



# Research Roundup

MVP Laboratories strives to stay current in the latest developments in veterinary microbiology. In this quarterly publication, we will bring you topics of interest that may have application in your practice situation. Some of the research discussed here is generated in our own laboratories and some is summarized from recent journals. We will occasionally address “frequently-asked-questions” that we get from our customers by phone or e-mail. We welcome ideas from you for future issues. Our contact information can be found on the back of this newsletter.

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## Spotlight on *Mycoplasma bovis*

A challenge facing many beef and dairy operations today is *Mycoplasma bovis*. First isolated in the U.S. in 1962, *M. bovis* seems to be increasing in prevalence and severity of disease. Herds infected with this pathogen can be plagued with a variety of problems, including pneumonia, polyarthritis, and mastitis. The infections are often chronic and tend to be very resistant to treatment with antibiotics. Once introduced, *Mycoplasma bovis* is difficult to eradicate from herds. What makes these bacteria unique from other microorganisms and so challenging for veterinarians and herd operators to control?

Mycoplasmas are prokaryotes that lack a cell wall. They are the smallest self-replicating microorganisms known to man. There are over one hundred species of Mycoplasmas that infect a wide variety of animals and birds. Most are host-specific and have an affinity for mucosal surfaces, such as the conjunctiva, respiratory tract, intestines, and genital tract. Mycoplasmas are short-lived in the environment and easily inactivated by disinfectants and dessication. Conversely, these organisms are not very susceptible to the effects of many antibiotics. This is in large part due to the fact that they lack a cell wall, which is the target for the mechanism of action of many classes of antibiotics.

It is ironic that although Mycoplasmas possess the smallest of genomes, they are among the bacterial pathogens with the highest capacity for antigenic variation. Antigenic variation, also known as “phenotypic switching,” enhances a microorganism’s ability to evade the host immune response by changing the surface structures typically recognized by immune effector cells and antibodies. Microbes accomplish this either by sensing the host environment and responding using signal transduction pathways (1) or by generating spontaneous, random mutations that result in a heterogenous population, with some variants better able than others to survive the host immune system. The frequency of mutations in organisms with this ability is very high, at  $10^{-4}$  to  $10^{-2}$  per cell per generation compared to  $10^{-6}$  to  $10^{-8}$  for normally occurring mutations (2). In the case of *Mycoplasma bovis*, the strategy of mutation is used very effectively. *M. bovis* has a family of highly antigenic surface proteins, called variable surface proteins (Vsp’s), that undergo dramatic structural changes (3). The genes encoding the Vsp’s undergo spontaneous chromosomal rearrangements, resulting in different-sized versions of the same proteins. These genes can also switch between “ON” and “OFF”, so that expression of the surface proteins is intermittent. Thus, using relatively limited genetic material, *M. bovis* can change its outer appearance and become a “moving target” for the bovine immune system.

### *M. bovis* Quick Facts

- Pneumonia, polyarthritis, mastitis, otitis infections
- Chronic infections
- Resistant to many antibiotics
- High degree of antigenic variability
- Smallest of self-replicating organisms
- Difficult to eradicate from herds

1. Robertson BD and Meyer TF. 1992. Genetic variation in pathogenic bacteria. Trends Genet. 8:422-427.
2. Razin S, Yogev D, and Naot Y. 1998. Molecular biology and pathogenicity of Mycoplasmas. Microbiol. Mol. Biol. Rev 62(4):1094-1156.
3. Lysnyansky I, Sachse K, Rosenbusch R, Levisohn S, Yogev D. 1999. The vsp locus of *Mycoplasma bovis*: gene organization and structural features. J. Bacteriol. 181(18): 5734-5741.

### **Antibiotic susceptibilities of recent isolates of *Mycoplasma bovis* in Belgium**

**Thomas A, Nicolas C, Dizier I, Mainil J, Linden A. 2003. Vet Record 153(14):428-31.**

**Abstract:**

The susceptibilities of 40 recent Belgian field isolates of *Mycoplasma bovis* to 10 antimicrobial agents were assessed. Tiamulin was the most active antimicrobial agent against *M. bovis*, with an initial inhibitory concentration (IIC50) of 0.06 microg/ml, but it is not licensed for the treatment of cattle. All three fluoroquinolones tested (danofloxacin, enrofloxacin and marbofloxacin) were effective against strains of *M. bovis*, and had a minimum mycoplasmacidal concentration (MMC50) less than or equal to 1 microg/ml. Gentamicin was poorly effective, having an IIC50 of 8 microg/ml. Many strains of *M. bovis* were resistant to tylosin, spectinomycin, lincomycin, tetracycline and oxytetracycline.

### **Comparison of Sampling Procedures for Isolating Pulmonary Mycoplasmas in Cattle**

**Thomas A, Dizier I, Trolin A, Mainil J, Linden A. 2002. Veterinary Research**

**Communications 26(5):333-339.**

**Abstract:**

Three sampling procedures were compared to determine the optimal technique for isolating mycoplasmas in cattle with respiratory diseases. The prevalence of mycoplasmas isolated from these animals is also reported. In the first group, bronchoalveolar lavage (BAL) and nasal swab cultures were compared with the corresponding lung cultures from cattle necropsied for fatal respiratory diseases (n=20). In a second group, nasal swabs were compared with corresponding BAL cultures in living animals with recurrent respiratory pathologies (n=49). There was complete agreement between the paired BAL and lung cultures. In contrast, nasal cultures were not representative of the mycoplasmas present in the lower respiratory airways. The relative sensitivity and specificity of the nasal swab technique compared to BAL in living animals confirmed that nasal swab cultures were not predictive of lower respiratory airway pathogens, such as *Mycoplasma bovis*. BAL is considered to be the best method for isolating *M. bovis* in cattle with respiratory diseases as it combines reliability and feasibility under field sampling conditions. In the present study, *Mycoplasma dispar* (43%) and *M. bovis* (29%) were mainly isolated in mixed infections. This confirms the need to search for mycoplasmas in routine examinations and to take them into account in therapeutic strategies for respiratory diseases in cattle.



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