FINAL REPORT (RESEARCH)

State:	Alaska			
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Project No.:	<u>W-21-1</u>	Project	Title:	Big Game Investigations
Job No.:	<u>18.1R</u>	Job Tit]	Le:	Serologic Surveys for Natural Foci of Contagious Ecthyma Infection
Period Covered	July 1	, 1979 to	June 30,	1980

SUMMARY

Contagious ecthyma (C.E.) antibody prevalence in domestic sheep and goats in Interior Alaska during 1978 was quite low (7-10%). This suggested a low level of transmission of the virus among these species during this time period. C.E. antibody prevalence in Dall sheep increased from 30 percent in 1971 to 100 percent in 1978. This suggested an increased level of transmission to, and/or among, these animals during this period. Following a C.E. epizootic in a band of captive Dall sheep in 1977, antibody prevalence was 80 percent in this group of sheep. Less than 1 year later, prevalence had dropped to 10 percent in the same band. Thus it appeared that antibody produced in response to this strain of C.E. is short-lived. Antibody was also detected in 10 of 22 freeranging muskoxen taken by sport hunters on Nunivak Island in 1978. Detectable antibody levels were not found in any of 19 muskoxen captured on the island in 1979. No antibody was found in a small number of captive muskoxen from Unalakleet. Several of the captive muskoxen were known to have been infected with C.E. within 1 to 2 years prior to the time of sampling. This further substantiates the belief that antibody produced in response to infection by the Alaskan strain of C.E. is short-lived.

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BACKGROUND

Contagious Ecthyma was unequivocally diagnosed (i.e. virus isolation) for the first time in captive Dall sheep (Ovis dalli) in midsummer 1977. All of a small flock held by University of Alaska personnel for experimental purposes came down with the infection and two of the four lambs became severely infected and were euthanized. All adults and the surviving lambs experienced only mild symptoms and made uneventful recoveries in several weeks.

Shortly after diagnosis of C.E. in the Dall sheep flock, the virus was also isolated from material recovered from fatal infections (6 of 39 yearlings) in the captive muskox (Ovibos moschatus) herd at Unalakleet. At this time it was realized that an outbreak of a mild, pox-like disease in this same herd during summer 1976, prior to their removal to Unalakleet, was also probably caused by the ecthyma virus. These are the first proven cases of C.E. in Alaskan muskoxen.

This disease is principally one of domestic sheep and goats, but it has been seen in various wild species in Canada (bighorn sheep, Ovis canadensis, and mountain goats, Oreamnos americanus, Samuel et al. 1975), Europe (chamois, Rupricapra rupricapra, Kater and Hansen 1962), and New Zealand (chamois and thar, Hemitragus jemlaicus, Daniel and Christie 1963). Samuel et al. (1975) reported occasional fatal infections in bighorns and mountain goats in several herds in which the disease has been known since 1953. Daniel and Christie (1963) summarized the effects of C.E. on chamois and thar, and two other diseases (keratoconjuctivitis and scabies which they considered the most important of the three) as follows: "It appears that these diseases are enzootic in certain parts of the Southern Alps. But they are negligible factors in limiting the numbers of these two alpine animals." However, both Daniel and Christie (1963) and Kater and Hansen (1962) reported that occasional fatal infections were seen. This was also true in Europe (Kater and Hansen 1962).

There has been considerable local controversy over how infected Dall sheep and muskoxen should be managed to prevent the spread of this disease to wild Dall sheep, muskoxen, or mountain goats. It has been strongly recommended by some that the animals be exterminated, but this action was not supported by other animal disease experts in Alaska and elsewhere. In order to resolve the controversy, the Board of Game recommended that an expert committee consider the problem and report their findings to the Governor and Board.

The Committee specifically recommended, in part, as follows:

1. The University of Alaska, represented by Dr. Robert Dieterich, and the Alaska Department of Fish and Game, represented by Mr. Kenneth Neiland, should immediately enter into a cooperative agreement to undertake:

A. Initial survey of susceptible captive, wild, and domestic populations. A report will be supplied to the committee by May 26, 1978, on the status of these surveys.

B. Design of an epidemiological study of C.E. to provide information necessary to better understand the implications of wildlife-domestic C.E. outbreaks.

5. Funding to survey wildlife and domestic animals for evidence of C.E. and for supervision of quarantines should be immediately provided.

7. Wild Dall sheep and mountain goat populations must be sampled to determine status of C.E. as soon as possible.

8. Domestic sheep and goats must be sampled to determine status of C.E.

9. Support of subsequent funding for a cooperative C.E. epidemiological study should be encouraged.

Further details on C.E. can be found in the report submitted to the Board of Game (Neiland 1978).

OBJECTIVES

To determine the prevalence and distribution of antibody to contagious ecthyma virus in wild, captive, and domestic animals in Alaska.

To determine the extent to which domestic animals may serve as reservoirs of contagious ecthyma virus for wildlife, and vice versa.

PROCEDURES

Blood samples were collected as follows:

Species	No.	Location	Date	Remarks		
Domestic sheep	10	Fairbanks	May-June 1978	Domestic flock		
Domestic sheep	21	Delta	May-June 1978	Domestic flock		
Domestic sheep	1	Tok	May-June 1978	Domestic flock		
Domestic goats	48	Fairbanks	May-June 1978	Domestic flock		
Domestic goats	26	Delta	May-June 1978	Domestic flock		
Domestic goats	13	Tok	May-June 1978	Domestic flock		
Dall sheep	all sheep 5 Kenai		MarApr. 1971	Population control		
Dall sheep 10 Dry Creek		Dry Creek	March 1971	ADF&G capture		
Dall sheep 13 Dry		Dry Creek	June 1978	ADF&G capture		
Dall sheep 30 Sheep Creek		Sheep Creek	1978	ADF&G capture		
Dall sheep	all sheep 11 Fairbanks		July 1977	Captive flock		
Dall sheep 9 Fairbanks		May-June 1978	Captive flock			
Muskox 9 Unala		Unalakleet	May 23, 1978	Domestic herd		
Muskox 22 Nunivak		Nunivak	FebMar. 1978	Sport hunts		
Muskox	19	Nunivak	February 1979	Univ. Alaska capture		

Blood samples were allowed to clot, serum was removed by aspiration, and then frozen. The frozen sera were shipped to Dr. Dieter Burger at the Washington Animal Disease Diagnostic Laboratory, located on the campus of Washington State University, Pullman, Washington. The sera were analyzed for the presence of contagious ecthyma antibody by means of standardized virus neutralization tests.

FINDINGS

Results of the serological tests are presented in Table 1. These results indicated that C.E. infection is present (although at a low level) in the domestic sheep and goat populations of Interior Alaska. Such low prevalence may indicate: 1) low level of transmission between individuals (enzootic condition), 2) high case mortality rate, or 3) short-lived C.E. antibody. It is believed that C.E. is presently enzootic in the Interior. It has been reported that infection with C.E. virus provides life-long immunity in domestic sheep and goats. However, based upon data presented below, we believe this may not necessarily be true with the strain of C.E. virus which is circulating in the Interior. Nor is this strain of C.E. believed to be highly virulent. Maximum titer in a domestic sheep was 256.

Results of the tests on wild Dall sheep sera were interesting for two primary reasons. Sera collected in 1971 contained evidence that C.E. virus was present in the Interior as early as 1971. No such evidence was found in a small sample from the Kenai Peninsula. Secondly, the samples collected in 1978 revealed a high prevalence of infection in two populations, those near Dry Creek and Sheep Creek. Thus, the rate of transmission to and/or among the Dall sheep apparently increased significantly between 1971 and 1978. During field collections at Dry Creek in June 1979 a

Table 1. Results of contagious ecthyma virus neutralization tests.

Domestic Sheep and Goats

Location	Sheep	Goats				
Fairbanks	0/10*	3/45				
Delta	2/21	0/26				
Tok	0/1	0/13				

Wild Dall Sheep

Location	1971	1978			
Dry Creek	3/10*	13/13			
Sheep Creek	-	22/30			
Kenai	0/5	-			

Captive Dall Sheep - Fairbanks

1977	9/11*
1978	1/9

Muskox

Unalakle	et (do	omestic)	0/9*
Nunivak,	1978	(wild)	10/22
Nunivak,	1979	(wild)	0/19

* Number positive/Number tested

typical C.E. lesion was observed on the udder of a female Dall sheep. Biopsy material was sent to the Animal Disease Diagnostic Laboratory at Washington State University. C.E. virus was isolated from the biopsy. This finding lends support to the belief (indicated by results of the serological tests) that C.E. is enzootic in this wild Dall sheep population. In the absence of reports of substantial mortality in these two populations, it appears that C.E. does not pose a serious threat to these populations, although young or compromised individuals may succumb to severe infections.

The high antibody prevalence in captive Dall sheep in 1977 (9/11) was not surprising considering the epizootic of overt disease in this population shortly before the samples were collected. Two lambs were euthanized as a result of particularly debilitating C.E.-induced lesions incurred during the 1977 epizootic. No adults suffered such severe disease. The fact that C.E. antibody prevalence was low in the same population less than 1 year later, indicates that antibody is short-lived in Dall sheep with the particular strain of C.E. virus which was active in the Interior at that time. The single individual which had detectable antibody at the later date was a lamb which had a high titer. This suggests that either: 1) the lamb acquired a high titer of antibody from its dam, 2) the lamb acquired an active infection from its dam and responded with its own antibody, or 3) the lamb acquired an active infection from the environment and responded by producing its own antibody. We believe that number 3 explains the situation. If so, the low, or nonexistent, titers of C.E. antibody in the remainder of the flock were apparently sufficient to protect these animals from active infection.

Of the nine domestic muskoxen sampled at Unalakleet in May 1978, three were known to have been infected with C.E. in 1977 and one in 1976. This once again emphasizes the shortlived aspect of antibody produced in response to the Alaskan strain of C.E. by several species of Alaskan wildlife. Diagnostic levels of antibody found in 10 of 22 muskoxen taken from Nunivak Island in 1978 indicated that this virus has been present in another area of the state. In the absence of reliable mortality data on this herd, interpretation of the potential impact of this disease on the wild, free-ranging muskoxen on Nunivak is difficult. During the outbreak of C.E. at Unalakleet, 6 of 39 calves died of the disease. Mortality has also been observed in adults captured in Greenland and transported to Norway (Kummeneje and Krogsrud 1978). Absence of detectable antibody levels in the 19 muskoxen taken from Nunivak in 1979 suggests that the disease may have disappeared from this population. Alternatively, and this seems the more likely explanation, this population may simply be experiencing an inter-epizootic phase of the disease. Antibody titers of individuals may have fallen to undetectable, and perhaps nonprotective,

levels in the absence of antigenic stimulus. In addition, calves which have not been exposed to the virus would be expected to be susceptible to the disease. As the number of susceptible individuals increases, and if these individuals are subsequently exposed to the virus, another outbreak of the disease may occur. Therefore, serological surveillance of this population should continue.

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FINAL REPORT (RESEARCH)

State: Alaska

Cooperator: Kenneth A. Neiland

Project Nos.: W-21-1 Project Title: Big Game Investigations

Job No.: <u>18.2R</u> Job Title: <u>Experimental Studies on</u> <u>Potential Hosts of</u> Contagious Ecthyma Virus

Period Covered: July 1, 1979 to June 30, 1980

SUMMARY

Caribou and moose are susceptible to experimental infection by a "muskox-strain" of contagious ecthyma virus. The lesions produced in one caribou fawn and one moose calf were mild and of short duration.

BACKGROUND

Contagious ecthyma (C.E.) was unequivocally diagnosed (i.e. virus isolation) for the first time in captive Dall sheep (Ovis dalli) in midsummer 1977. All of a small flock held by University personnel for experimental purposes came down with the infection and two of four young lambs became severely infected and were euthanized. All adults and the surviving lambs experienced only mild symptoms and made uneventful recoveries within several weeks.

shortly after diagnosis of C.E. in the Dall sheep flock, the virus was also isolated from material recovered from fatal infections (6 of 39 yearlings) in the captive muskox (Ovibos muschatos) herd at Unalakleet. At this time it was realized that an outbreak of a mild, pox-like disease in this same herd during the summer of 1976 prior to their removal to Unalakleet also was likely caused by the ecthyma virus. These are the first proven cases of C.E. in muskoxen. (We now have serologic evidence of the virus in muskoxen on Nunivak.)

The disease is principally one of domestic sheep and goats, but it has been seen in various wild species in Canada [bighorn sheep (Ovis Canadensis) and mountain goats (Oreamnos americanus), Samuel et al. 1975], Europe [chamois (Rupicapara rupicapara) and ibex (Ovis canadensis), Kater and Hansen 1962] and New Zealand [chamois and tahr (Capra ibex), Daniel and Christie 1963]. Samuel et al. (1975) reported occasional fatal infections in bighorns and mountain goats in several herds in which the disease has been known at least since 1953, but one of the bighorn herds is now so large that a crash is feared. Daniel and Christie (1965) summarize the effects on chamois and tahr of C.E. and two other diseases (keratoconjunctivitis and scabies which they considered the most important of the three) as follows: "It appears that these diseases are enzootic in certain parts of the southern Alps. But they are negligible factors in limiting the numbers of these two alpine animals." However, both Daniel and Christie (1963) and Kater and Hansen (1965) reported that occasional fatal infections were seen. And this is also true in Europe (Kater and Hansen 1962).

There has been considerable local controversy over how the infected Dall sheep and muskoxen should be managed to prevent spread of the disease to wild Dall sheep, muskoxen or mountain goats. It was strongly recommended by one faction during the earlier stages of the debate that the animals be exterminated. But this action was not supported by most other animal disease experts in Alaska and elsewhere. In order to resolve the controversy, the Game Board recommended that an expert committee consider the problem and report their findings to the Governor and Board of Game. The Committee specifically recommended in part as follows:

1. The University of Alaska, represented by Dr. Robert Dieterich, and the Alaska Department of Fish and Game, represented by Mr. Kenneth Neiland, should immediately enter into a cooperative agreement to undertake:

A. Initial survey of susceptible captive, wild and domestic populations. A report will be supplied to the Committee by May 26, 1978 on the status of these surveys.

B. Design of an epidemiological study of C.E. to provide information necessary to better understand the implications of wildlife-domestic C.E. outbreaks.

FINDINGS

Because only limited funds remained in our FY 78 budget for capture and care of young caribou and moose in June 1978, we were only able to secure two caribou fawns and a moose calf for our initial experimental work. We also obtained two surplus, female Dall sheep lambs from the experimental flock maintained by Dr. Dale Guthrie, Division of Life Sciences, University of Alaska. However, one of the caribou fawns and both Dall sheep lambs died from illdefined causes soon after they were taken into custody in the experimental isolation facilities at the Institute of Arctic Biology, University of Alaska.

Our plan was to do a preliminary experiment on susceptibility and antibody response of caribou and moose to infection by the strain of contagious ecthyma virus causing infection in muskox. A serologically negative domestic sheep was used as a control to demonstrate the infectivity of our experimental virus preparation.

A larger experiment involving more animals was planned for 1979 when funds would be available for the acquisition and care of more caribou fawns and moose calves. After several months adjustment to captivity, the caribou, moose and domestic sheep were infected. All three animals developed mild, short-term lesions on the lips. The antibody responses are shown in Figure 1. Antibody levels were monitored longer than shown in Figure 1, but the serologic measurements on later serum samples are not yet available from the consulting laboratory.

We anticipate doing another experiment using larger numbers of caribou fawns and moose calves following the next fawning (calving) period (May-June 1979). There does not appear to be any published evidence that this disease has been previously studied in natural or experimentally infected caribou or moose. The disease has not been seen in cervids in areas in western Canada where naturally infected bighorn sheep and mountain goats have been seen. Serologic data on Dall sheep indicate that the disease is enzootic in this species in Alaska, but we have seen no lesions in moose or caribou suggesting that ecthyma also occurs in them. And the results of serologic tests on a substantial collection of serum samples from these species are not yet available.

LITERATURE CITED

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FIGURE 1. Antibody body response to experimental infection by contagious ecthyma.

FINAL REPORT (RESEARCH)

State: Alaska

Cooperator: Kenneth A. Neiland

Project No.: W-21-1 Project Title: Big Game Investigations

Job No.: <u>18.4R</u> Job Title: <u>Experimental Studies on</u> <u>Sarcosystis Infections in</u> Caribou and Canid Hosts

Period Covered: May 21, 1979 to March 20, 1980

SUMMARY

No work was accomplished because suitable experimental facilities could not be obtained.