Protozoa 3

BVM&S Parasitology

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What are the arthropod-borne Protozoa?

- Parasites of major importance to
  - Humans
    - Malaria, trypanosomiasis, leishmaniasis
  - Animals
    - Trypanosomiasis
    - Theileriosis
    - Babesiosis
    - Malaria (avian)
    - Leishmaniasis

Lecture Outcomes

- Describe the characteristics of abp in relation to epidemiology and their role as emerging diseases.
- Describe the characteristics of the lifecycles of the abp featured in this lecture.
- Compare and contrast the characteristics of tick-borne vs insect-borne protozoa.

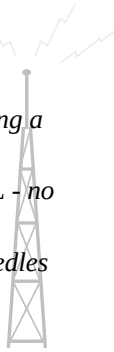
What are the important features of ABP?

- They are transmitted by blood-sucking arthropods – referred to as VECTORS
  - insects or ticks
- They are blood parasites of vertebrates
- All stages in the life cycle are parasitic.
- They usually have highly specific host:vector combinations

Vector-dependent Parasite Distribution

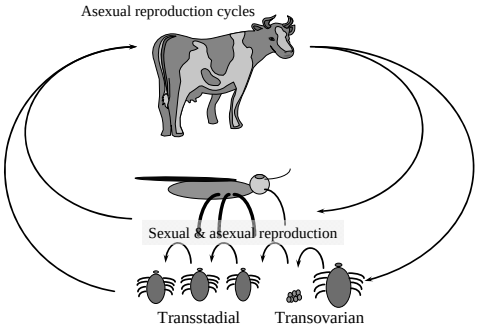
- The tseste transmitted trypanosomes are restricted to Africa, south of the Sahara where the tsetse fly (Glossina sp.) lives.
- *Theileria parva*, east and central Africa where its tick vector, is found.
- In the UK *Babesia major* infection of cattle is restricted to the south of England, vector *Haemaphysalis punctata* is found.

How are ABP transmitted?



- CYCLICAL or BIOLOGICAL – *having a developmental cycle in the vector.*
- NON-CYCLICAL or MECHANICAL - *no development in the vector.*
- IATROGENIC - *via contaminated needles and by blood transfusion.*

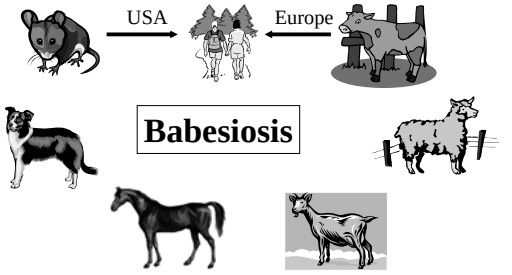
Transmission cycles



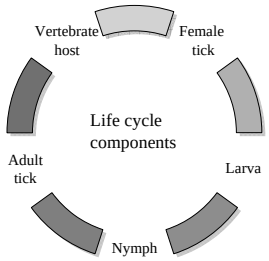
Which ABP are important to vets?

- ***Babesia sp***. - INTRA-ERYTHROCYTIC, SPOROZOA transmitted by hard ticks of the family IXODIDAE.
- **Trypanosomes** - EXTRACELLUAR HAEMOFLAGELLATES transmitted by biting flies.
- **Malaria** - INTRA-ERYTHROCYTIC SPOROZOA transmitted by a range of BLOOD-SUCKING FLIES.
- ***Leishmania sp***.- INTRACELLULAR FLAGELLATES transmitted by SANDFIES.

Babesiosis : a world-wide problem



Babesia life cycle



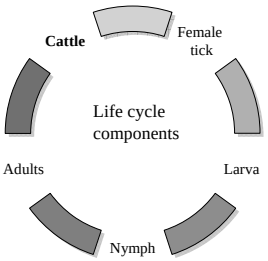
What is the cause of bovine babesiosis in the UK?

Feature	*B.divergens*	*B.major*
Size	"Small"	"Large"
Vector	*Ixodes ricinus*	*Haemaphysalis punctata*
Distribution	All areas with *I.ricinus*	S.E.England

How is *B.divergens* transmitted in UK?

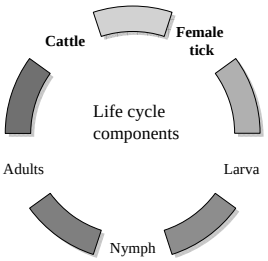
- Female tick is the only stage that can become infected and passes the parasite onto the egg.
- Larva, nymph and unfed adults can all transmit the infection.

Babesia divergens



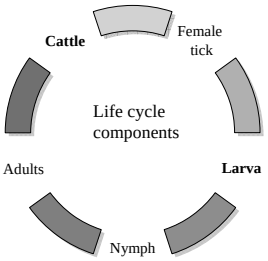
- Asexual reproduction
- Destruction of infected erythrocytes
- Clinical babesiosis

Babesia divergens



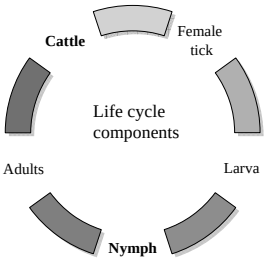
- Ingests infected rbcs
- Sexual reproduction in gut
- Asexual reproduction in gut epithelium
- Invades ovary>egg
- 40% eggs infected

Babesia divergens



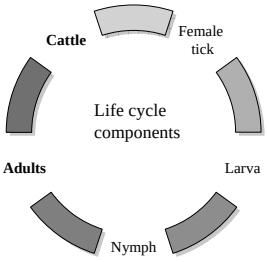
- Emerges from egg already infected
- Asexual reproduction in gut epithelium
- Invades salivary glands
- Injected into vert host during feeding

Babesia divergens



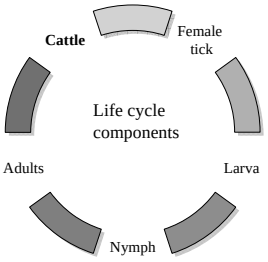
- "Inherits" infection from larva
- Asexual reproduction in gut epithelium
- Invades salivary glands
- Injected into vert host during feeding

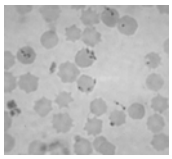
Babesia divergens



- "Inherit" infection from nymphs
- Asexual reproduction in gut epithelium
- Invades salivary glands
- Injected into vert host during feeding

Babesia divergens





Which factors affect the epidemiology of bovine babesiosis in UK?

- Restricted to pastures that support **high numbers of ticks**
- Inverse age resistance - animals up to 6 months old develop an **immunity** (non-sterile).
- **Enzootic stability** develops in endemic areas - high challenge, low disease.
- Principally a disease of **older animals (Redwater)**.
- Disease outbreaks associated with peaks of **tick feeding activity** - spring and autumn.

Which factors influence outbreaks of bovine babesiosis?

- Introduction of *Babesia* naive adults
- Introduction of infected ticks
- Fluctuations in tick numbers eg
  - Set aside schemes
  - Changes in pasture harvesting
  - Presence of dipped sheep
  - Use of Ivermectin for helminths

How can we control Bovine babesiosis?

- Ensure adequate exposure of young animals to tick challenge before 6 months of age.
- Treatment of affected animals.
  - Drugs - Imidocarb diproprionate or LA oxytetracycline.
  - Supportive therapy.
- Monitor introduced adults for evidence of infection and treat early to stimulate immunity.
- *Tick reduction measures e.g. dipping (not UK)*
- *Vaccination (not UK)*

Trypanosomes – not just a problem for vets in the wild!

	Salivaria	Stercoraria
Distribution	Africa, Asia, S.America	Worldwide
Principal vectors	•Tsetse (Africa) •Tabanids (Asia & S.America)	Blood sucking flies
Pathogenicity	High	Low
Hosts affected	Cattle, buffalo, sheep, goats, wildlife, dogs, horses	Cattle, sheep, goats

Trypanosome Infections in UK

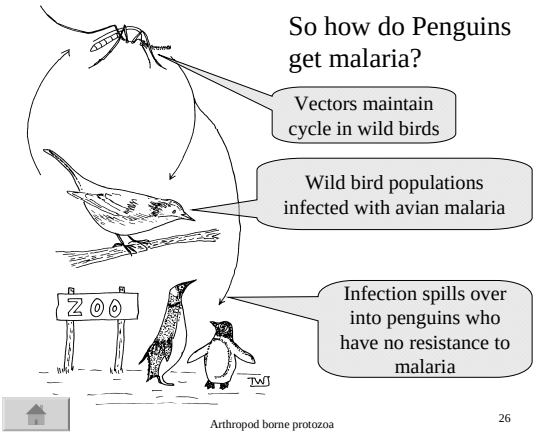
- Considered to be non-pathogenic.
- All belong to the STERCORARIAN division.
- Transmitted by biting diptera.
  - *T.theileri* infects cattle, vector tabanids.
  - *T.melophagium* infects sheep, vector sheep ked.
- Mostly of "nuisance" value in blood films and cultures from whole blood.
- *But*

Malaria

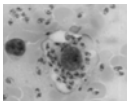
- **Human**
  - Tropical /sub-tropical
  - Transmitted by mosquitoes
- **Avian**
  - Worldwide
  - Transmitted by blood sucking flies

Avian Malaria in UK

- Principally an infection of wild bird populations.
- Important when it spills over into susceptible domestic bird populations e.g. Pigeons and cage birds.
- An important pathogen of penguin colonies in zoos.



Leishmania



- Infects host **macrophages**
- Transmitted by **sandflies**
- Infects humans, dogs & rodents
- Two forms
  - Cutaneous (humans)
  - Visceral (humans & dogs)

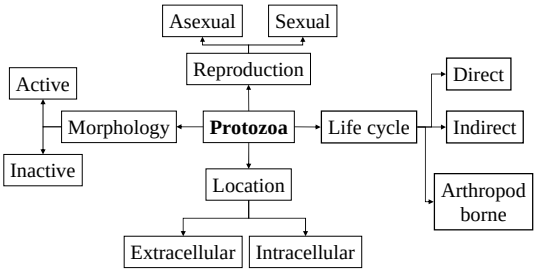
Canine leishmaniasis - coming to your practice soon?

- Endemic in humans and dogs in parts of Africa, Asia, South America and Europe.
- Potential problem in UK dogs imported from endemic areas, especially Southern Europe.
- Will current quarantine regs result in more cases?
- Already a recognised problem in dogs in USA
- Vectors not (currently) present in UK

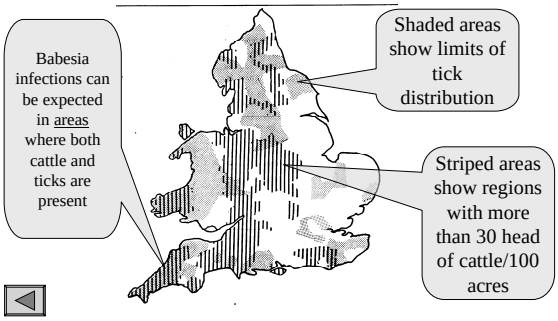
Summary

- Intracellular and extracellular protozoa transmitted by arthropods.
  - Ticks (arachnids).
  - Blood-sucking flies (insects).
- Transmission adapted to feeding habit of the vector.
- Parasite distribution dependent on vector distribution – impact of climate change?

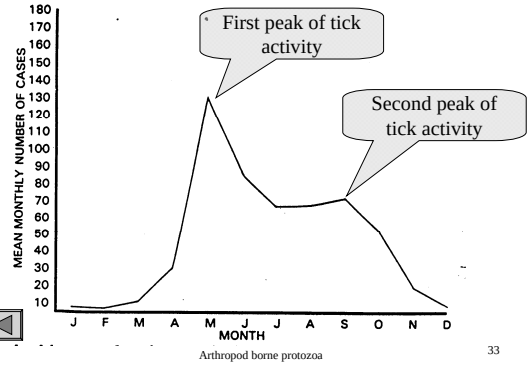
Ways of thinking about parasitic protozoa



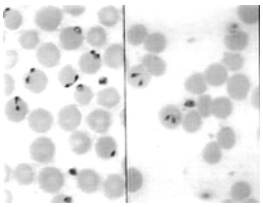
Babesia Distribution



Incidence of bovine babesiosis over one year



Bovine babesia

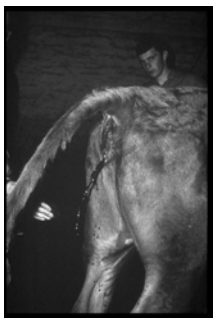


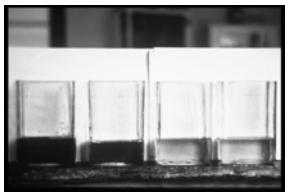
Babesia divergens *Babesia major*

Ixodes ticks

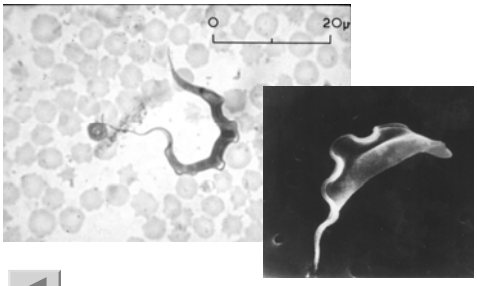
Tick life stages

Redwater





Trypanosoma theileri



Leishmania

Dragging for ticks

First case of canine trypanosomiasis in UK!

- The first recorded case of canine trypanosomiasis in UK was diagnosed at the **R(D)SVS Hospital for Small Animals** on 6th October 2006.
- The dog had been brought to UK from Mozambique
- The dog died two days later.