Protozoal diseases
Module # 8 - Component # 4

Protozoal diseases

Objective

Identify the symptoms of important protozoal diseases of wildlife and understand the control of these diseases.

Expected Outcome

- List the most common symptoms of various important protozoal diseases.
- Know how these diseases are transmitted.
- Assist veterinarians in the control of these various diseases.

Buffalo: Syncerus caffer
Introduction

Classification of protozoa

The word protozoa denotes unicellular animal. The word is of Greek origin, protos meaning first, and zoon an animal. There are more than 25 000 species of protozoa, of which 7000 are parasitic.

There are seven phyla, but only four are of importance in this context:

- Phylum sarcomastigophora
- Phylum apicomplexa
- Phylum ciliophora
- Phylum microspora

Present-day protozoa are not necessarily primitive creatures. Many species are, in fact, highly specialised. The cells of multicellular animals have become part of various tissues and organs, each specially developed for certain tasks. The unicellular animal has remained an 'all-rounder' and has developed organelles fulfilling essentially the same tasks as the organs of multicellular animals.

Sable antelope: *Hippotragus niger*
Coccidia/Coccidiosis

This disease commonly occurs in animals in captivity, kept under less than ideal conditions. Two genera of coccidia, *Eimeria* and *Isospora*, are present in almost all animal species' gastrointestinal tracts. However, they only cause clinical disease when the animal's resistance is poor for whatever reason. *Oocysts* (the spore stage of the protozoan life cycle), which are the infective stage, are taken in per mouth, and the protozoa then develop further in the mucous membranes of the animal's gastrointestinal tract.

*Oocysts* are then again released in the animal's faeces but are only infective after sporulating outside the host in the environment - a process that takes at least two days. These spores can survive for long periods in cool, moist conditions but are very susceptible to heat and desiccation.

Severe symptoms have been documented in *impala, buffalo, springbok, kudu, eland*, and *wild dogs*. 
Clinical symptoms are:

- **Diarrhoea** that can often be bloody.
- Chronic cases may show **emaciation** and/or **dehydration**.

The diagnosis can be confirmed through large amounts of oocysts in the faeces.

**Treatment consists of:**

- Sulpha antibiotics.
- Amprolium and monenzin have preventative effects and can be included in the feed.
- **Hygiene in terms of keeping bomas and camps clean and dry.**

The disease is host species, and there is no **human zoonosis**.

**Buffalo: Syncerus caffer**
Theileriosis/Cytauxzoonosis/Tileria

This tick-transmitted, deadly disease of cattle is important to the game rancher because buffalo harbour the parasite without showing any clinical symptoms and act as a source of infection for ticks that can then transmit the disease to cattle.

The disease is caused by *Theileria parva lawrencei* and can be transmitted by the following two tick species:

- Brown ear tick (*Rhipicephalus appendiculatus*)
- Zambesi brown ear tick (*Rhipicephalus zambeziensis*)

After being bitten by a tick, the parasite *multiplies* within the host's white blood cells.

It is this stage of the infection that causes the following clinical symptoms in cattle:

- Fever
- Enlarged lymph nodes
- Emaciation
- Diarrhoea
- Watery nose secretions
- Weakness
- Muscle spasms
- Coughing
- Death. Almost all cattle die - extremely high mortality rate.

In the next stage of the parasite's life cycle, they enter the animal's red blood cells. However, this stage only occurs in buffalo as cattle die before this stage. When a tick now feeds on such a buffalo, it becomes infected and capable of spreading the disease.
Various drugs are available that is effective in treating the disease in cattle but are not permitted in South Africa for the following reasons:

- The drugs are effective against the first stage of the parasite but **do not kill all the parasites**. The *bovine will thus survive, but so will a few of the parasites*, and they will then **complete their lifecycles** in the host's red blood cells. This *bovine will then become a carrier and capable of infecting ticks and thus spreading the disease to other cattle.*

- **Tick larvae** and nymphs that have fed on infected buffalo can remain **alive for a long period of time in the veld**. This has the implication that even if buffalo moved through an area a while ago, cattle could still become infected when bitten by a tick on this veld.

**Buffalo** from the **Addo-elephant National Park** are **free from this disease** since the two most important **tick-vector species do not occur there**. Should these buffalo be moved to an area where the infected ticks are present, they will become infected too and act as carriers.
Control to prevent the spread of the disease is therefore aimed at:

- Prevent contact between cattle and infected buffalo.
- Prevent cattle from becoming carriers by not treating them.
- Prevent ‘clean’ buffalo populations from becoming infected.

Certain areas in South Africa are proclaimed as controlled areas where the above-mentioned control measures are strictly enforced in conjunction with the following:

- All cattle must be dipped or treated with an appropriate registered drug to protect them against ticks.
- No animal may be treated for corridor disease without written permission from the Directorate Animal Health.
- All property with buffalo must be registered with the Directorate Animal Health.
- Such a property must be fenced according to the local nature conservation authority’s regulations pertaining to buffalo. If this property is in a controlled area, the fence must also be electrified.
- Buffalo are only allowed to be moved with an appropriate permit from the relevant state veterinarian.

Buffalo can also act as carriers of East Coast Fever (Cytauxzoonosis) caused by Theileria parva parva. This tick-borne disease of cattle was luckily eradicated from South Africa in the 1950s.

The genus Cytauxzoon closely resembles Theileria and is also transmitted by ticks. It occurs in various wildlife species but only causes clinical disease in animals with decreased resistance. This disease is an important killer of tsessebe calves but has also been documented in kudu, sable, roan, giraffe, and grey duiker.

Clinically ill animals show the following symptoms:

- Fever
- Weak
- Emaciated
- Anaemic
- Enlarged lymph nodes

Control of this parasite is not practical due to its widespread occurrence.
Heartwater

This disease of ruminants is not caused by a protozoon but by the rickettsia Cowdria ruminantium. The Rickettsiae comprise a group of non-motile, non-sporeforming small bacteria-like organisms with typical cell walls that are commonly found in the tissues of arthropods, such as fleas, lice, mites, and ticks.

Heartwater is restricted to the sub- and tropical regions and is transmitted by the ‘bont tick’ hamblyoma hebraeum. Springbok, eland, and various exotic wildlife species are susceptible. Infection in blesbok and black wildebeest is transitory. Blue wildebeest, impala, buffalo, kudu, giraffe, and warthogs are susceptible but do not show any clinical signs. In general, wildlife appears to be more resistant to heartwater than domesticated livestock.

Clinical symptoms include:

In peracute cases in livestock, the animals die without showing any clinical signs.

In acute cases, the following can be seen:

- Increased rectal temperature.
- Hypersensitivity.
- Rapid, shallow breathing.
- Abnormal behaviour.

Nervous symptoms such as:

- Gritting on teeth.
- Backward arching of the neck.
- Abnormal eye movements.
- Continuous muscle spasms.

Large amounts of fluid are found in the animal's lungs and thorax at post-mortem examination.

Control measures should include:

- Vaccination of all susceptible wildlife before relocating them to areas where the disease occurs.
- The use of certain antibiotics such as doxycycline is very effective but needs further research.
- Tick control to decrease the incidence of the disease.
- Veld management as the ticks require bushveld as a habitat. The disease does not occur in animals restricted to grassveld only.
Ecological effect of Heartwater

This disease is also very significant in terms of the distribution of game animals. Looking at the many reserves in South Africa will show that while many species occur in all habitats, certain species are restricted by habitat. This is mostly a function of the desert and semi-desert animals preferring this habitat, and even when unrestricted in movement, they do not migrate to temperate climates. One specific species that early wildlife managers attempted to introduce from semi-desert to bushveld was the springbok. This is our national animal, after all. It would seem only right that tourists should be able to view them in all our National Parks, particularly the Kruger National Park, the flag-ship of our National Park board. Small herds of springbok were captured from the dry western parts of the country and translocated to the Kruger, where they promptly died within a few weeks. Most deaths were not due to either predation or capture myopathy, but still, the whole population of translocated springbok died.

The reason for this was the Heartwater tick and its associated disease. Springbok are extremely susceptible to this disease and, when exposed, quickly contract it and die. Death is partly due to an accumulation of fluid in the pericardial sac surrounding the heart - thus heartwater disease. The reason why springbok thrive in the arid western region of South Africa is that the heartwater tick cannot survive in these dry conditions. Therefore, we very seldom see impala and springbok together. These antelope are ecological equivalents, but due to the disease, they cannot live together. Well, not quite. The Pilanesberg National Park is one of the very few areas where both species can be seen side by side. This is primarily because this area falls between the dry West and the Eastern savanna (KNP).

Springbok: Antidorcas marsupialis
Protozoal diseases

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Babesiosis

This disease is caused by protozoa from the genus *Babesia* and is transmitted by several tick species. In general, a specific animal species will be parasitised by its corresponding *Babesia protozoa only*. The protozoa that causes ‘redwater’ in cattle, for instance, does not affect wild antelope.

*Babesia* protozoa parasites infect the host’s red blood cells and causes the destruction of these cells.

This causes the following clinical signs:

- Red discolouration of the urine (not always seen in wildlife).
- Animals become anaemic.
- Feverish.

*Warthog: Phacochoerus africanus*
The disease is mostly **seen in individuals that were not exposed to the protozoa from early on in their life.** This is especially so in animals raised in zoos and then released back into the wild. This was the case with several **sable imported from Europe** that died from babesiosis caused by *Babesia irvinesmithi*. **Wild dogs also seem to be susceptible to *Babesia canis*** from time to time, whilst **black-backed jackal** might act as **carriers** of this disease.

**Other animal species infected with *Babesia* protozoa but not always showing clinical signs thereof include:**

- **Lion**
- **Leopard**
- **Cheetah**
- **Warthogs and bushpigs** - These two species may carry *Babesia trautmanni*, which can be transmitted by the tick *Rhipicephalus simus* to domesticated pigs.

**Leopard: Panthera pardus**
Sarcocystosis

These protozoa have what is called an 'obligatory heteroxenic' life cycle. This means that the protozoa require two hosts, one a herbivore and the other a carnivore, to complete their life cycle. The protozoa are very host-specific. The herbivore becomes infected orally when sporocysts are ingested. The protozoa then form sarcocysts in the herbivorous host's muscles. When the carnivorous host consumes meat infected with sarcocysts, it then becomes infected and sheds sporocysts in its faeces.

The clinical symptoms in the carnivorous host are usually very mild, and slight gastrointestinal upsets might be seen. People acting as the carnivorous host can suffer from abdominal pain and diarrhoea.

Lion: Panthera leo
Toxoplasmosis/Neosporosis

Toxoplasma is a coccidian that has a typical *gastrointestinal cycle in cats* but forms *tissue cysts in a wide range of mammals and birds*.

![Rhino and gazelle in savanna](image.png)

Toxoplasmosis is an *important disease of humans*. Acquired infections are usually asymptomatic, but *abortions and congenital diseases* may occur.

*Neospora caninum* closely resembles *Toxoplasma*, but dogs rather than cats play a role in its life cycle. It is not a very significant disease for wildlife.
Anaplasmosis

This disease is known as ‘gallsickness’ in cattle. Wildlife species such as blesbok, blue- and black wildebeest, grey duiker and impala can be carriers, but their role as reservoir hosts is unknown. Anaplasmosis can be transmitted by ticks feeding on animals and mechanically by biting flies.

Blue wildebeest: Connochaetes taurinus
**Protozoal diseases**

The protozoan *Besnoitia besnoiti* causes this mild or severe but usually **non-fatal disease of cattle**, known as 'elephant skin disease'. Biting flies probably transmit the disease. Similar protozoa are found in impala and blue wildebeest but do not cause **clinical disease**. These protozoa can also infect cattle, but they do not become clinically ill either. Instead, they become immune against *Besnoitia besnoiti*.

In fact, the **vaccine against cattle' elephant skin disease'** was manufactured from **protozoa of blue wildebeest** origin. The significance for wildlife is the potential for its spread from wildlife to domestic animals, where they share the same habitat.

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**Blue wildebeest**: *Connochaetes taurinus*
Protozoal diseases

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Nagana

This disease of domesticated stock is caused by a Trypanosoma species and is transmitted by tsetse flies. Various species of wildlife can carry the disease without showing clinical signs. Tsetse flies become infected when feeding on carrier animals.

Cattle show the following clinical symptoms:

- Undulating fever
- Lethargy
- Anaemia
- Emaciation
- Enlarged lymph nodes

Previously large numbers of game were killed in the KwaZulu/Natal province to control the carrier wildlife populations of nagana. This was ineffective, and the disease was only controlled in the 1950s when tsetse flies were killed by poison sprayed from aircraft. Recently, cases of nagana were reported from the KwaZulu/Natal province, but no control measures involving game are in place.

Trypanosomes in a blood smear

Photo Credit: CDC/Dr. Myron G. Schultz - This media comes from the Centers for Disease Control and Prevention's Public Health Image Library.