

## PARASITES AND DISEASES OF BISON IN CANADA

### 1. TUBERCULOSIS AND SOME OTHER PATHOLOGICAL CONDITIONS IN BISON AT WOOD BUFFALO AND ELK ISLAND NATIONAL PARKS IN THE FALL AND WINTER OF 1959-60.

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AT THE END of the 19th century there were so few specimens of plains bison left after years of carnage, that the species was threatened with extinction. Corner and Connell (3) have discussed the steps taken by the Government of Canada at the beginning of the present century for the establishment of plains bison herds in Canada. As early as 1893, the Canadian authorities had enacted legislation for the protection of the few hundred wood bison (*Bison bison athabascae*) that were still to be found in the general region of the present Wood Buffalo National Park.

In November 1959, there were about 1,200 plains bison within the 75 square miles of the Elk Island National Park which is located some 20 miles east of Edmonton, Alberta. Nowadays, the bulk of the bison population in Canada is found at Wood Buffalo National Park, an area of 17,300 square miles located on the Alberta-Northwest Territories border. A survey by Novakowski in 1957 (7) established the bison population in the area to be between 14,000 and 16,000.

As stated by Fuller (4), the wood buffalo population in the area in 1922 was between 1,500 and 2,000. Between 1925 and 1928 some 6,000 plains bison from Buffalo National Park at Wainwright, Alberta, were introduced into Wood Buffalo National Park. Cross-breeding occurred between the plains bison and the wood bison. This process has been going on ever since with the result that the bison in the area are hybrid: *Bison bison* x *Bison bison athabascae* with a predominance of progenitors of the former type. More recently in August 1960, Banfield and Novakowski (1) reported the existence of a herd of about 200 pure-bred wood bison in a remote corner of Wood Buffalo National Park.

Small herds of plains bison are also located at Riding Mountain National Park in Manitoba, at Prince Albert National Park in Saskatchewan, and at Banff National Park and Waterton National Park in Alberta.

The bison management program calls for periodic slaughter of animals. Thus in November and December 1959 and January 1960 a total of 936 bison from herds in the Lake Claire area of Wood Buffalo National Park (436) and Elk Island National Park (500) was slaughtered. The 1959-60 slaughtering operation again provided an excellent opportunity for the collection of biological data and information on the health of the bison at both parks. The present report deals with tuberculosis and some of the pathological conditions encountered at the postmortem examination of the slaughtered animals.

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## TUBERCULOSIS

In October 1959, 1,116 animals (831 females and 285 males) drawn from herds in the Lake Claire area of Wood Buffalo National Park, were tested with bovine tuberculin. The tested animals were identified by means of ear tags. One hundred and fifty-one (13.5%) showed a positive reaction; 104 were female and 47 were male. All reactors were set aside for slaughter. Thirteen of these animals were killed or shot prior to the start of the slaughter program. Postmortem examination was conducted on 135 (42 males and 93 females) of the remaining 138 reactors. The other 3 reactors were slaughtered but could not be properly identified because of the loss of their ear tags.

As shown in Table I tuberculous lesions were observed in 219 (50.2%) of the 436 animals slaughtered at Wood Buffalo National Park. Three hundred and fifty-seven of the animals had been tested with bovine tuberculin; 135 of these animals were reactors. Lesions were observed in 116 of them but no visible lesions (NVL) were present in the other 19 animals. These 116 animals represent 26.6% of the total number of the animals slaughtered and 53.0% of the 219 animals showing lesions. Of the other 103 animals (23.6% of the total) in which lesions were also observed (Table I), 58 had been tested with bovine tuberculin and showed no reaction. As stated previously, lesions were found in 219 animals but none was detected in 19 animals that had shown a positive tuberculin test. This brings to 238 the number of animals in which lesions were noted or that had given a positive reaction when tested with bovine tuberculin.

Of the 219 animals with lesions, 168 (76.7%) showed evidence of infection in the lymph nodes of the head. Lesions were found in the thoracic cavity of 70 (32.0%) of the infected animals, and in the abdominal cavity of 47 (21.5%). The latter figure includes lesions in the spleen, in the liver and in the hepatic and mesenteric lymph nodes. The lymph nodes of the body were affected in 35 (16.0%) cases. Lesions were found in the prescapular, in the precrural and in the internal iliac lymph nodes of 33, 25 and one animal respectively.

In 55 of the 219 animals (25.1%) two or more lesions were found. Single lesions were found in the lymph nodes of the head of 132 animals, in those of the thorax

TABLE I

RESULTS OF BOVINE TUBERCULIN TEST IN BISON AND POSTMORTEM EXAMINATION OF REACTORS AND OTHERS IN WOOD BUFFALO NATIONAL PARK, NOVEMBER 1959

Tuberculin tested animals		Postmortem examination	
Number tested	1,116	Total examined	436
Number positive	151	Total reactors	135
(Per cent positive)	13.5	Reactors with lesions	116
		Reactors nvl	19
		Number of animals negative at test or untested and showing lesions	103*
		Total with lesions	219
		Animals without lesions	198

\*58 of these animals showed no reaction when tested with bovine tuberculin.

of 21 others and in those of the abdominal cavity and of the body of 10 males and 2 females.

Generalized tuberculosis was noted in 31 cases. The carcasses of these animals were destroyed. In 18 cases, the carcasses were those of reactors, in 5 cases of non-reactors; and in the other 8 cases of non-tested animals.

In 138 of the 219 infected animals the lesions were caseous. They were calcified in 89 cases. In the 116 reactors examined, the lesions were caseous in 59 cases while in 48 others they were calcified. Both caseous and calcified lesions were found in 9 animals.

None of the 500 animals (302 females and 198 males) examined at Elk Island National Park had been tested prior to slaughter, nor were tuberculous lesions observed in them at postmortem examination.

#### METRITIS

Metritis was noted in 9 animals: 6 adults, 2 four-year-olds and 1 two-year-old. Seven of these animals had been tested with bovine tuberculin. The test was positive in 3 cases. A dead fetus was recovered from the uterus of each of 3 animals, one in each of the age categories in which metritis was observed. The uterus of one of the animals and two of the dead fetuses were examined bacteriologically. In no case were brucella organisms recovered. From the uterine material and from one of the fetuses, acid-fast micro-organisms indistinguishable from *Mycobacterium tuberculosis* var. *bovis* were isolated. This was accomplished by inoculating guinea pigs with suspensions of the uterine or fetal tissues and seeding material from the lesions that developed in these animals onto appropriate culture media. In one of these cases the tuberculin test had been negative whereas it had not been conducted in the other; however, in both cases tuberculous lesions were noted at postmortem examination. No acid-fast organisms were recovered from the third specimen which came from a cow in which the tuberculin test had been negative and which showed no visible lesions suggestive of tuberculosis.

Only in one case was a dead fetus recovered during the Elk Island National Park slaughter. It was not examined bacteriologically.

#### ORCHITIS

Eleven cases of orchitis were recorded in bulls of various ages at Wood Buffalo National Park. Nine of the animals had been tested for brucellosis (rapid serum agglutination technique). A positive reaction had been secured in seven cases. The 11 animals also had been tested with bovine tuberculin.

Bacteriological examination was conducted on diseased testicles from 7 animals. In 6 cases, the testicles were from animals that had given a positive reaction when tested for brucellosis. In no case were brucella organisms recovered. Acid-fast organisms, indistinguishable from *M tuberculosis* were seen in smears made from the testicular material of two animals. In both cases the tuberculin test had been positive. In one case the organism could not be isolated by direct culture of the testicle nor did lesions develop following its inoculation into experimental

animals. In the other cases, inoculation of testicular material into guinea pigs produced therein tuberculous-like lesions from which recovery of *M. tuberculosis* or other pathogenic bacteria was not successful. Bacteria of little or no pathogenic significance were found in the other five cases.

No cases of orchitis were observed at the 1959 bison slaughter at Elk Island National Park.

#### OTHER PATHOLOGICAL CONDITIONS

Arthritis was observed in many of the animals slaughtered at Wood Buffalo National Park. The stifle joint was the most commonly affected part. Abscessed articulations from two animals were sent to the laboratory for bacteriological examination. *Brucella abortus* was isolated in one case. Arthritis was also recorded in a few animals at Elk Island National Park.

In addition actinobacillosis was detected in three of the animals slaughtered at Elk Island National Park.

Peritonitis, pleuritis, pyemia, multiple abscesses and mucoid degeneration were noted in Wood Buffalo National Park bison and resulted in the condemnation of 7 carcasses. At Elk Island National Park one carcass was condemned because of pyemia. Hepatic lesions (cirrhosis, telangiectasis, abscesses) were also seen in animals slaughtered at both places. Adhesions were a very common finding in animals from both localities.

At this time mention should be made of a number of pathological conditions and anomalies of the genital tract which were observed. These and the results of serological studies will be the subject of subsequent reports. One fetus recovered at Elk Island National Park was a coelosomian. This finding was reported earlier (5).

#### DISCUSSION

Tuberculosis was first reported in bison in 1923 by Cameron (2) who observed it in the Wainwright herd. Hadwen (6) found tuberculous lesions in 6,400 (53.4%) of the 12,005 bison slaughtered at Wainwright between 1923 and 1939. He was of the opinion that the disease most probably originated with bison of Canadian origin and that it was improbable it came with animals introduced from the USA between 1907-12. Whatever its origin, tuberculosis was most probably brought into Wood Buffalo National Park by animals from Wainwright. Tuberculosis in Wood Buffalo National Park bison was first observed in the years 1947 to 1948 (4). As stated previously no tuberculous lesions were observed in the 500 bison slaughtered at Elk Island National Park.

The percentage of reactors found in 1959 (13.5%) is almost identical with the findings made by one of us (Gallivan) in 1957 (14.5%) and in 1958 (19.1%).

Postmortem examination revealed tuberculous lesions in 219 (50.2%) of the 456 animals slaughtered at Wood Buffalo National Park. It is evident that this figure does not reflect a true picture of the incidence of tuberculosis in the bison in this locality, as it is influenced to a great extent by the number of reactors slaughtered. That tuberculosis is prevalent in the Wood Buffalo National Park bison is indi-

cated by the fact that 39% of the 1,508 animals from the Hay Camp areas which were slaughtered between 1952-56 and which were not tested prior to slaughter showed tuberculous lesions (4).

An interesting observation is the relatively large number of non-reactors showing tuberculous lesions and conversely of reactors exhibiting no visible lesions. As stated previously, 19 animals with a positive tuberculin test showed no lesions. Of course, there is always the possibility that the lesions were so minute they escaped detection. It is also realized that in bison, as in cattle, NVL may be the result of sensitization of the animal to other agents. The loss of sensitization to mammalian tuberculin is not uncommon in cattle in very advanced cases; the same is probably true of bison.

During the course of his 1952-56 study of bison in Wood Buffalo National Park, Fuller (4) recorded 4 cases of metritis he considered to be due to an unidentified but non-tuberculous infection. At the 1952 slaughter he reported 2 cases of metritis he claimed were due to a tuberculous infection. In 1957, Novakowski (7) also noted a few cases of metritis and of mummified fetus in bison in the Lake Claire area and at the 1958 slaughter he recorded 6 cases of metritis (8). In no cases were the specimens examined bacteriologically. In the present study acid-fast microorganisms, indistinguishable from *Mycobacterium tuberculosis* var. *bovis*, were isolated from uterine material and a dead fetus. In no cases were brucella organisms recovered.

There are a few reports of orchitis in bison in Canada. Hadwen (6) in 1942 reported it in several bison at Wainwright but in no case were tubercle bacilli recovered. Corner and Connell (3) also reported the occurrence of orchitis in bison at Elk Island National Park. In two cases in particular, the serum of the animals strongly agglutinated *Brucella abortus* antigen but attempts to recover brucella directly from lesion material failed. The organism was recovered however from a guinea pig inoculated with a suspension of pus and necrotic testicular material.

Fuller (4) and Novakowski (7,8), also reported orchitis in bison at Wood Buffalo National Park but in no case were diseased testicles examined bacteriologically. Material collected by the authors in 1959 was submitted to such examination and acid-fast microorganisms indistinguishable from *M tuberculosis* were observed in smears made of testicular material from two animals that had given a positive tuberculin test. Attempts to isolate *M tuberculosis* from this material by direct culture and by inoculation of experimental animals failed.

In Canada, as in many other countries, the economic importance of tuberculosis in cattle, and the public health hazards of this disease have resulted in strong measures of control. Thus the same broad, basic principles governing the control of the disease in cattle are being applied at Wood Buffalo National Park: periodical testing with tuberculin and slaughter of reactors. Such a policy was initiated a few years ago.

Considering the bison population in this area, its free movement over a large expanse of range land, and the extreme difficulty of rounding up all the animals in the area, it is evident that all the sound and proven principles governing the eradication of tuberculosis in cattle cannot be fully applied here. Under the circumstances, tuberculosis control in bison at Wood Buffalo National Park at this time is at best a disease reduction program.

## SUMMARY

A total of 936 bison from herds in Wood Buffalo National Park (436) and Elk Island National Park (500) was slaughtered in Nov and Dec 1959, and Jan 1960.

Tuberculosis is prevalent in bison at Wood Buffalo National Park. One hundred and fifty-one (13.5%) of a total of 1,116 animals tested with bovine tuberculin in October 1959, showed a positive reaction. This finding agrees with previous results. All reactors were disposed of.

Tuberculous lesions were observed in 219 (50.2%) of the 436 animals slaughtered. Of these animals, 357 had been tested prior to slaughter and 135 were reactors. Lesions were found in 116 of the reactors but no visible lesions were observed in the other 19 animals. Of the other 103 animals which showed lesions, 58 had been tested and showed no reaction. Thirty-one cases of generalized tuberculosis were encountered. The site and character of the lesions are recorded.

Tuberculosis was not found in the bison slaughtered at Elk Island National Park.

Metritis was noted in 9 Wood Buffalo National Park animals. In 3 cases the tuberculin test had been positive. Brucella organisms were not recovered when bacteriological examinations were conducted on the uterus of one of the animals and on two dead fetuses; however, *Mycobacterium tuberculosis* var. *bovis* was isolated from the uterine material and from one of the fetuses. The only dead fetus recovered during the Elk Island National Park slaughter was not examined bacteriologically.

Orchitis was noted in 11 bulls at Wood Buffalo National Park. Nine of these animals had been tested serologically for brucellosis and a positive reaction secured in 7 cases. The tuberculin test was positive in 4 cases and tuberculous lesions were found in all the animals. Brucella organisms were not recovered from 7 diseased testicles examined bacteriologically. In 6 cases the testicles were from animals that had given a positive serological reaction when tested for brucellosis. Acid-fast microorganisms, indistinguishable from *M. tuberculosis* were seen in the smears of testicular material from 2 animals. In both cases, the tuberculin test had been positive. No case of orchitis was observed in the bison slaughter at Elk Island National Park.

A policy based upon the tuberculin testing and the slaughter of reactors was initiated a few years ago at Wood Buffalo National Park. However under prevailing conditions, it is at best, for the time being, a disease reduction program.

Arthritis was observed in animals killed at both places. The authors also noted other pathological conditions, some of which will be the subject of subsequent reports.

## RÉSUMÉ

Durant novembre, décembre 1959, et en janvier 1960, 936 bisons furent abattus: 436 dans le Parc National de Wood Buffalo et 500 dans le Parc National d'Elk Island.

La tuberculose est fréquente chez le bison à Wood Buffalo où, en octobre 1959, 1,116 animaux furent tuberculinisés (tuberculine bovine). La tuberculo-réaction s'est révélée positive chez 151 (13.5%) des sujets éprouvés. Tous les réacteurs furent éliminés. L'examen postmortem révéla la présence de lésions tuberculeuses chez 219 (50.2%) des 436 animaux abattus. Trois cent cinquante-sept avaient été tuberculinisés. On réussit à déceler des lésions tuberculeuses chez 116 des 135 réacteurs abattus en novembre; on n'en nota aucune chez les 19 autres. Cinquante-huit des 103 autres animaux chez qui on observa aussi des lésions avaient été tuberculinisés, mais la tuberculo-réaction s'était révélée négative. En tout, on rencontra 31 cas de tuberculose généralisée. Le site et l'état des lésions (caséifiées, calcifiées) sont notés. On ne constata aucune lésion tuberculose chez les 500 animaux abattus à Elk Island.

On décéla 9 cas de métrite chez les animaux abattus à Wood Buffalo. L'utérus d'un de ces animaux et deux fœtus furent soumis à l'examen bactériologique. La

recherche de brucella s'avéra infructueuse; cependant, on isola de l'utérus et d'un des fœtus, un bacille acido-résistant en tout point identique au bacille tuberculeux bovin. Dans les deux cas, le matériel d'examen provenait d'animaux présentant des lésions de tuberculose.

A Wood Buffalo, on nota aussi de l'orchite chez 11 animaux, tant chez des jeunes mâles que chez des animaux plus âgés. Neuf de ces animaux avaient été éprouvés pour la brucellose. La réaction s'était avérée positive dans 7 cas. La tuberculo-réaction avait été positive dans 4 cas et on décela des lésions de tuberculose chez ces animaux. Sept testicules d'animaux différents furent soumis à l'examen bactériologique. Dans 6 cas, les testicules provenaient d'animaux dénoncés comme brucelliques par l'examen sérologique. Cependant, la recherche de brucella s'avéra infructueuse. Par contre, on a noté la présence d'un microbe acido-résistant identique au bacille tuberculeux bovin dans le matériel provenant de 2 animaux. Dans les 2 cas, la tuberculo-réaction avait été positive.

Un programme de contrôle de la maladie comportant la tuberculisation et l'abattage des réacteurs a été institué à Wood Buffalo, il y a quelques années. Cependant, dans les circonstances, il s'agit, tout au plus, pour le moment, d'un programme de réduction de la maladie.

Plusieurs animaux abattus à Wood Buffalo et à Elk Island présentaient des signes d'arthrite. On isola *Brucella abortus* d'une articulation abcédée d'un de ces animaux.

Les auteurs notèrent aussi l'existence d'autres états pathologiques dont certains feront l'objet de rapports subséquents.

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