



SCC DIAGNOSTICS TOOL BOX



R-MC-4: Prototheca – Unseen Danger

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Introduction

An invisible intruder has been threatening the udder health of herds on some Ontario dairy farms. High bulk tank bacteria counts may tip you off that this intruder - Prototheca - is lurking around your cows. Prototheca, a colorless algae, can be hard to detect. But on farms where it does turn up, it turns up everywhere.

What Do We Know?

Unlike green algae, Prototheca lacks the pigment chlorophyll. The colorless organisms are commonly found in manure, sewage, soil and water. They grow rapidly when humidity is high and organic material is plentiful. The organism is common throughout the environments of some farms, particularly where there's damp manure.

Prototheca was first linked to mastitis in dairy cows in 1952. In Ontario, Prototheca has been routinely isolated from milk samples from 30 to 40 herds annually. Herd outbreaks infecting more than three per cent of cows are rare.

Like many mastitis cases caused by organisms in the cow's environment, Prototheca infections are opportunistic. High numbers of organisms outside the teat end can eventually overwhelm udder defenses. Sometimes a particular cow's immune defenses are already compromised, making her more susceptible. In one study of a herd experiencing an outbreak of Protothecal mastitis, cows with a clinical mastitis history in the same lactation were almost twice as likely to be diagnosed with Prototheca. Previous antibiotic treatments increased the risk by three. In this herd, Prototheca mastitis diagnoses peaked by the second month of lactation, supporting the idea that early lactation cows are more susceptible.

Prototheca-infected cows can have clinical or subclinical mastitis. Clinical mastitis is usually limited to mild changes in milk. Few infected cows become sick. Compared to reactions caused by bacterial udder infections, the immediate reaction to Prototheca is only mildly inflammatory.

A key feature of Prototheca infection is the progressive drop in milk production in the affected quarter as this invasive organism damages udder tissue. Often producers don't recognize infection has occurred until the quarter's nearly dry. Occasionally organisms further invade the cow's body, infecting not only the udder but local lymph nodes as well.

Somatic Cell Counts

Quarters infected with Prototheca react on the California Mastitis test (CMT) paddle, indicating high somatic cell counts (SCC). However, elevation in composite cow SCCs is occasionally not as pronounced as with bacterial mastitis. This is because of reduced milk production in chronically infected quarters and dilution of somatic cell concentrations by healthy, uninfected quarters.

Most *Prototheca* infected cows have had SCCs greater than 300,000 cells per milliliter. However, a few have not. Ontario Dairy Herd Improvement's cow SCC reports cannot be used to identify all *Prototheca*-suspect cows, though they may give guidance.

Antibiotics are unsuccessful in treating *Prototheca* since it isn't a bacterial organism. The infection it causes is slowly progressive and often subclinical, making it difficult to recognize early. The organism's invasive nature reduces contact with intra-mammary or systemically administered antibiotics. Spontaneous cures of *Protothecal* mastitis have not been reported.

Bacteria Counts

Bacteria can enter a herd's bulk tank milk from many sources, including contaminated milking equipment, teat skin surfaces and milk from infected cows.

Generally speaking, cows with mastitis infections don't account for much of the bulk tank bacteria count. This is because bacterial shedding from mastitis is of relatively short duration and relatively few quarters are actively shedding organisms at any one time. The greatest proportion of bacteria found in high bulk tank milk counts are from poor milking equipment cleaning or because non-mastitic bacteria have multiplied before milk is picked up. This occurs when cooling is too slow after warm milk is added or stored milk isn't kept at the correct temperature all the time.

Prototheca is occasionally an exception. In contrast to most udder infections, quarters infected with *Prototheca* continually shed large numbers of organisms in milk. A study conducted at the Ontario Veterinary College last summer found that three chronically infected quarters in two cows shed organisms at every milking during the 16 days they were studied.

Amounts varied somewhat by quarter. One quarter shed extremely high amounts, while the other two shed fewer. Milk samples from *Prototheca* cows from Ontario herds almost always indicate large numbers of organisms.

Milk from *Prototheca* cows has been shown elsewhere to increase raw bacteria counts in bulk milk. This occurs when organisms are counted using the method similar to Ontario's previous method, the standard plate count.

Two events made the Ontario dairy industry more aware of bulk tank bacteria counts.

First, the regulatory limit for raw milk bacteria was lowered to 50,000 plate loop count (PLC) from 100,000 colony forming units (CFU) per milliliter on Jan. 1, 2000. Lowering the level has increased the number of herds scrutinized for high counts. When more herds with high counts are examined, it's likely the industry will find relatively rare causes of high counts more frequently.

Secondly, there's been concern that changing test technology from PLC to the BactoScan may detect more organisms such as *Prototheca*. However, evidence suggests that not only can *Prototheca* cause high counts in raw milk, it can cause these high counts no matter what technology evaluates the milk.

In Ontario, cows infected with *Prototheca* have been found in some herds with high bulk tank milk bacteria counts. Troubleshooters exhaustively investigated and eliminated all other problems that could increase bacteria numbers-equipment cleanliness, cooling, water quality, and teat preparation. In a small number of herds, *Prototheca* cows proved to be the source of the problem.

Between July 1999 and December 2000, 65 herds had a *Prototheca* diagnosis made on a culture of either a cow or bulk tank milk sample at the Animal Health Laboratory in Guelph. Of these 65 herds:

- 31% never had a bacteria test result greater than 109,000;
- 22% had one monthly test result greater than 109,000;
- 48% had two to nine counts greater than 109,000;

- 65% of the 31 farms that had two to nine counts greater than 109,000 paid one or more bacteria penalties.

A penalty is applied when the official monthly count exceeds 109,000 in two out of three consecutive official tests. While having *Prototheca* mastitis infections in the herd can cause high counts, a *Prototheca* diagnosis is not always associated with high counts. The impact of *Protothecal* mastitis on a herd's monthly bacteria counts depends on the number of infected cows or quarters at one time. Some cow factors might also be important. Infection stage and the infected quarter's production level can also determine how much an infected cow's milk affects the bulk tank bacteria count.

Cause of Most Bacteria Counts

In Ontario, inadequate milk equipment cleaning, poor cooling and poor teat cleaning cause most high bacteria counts in raw milk. Evaluating these traditional sources is still the most efficient approach to reducing high counts.

However, for persistent high counts, after you have eliminated other sources, culturing lactating cows when high counts occur is warranted for potentially identifying *Prototheca* infected cows. You can determine the impact of suspect cows if you exclude their milk from the bulk tank and retest bulk tank milk.

Prototheca Prevention

There's no easy way to prevent *Prototheca* infections. In studies of herds where *Protothecal* mastitis has occurred, the organism has at some time been cultured from virtually every area of the dairy farm, including pasture soil, milk parlor wash water, cow drinking troughs, forage, calf manure and cow manure. However, examining the farm environment the same way on farms without *Prototheca* mastitis has either not found the organism at all, found it in very low numbers or at only a few sites. So, while not all farms have this algae in their environments, on farms where it is present, *Prototheca* is widely spread.

Prototheca has been shown to survive and pass through the intestines of single-stomached animals without multiplying. It's likely this can occur in calves and cows too. After ingesting the organism, the cow passes manure and contaminates her own bedding, as well as that of her herd mates, alleyways and stalls.

What all infected areas on *Prototheca* farms have in common is that they've all become contaminated with cow manure presumably containing this organism.

In warm weather, or in humid farm sites, *Protothecal* organisms survive and multiply outside the cow. When numbers are high, there's greater probability of teat-end contact and, if conditions are right, mastitis begins.

Prevention Approach

Take the same approach to preventing *Prototheca* as you would for any manure-borne, environmental mastitis causing organism. Teat ends need to be clean and dry at all times, including the dry period.

Bedding needs to be clean and dry. Manure can contaminate bedding directly or by cows with dirty feet from poorly cleaned alleyways. In tie-stall barns, cows repeatedly forced to stand in gutters continually contaminate bedding and the lying area under the udder with manure. Special attention should be paid to cows' environment around calving.

Milking preparation must be first rate. Teats must always be clean and dry before the milking unit is applied. All herds, but especially those at risk of *Protothecal* mastitis, must adhere to the gold standard of milking prep to ensure all contaminating environmental bacteria and *Prototheca* are removed from the teat skin before milking. This prep involves either washing and drying with individual paper or cloth towels, or predipping with a licensed iodine product and drying the teats with an individual paper or cloth towel.

Remember, Prototheca thrives in times and areas where humidity is highest. Lowering humidity will reduce Prototheca's ability to survive and multiply. As we head into our time of greatest seasonal risk of environmental mastitis, July to September, think now about how to adapt housing and calving areas to increase air movement and remove moisture. This will be another key measure in reducing the risk of environmental and, specifically, Protothecal mastitis in the long term.

What To Do If You've Got It

1. Prevent new Prototheca infections through milking order. Infected cows shedding large numbers of organisms in their milk may be contagious to herd mates via teat liners. Milk the known infected cows last.
2. Prevent new Prototheca infections through teat preparation. Cows may become newly infected when organisms on teat skin get a chance to enter the teat end during milking. Improve milk prep to ensure teat skin is always clean and dry before milking. Use either a wash/ dry prep with individual paper or cloth towels, or predip with an approved iodine product and dry with a separate paper or cloth towel.
3. Stop milking infected quarters to prevent this milk from entering the bulk tank and causing high bacteria counts. Just stop milking the affected quarters-no quarter treatments should be given.
4. Examine the infected cow's records of clinical mastitis and cow SCCs to determine if the start of infection can be identified. Unless shown otherwise, suspect that new cases are beginning in the periparturient or early lactating period.
5. If you're keeping infected cows in the herd, closely monitor the remaining quarters milked into the bulk tank using a CMT paddle. If new quarters show reaction, culture them individually to identify cases that have spread.
6. Do not feed milk from Prototheca infected quarters to calves. Calves pass the organisms into the environment via manure and increase the general contamination level on the farm.

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