Identifying pre-clinical MAP infected cattle

Project Code: ANH.01.13
Completed: *March 2016*

Project Title:

Identifying Mycobacterium avium subsp. paratuberculosis (MAP) exproteome components recognized during early infection to develop diagnostic and vaccine targets

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Published:

- Novel Secreted Antigens of Mycobacterium paratuberculosis as Serodiagnostic Biomarkers for Johne's Disease in Cattle.

Background

Mycobacterium avium subspecies *paratuberculosis* (MAP) causes Johne's disease (JD), a chronic infectious disease of ruminants. Infection normally occurs in the neonatal period when calves ingest an infectious dose of MAP but clinical, irreversible and ultimately fatal disease does not occur until years later. In the meantime, animals with preclinical JD may look healthy while still shedding MAP in their feces, transmitting the disease to new animals.

There are no effective vaccines or treatments, and diagnostic tests fail to identify many infected animals in the pre-clinical state. A reliable, sensitive, specific diagnostic test that accurately identifies MAP carriers in the early stages of infection would greatly help efforts to control the disease.

Objectives

The main objective of this study is to identify proteins secreted by MAP that can elicit a MAP-specific immune response.

What They Did

Three different MAP strains were isolated and cultured from fecal samples collected from dairy herds throughout Ontario. Proteins secreted by MAP bacteria (the proteins that the animal's immune system is most likely to respond to) were isolated and purified. These proteins were then tested using serum collected from 25 cows known to be infected and shedding high levels of MAP, low levels of MAP or no MAP at all, as well as 10 cows and calves from a Johne's-free herd.

What They Learned

A total of 163 antigenic proteins were identified from the three MAP strains, 76 of which had never been discovered before. A number of these proteins specifically reacted with serum samples collected from MAP-infected cows, suggesting that the cow's immune systems were recognizing them as foreign antigens. The new antigens discovered in this study reacted most strongly with cows that were shedding high levels of MAP and tested positive using commercial diagnostic tests. However, they also identified animals that tested negative using commercial diagnostic tests because they were shedding so little MAP (so fewer false negatives). Equally importantly, these new antigens did not identify any false positives among the cows or calves from a Johne's-free herd. These new antigens were not found in other species of Mycobacteria that are commonly found in the environment. This is a good thing, because commercial diagnostic tests need to add extra steps to prevent environmental Mycobacteria from producing false-positive results.

What it Means

If additional validation on larger numbers of high shedding, low-shedding and MAP-free cattle give the same results, we may be close to a test that can accurately identify cattle much, much sooner. This will greatly aid efforts to deal with Johne's disease.

These researchers are collaborating with the University of Saskatchewan's Vaccine and Infectious Diseases Institute to further refine these tests, and to study whether they can detect MAP antibodies in more easily-collected fecal samples. Down the line, additional work looking at the detailed immune response in the intestine of newly infected calves done as part of the Beef Cluster study may also contribute to an effective vaccine to protect against Johne's disease.

In the meantime, you can help protect your herd from Johne's (and many other calfhood diseases) by calving on a well-drained pasture (if possible) to keep the herd spread out, ensure shelter and bedding are adequate so that calves aren't nursing filthy udders, not "borrowing" colostrum from a dairy or neighbor, and not buying bargain breeding stock with unknown disease status at the auction market.

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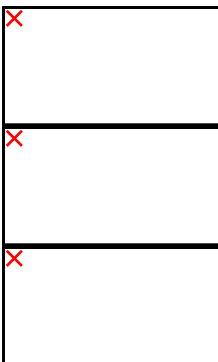
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