Animal & Plant Health Agency

SRUC

# *Mycoplasma bovis*: current knowledge, industry challenges and knowledge gaps for the UK cattle industry

## UK Cattle Expert Group 2018

### October 2018

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# *Mycoplasma bovis*, the organism

*Mycoplasma bovis* is one of 13 *Mycoplasma* species known to infect cattle. Many of these *Mycoplasma* species do not cause disease but *M. bovis* is recognised as a significant pathogen for UK cattle. *Mycoplasma* species lack a cell wall, so certain widely-used antibiotics such as penicillins are not effective. Other defence mechanisms the organisms possess include:

- An ability to change the surface proteins to evade the cow's immune response.
- An ability to produce a sugar matrix (biofilm) so that it can temporarily hide from both the immune system and antibiotic treatment.

# Clinical presentation

*M. bovis* causes several clinical disease presentations in UK cattle:

## Pneumonia

This is the commonest clinical disease presentation associated with *M. bovis* infection and the organism can cause disease as a sole pathogen, or more commonly in combination with other pathogenic respiratory bacteria, viruses or parasites. Disease can occur in all ages of cattle in both beef and dairy systems but especially in younger animals. A pathology finding of caseonecrotic pneumonia is recognised with greater regularity in dairy calves. . Response to treatment is poor in some cases, with relapses commonly reported.

## Mastitis

*M. bovis* mastitis is not so common in the UK dairy herd and the organism can be detected as an incidental finding in milk. However, outbreaks of mastitis in individual herds can be severe and sometimes occur in association with arthritis. *M. bovis* is considered a contagious mastitis pathogen spreading during the milking process and response to treatment is very poor.

## Arthritis/synovitis

This can occur in all ages of cattle, presenting as single sporadic cases, or as outbreaks. Lower limb joints are usually affected and in severe and in established cases recovery is unlikely. It is suspected that lower grade cases of *M. bovis*-associated arthritis occur in herds but may be unrecognised and under-diagnosed.

## Otitis media

This clinical presentation is seen most commonly in young stock, particularly young dairy calves which present with an ear droop or head tilt. Veterinary practitioners report this presentation to have been increasing over the past 10 years.

## Other disease presentations

These occur less commonly and include keratoconjunctivitis, meningitis, infertility and abortion.

*M. bovis* does not cause disease in humans and is not a notifiable disease.

# Surveillance information

No national prevalence estimates for *M. bovis* are available in the UK. UK Veterinary Investigation Diagnosis Analysis (VIDA) data (figure 1) show an increased diagnostic rate in recent years with the data expressed as a percentage of diagnosable submissions.

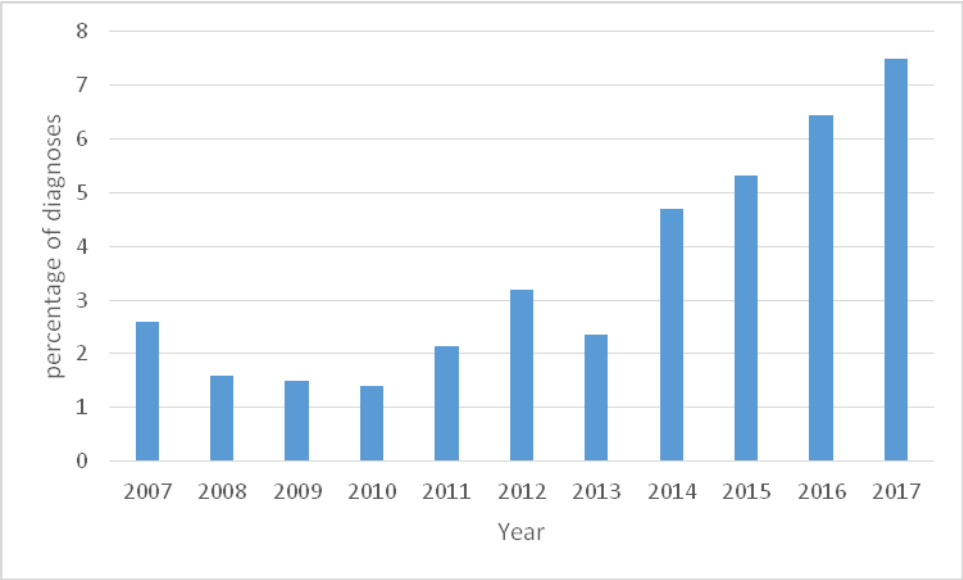


Figure 1: UK Diagnosis of *Mycoplasma bovis* infection as a percentage of diagnosable submissions by year

This increasing trend may represent a genuine increase in *M. bovis* associated disease or an increased awareness of the disease by veterinary diagnosticians, practising vets and farmers, complemented by the availability of improved diagnostic tests.

# Diagnostic tests

Diagnostic tests have improved and become more readily available in recent years with simpler culture techniques, polymerase chain reaction (PCR)-based molecular methods, including real-time PCR and PCR combined with denaturing gradient gel electrophoresis (PCR-DGGE) available for detection of the organism. Antibody ELISA tests for serological diagnosis are widely available and can be targeted on sentinel calf groups and bulk milk to provide evidence of herd status.

# Treatment

Treatment options for *M. bovis* are limited because of the nature of the organism as described above and its relationship with the host. There are also concerns about the development of antibiotic resistance. In addition, some of the preferred treatment options (macrolides and fluoroquinolones) have their use restricted by UK Farm Assurance standards as Critically Important Antibiotics. In addition, prophylactic and metaphylactic treatments are used quite commonly to control pneumonia, increasing herd antibiotic use at a time where industry efforts are being made to reduce this.

Although no commercial vaccines are licensed in Europe for *M. bovis*, there are commercial companies licensed to produce autogenous vaccines.

# Risk Factors

Putative risk factors for *M. bovis* infection and disease transmission in the UK are recognised and although these are poorly evidence-based, managing them can help with control. An open-herd policy, large and expanding herd size, unpasteurised cows' milk / waste milk feeding to calves, poor milk feeding practices, automatic calf feeding systems, aerosol transmission, quality of housing/ventilation, and spread via the milking parlour are all considered to be risk factors for disease transmission.

# Knowledge gaps for the UK cattle industry

Outlined below is an opinion on the principle knowledge gaps with regard to *M*. associated disease in the UK cattle herd. As described above it is considered a significant industry problem with limited treatment options, no commercial vaccine and no recognised eradication programme. Further research in these areas in the UK would improve our understanding to allow more focussed control options.

1. The organism and its relationship with the host: The role and variability of surface antigens in causing disease and promoting immunity are not well understood. Intracellular survival within the host, survival within biofilms, the role of the host's immune system in lesion development and the relative contributions of other

respiratory pathogens in the 'pneumonia complex' are also crucial to the understanding of the disease process. An understanding of the potential for asymptomatic carriage, organism shedding from carrier animals and survival of the organism in the environment and on fomites is also required.

2. Strain types in the UK and association with disease: Currently, complete genome sequences are publically available for 25 *M. bovis* isolates. Molecular characterisation tools are now available which can examine strain variability within and between herds and consider associations between strain types and clinical disease presentations and severity. Strain typing could also be used to better understand variations in antimicrobial sensitivity.

3. National herd prevalence data: We have a poor understanding of the national herd prevalence of *M. bovis*, identification of negative herds and cohorts of animals with confidence and the range of disease presentations seen in association with presence of the organism in a herd. Such knowledge would be crucial to improve biosecurity screening and disease eradication programmes.

4. Risk factors and management practices associated with the presence and absence of disease: Risk factor analysis for positive and negative herds is urgently required for the UK cattle herd so that current advice can be enhanced and evidence-based.

5. Antibiotic susceptibility data availability: Currently, treatment decisions are frequently made without access to specific sensitivity data at a farm / case level. Standardisation and simplification of laboratory techniques where possible to assess antibiotic resistance and define sensitivity data for UK isolates is essential.

6. The development of a vaccine: Autogenous vaccines are currently being used to aid in the control of *M. bovis* infections with variable clinical effects noted and no evidence base for their use. The availability of a safe and effective commercial vaccine across the range of disease manifestations would be an essential, practical tool for disease control.

The Cattle Expert Group believe that the above knowledge gaps are a priority for further research and development funding in the UK, to better understand an increasingly important disease for the national herd.

It is hoped that this information note can be considered by policy makers, research providers and funding bodies to consider next steps for future research.

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Any enquiries regarding this publication should be sent to us at SIU@apha.gov.uk

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The Animal and Plant Health Agency (APHA) is an executive agency of the Department for Environment, Food & Rural Affairs, and also works on behalf of the Scottish Government and Welsh Government.