Survey of *Fascioloides magna* in farmed wapiti in Alberta

Murray J. Kennedy, Robert C. Acorn, David T. Moraiko

Abstract — The formalin-ethyl acetate sedimentation procedure was used to detect ova of the giant liver fluke, *Fascioloides magna*, in feces of farmed wapiti in Alberta. Twenty (3.2%) of the 629 fecal samples examined contained ova of *F. magna*. Thirteen (33.3%) of the 39 farms surveyed had wapiti positive for *F. magna*. The presence of *F. magna* in farmed wapiti north of the North Saskatchewan River is confirmed, and 3 areas where the infection has become endemic are identified.

Résumé — Enquête sur *Fascioloides magna* chez des wapiti d'élevage de l'Alberta. Le procédé de sédimentation formol-acétate d'éthyl a été utilisé pour détecter les oeufs de la douve hépatique géante, *Fascioloides magna*, dans les fèces de wapiti d'élevage en Alberta. Vingt (3,2 %) des 629 échantillons fécaux examinés contenaient des oeufs de *F. magna*. Treize (33,3 %) des 9 fermes étudiées étaient positives à *F. magna*. La présence de *F. magna* chez des wapiti d'élevage du nord de la rivière Saskatchewan nord est confirmée et 3 régions où l'infection était devenue endémique sont identifiées.

(Traduit par docteur André Blouin)

Can Vet J 1999; 40: 252–254

Introduction

The giant liver fluke, *Fascioloides magna,* is a common parasite of white-tail deer *(Odocoileus virginianus)* (1–2), wapiti *(Cervus elaphus)* (2), and woodland caribou *(Rangifer tarandus caribou)* (3) in some regions of North America. *Fascioloides magna* has a life cycle that involves aquatic snails as intermediate hosts and cervids as final hosts. Adult flukes encysted in the livers of cervids excrete eggs, which pass down the hepatic ducts into the intestine and leave the body in feces (4,5). *Fascioloides magna* matures in the liver of wapiti, white-tailed deer, mule deer *(Odocoileus hemionus hemionus),* and black-tailed deer *(Odocoileus hemionus columbianus)* (4,5). Cattle, bison, and moose, being unsuitable hosts for *F. magna,* form thick-walled cysts in the liver to wall off the migrating fluke. Flukes in cattle, bison, and moose rarely mature to produce eggs. Establishing and maintaining infections in these animals depends on cohabitation with infected cervids that are suitable hosts of *F. magna.* Cysts do not form around the flukes migrating in the livers of sheep and goats, resulting in severe damage to the liver (6,7). The eggs in feces can overwinter but are susceptible to dessication. The egg develops and hatches in water, releasing a free-living larva, a miracidium, that swims about until it locates a suitable lymnaeid snail host. As previously cited (8), 5 species of lymnaeid snails have been found naturally infected with *F. magna* in North America. Other potential lymnaeid intermediate hosts have been identified by experimental infections (9–12). Thirteen species of lymnaeid snails occur in Alberta (13); four are known to be natural or experimental hosts for *F. magna.* The miracidium penetrates the snail and continues developing, eventually producing a different free-living larva, the cercaria, which leaves the snail and encysts on aquatic vegetation as metacercaria. The vertebrate host becomes infected by ingesting the metacercaria with aquatic plants or in drinking water. The fluke excysts in the intestine and migrates through the wall of the intestine to the peritoneal cavity and then to the liver. The entire life cycle may require 5 mo to complete. *Fascioloides magna* continue to produce eggs for up to 5 y (14).

Natural infections of *F. magna* are common in wapiti in the foothills and mountains of southern Alberta, and occur in moose and white-tailed deer sympatric with infected elk (2). *Fascioloides magna* also occurs in wild wapiti, moose, bison, and *Odocoileus* spp. in Banff and Waterton National Parks, Cypress Hills Provincial Park (2,4), and in farmed elk on one ranch in southern Alberta (15).

Wapiti ranching is a growing industry in Alberta. Presently, there are 273 government licensed wapiti farms in Alberta, totaling over 14 500 animals. Farmed herds range in size from fewer than 10 to over 400 animals. Most wapiti farmers routinely examine and treat their animals for respiratory and gastrointestinal parasites but do not examine for the giant liver fluke. Moving infected wapiti to new or existing farms could establish new endemic areas of *F. magna* throughout the province and have important implications for domestic livestock, wild wapiti, and deer. The anthelmintics used to control gastrointestinal nematodes are not effective against *F. magna.* Although liver flukes rarely kill their hosts, their numbers may increase in wapiti in high density stocking situations. Because of the importance of the giant liver fluke to Alberta's alternative and traditional livestock, we conducted a survey to determine the distribution of *F. magna* in farmed elk in Alberta.

Materials and methods

One hundred ninety government licensed Alberta gamefarms having 10 or more animals were asked to participate in a survey for *F. magna.* Fresh fecal samples

Alberta Agriculture, Food and Rural Development, Animal Health Laboratories Branch, 6909 116th Street, Edmonton, Alberta T6H 4P2 (Kennedy, Moraiko); Alberta Agriculture, Sheep and Diversified Livestock Group, Provincial Building, Box 4534, Barrhead, Alberta T7N 1A4 (Acorn).

Address correspondence and reprint requests to Dr. Murray J. Kennedy.

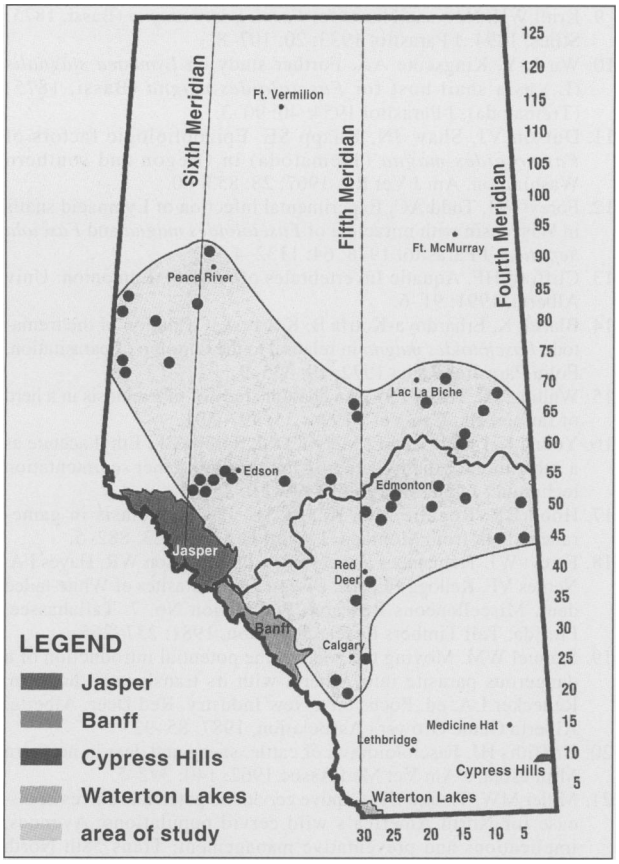

Figure 1. Wapiti farm localities and area of study, with national and provincial parks of Alberta; the large, solid circles (●) represent the approximate localities of the wapiti farms surveyed.

were collected randomly from adult and yearling wapiti between August and October, 1997. Wapiti were identified by a unique ear tag number, when possible. Calves were not sampled because flukes require a minimum of 32 wk to produce ova that are passed in the feces (5). In most cases, fecal samples were collected off the ground immediately following individual elk defecation. Fecal samples were frozen and sent for analysis to the Provincial Veterinary Laboratory Edmonton, Alberta.

The formalin-ethyl acetate procedure (16) was used to detect trematode ova in wapiti feces. Wet mount preparations were made of the sediment and examined at 67.5X magnification by using a compound microscope (Phase Star, American Optical, Leica Microsystems, Willowdale, Ontario). Results were recorded as either positive or negative. Information about farm size, on-farm water source, animal histories, use of anthelmintics, and proximity of farmed wapiti to free-ranging cervids or domestic livestock was obtained from each cooperator who had wapiti that tested positive for *F. magna.*

Results

Thirty-nine of the 190 wapiti farms (20.5%) submitted samples between August and October, 1997 (Figure 1). The number of wapiti on each farm surveyed varied from 9 to 145 (mean = 67) animals. The producer with 9 wapiti had sold 1 of his animals prior to collecting samples for this survey. Fecal samples containing trematode ova were found on 13 (33.3%) of the farms surveyed

Table 1. Number of fecal samples examined from game farms in Alberta with wapiti infected with *Fascioloides magna*

Farm	No. of wapiti on farm	No. of samples examined	No. of samples positive	Sample prevalence (%)
1	9	9	1	11.1
2	23	9	3	33.3
3	34	12	1	8.3
4	35	18	1	5.5
5	47	27	1	3.7
6	49	20	1	5.0
7	54	3	3	100
8	59	23	1	4.3
9	89	10	1	10.0
10	92	20	2	10.0
11	106	18	2	11.1
12	122	25	2	8.0
13	145	17	1	5.9
Total	864	211	20	

(Table 1). Twenty (9.5%) of the 211 fecal samples examined from the 13 positive herds contained ova of *F. magna.* Overall, 20 (3.2%) of the 629 fecal samples examined from the 39 farms contained ova of *F. magna.* Nine of the 24 herds north of the North Saskatchewan River were positive, while 4 of the 15 herds south of the North Saskatchewan River were positive.

From the questionnaire, we determined that, of the 13 farms with infected animals, 9 had obtained their positive wapiti from other farms, while 4 had wapiti that became infected on their farm. Three of the 4 farms are new foci of infection north of the North Saskatchewan River. The fourth farm is located south of the North Saskatchewan River.

Discussion

The prevalence of game farms in Alberta with *F. magna* (33.3%; 13/39 farms) was higher than that found for wapiti ranches in Montana (17.2%; 5/29 farms) (17). However, the prevalence (3.2%; 20/629 fecal samples) of *F. magna* in farmed wapiti in Alberta was lower than that reported for Montana (22.3%; 23/103 fecal samples).

Because of the long-lived nature of *F. magna,* (> 5 y) (1), annual changes in prevalence and intensity (mean number of flukes per infected host) are not expected in wild host populations (3). Lankester and Luttich (3) noted that there was no difference in prevalence or intensity of infection in the population of caribou they studied on 2 successive years (1985 and 1986). Although prevalence increased with age, the prevalence and mean intensity of infection did not differ between male or female caribou. There was no relationship between intensity of infection and host age.

The dynamics of *F. magna* infection in caribou populations is similar to that in populations of wapiti and deer (3). Immature flukes can be found in deer up to 1 y after infection (5), which suggests that migrating, immature flukes may persist indefinitely until they pair and become encapsulated (18).

Fascioloides magna can expand its range through the natural dispersal or translocation of infected animals. To limit the spread of *F. magna* in northern Alberta, wapiti from areas that have a high prevalence of *F. magna*

in free-ranging cervids should not be translocated to areas north of the North Saskatchewan River (2,19). Our survey has shown that *F. magna* occurs in some localities north of the North Saskatchewan River and is likely present in wild cervids.

The spread of *F. magna* depends on the presence of a suitable snail intermediate host and a natural or reservoir host capable of disseminating fluke ova in its feces (20). Conditions that are suitable for snails include footprint pools created by livestock, mud flats bordering slow-moving rivers or streams, river backwater, permanent or seasonal runoff streams, irrigation ditches, dugouts, and marshy areas. Accidental transmission of *F. magna* to cattle and sheep has occurred in areas where pastures are shared with infected cervids. In Minnesota, where infected deer had access to livestock grazing areas, *F. magna* caused numerous liver condemnations in cattle and heavy losses in sheep (20).

Attempts to control *F. magna* in wapiti include snail eradication, eliminating infected animals, and treating infected animals with an anthelmintic. Producers in Alberta use triclabendazole against *F. magna* in wapiti, but this drug is currently only available to veterinarians in Canada as a medical emergency drug. Limiting the movement of infected animals to areas where suitable intermediate hosts (aquatic snails) are absent will help to control this parasite (21). Infections can be prevented by not allowing farmed wapiti access to water bodies where snails and plants abound. Controlled burning of grasses and rushes in the spring may reduce the number of larvae available to infect the wapiti.

Acknowledgments

We thank M.J. Dorrance, D.A. Brennan, D.C. Rodtka and P.N. Merrill, Alberta Agriculture, Food and Rural Development (AAFRD), Problem Wildlife Sheep and Diversified Livestock Group, for assistance in contacting wapiti producers and arranging fecal collections. We thank the University of Alberta, Ministik Wildlife Research Centre and the wapiti farmers who collected and submitted fecal samples. We also thank John Gillmore, AAFRD, Publishing Branch, for drawing Figure 1. CVJ

References

1. Foreyt WJ, Samuel WM, Todd AC. *Fascioloides magna* in white-tailed deer *(Odocoileus virginianus)*: observations on the pairing tendency. J Parasitol 1977; 63: 1050–2.
2. Pybus MJ. Survey of hepatic and pulmonary helminths of wild cervids in Alberta, Canada. J Wildl Dis 1990; 26: 453–9.
3. Lankester MW, Luttich S. *Fascioloides magna* (Trematoda) in woodland caribou *(Rangifer tarandus caribou)* of the George River herd, Labrador. Can J Zool 1988; 66: 475–9.
4. Swales WE. The life cycle of *Fascioloides magna* (Bassi, 1875), the large liver fluke of ruminants, in Canada. Can J Vet Res 1935; 12D: 177–214.
5. Foreyt WJ, Todd AC. Development of the large American liver fluke *Fascioloides magna* in white-tailed deer, cattle and sheep. J Parasitol 1976; 62: 26–32.
6. Foreyt WJ, Hunter RL. Clinical *Fascioloides magna* infection in sheep in Oregon on pasture shared by Columbian white-tailed deer. Am J Vet Res 1980; 41: 1531–2.
7. Foreyt WJ, Leathers CW. Experimental infection of domestic goats with *Fascioloides magna*. Am J Vet Res 1980; 41: 883–884.
8. Dunkel AM, Rognlie MC, Johnson GR, Knapp SE. Distribution of potential intermediate hosts for *Fasciola hepatica* and *Fascioloides magna* in Montana, USA. Vet Parasitol 1996; 62: 63–70.
9. Krull WH. New snail hosts for *Fascioloides magna* (Bassi, 1875) Stiles, 1894. J Parasitol 1933; 20: 107–8.
10. Wu L-Y, Kingscote AA. Further study on *Lymnaea stagnalis* (L.) as a snail host for *Fascioloides magna* (Bassi, 1875) (Trematoda). J Parasitol 1954; 40: 90–3.
11. Dutson VJ, Shaw JN, Knapp SE. Epizootiologic factors of *Fascioloides magna* (Trematoda) in Oregon and southern Washington. Am J Vet Res 1967; 28: 853–60.
12. Foreyt WJ, Todd AC. Experimental infection of Lymnaeid snails in Wisconsin with miracidia of *Fascioloides magna* and *Fasciola hepatica*. J Parasitol 1978; 64: 1132–4.
13. Clifford HF. Aquatic Invertebrates of Alberta. Edmonton: Univ Alberta, 1991: 91–6.
14. Blazek K, Erhardova-Kotrla B, Kotrly A. Ovulation of the trematode *Fascioloides magna* in relation to the duration of parasitation. Folia Parasitol Praha 1972; 19: 335–9.
15. Whiting TL, Tessaro SV. An abattoir study of tuberculosis in a herd of farmed elk. Can Vet J 1994; 35: 497–501.
16. Young KH, Bullock SL, Melvin DM, Spruill CL. Ethyl acetate as a substitute for diethyl ether in the formalin-ether sedimentation technique. J Clin Microbiol 1979; 10: 852–3.
17. Hood BR, Rognlie MC, Knapp SE. Fascioloidiasis in game-ranched elk from Montana. J Wildl Dis 1997; 33: 882–5.
18. Foreyt WJ. Trematodes and cestodes. In: Davidson WR, Hayes FA, Nettles VF, Kellogg FE, eds. Diseases and Parasites of White-tailed deer. Miscellaneous Research Publication No. 7. Tallahassee, Florida: Tall Timbers Research Station, 1981: 237–265.
19. Samuel WM. Moving the zoo, or, the potential introduction of a dangerous parasite into Alberta with its translocated host. In: Renecker LA, ed. Focus on a New Industry. Red Deer, Alberta: Alberta Game Growers Association, 1987: 85–92.
20. Griffiths HJ. Fascioloidiasis of cattle, sheep and deer in northern Minnesota. J Am Vet Med Assoc 1962; 140: 342–7.
21. Miller MW, Thorne ET. Captive cervids as potential sources of disease for North America's wild cervid populations: Avenues, implications and preventative management. Trans 58th North Am Wildl Nat Resources Conf 1993: 460–467.