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S. T. Stroandt
Purdue University

D. R. Virchow
University of Nebraska - Lincoln

M. W. Dryden
Kansas State University

Scott E. Hygnstrom
University of Nebraska - Lincoln, shygnstrom1@unl.edu

K. R. Kazacos
Purdue University

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Distribution and Prevalence of *Echinococcus multilocularis* in Wild Predators in Nebraska, Kansas, and Wyoming

S. T. Storandt, D. R. Virchow*, M. W. Dryden†, S. E. Hygnstrom*, and K. R. Kazacos, Department of Veterinary Pathobiology, Purdue University, West Lafayette, Indiana 47907-1243; *School of Natural Resource Sciences, University of Nebraska, Lincoln, Nebraska 68583-0758; †Department of Diagnostic Medicine and Pathobiology, Kansas State University, Manhattan, Kansas 66506. *e-mail: kkazacos@purdue.edu*

ABSTRACT: To further determine the distribution and prevalence of *Echinococcus multilocularis* in the central United States, 245 wild canids (125 red foxes, 120 coyotes) and 33 bobcats were collected from Nebraska, Kansas, and Wyoming and examined for this parasite. Animals examined included 11 red foxes from the western panhandle of Nebraska; 5 red foxes and 30 coyotes from southern Nebraska; 56 red foxes and 1 coyote from northeastern Nebraska; 20 red foxes, 63 coyotes, and 13 bobcats from northern Kansas; 2 red foxes, 26 coyotes,

and 20 bobcats from southern Kansas; and 31 red foxes from east-central Wyoming. Of these, 27 of 72 (37.5%) red foxes from Nebraska were positive, including 2 of 11 (18.2%) from the western panhandle and 25 of 56 (44.6%) from the northeastern part of the state. Mean intensity of infection was 282 worms (range, 1–5,150). New distribution records were established for *E. multilocularis* in western Nebraska as well as for several northeastern counties. These findings support previous estimates that the southernmost front of the parasite's range extends along the southern border of Wyoming, eastward through central Nebraska and central Illinois into Indiana and Ohio.

In North America, *Echinococcus multilocularis* occurs in 2 endemic areas: 1 encompassing the tundra zone of Alaska and Canada and the other the central part of the continent (Rausch, 1985, 1995). In the latter area, the parasite has been reported from 3 Canadian provinces and 11 contiguous states and has been found as far east as Ohio (Storandt and Kazacos, 1993). In the central region, the primary definitive hosts are red foxes (*Vulpes vulpes*) and coyotes (*Canis latrans*). Meadow voles (*Microtus pennsylvanicus*) and deer mice (*Peromyscus maniculatus*) are the main intermediate hosts (Hildreth et al., 1991). Because of the abundance of suitable hosts in areas surrounding the known endemic region, further spread of *E. multilocularis* is anticipated (Rausch, 1995). To further determine the distribution and prevalence of *E. multilocularis* in the central United States, wild canids and bobcats (*Lynx rufus*) from Nebraska, Kansas, and Wyoming were examined for this parasite.

During 1991–1992 (in Kansas) and 1994–1996 (Nebraska and Wyoming), 245 wild canids (125 red foxes, 120 coyotes) and 33 bobcats were collected and examined for *E. multilocularis*. Most were collected from participating fur buyers and trappers during the fall and winter trapping seasons, and some were supplied by USDA-APHIS Wildlife Services personnel. The small intestine was ligated, removed, double-bagged, frozen, and later processed and examined for *E. multilocularis* at Purdue University as previously described (Storandt and Kazacos, 1993). Representative specimens have been deposited in the U.S. National Parasite Collection (USNPC 091271.00).

Animals examined included 11 red foxes from the western panhandle of Nebraska; 5 red foxes and 30 coyotes from southern Nebraska; 56 red foxes and 1 coyote from northeastern Nebraska; 20 red foxes, 63 coyotes, and 13 bobcats from northern Kansas; 2 red foxes, 26 coyotes, and 20 bobcats from southern Kansas; and 31 red foxes from east-central Wyoming. Of these, 27 of 72 (37.5%) red foxes from Nebraska were positive, including 2 of 11 (18.2%) from the western panhandle and 25 of 56 (44.6%) from the northeastern part of the state (Table I; Fig. 1). Mean intensity of infection was 282 worms (range, 1–5,150).

In Nebraska, *E. multilocularis* was collected from red foxes taken in the counties listed in Table I. No positive animals were collected from the following counties in Nebraska, Kansas, or Wyoming (number of animals examined in parentheses; F = red fox, C = coyote, B = bobcat)—Nebraska: Chase (1C), Clay (1C), Colfax (2F), Dawson (4F, 9C), Dodge (1C), Dundy (3C), Fillmore (1C), Franklin (3C), Frontier (1F), Furnas (2C), Hitchcock (2C), Lincoln (1C), Morrill (1F), Nuckolls (2C), Red Willow (2C), Webster (3C); Kansas: Chase (1F, 12C, 7B), Clay (1F, 2C), Coffey (11C, 10B), Ellis (1F), Graham (10C, 1B), Harper (1C), Jackson (5F, 12C, 1B), Jewell (2C), Lincoln (9C, 3B), Meade (1F, 2C, 1B), Mitchell (1F, 3C, 3B), Morris (2B), Norton (10C, 1B), Osborne (1F, 9C), Ottawa (4F), Republic (1F, 4B), Rooks (1C), Rush (4C), Smith (6F, 1C); Wyoming: Converse (2F), Natrona (13F), Niobrara (5F), and unknown of latter 3 counties (11F).

TABLE I. *Echinococcus multilocularis* infection in red foxes in Nebraska (1994–1996).

County	Number examined	Infected	
		Number	%
Burt	5	2	40.0
Box Butte	4	1	25.0
Cuming	7	4	57.1
Dodge	16	10	62.5
Platte	12	3	25.0
Saunders	7	2	28.6
Scotts Bluff	6	1	16.7
Thurston	6	3	50.0
Unknown (northeast)	1	1	100.0

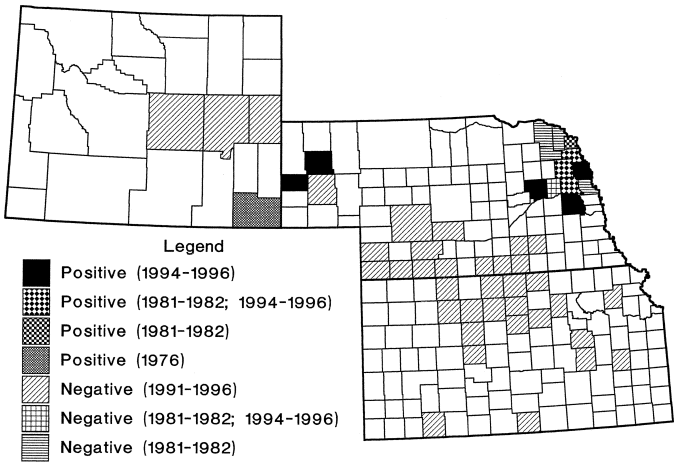

FIGURE 1. Distribution of *Echinococcus multilocularis* in wild canids in Nebraska, Kansas, and Wyoming, including data for Nebraska from Ballard and Vande Vusse (1983), and for a rodent infection in Wyoming from Kritsky et al. (1977).

Since it was first discovered in the north-central United States in the mid-1960s (Leiby and Olsen, 1964), *Echinococcus multilocularis* has steadily expanded its range to include all or part of 11 contiguous states. The parasite was found in wild canids or rodents in South Dakota, Iowa, Minnesota, and Montana in 1965–1969 (Carney and Leiby, 1968; Leiby et al., 1970; Rausch and Richards, 1971); in a wild woodrat in southeastern Wyoming in 1976 (Kritsky et al., 1977); and in wild canids in northeastern Nebraska and northern Illinois in 1981–1982 (Ballard and Vande Vusse, 1983), in Wisconsin in 1982–1983 (Ballard, 1984), and in northern Indiana, northwestern Ohio, and east-central Illinois in 1990–1991 (Storandt and Kazacos, 1993). Annual surveys conducted in eastern South Dakota in 1987–1991 found a high prevalence of infection in red foxes in that area (64.0–88.9%, mean 74.5%; Hildreth et al., 2000). In the early 1990s, it was estimated that the southernmost front of the parasite's range extended along the southern border of Wyoming, eastward through central Nebraska and central Illinois into Indiana and Ohio (Hildreth et al., 1991; Storandt and Kazacos, 1993). Results of the present study further support this assertion because *E. multilocularis* was not found south of a line through central Nebraska (Fig. 1). The parasite was not detected in 35 wild canids from southern Nebraska or 111 wild canids and 33 bobcats from Kansas (Fig. 1).

Echinococcus multilocularis has a much lower prevalence in wild canids in western Nebraska and Wyoming compared to northeastern Nebraska, in that only 2 of 42 (4.8%) red foxes from the west were infected versus 25 of 56 (44.6%) red foxes from the northeast. Presumably, this same pattern would hold true for coyotes but could not be assessed because only a single coyote was examined from the northeastern counties and none from the west. In other studies, coyotes have been found to be as susceptible to infection with *E. multilocularis* as red foxes and, in several cases, to have a higher prevalence and intensity of infection. For example, in Indiana, 22.5% of 71 red foxes and 18.6% of 70 coyotes were infected, and in Illinois, 35.3% of 17 coyotes carried the parasite. Mean intensity of infection for red foxes was 372 worms (range, 2–3,640) versus 6,579 worms (range, 1–52,000) for coyotes (Storandt and Kazacos, 1993).

Coyotes typically have a more diverse diet than red foxes, eating rabbits, hares, and other larger mammals, in addition to rodents. However, even though they consume fewer rodents than do red foxes (Voigt and Berg, 1987), they eat enough rodents to contact the larval cestode and become infected with *E. multilocularis*. It is well known that a very low prevalence of larval infection in rodents in an area is sufficient to maintain moderate to high levels of infection in wild canids (Rausch,

1995). It is likely that infected coyotes are more important in the spread of this parasite because they typically have larger home ranges and can travel much longer distances than red foxes (Voigt and Berg, 1987). Suitable intermediate hosts for *E. multilocularis* occur in all of the areas examined in the present study. Therefore, the absence of *E. multilocularis* in wild canids in southern Nebraska, Kansas, and east-central Wyoming either reflects the absence of the parasite in these areas (southern Nebraska, Kansas) or a sufficiently low prevalence (<1–2% in canids) so that it was not detected based on the number of hosts examined. Continued vigilance is necessary to monitor the distribution, prevalence, and spread of this important parasite in different areas of central North America.

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LITERATURE CITED

BALLARD, N. B. 1984. *Echinococcus multilocularis* in Wisconsin. Journal of Parasitology **70:** 844.

———, AND F. J. VANDE VUSSE. 1983. *Echinococcus multilocularis* in Illinois and Nebraska. Journal of Parasitology **69:** 790–791.

CARNEY, W. P., AND P. D. LEIBY. 1968. *Echinococcus multilocularis* in *Peromyscus maniculatus* and *Vulpes vulpes* in Minnesota. Journal of Parasitology **54:** 714.

HILDRETH, M. B., M. D. JOHNSON, AND K. R. KAZACOS. 1991. *Echinococcus multilocularis*: A zoonosis of increasing concern in the United States. Compendium on Continuing Education for the Practicing Veterinarian **13:** 727–741.

———, S. SRIRAM, B. GOTTSTEIN, M. WILSON, AND P. M. SCHANTZ. 2000. Failure to identify alveolar echinococcosis in trappers from South Dakota in spite of high prevalence of *Echinococcus multilocularis* in wild canids. Journal of Parasitology **86:** 75–77.

KRITSKY, D. C., P. D. LEIBY, AND G. E. MILLER. 1977. The natural occurrence of *Echinococcus multilocularis* in the bushy-tailed woodrat, *Neotoma cinerea rupicola*, in Wyoming. American Journal of Tropical Medicine and Hygiene **26:** 1046–1047.

LEIBY, P. D., W. P. CARNEY, AND C. E. WOODS. 1970. Studies on sylvatic echinococcosis. III. Host occurrence and geographic distribution of *Echinococcus multilocularis* in the north central United States. Journal of Parasitology **56:** 1141–1150.

———, AND O. W. OLSEN. 1964. The cestode *Echinococcus multilocularis* in foxes in North Dakota. Science **145:** 1066.

RAUSCH, R. L. 1985. Parasitology: Retrospect and prospect. Journal of Parasitology **71:** 139–151.

———. 1995. Life cycle patterns and geographic distribution of *Echinococcus* species. *In Echinococcus* and hydatid disease, R. C. A. Thompson and A. J. Lymbery (eds.). CAB International, Wallingford, U. K., p. 89–134.

———, AND S. H. RICHARDS. 1971. Observations on parasite–host relationships of *Echinococcus multilocularis* Leuckart, 1863, in North Dakota. Canadian Journal of Zoology **49:** 1317–1330.

STORANDT, S. T., AND K. R. KAZACOS. 1993. *Echinococcus multilocularis* identified in Indiana, Ohio, and east-central Illinois. Journal of Parasitology **79:** 301–305.

VOIGT, D. R., AND W. E. BERG. 1987. Coyote. *In* Wild furbearer management and conservation in North America, M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch (eds.). Ontario Ministry of Natural Resources, Toronto, Canada, p. 344–357.