

# Can *Mycobacterium avium* subspecies *Paratuberculosis* be Transmitted from Cattle to Deer and Rabbits, and Vice Versa?

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## Introduction

*Mycobacterium avium* subspecies *paratuberculosis* (MAP), the causal agent of Johne's disease (JD), infects both wild and domestic ruminants, especially dairy cows. In cattle, the usual route of infection is fecal-oral, with young cattle becoming infected by exposure to manure from infected adult cattle or their environment. The disease manifests in adult cows and results in economic losses. Clinical paratuberculosis has been diagnosed in a number of free-ranging wild ruminant species, especially in North America and Europe, such as Rocky Mountain bighorn sheep, red deer in the western Alps, key deer, and tule elk. In both cattle and wild ruminants, the gastrointestinal tract is the primary site of infection, predominantly the small intestine. In the United States, infected cattle herds have been considered to be an infection source for wild ruminants. In Scotland, MAP was found in rabbits (*Oryctolagus cuniculus*) that shared the same pasture infected by cattle, and a significant association was found between the presence of MAP in rabbits and cattle farms with JD. Despite the obvious link between JD in wild ruminants or rabbits and domestic ruminants, especially dairy cows, no study has evaluated the possible risk factors associated with cross infection between wildlife and domestic ruminants. The objectives of this study were to assess risk of transmission of MAP among dairy cattle, deer and rabbits, and to estimate prevalence of MAP among deer and rabbits surrounding infected and uninfected Minnesota dairy farms using fecal culture.

## Materials and Methods

### Dairy farm sampling

One hundred and eight dairy herds were selected from the database available for two JD programs in Minnesota. Included were 80 herds known to be infected from previous testing in the Johne's Disease Control Program (JDGP) of the Minnesota Board of Animal Health (MBAH), and 28 herds known to be noninfected

based on previous testing in the Voluntary Johne's Disease Herd Status Program (VJDHSP) of the MBAH. Samples of cattle feces and farm environment were collected during summer 2002.

### Farm questionnaire

A 24-item questionnaire was conducted with 114 herd owners (108 farms sampled for cattle and environment plus six farms that declined posterior cow and environment sampling), during the winter of 2002 (n=60) and the summer of 2002 (n=54). The objective of the questionnaire was to assess prevalence of the following risk factors for possible MAP transmission among cattle and rabbits or deer: 1) use of pasture or dry lot, 2) manure disposal on pasture or crop fields, 3) frequency and location of observing wildlife, as well as estimation of potential physical contact with feces between cattle and rabbits/deer and vice versa (Questionnaire available upon request).

### Wildlife sampling around dairy farms

The areas surrounding 114 farms were sampled from February to March 2002 (n=60) and November 2002 to March 2003 (n=54) for fecal pellets of free ranging white-tailed deer (*Odocoileus virginianus*) and Eastern cottontail rabbit (*Sylvilagus floridanus*).

From the area surrounding each farm (a radius of up to 1 mile), up to ten deer fecal-pellet piles, and approximately 100 g of rabbit fecal pellets were collected. Rabbit pellets were occasionally split into two samples if the amount of pellets was greater than 80 g to increase the probability of MAP detection on culture. Rabbit pellets were collected mainly around the farmyard (i.e. near housing, farm buildings, or cattle area) and the adjacent wooded area. Occasionally, rabbit feces were also collected on the edge of the farm corn or hay field, or near an adjacent wooded area. Deer feces were collected in the farm corn and hay fields, farm wooded area or wooded area adjacent to the crop fields, and occasionally in the farm backyard if available.

## Results

Sixty-two percent of the herds had at least one positive fecal pool or environment sample. A total of 218 rabbit samples were collected from 90% of the 114 herds and 309 deer samples were collected from 47% of the herds. On each of two farms, one deer fecal sample was positive to MAP. Both farms had positive fecal pools and environment. One rabbit fecal sample was culture-positive to MAP on each of two farms. Only one of these farms had positive fecal pools and environment. Of 114 farms, 79% used pasture as a grazing area for cattle, mainly for dry cows (75%), and bred or pre-bred heifers (87%).

Of 114, 77% of farms provided access to dry lot for their cattle, mainly for milking cows (88%) and bred heifers (87%). Seventy nine percent of the study farms used some solid manure broadcasting on their crop fields. Deer were seen around the farms mainly weekly

throughout the year (26%) and seasonally (24%) during the months of October-December. Eighteen and 20% of the 114 farms estimated as daily the probability of physical contact between cows and heifers and deer, respectively, and 22 and 28% between cows and heifers and rabbits, respectively. Possible contact between cattle and deer was estimated to occur mainly during the months of April-December, and March to December between cattle and rabbits.

## Significance

Use of pasture or dry lot and the practice of manure spreading on crop fields were suggested as possible risk factors for cross MAP infection between dairy cattle and deer and rabbits. Although the MAP prevalence among rabbits and deer is low, their role as MAP reservoir should be considered and further explored.