Motile gut organisms affecting gamebirds (part 1)

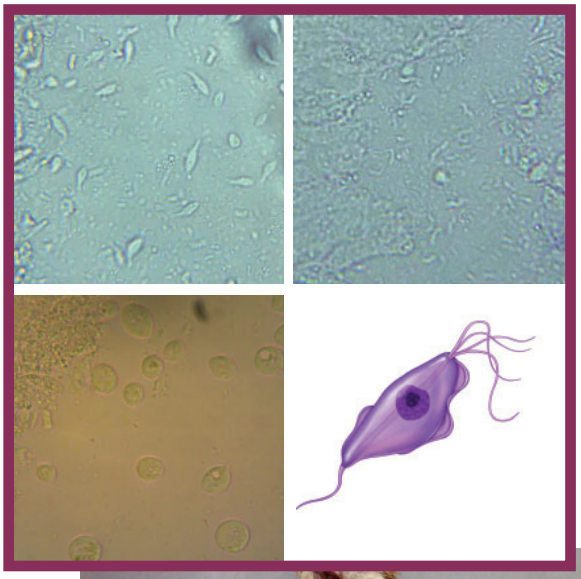
In his second disease in focus article, Dr Mark Elliott BVSc VetFFHom MRCVS PCH DSH RSHom begins the story of key gut bacteria and protozoans.

The motile bacteria and protozoans often found on post-mortem examination are probably the biggest challenge in game rearing and releasing for farmers, gamekeepers and vets.

This is partly because of the limited knowledge, lack of research into, and understanding of the lifecycles and behaviours of these organisms. This impacts on developing ways in which we can mitigate, control and treat. It seems amazing that today we still do not know how the treatments we use actually work on these organisms, and in reality what the significance of finding infection always means. This has led to all kinds of myths, magic and fantastical thinking when it comes to solutions. All sorts of products come and go with claims of prevention, cure and so on, yet we still come back to having to use antibiotics in significant quantity to resolve disease outbreaks.

Work has been going on for a couple of years, with a partnership of veterinary practices and the University of Surrey, and this is shedding some light on the problem.

Terminology can be confusing, findings can be grouped together under complex syndromes and yet the individual organisms can behave and respond to treatment differently. This can lead to over treatment and over use of antibiotics, something we all need to avoid. I find it useful therefore to define post-mortem findings by the organisms actually seen on the screen, with the big four being Hexamita, Trichomonas, Brachyspira and Blastocysts.



Top: Images as seen under a microscope – top left Trichomonas (note the tails); top right Brachyspira (motile 'turkey twizzlers'); bottom left Blastocysts (which rotate and are larger than other protozoans); bottom right, a Trichomonad (diagramatic).

Bottom: Brachyspira in a partridge.

Images: Mark Elliott

Brachyspira

Brachyspira is a large motile bacteria that appears under the microscope as a wriggling 'Turkey Twizzler'-shaped organism. There are many Brachyspira species, and many types can be present at the same time, making any confirmation of diagnosis of pathogenic (disease-causing) strains often retrospective of treatment. However, in samples I contributed to one research study, where I had seen Brachyspira organisms under the microscope, in 90% of my cases in pheasants the organisms were confirmed as pathogenic (disease-causing); so I always now treat in pheasants on first observation.

The important strain in pheasants and grey partridges is *B pilisicoli*, which leads to some thought that contact with free-range laying flocks of chickens was the original route and source of the problem in gamebirds as it is common in those. It is not seen as a problem in game before six weeks of age and the jury is out as to whether it's a problem in red-legged partridges (as a personal observation I do think it can occasionally be a concern).

In poults, the symptoms are generally mild, with large swollen gassy and light brown fluid filled caeca with consequent diarrhoea. Older poults (12 weeks +) have been found to seem weak and will collapse when dogged back to pens, probably due to the weight of the caeca affecting breathing. Response to treatment is usually rapid and effective and tiamulin is the antibiotic of choice.

However, Brachyspira are often seen in poults when other diseases such as

Hexamita are present, and in those cases it seems to make the symptoms of disease much worse. If found, vets will often have to combine multiple antibiotics to solve the problem, and this does not help our programme of reducing antibiotic use, so we need to understand it better.

In pheasant laying flocks most cases are mild, but it can be a factor to look for when increased mortality is seen, egg production falls and eggs are smaller with poor quality shells. Diarrhoea is common and, in layers, it is often described a 'cappuccino faeces' due to the colour and consistency, and this contamination will be seen on the egg-shells when collected. In chickens it is thought that chicks hatched from eggs laid by infected hens show reduced weight gain and ill-thrift, raising concerns of the epigenetic effects of the disease. I am not aware this has been noted as a concern in gamebirds.

In mallards, the species of importance is *B hyodysenteriae*. If disease does take hold, it is severe. However, I generally find Brachyspires are present to some degree on most duck post-mortem examinations so likely most are not pathogenic and simple gut commensals. Mostly I have seen them in quantity when the problem is traced back to an issue with contaminated water supplies, such as algal blooms on release ponds. The solution is usually just a few days treatment while the water problem is resolved.

On post-mortem examinations, the organism is a mobile corkscrew shape, and the microscope screen in severe cases can seem alive with these. It is described as having a central protoplasmic cylinder covered by a membrane sheet, between which the flagellae (of which there are eight to 10) are located. These latter give it a high degree of motility and hence also a high virulence. The configuration produces a clockwise or anticlockwise movement as the organism moves around.

We do not yet fully understand the actual structure of the component parts and lifecycle, making development of prevention strategies difficult; nor do we know how it evades the immune system, although we do know how it breaks down the intestinal wall and causes the clinical signs. These gaps in knowledge are not helpful when evidence shows that it is developing resistance to some antibiotics. In chicken layers, we know that good biosecurity is important. We will likely develop and evolve new treatment strategies for this bacteria, such as targeted probiotics, by following events in the wider poultry sector.

Typical appearance of the caecum with trichomonas infection.

Hexamita

A disease that strikes fear into the heart of those who rear gamebirds, and yet, due to the acute nature of the disease with its rapid onset, easy identification and usually a quick response to treatment, it is perhaps less of a concern when the birds are well cared for and any issues can be spotted and addressed quickly.

It is commonly said that you will lose as many birds after diagnosis and treatment is started as you have lost before that point – emphasising the need for rapid intervention when sick birds are identified.

The causative organism is a protozoan now called *Spironucleus meleagridis* (its previous name was *Hexamita mealagridis* – hence it is known still as 'hexi' in the industry) and on post-mortem examination under the microscope it is seen as small, oval-shaped organisms darting around the screen, often in huge numbers. In more detail it has four anterior, two anterio-lateral and two posterior flagella (the wavy bits that move it around). The organism seems first to appear in the small intestine, especially the duodenum and upper jejunum, which will usually look dilated, thin-walled and filled with watery content.

Affected birds will present as acutely sick, with rapid weight loss, unkept feathers, and listlessness. However, they will continue to eat until near death as the demand on the birds' metabolism created by the Hexamita is such they are in a state of effective starvation. Work by the Game & Wildlife Conservation Trust (GWCT) suggests that the bird is deprived of vital glucose supplies, probably as the organism feeds on carbohydrate and proteins much like bacteria do, and this is perhaps why the muscle mass is broken down so quickly to keep the bird alive. Classically, the razor-like appearance of the breastbone is quickly seen in the sick birds.

The GWCT also found electrolytes were beneficial in the early stages of disease, but less so as the gut is quickly damaged – again emphasising the importance of rapid diagnosis and interventions.

Quite how the birds initially infect is a matter of debate. GWCT research did not support the existence of an encysted stage that might survive year to year, and yet others have suggested this must be so. Observations of release pens that consistently produce problems year on year with identical timing suggest an encysted stage, and how else does →

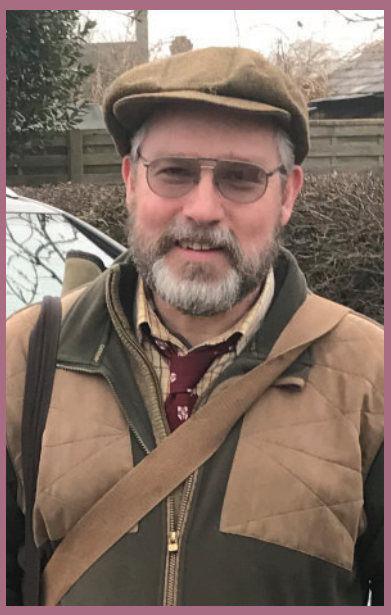
it appear on new ground with new kit without any other contact with older birds? Surveillance post-mortem of older birds will occasionally pick up the odd organism that looks like Hexamita, and it is thought once affected a significant percentage of birds do become carriers. However, recent research at the University of Surrey on samples collected during 2021 outbreaks identified another type of protozoan called Chylomastix rather than Hexamita – they look the same under the microscope and Chylomastix has an encysted stage within its lifecycle – so have we been dealing with something we have called Hexamita all along, but is actually something else? On a practical level, it makes little difference to our treatment decisions, but might give us some clues for future solutions. Watch this space!

We do know that once established 'Hexamita' rapidly spreads bird to bird from feacal contamination, made worse in damp conditions, and it can spread on contaminated clothing and footwear. It has such a short replication/multiplication time that all birds are likely to get exposed very quickly, but disease is not necessarily inevitable if conditions for the birds are ideal. There may also be a strain effect, in that we can see presence of large numbers of organisms when there is no, or only mild, illness and so treatment is probably not always indicated. (This can test keepers' and vets' nerves!)

As birds get older and their immunity from exposure develops, the presence of a few organisms may become unimportant in terms of disease and need for treatment.

It may seem odd, but there is arguably no legal effective treatment for Hexamita in gamebirds. The use of antibiotics, mostly of the tetracycline family of drugs, is based only on anecdotal observation of benefit and is said by some to work only by controlling secondary infections. However, evidence is emerging that these drugs might actually have a restricting effect on the organisms' primitive mitosomes (the energy generating part of the cells) such that they cannot complete their division process (how they multiply). The antibiotics may also, by having a beneficial effect on gut inflammation and in depleting/modifying the bacterial load of the gut, remove much of the food source for the Hexamita at the same time.

Look out for Part 2 on this subject in *KtB* Summer 2022. •



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Routine on-site post mortems can be useful in early detection of disease outbreaks.