Tick-borne diseases of extensive cattle and sheep

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Ticks as disease vectors

Phylum: Arthropoda, Class: Arachnida, Order: Parasitiformes

Three families: Argasidae (Soft ticks), Ixodidae (Hard ticks), Nutelliedae (1 sp)

3 genera (Ixodes, Haemaphysalis, Dermacentor) described from UK

- Ticks may feed on multiple hosts during their life cycle
- Ticks secrete salivary fluid on attachment which is proteolytic, immunomodulatory.
- Tick borne pathogens transmitted in salivary fluid during feeding

Diseases transmitted to animals in UK
- Protozoa - babesiosis, theileriosis,
- Bacteria – Tick borne fever, Lyme borreliosis.
- Virus - Louping Ill
Ixodes ricinus (sheep, deer, castor bean tick)

Life cycle

**Egg.** (Ca 2000 per clutch)

- **Larva.** Small and large mammals and birds
  - All feeding stages hatch in late summer/autumn

- **Nymph.** Small, large mammals and birds
  - Host seeking peaks in spring and late summer/autumn
  - Ticks unable to find host in Autumn seek host in following spring

- **Adult.** Large mammals
  - Ca 3 years to complete life cycle (only 20 days feeding on host)

- *I. ricinus* requires rH ca 90% to survive off host.
Babesia sp. infecting cattle in UK

B. divergens (Redwater Fever)
- Intra-erythrocytic protozoan parasite
- *B. divergens* transmitted by *I. ricinus*
- *B. major* transmitted by *Haemaphysalis punctata*.
- Infection picked up by feeding female tick – transovarial transmission to larva via egg then transtadially to nymph and adult
- Infection via sporozoites in the salivary fluid of feeding tick

B. major (non pathogenic ??)
Signs and symptoms of clinical babesiosis

Haemolytic anaemia following *B. divergens* infection

- Increased temperature (>40°C)
- Pipe stem diarrhoea may be followed by constipation
- Hammer pulse (visually evident)
- Respiratory distress
- Haemoglobinuria (port wine red urine due rupture of the rbcs)
- Anaemia
- Abortion in pregnant cows
- Death (although rare in UK cattle)
- Premunity following recovery (carrier state)

**Endemic Stability** = Low level of disease
- Calves below 6 months resistant to disease
- Colostral Ab from carrier dams
- Continued tick challenge
Tick borne fever: *Anaplasma phagocytophilum*

*Anaplasma phagocytophilum* in bovine neutrophil

- Transmitted by *I. ricinus*, in UK.
- Symptoms include high fever >40°C, severe loss in milk production.
- Infects neutrophils, eosinophils and later monocytes.
- Immunosuppressive - may lead to Tick pyaemia, pasteurellosis, septicaemic listeriosis, louping ill.
- Abortion storms in naive animals.
Louping Ill

A Flavivirus,
Limited geographical distribution
Causes acute encephalomyelitis in sheep
Vaccine available for veterinary use
Other domestic animals and wildlife affected
Transmitted by *Ixodes ricinus* ticks

### Louping Ill in the UK (2007)

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep (<em>Ovis aries</em>)</td>
<td>31</td>
</tr>
<tr>
<td>Cattle (<em>Bos taurus</em>)</td>
<td>12</td>
</tr>
<tr>
<td>Red grouse (<em>Lagopus lagopus scoticus</em>)</td>
<td>67</td>
</tr>
<tr>
<td>Hare (<em>Lepus timidus</em>)</td>
<td>17</td>
</tr>
</tbody>
</table>

[Geographical distribution of Louping Ill diagnoses]
Theileriosis of cattle and sheep

Ovine *Theileria sp* in sheep rbc

- Transmitted by *Haemaphysalis punctata* ticks (Coastal habitats in South East and West Wales)

Cattle

Sheep
- *T. ovis* – Lewis & Purnell 1981 (Ogmore, South Wales)
- *T. recondita* – Alani and Herbert 1988 (Lleyn peninsular, North Wales)
  - Low pathogenicity

However……….
Ovine theileriosis UK

Phipps et al. (2016) Detection of *Theileria luwenshuni* in sheep from Great Britain. Parasites & Vectors 9:203

- April **2005** mortality associated with heavy infestations of *H. punctata*.
- 60 ewes and their lambs grazing north Kent marshland **25 deaths**.
- PM revealed: Oedema of lips, tongue, lungs, froth in trachea. Spleen enlarged, kidneys pale, anaemia.
- Anaplasmod inclusions in Giemsa stained blood smears
- **No disease reported since 2012**

2012
- 21 blood samples collected from sheep grazing same pastures
- 16/21 positive by pan-piroplasm PCR, sequencing revealed *T. luwenshuni*.
- Same parasite reported as pathogenic in China and transmitted by *Haemaphysalis* sp. (Yin et al 2007)

- Is this *T. ovis/T recondita* previously reported in the 1980s?
**Bovine theileriosis UK**

- **Brugman et al (2015) Parasites and Vectors, 8(421), 1-8**
  Molecular species detection, host preferences and detection of Myxoma virus in the *Anopheles maculopennis* complex in Southern England.

- Xenodiagnosis of viral disease in mosquitoes collected from Elmleigh Marshes, Isle of Sheppey.

- Blood meal analysis showed that *A. atroparvus* and *C. annulata* (mosquitoes) both fed on cattle

- *Theileria orientalis* detected by pan-piroplasm PCR and sequencing – a strain of the organism currently causing well publicised disease outbreaks in NZ and Australia

- Is this the *T. mutans* described by Brockelsby et al in 1972?
Thank you for your attention!

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