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Source: Journal of Wildlife Diseases, 33(4) : 882-885

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-33.4.882

Journal of Wildlife Diseases, 33(4), 1997, pp. 882–885

Fascioloidiasis in Game-ranched Elk from Montana

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ABSTRACT: The distribution of *Fascioloides magna* in game-ranched elk and the potential for spread of the parasite through movement of infected animals was examined in Montana (USA). Fecal samples (n = 448) collected from captive elk on 29 game ranches were examined for eggs of *F. magna* by fecal sedimentation. Eggs were detected in elk on 5 ranches. This suggests that *F. magna* has been translocated by infected game-ranched elk. The wide distribution of snail intermediate hosts for *F. magna* in Montana indicates a potential to spread the parasite to other captive cervids, domestic livestock or free-ranging wildlife.

Key words: *Cervus elaphus*, elk, *Fascioloides magna*, game ranch, snails, transmission.

The giant liner trematode or "fluke," *Fascioloides magna*, described by Bassi (1875), is a common parasite of white-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) in some regions of North America (Foreyt, 1992). Prior to the current study, most reports in Montana (USA) were limited to the northwest region of the state where the liver fluke had infected elk and moose (*Alces alces*) (K. Aune, pers. comm.), white-tailed deer (Alton, 1938), cattle (Knapp et al., 1992), sheep (Hall, 1914), and swine and llamas (D. Worley, pers. comm.). A single report of *F. magna* in a captive elk from eastern Montana was probably due to translocation of infected animals to the area (Hood, 1995).

In Montana, elk ranching is a growing industry. Animal movements practiced by the industry could extend the distribution of *F. magna*, which would have important implications for domestic livestock. Although the trematode rarely causes debilitation or death in deer and elk (Foreyt, 1982), infection in cattle results in liver condemnation at slaughter. In sheep and goats, the infection is usually fatal (Foreyt and Hunter, 1980; Foreyt and Leathers, 1980). This study was conducted to determine the distribution of *F. magna* in Montana game-ranched elk and the potential for expanding the range of the parasite by moving infected animals.

Fifty-six game ranches licensed by the Montana Department of Fish, Wildlife, and Parks (MTFWP) were contacted regarding their willingness to participate in a survey for fascioloidiasis. Those participating were surveyed for information about ranch size, animal histories, use of anthelmintics, and proximity of captive elk to free-ranging wildlife or domestic livestock.

At each study site, fecal samples were randomly collected from the ground and, in some cases, from individual elk upon defecation. Two grams of each sample were then evaluated for number of trematode eggs with a modified sedimentation technique (Flukefinder®, Visual Difference, Moscow, Idaho, USA) and a dissecting microscope. Results were recorded as eggs per gram of feces (EPG). Eggs of *F. magna*, *Fasciola hepatica*, and *Paramphistomum liorchis* are indistinguishable. However, *P. liorchis* has not been reported in Montana, and infections of *F. hepatica* in elk rarely are reported. Therefore, trematode eggs in feces were assumed to be the eggs of *F. magna*.

Twenty-nine elk ranches in 16 of the 56 Montana counties were sampled from November 1995 through August 1996. The number of elk on each ranch varied from seven to 650. Size of enclosures ranged from one to 600 ha. Fecal samples containing trematode eggs were found at five (17%) ranches in four Montana counties (Fig. 1) The results are summarized in Table 1.

Results of elk owner interviews revealed that five of 29 ranchers (17%) had used a trematodicide at various times. Five ranch-

TABLE 1. Ranches in Montana with captive elk infected with *Fascioloides magna*, November 1995–August 1996.

Ranch number	Location	County	Number of elk on ranch	Prevalence[a] (percent)	Range[b]
1	48°10′N; 114°10′W	Flathead	7	7/7 (100)	108–915
2	48°16′N; 114°11′W	Flathead	61	1/24 (4)	2
3	47°54′N; 105°20′W	McCone	60	2/21 (10)	27–53
4	47°33′N; 111°45′W	Cascade	90	5/42 (12)	2–46
5	48°45′N; 114°51′W	Lincoln	35	8/9 (89)	1–196

[a] Number of fecal samples positive for fluke eggs/number of fecal samples collected.
[b] Expressed in number of trematode eggs/g of feces.

es (17%) grazed elk and domestic livestock in common enclosures. At least 14 ranches (48%) contained domestic livestock on pasture adjacent to elk. Domestic livestock included cattle, bison, sheep or goats. Free-ranging elk and/or deer were present in the vicinity of every ranch we sampled.

Positive samples from Ranch 3, in McCone County, were collected from elk recently purchased from out-of-state locations. McCone County is in eastern Montana, a region where *F. magna* has not been previously reported. When fecal samples were collected, the animals had been in one enclosure since their arrival. The enclosure was a small corral with a dry dirt floor. Because the enclosure contained no snails or aquatic habitat, we assumed the elk were infected before their arrival.

As mentioned previously, reports of *F. magna* in free-ranging wildlife and domestic livestock are restricted to the northwest region of Montana. Results of this study show that *F. magna* is present in game-ranched elk in at least four Montana counties, including one west of the known enzootic area (Ranch 3, Table 1). Captive elk in Montana could spread the parasite to free-ranging wildlife and domestic livestock in trematode-free areas, because of a wide distribution of intermediate hosts, sporadic use of anthelmintics of low efficacy, the proximity of game-ranched elk to livestock and wildlife, and the common practice of livestock translocation. Dunkel et al. (1996) found that lymnaeid snails capable of serving as intermediate hosts for *F. magna* are widely distributed in Montana. The most frequently collected species were *Lymnaea modicella* and *L. caperata*, although other vector snails were found. The distribution of elk ranches and snail intermediate hosts for *F. magna* overlap considerably (Fig. 1).

In November 1995, an epizootic of fascioloidiasis occurred on an elk ranch in northwestern Montana (Ranch 1, Table 1). Three adult elk died presumably from infections with numerous *F. magna* (D. Yarborough, pers. comm.); one liver contained over 300 adult flukes. This observation confirmed EPG counts as due to *F. magna*. Because the ranch is within an en-

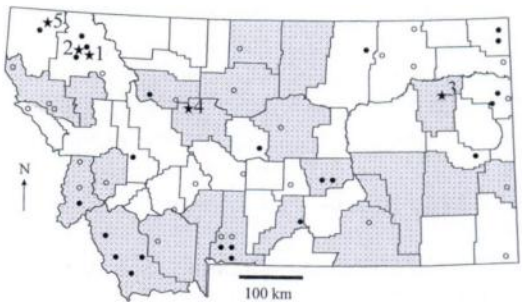

FIGURE 1. Map of Montana (USA), including county borders, showing the occurrence of *Fascioloides magna* in elk (*Cervus elaphus*) on game ranches examined in the study. Open circles show elk ranches that were not examined in this study. Ranches that participated in the study and had no evidence of fluke eggs in fecal samples are indicated by closed circles. Ranches that held *F. magna*-positive elk are labeled with stars, and numbered using the notation in Table 1. Shaded counties were reported by Dunkel et al. (1996) as holding snail intermediate hosts for *F. magna*.

zootic area and high numbers of lymnaeid snails were observed, the elk probably obtained the infection at that location.

Concern has been expressed about game-ranching because of the possibility of spreading disease to free-ranging wildlife or domestic livestock (Samuel et al., 1992; Miller and Thorne, 1993). Recently, tuberculosis was spread from infected game-ranched elk to nearby free-ranging deer (Rhyan et al., 1995; D. Whipple, pers. comm.). The infected deer shared pasture with domestic cattle. Accidental transmission of *F. magna* to cattle and sheep has occurred in areas where pastures are shared with infected cervids. In Minnesota (USA) *F. magna* caused numerous liver condemnations in cattle and heavy losses in sheep in areas where infected deer had access to livestock grazing areas (Griffiths, 1962). Some of the ranches we sampled grazed elk and domestic livestock on common pasture, and almost half had domestic livestock adjacent to elk enclosures. Every ranch was surrounded by habitat containing free-ranging elk or deer that are capable of perpetuating the parasite under proper conditions.

No approved and effective anthelminitic is available for treating elk for fascioloidiasis in the United States. As mentioned by Samuel (1987), control of this parasite in captive elk can only be successful by limiting the movement of infected animals to areas where suitable intermediate hosts exist.

We appreciate the cooperation of the participating elk ranchers, all of whom are members of the Montana Alternative Livestock Producers (MALP). We especially thank R. Spoklie and D. Yarborough for their help. We also thank S. Stoneberg, S. Bousom, M. Sampson and P. Hettinger for technical assistance. This project was supported in part by USDA Animal Health (Formula Funds-MONB00049). This report is a contribution by the Montana State University Agricultural Experiment Station Series J5086, and contributes to the Western Regional Research Project W-102: Integrated methods of parasite control for improved livestock production.

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Received for publication 28 October 1996.