

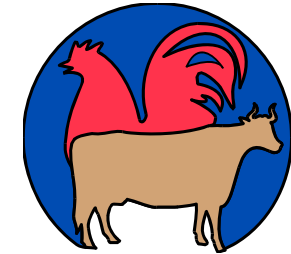
Protozoa 3

BVM&S Parasitology

T.W.Jones



What are the arthropod-borne Protozoa?



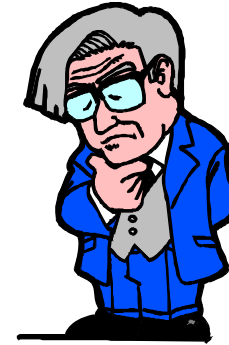
- Parasites of major importance to
 - Humans
 - Malaria, trypanosomiasis, leishmaniasis
 - Animals
 - Trypanosomiasis
 - Theileriosis
 - Babesiosis
 - Malaria (avian)
 - Leishmaniasis

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

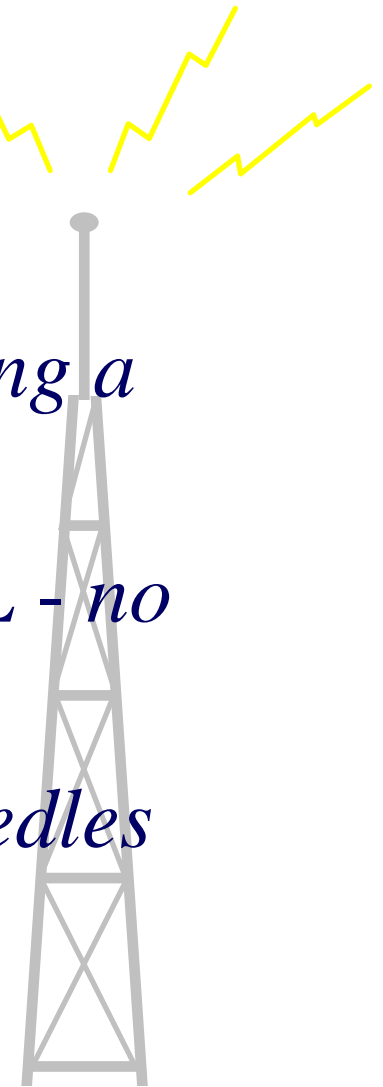
Vector-dependent Parasite Distribution



- The tsetse 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.

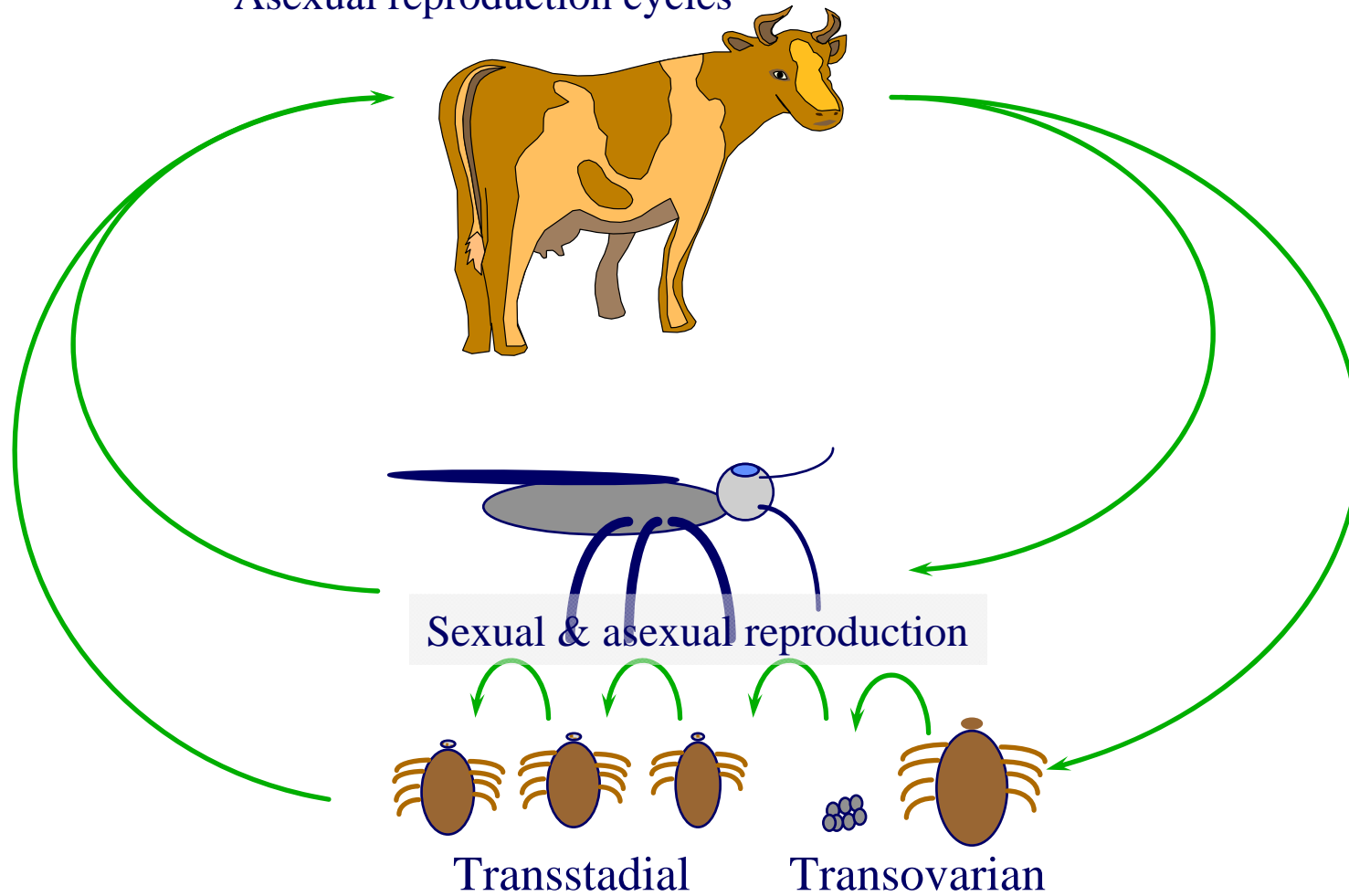
How are ABP transmitted?

- 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

Asexual reproduction cycles



Arthropod borne protozoa

Which ABP are important to vets?



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

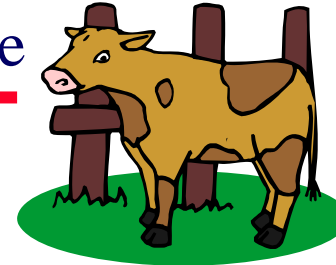
Babesiosis : a world-wide problem



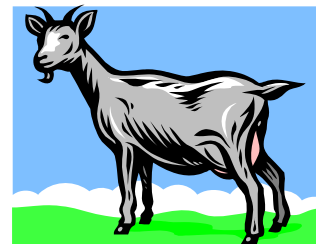
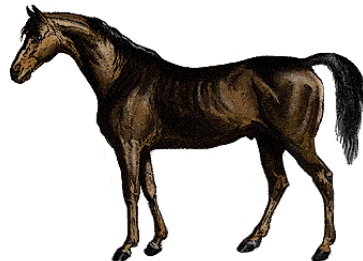
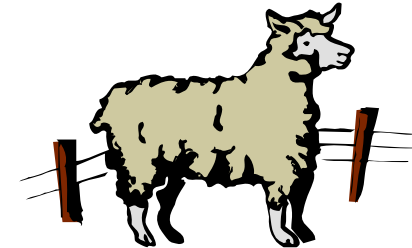
USA



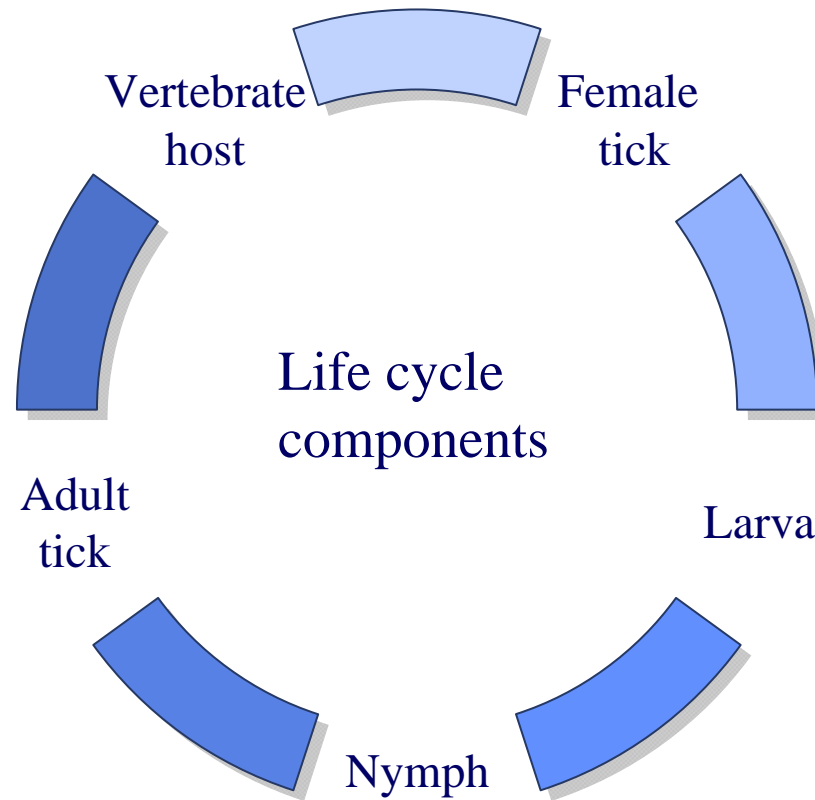
Europe



Babesiosis



Babesia life cycle

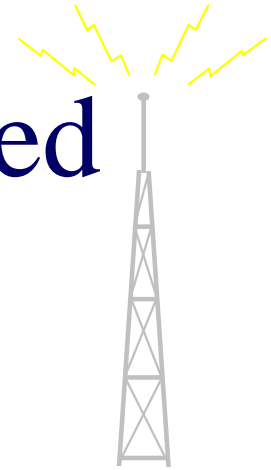


What is the cause of bovine babesiosis in the UK?



Feature	<i>B.divergens</i>	<i>B.major</i>
<i>Size</i>	“Small”	“Large”
<i>Vector</i>	<i>Ixodes ricinus</i>	<i>Haemaphysalis punctata</i>
<i>Distribution</i>	All areas with <i>I.ricinus</i>	S.E.England

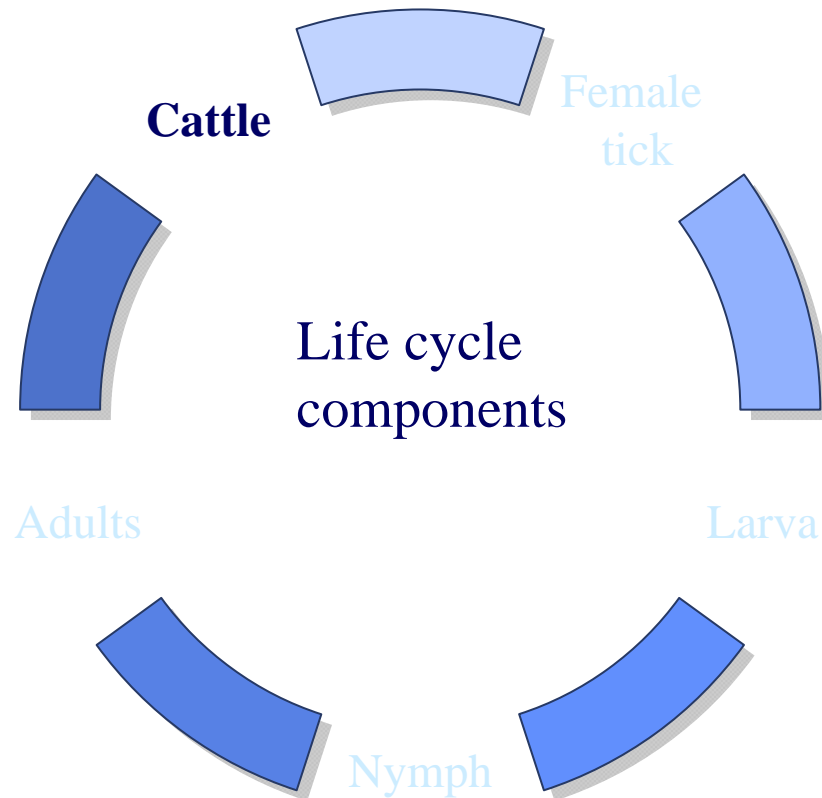
How is *B. divergens* transmitted in UK?



- 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.

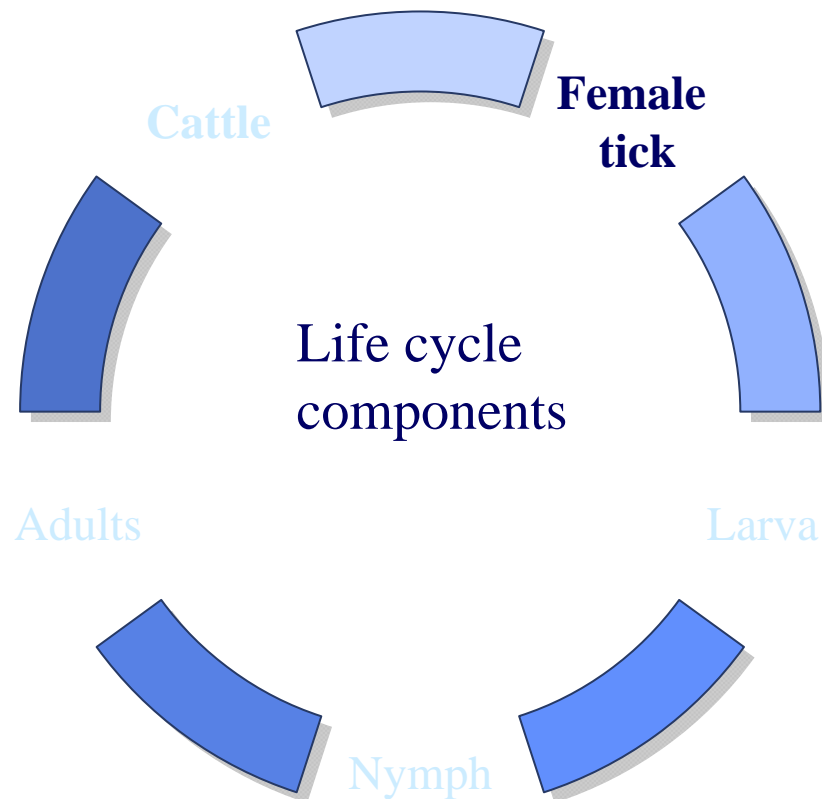


Babesia divergens



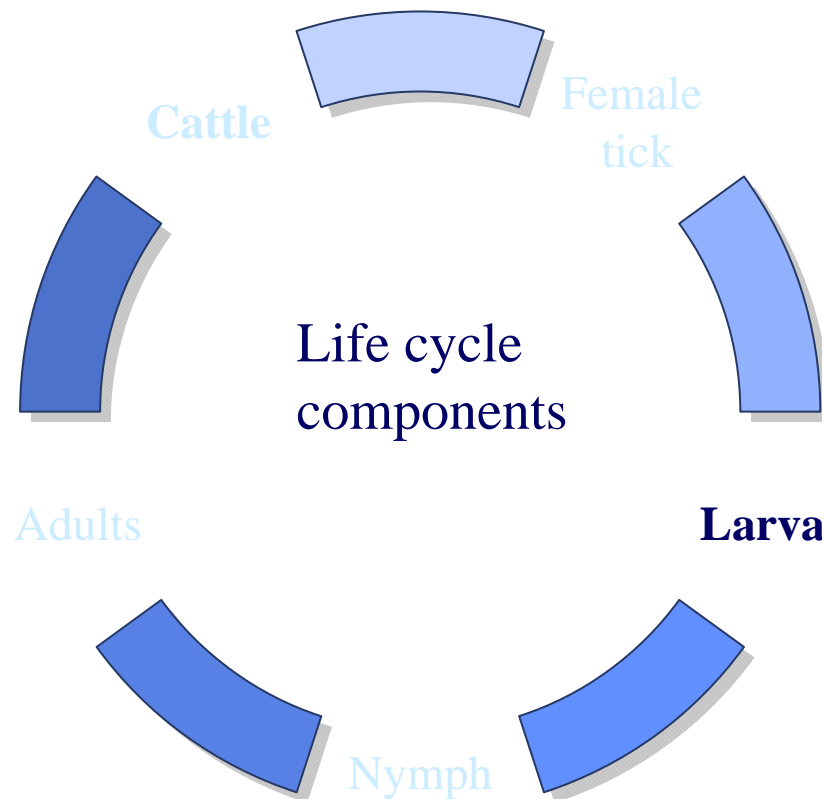
- Asexual reproduction
- Destruction of infected erythrocytes
- Clinical babesiosis

Babesia divergens



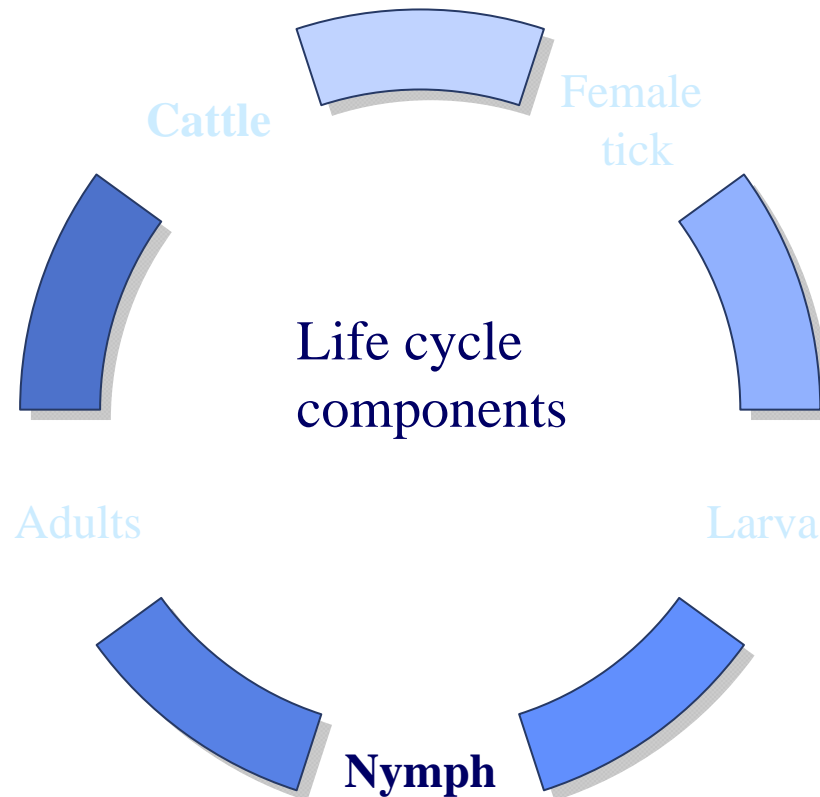
- Ingests infected rbc's
- Sexual reproduction in gut
- Asexual reproduction in gut epithelium
- Invades ovary>egg
- 40% eggs infected

Babesia divergens



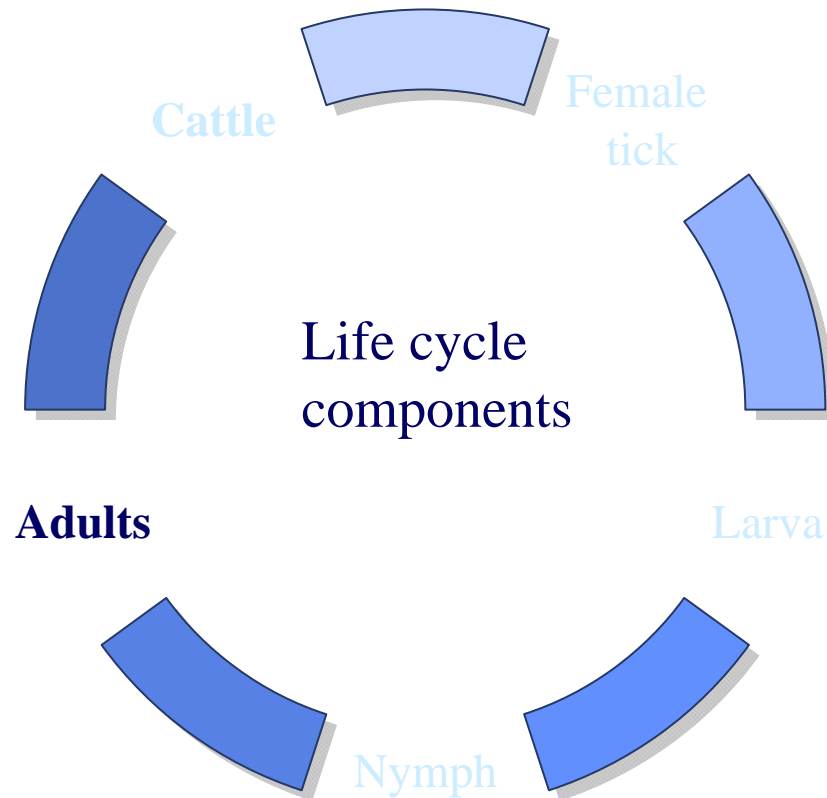
- Emerges from egg already infected
- Asexual reproduction in gut epithelium
- Invades salivary glands
- Injected into vert host during feeding

Babesia divergens



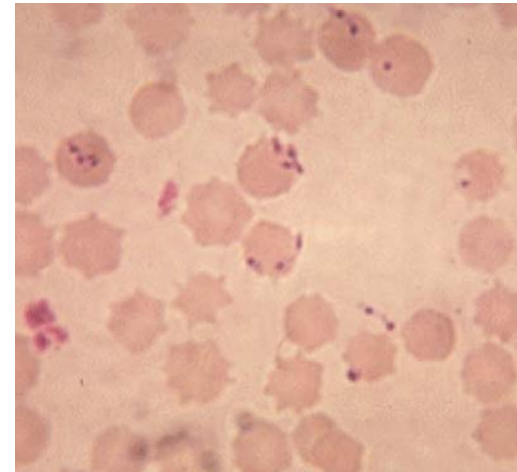
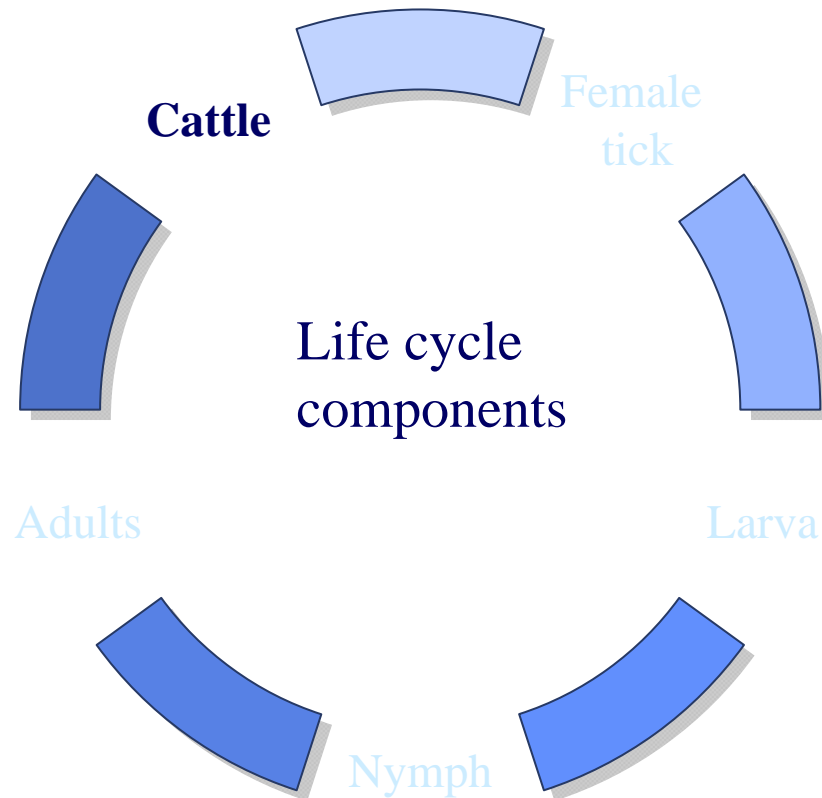
- “Inherits” infection from larva
- Asexual reproduction in gut epithelium
- Invades salivary glands
- Injected into vert host during feeding

Babesia divergens



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

Babesia divergens



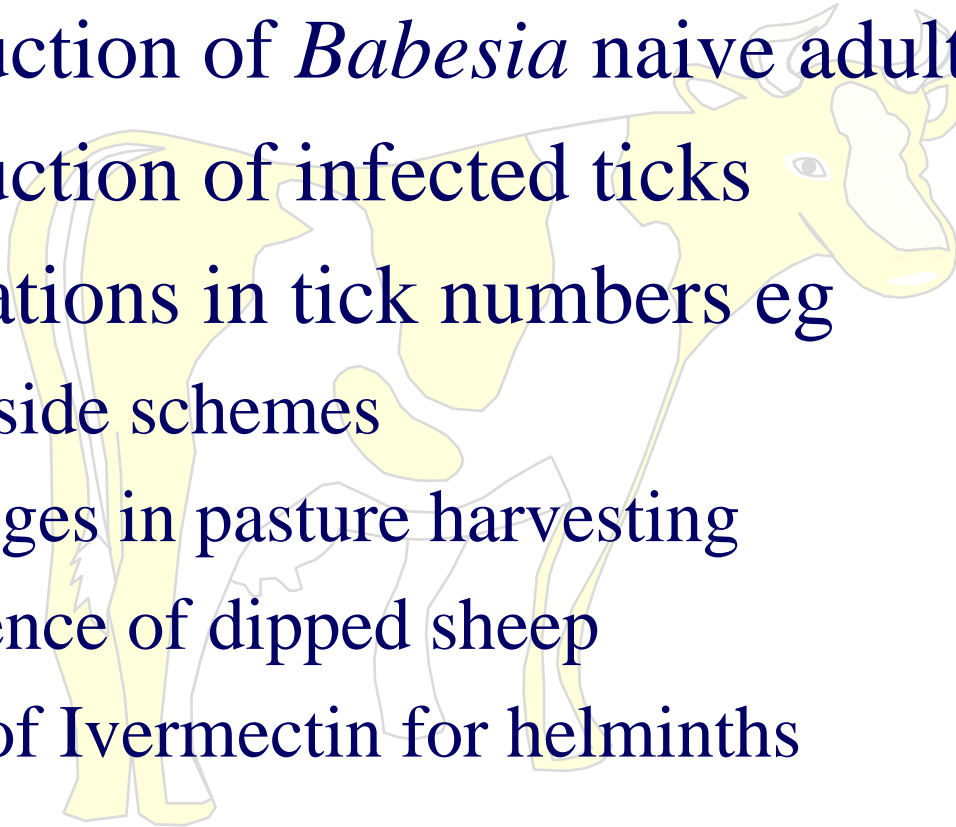
Which factors affect the epidemiology of bovine babesiosis in UK?



- 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?

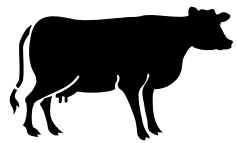


- Ensure adequate exposure of young animals to tick challenge before 6 months of age.
- Treatment of affected animals.
 - Drugs - Imidocarb dipropionate or LA oxytetracycline.
 - Supportive therapy.
- Monitor introduced adults for evidence of infection and treat early to stimulate immunity.
- *Tick reduction 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	<ul style="list-style-type: none"> •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

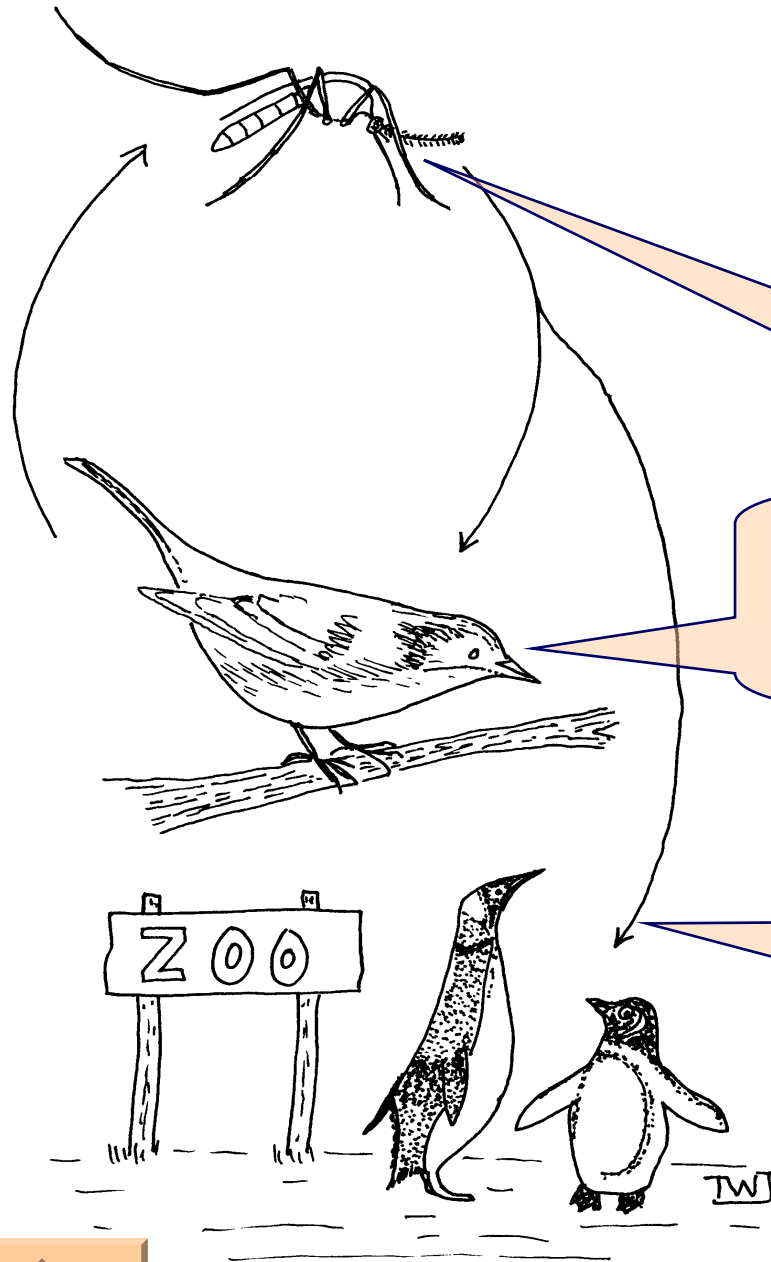


Avian Malaria in UK



- 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.

So how do Penguins get malaria?



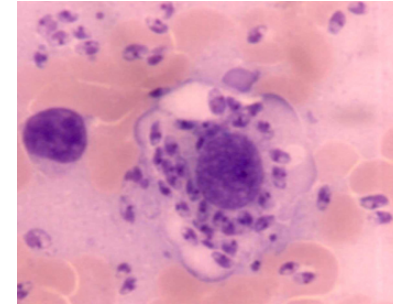
Vectors maintain cycle in wild birds

Wild bird populations infected with avian malaria

Infection spills over into penguins who have no resistance to malaria

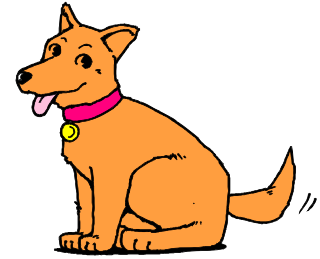


Leishmania



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

Canine leishmaniasis - coming to your practice soon?



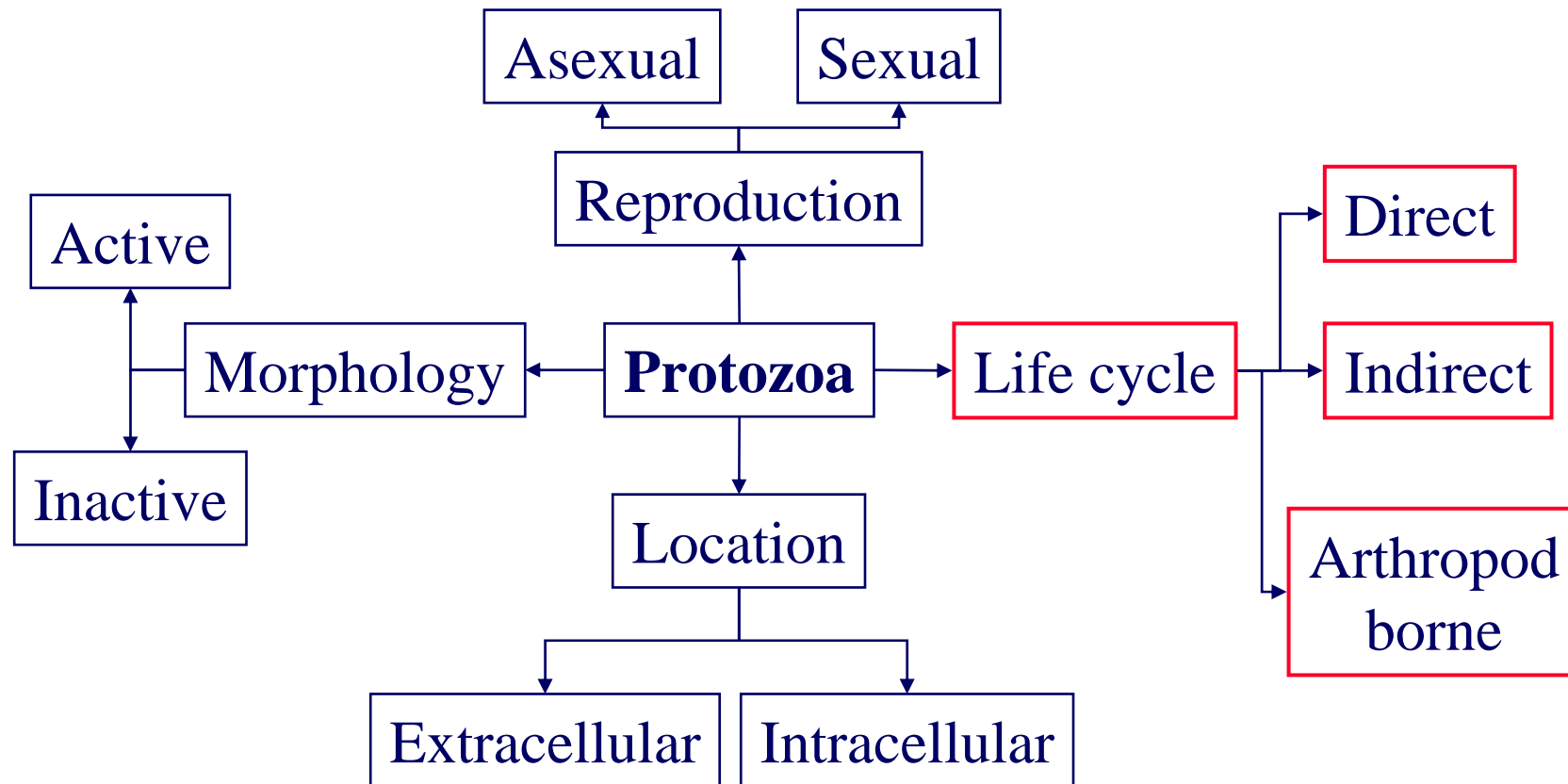
- Endemic in humans and dogs in parts of Africa, Asia, South America and Europe.
- Potential problem in UK dogs imported from endemic areas, especially Southern Europe.
- Will current quarantine regs result in more cases?
- Already a recognised problem in dogs in USA
- Vectors not (**currently**) present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



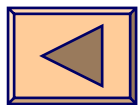
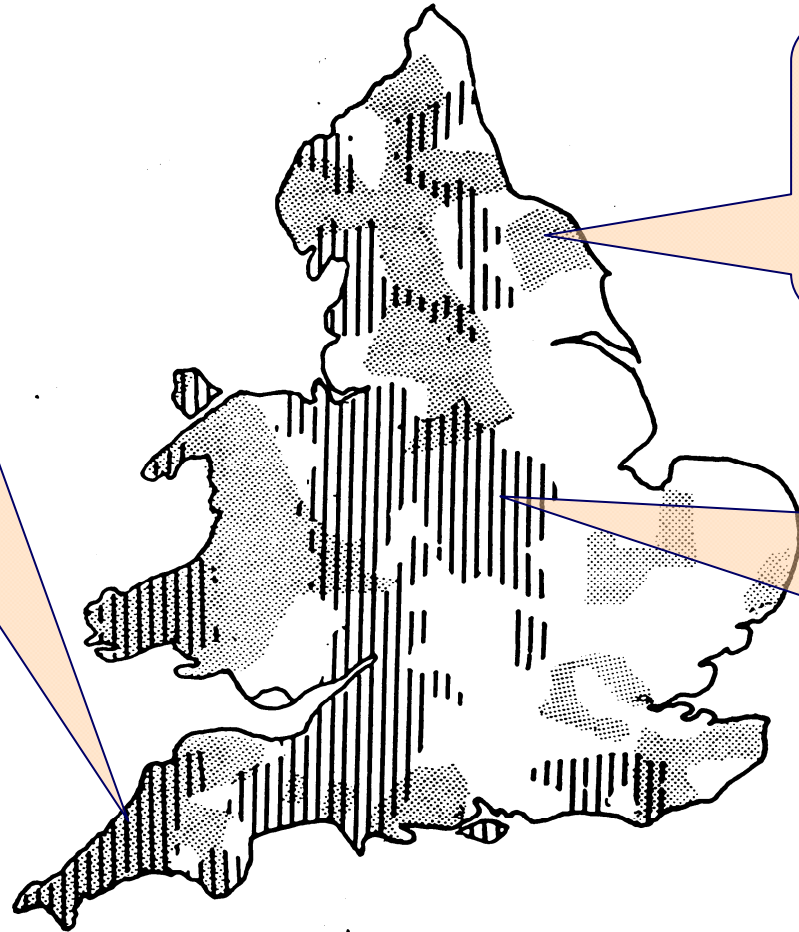


Babesia Distribution

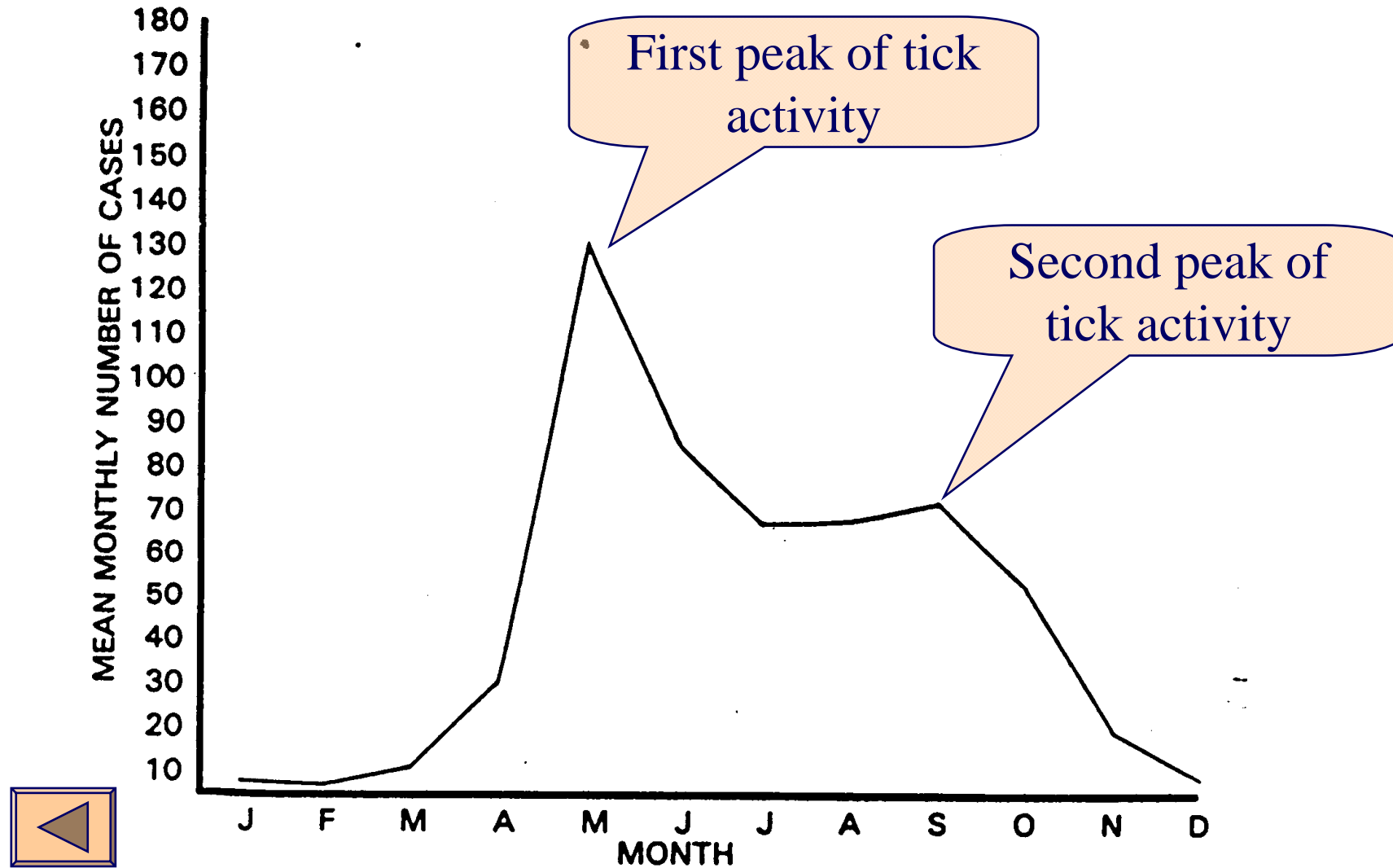
Babesia infections can be expected in areas where both cattle and ticks are present

Shaded areas show limits of tick distribution

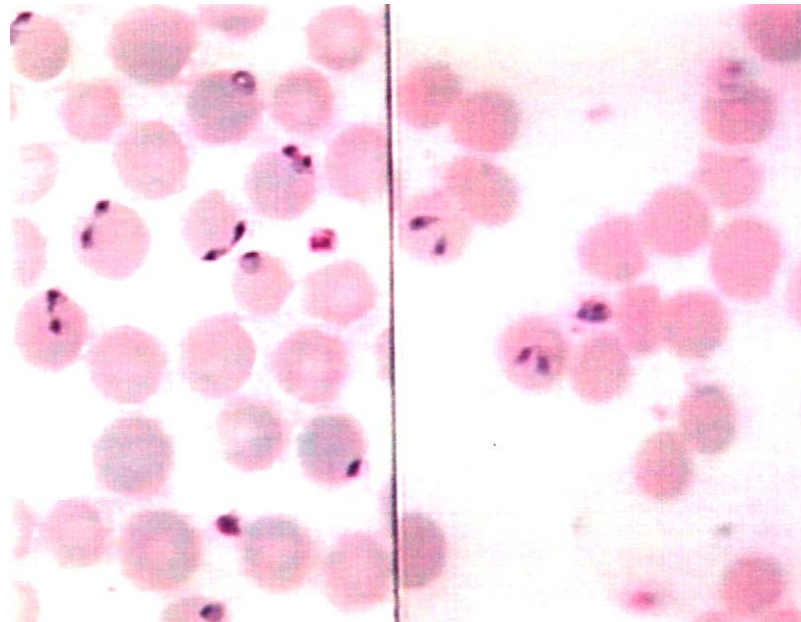
Striped areas show regions with more than 30 head of cattle/100 acres



Incidence of bovine babesiosis over one year



Bovine babesia



Babesia divergens

Babesia major



Ixodes ticks



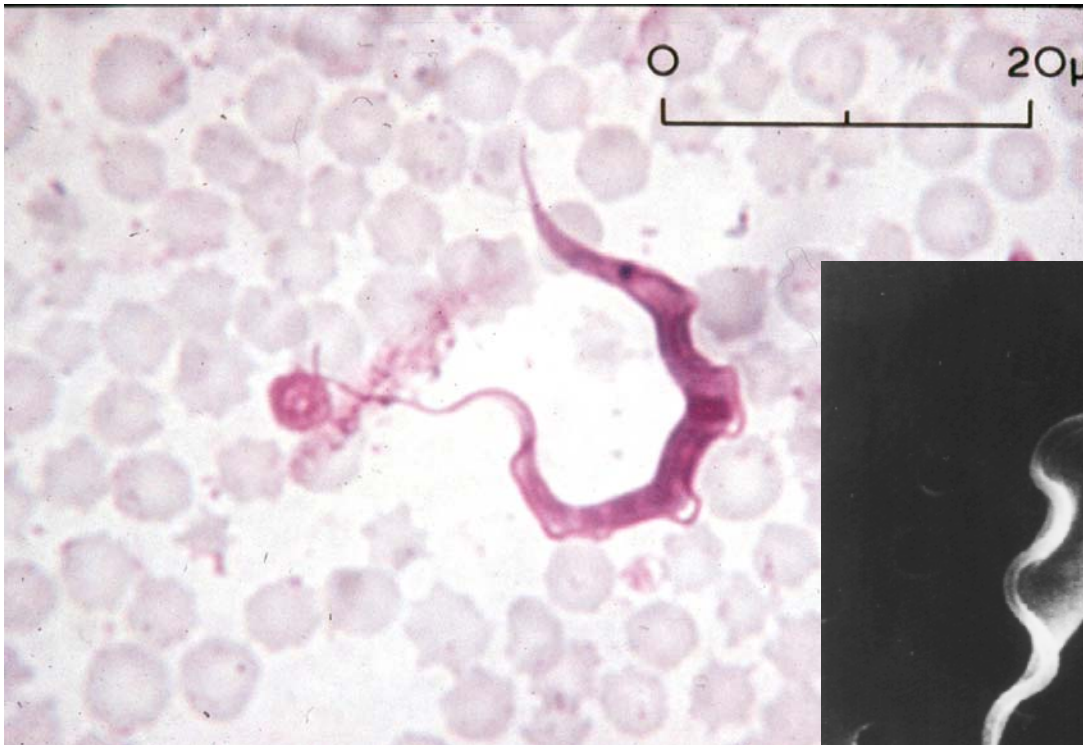
Tick life stages



Redwater



Trypanosoma theileri



Leishmania



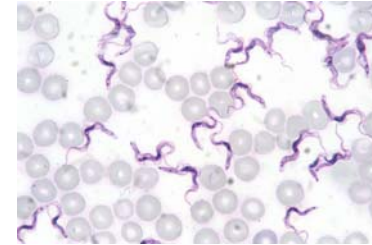
Arthropod borne protozoa

Dragging for ticks



Arthropod borne protozoa

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.

