

Disease in focus: Coccidiosis

Dr Mark Elliott BVSc VetFFHom MRCVS PCH DSH RSHom, kicks off a series of articles looking at different diseases that affect gamebirds. He begins with a well-known problem caused by gut parasites.

Coccidiosis is an intestinal disease caused by protozoan parasites from the *Eimeria* family, an incredibly successful genus of organisms that evolved to affect most animals and birds. Each type of animal or bird will have one or more types of *Eimeria* that are specific to that species, so for our purposes it is key that partridge Coccidiosis organisms do not affect pheasants and vice versa.

Eimeria are highly prolific and remarkably resilient to cleaning and disinfection such that they are impossible to eliminate in most rearing environments. They reproduce quickly and in large numbers, with some species able to multiply from one oocyst (egg) to over 50,000 progeny in just four to seven days.

Acute outbreaks can result in severe diarrhoea and significant mortality, but this is rare today in well-managed game rearing businesses. More commonly low-level

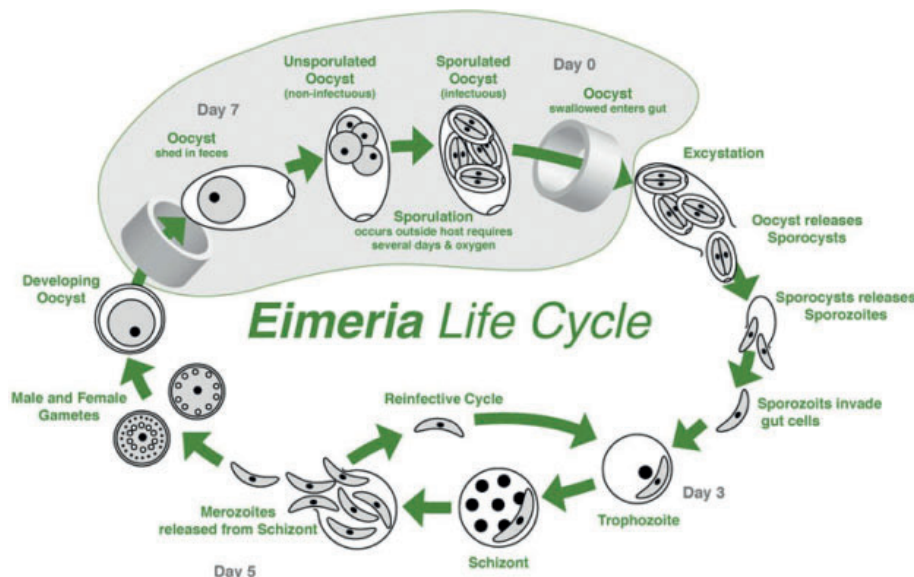
disease with lethargy, mild diarrhoea and some weight loss is seen. Whatever, Coccidiosis is costly in time, treatment and any losses, but of particular concern is that the gut damage resulting from the Coccidiosis predisposes to bacterial and motile protozoan infections (such as Hexamita, Trichomonas, etc.)

Eimeria, however, did not evolve to cause mass mortalities: it makes no sense for a parasite to kill its host species. Chicks are born with no immunity to the organisms and need exposure at least twice (think of it like vaccinations) to acquire a level of protection. In the wild, a chick would be exposed early in life, probably from its mother, and certainly before the gut is developed enough for *Eimeria* to be able to cause clinical illness. That early exposure leads to a better ability to survive ongoing infections. In post-mortems of wild grey partridges, it is normal to find a

few organisms, but I've never seen clinical disease in those. Similarly adults off a game-cart will carry some organisms, and, in surveillance post mortems of most wild birds, generally a few are often present. In commercial chicken rearing, vaccination is done at day-old with strains of the endemic types on the farm, but ones that do not cause clinical illness. It would be good to find non-pathogenic strains for game to create a vaccine as that would have a huge positive impact, reducing our use of medications, particularly antibiotics, as well as the economic gains.

Rearing birds in any intensive environment presents *Eimeria* species with the perfect opportunity to multiply and spread. Infection cannot be avoided, but disease can. So at this time, the aim of rearing fields and shoots should be to control levels of infection to that which the birds can cope with while they develop their immunity. Using coccidiostats in the food, monitoring and dosing with additional medications as soon as emerging problems are seen, and controlling the environment as far as is possible is key. On rearing fields *Eimeria* love wet damp litter, and stress factors for birds such as cold, over-crowding and poor ventilation reduce their ability to cope with infection. By the time of release, the aim is for birds to have coped with infection well on the rearing fields so they are near immune, but of course any immunity can be over-ridden if stress is extreme – such as horrendous weather, pressure from predators, over-crowding, inadequate access to food and water and so on. And to throw in a conundrum, with multiple species of and imperfect cross-over immunity from exposure to other species, there is some thought that changing long-term suppliers might increase risk of other species breaking

Eimeria are highly prolific reproducing in large numbers very quickly.

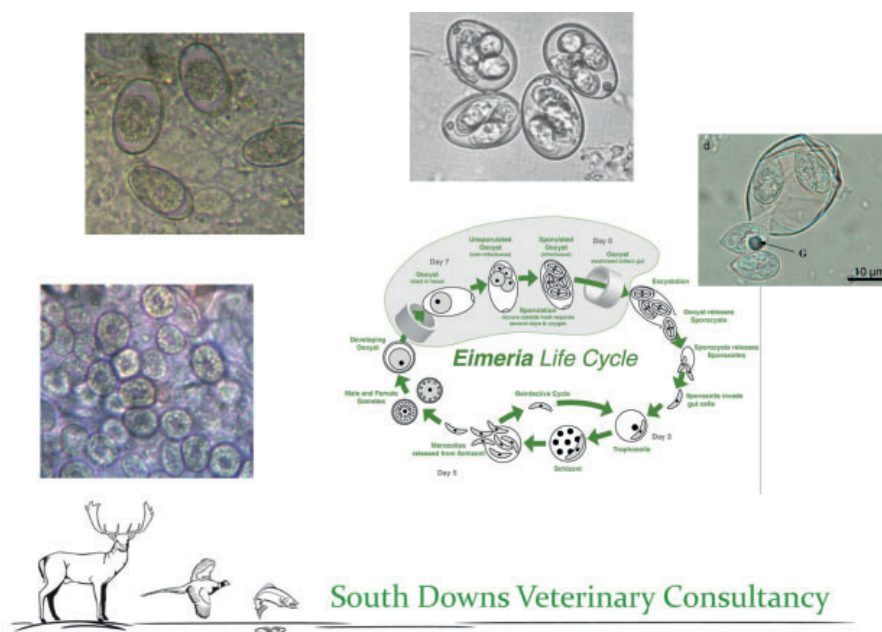


through after release – anecdotally the same supplier of birds to same pens year on year seems to work.

It is important to understand the lifecycle (see box) to understand control and how the treatments we have available work.

EIMERIA LIFECYCLE

1. Unsporulated oocysts are shed in the faeces into the litter. Oocysts sporulate (become infective) in the presence of adequate moisture, oxygen and temperature. Oocysts are very environmentally resistant and can survive for at least a year.
2. Sporulated oocysts, containing four sporocysts that each contain two infective sporozoites, are ingested by the birds from ground and litter pecking.
3. Sporocysts and then sporozoites are released into the gut from the sporulated oocyst, a process facilitated by the physical grinding effect and the presence of digestive enzymes and bile salts.
4. Sporozoites penetrate gut cells to initiate development of asexual intracellular schizonts. Schizonts produce large numbers of a second invasive stage called merozoites that penetrate other gut cells to produce a further generation of schizonts.
5. The number of asexual generations varies with *Eimeria* species from two to four, and this results in an exponential increase in parasite numbers.
6. Following the asexual part of the lifecycle, a sexual stage begins during which male and female gametes form. These fuse to form a zygote which develops into an immature, unsporulated oocyst that is shed onto the litter in faeces
7. With each cycle the number of oocysts in the environment massively increases and unless immunity has developed, or an anticoccidial is used, when conditions are favourable for the *Eimeria* to sporulate then exposed birds cannot cope with the sudden massive exposure in the number of infective sporulated oocysts and consequent gut damage. ●



Eimeria lifecycle with corresponding microscope photographs showing the different stages of development.

In-feed anticoccidials

Commonly known in the industry as Avatec, and added to game feed routinely now without prescription, the actual drug name is Lasalocid. It is pretty much the only in-feed anticoccidial we have available that gamebirds can tolerate; its use is to control the *Eimeria* rather than treat it as too much Avatec is toxic for the birds.

The drug's mode of action is to interfere with the ionic homeostasis that stabilises the sporozoite's outer membrane such that it ruptures, resulting in death of that organism. As only so much can be given to the birds, only so many sporozoites can be killed, and hence it is an imperfect aid, albeit without it disasters are seen.

As pheasants transition to wheat from 12-14 weeks, the levels of Avatec in the gut will consequently reduce and we expect the birds to have developed their immunity. Red-legged partridge are less good at developing immunity, needing certainly more than two exposures to Coccidiosis, but the rearing cycle tends to keep them on pellet and hence Avatec longer anyway.

Coccidistats

The main one in use and available is Amprolium, running mostly under the trade names of Coccibal and Amprolene.

Amprolium is a thiamine antagonist which mimics and blocks receptors to thiamine on the trophozoites and schizonts, effectively starving them of this essential nutrient at a key stage in the lifecycle, and impacting mostly therefore on day three. It is important to note that

infection of the birds occurs over days, and not all at the same time, so in consideration of the seven-day lifecycle, seven days' treatment is normally prescribed, and for the same reason responses seen are not always instantaneous.

Amprolium does also have a suppressant effect on the sexual phases of *Eimeria*, gametogony and sporulation of the oocyst, so does also reduce the load of exposure of birds to infection from environmental contaminants going forward from an outbreak.

Care is needed at higher doses as it can cause thiamine deficiency in the birds if overdosed or given for too long, which will weaken and cause symptoms of collapse in some.

Amprolium mixes well with almost all the antibiotics, vitamins and minerals used in rearing gamebirds so is a common choice for treatment when other diseases are present. However, if continually relied on it is known for *Coccidia* to evolve drug resistance, so alternating treatments is best.

Coccidicides

The only one we have available is Toltrazuril, common trade names for that in the UK being Baycox, Toltra-K and Zorabel.

Probably the most reliable, quicker and preferred treatment/control as it acts on all the intracellular development stages of *Coccidia*. It has the advantage of reducing oocyst production even if administered after the appearance of the first oocysts in the birds faeces (it is excreted in the faeces). In consideration again of the lifecycle and →

staged timings of infections, it is commonly recommended in gamebirds to treat for three days.

Its mode of action is to induce changes in the fine structure of coccidian development stages that are mainly via swelling of the endoplasmic reticulum and of the Golgi apparatus and to causing abnormalities in the peri-nuclear space, as well as disturbances in nuclear division. Toltrazuril also leads to a reduction of enzymes of the respiratory chain of the parasites. The biochemical mode of action of Toltrazuril also causes obstruction of the wall-forming bodies of Eimerian macrogamonts. (Yes, my mind rejects such detail at times too! It is important to know that basically it kills *Coccidia*.)

Prolonged and over-use can also lead to resistant strains of *Coccidia* so working with your vet to develop a programme of strategised treatment is important. Dosages should be adjusted for age, weight and water intake of the birds.

Toltrazuril can struggle with solubility in hard and/or acidic water. Buffers can be used to improve this to a degree, but not always at below toxic levels, so some sites cannot practically use it which can be a concern long term if resistance to other solutions develops. Manganese in the water at high levels seems an issue. If using water acidifiers routinely, as many do now, then these must be flushed out before adding Totrazuril for treatment.

Toltrazuril, being an alkaline product, does not mix well with many of the other medications used in gamebirds, which are mostly acidic – so it is usually used on its own.

Some key points

- Two challenges are required in pheasants to achieve immunity to the strains on the rearing field.
- Partridges do not produce good immunity until 12 weeks plus, so exposure levels are much more important in partridges, and consistency of control avoids ‘Cocci storms’.
- There are at least five strains in pheasants, three in red-legged partridges, and one in grey partridges. There is no species cross-over or risk.
- Coccidiosis appears to drive the early risk of disease due to motile protozoa.
- Rainfall, humidity and litter condition are all associated with increased early Coccidiosis challenge.
- Timing of exposure is important to ensure birds are immune before they go to wood. Effectively this means not keeping them shut in too long as they need to be exposed to *Coccidia* early in life.
- Post mortems are justifiable both logically and economically if any response to *Coccidia* treatment is poor.
- Understanding and knowing the behaviour of this disease on your farm is key to its control. ●



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