under study were from Saskatchewan (Table V). Of 1,015 positive cases, 886 or 87.3% were skunks. Although submissions were received from throughout the settled areas of the province the positive cases were, with few exceptions, from an area east of a line from Maple Creek in the south to Prince Albert in the north.

In many of the positive cases in other species, where complete histories accompanied the submissions, the involvement of laboratory-tested positive skunks was indicated.

The positive muskrat (*Ondatra zibethicus*) in Saskatchewan was the first rodent diagnosed as rabid by this laboratory, although a number of muskrats had been similarly diagnosed in the state of Montana (9).

*Northwest Territories* — When compared to other regions, the results of the NWT submissions (Table VI)

TABLE V  
RESULTS OF RABIES EXAMINATIONS 1978-1984  
(SASKATCHEWAN)

Species	Human Contact		No Human Contact		Total
	Neg	Pos	Neg	Pos	
Badger	2	0	18	1	21
Bat	66	11	572	12	661
Cat	717	15	386	3	1121
Cattle	310	33	179	23	545
Coyote	43	0	156	1	200
Dog	767	11	219	5	1002
Fox	45	0	59	0	104
Horse	33	6	15	1	55
Muskrat	20	1	64	0	85
Pig	9	1	11	4	25
Raccoon	35	0	129	1	165
Sheep	15	0	4	0	19
Skunk	74	27	981	859	1941
Weasel	6	0	14	0	20
Others	206	0	118	0	224
Total	2348	105 (4.28%)	2925	910 (23.73%)	6288

TABLE VI  
RESULTS OF RABIES EXAMINATIONS 1978-1984  
(NORTHWEST TERRITORIES)

Species	Human Contact		No Human Contact		Total
	Neg	Pos	Neg	Pos	
Caribou	1	1	0	1	3
Cat	3	0	0	0	3
Dog	41	11	23	6	81
Fox	15	3	38	42	98
Wolf	3	2	7	1	13
Others	5	0	7	0	12
Total	68	17 (20.0%)	75	50 (40.0%)	210

TABLE VII  
RESULTS OF RABIES EXAMINATIONS 1978-1984  
(YUKON TERRITORY)

Species	Human Contact		No Human Contact		Total
	Neg	Pos	Neg	Pos	
Cat	10	0	0	0	10
Coyote	1	0	0	0	1
Dog	9	0	0	0	9
Fox	0	0	1	0	1
Others	3	0	0	0	3
Total	23	0	1	0	24

TABLE VIII  
COMPARISON OF FLUORESCENT ANTIBODY AND MOUSE INOCULATION TESTS  
1978-1984

Species	Number Examined	FAT Neg MIT Neg	FAT Neg, MIT Pos		1968-1977 % <sup>a</sup>
			No.	%	
Badger	3	3	0	0.00	0.00
Bat	236	234	2	0.85	3.20
Caribou	1	1	0	0.00	0.00
Cat	1324	1320	4	0.30	1.37
Cattle	419	417	2	0.48	1.02
Coyote	102	102	0	0.00	0.00
Dog	1605	1598	7	0.44	0.71
Fox	72	72	0	0.00	5.15
Horse	69	68	1	1.45	0.00
Muskrat	50	50	0	0.00	0.00
Pig	11	10	1	9.09	15.38
Raccoon	50	50	0	0.00	0.00
Sheep	18	18	0	0.00	0.00
Skunk	117	117	0	0.00	4.21
Weasel	9	9	0	0.00	0.00
Wolf	7	7	0	0.00	0.00
Others	514	514	0	0.00	0.00
Total	4607	4590	17	0.37	1.07

<sup>a</sup>Bradley JA (1)

showed a high rate of positive cases (31.9%). Nearly half of the fox submissions were positive for rabies (46.0%) and 17 of 81 cases (21%) proved positive in dogs. The latter made up nearly half of the total of 35 positive dogs from western Canada. The common practice of keeping working dogs of the arctic region staked outdoors at all times may have had a bearing on this high number of positive cases. The high rate of positive submissions from this region may have been due to the northerners' awareness of the clinical symptoms of the disease as was stated by Bradley (1).

*Yukon Territory* — The Yukon Territory submissions (Table VII) were, as in the previous report (1), low in number and all were negative for rabies.

Based on the results of the submitted specimens skunks and bats appear to be the main reservoirs of rabies in the southern regions of western Canada. In the arctic region, foxes (*A. lagopus*) fill the role of main reservoir of rabies at least as indicated by submissions to this laboratory. There appears to be a higher "spill over" to other species in the north than is seen in the south.

#### *FA and MI Test Comparison*

Table VIII compares the FA and MI test results on 4,607 cases where both tests were performed on submissions. The data demonstrate and reaffirm the reliability of the former test as the results differed in only 0.37% of the cases, comparing favorably with the 1.07% obtained in the previous report (1). The specimens

with FA negative and subsequent MI positive results usually came from animals that had been killed or in which autolysis of the brain was well advanced. It has been reported previously that due to a low level of antigen in tissue from killed animals, FA negative and MI positive results can occur (1,5). In cases of advanced putrefaction, nonspecific fluorescence can interfere with detection of the specific fluorescence under study. There may be some special difficulties with porcine specimens as referred to previously by Yates *et al* (10) but the numbers are insufficient for a conclusive statement in that regard.

The results continued to indicate that the FA test is a reliable test for the detection of rabies in well preserved specimens. By way of reassurance for those whose role involves explaining

the small percentage of test failures, it has been pointed out that, when the initial FA test on a fresh specimen is negative and the MI test subsequently proves positive, the exposure level is deemed to be below that needed for human infection (1,5).

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## LETTER TO THE EDITOR

### Giardiasis in a Home

DEAR SIR:

Giardia is a known cause of enteritis in many animal species and in humans and yet is frequently overlooked in routine fecal exams. As well, even in clinical cases, it may be difficult to detect in the stool. We recently had an outbreak in a household in our practice area involving pets and the owner.

A nine year old female Cocker Spaniel that had whelped one and one-half months previously was presented for panting, soft stool, and hematochezia. Two routine fecal samples submitted to a local veterinary pathology laboratory were negative. A complete blood count and chemistry profile were normal. Routine survey radiographs did not reveal any abnormalities. The dog did not respond to symptomatic therapy (Tribrissen®, Neoatropec®, peptobismol, bland diet) during this period (3 weeks). Mucoïd diarrhea and hematochezia persisted. It was decided to

treat empirically for *Trichuris vulpis* infection at this time.

One week later the owner returned with two puppies for routine vaccination. She reported that the bitch had improved but still had soft stools and hematochezia. Questioning revealed that the two puppies had also developed soft, cow-pie stools as had the only cat in the household. The owner also admitted that she had had soft stools for two weeks. She had submitted stool samples herself to the local medical laboratory, all of which were negative. It was suggested that she ask them to check specifically for giardia and that she bring in stool samples from the two puppies.

She returned the following day with stool samples and reported that the medical laboratory had identified giardia in her stool. Direct smears of the puppy stools revealed large numbers of giardia cysts. All members of the household (dogs, cat and human) were treated with metronidazole for five days. The problem resolved.

This case points out the potential

for giardiasis as a zoonotic disease. Giardia may be present in the stools of normal dogs but it should be considered a potential cause of diarrhea in dogs and cats of all ages. It has also been suggested that many subclinical bitches harboring giardia may break with disease at the time of whelping. Multiple fecals may be required to identify the parasite. One cat required four fecal exams to identify giardia and the cat responded to treatment. If one is not aware, giardia may be easily overlooked on a routine fecal examination.

Sincerely,

ALASTAIR E. CRIBB, DVM  
DONNA SPRACKLIN, DVM  
P.O. Box 220  
Shubenacadie, Nova Scotia  
B0N 2H0

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