New challenges for the control of helminth parasites of Scottish livestock in the face of climate change

P.J.Skuce[1], N.D.Sargison[2], F.Kenyon[1], F.Jackson[1] and G.B.Mitchell[3]

[1]Parasitology Division, Moredun Research Institute
[2]Royal (Dick) School of Veterinary Studies
[3]Scottish Agricultural Colleges Veterinary Services
Scotland, UK

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Moredun Research Institute

- Animal disease research organisation, funded by Scottish Government

- Conduct commissioned research on viral, bacterial & parasitic diseases of livestock

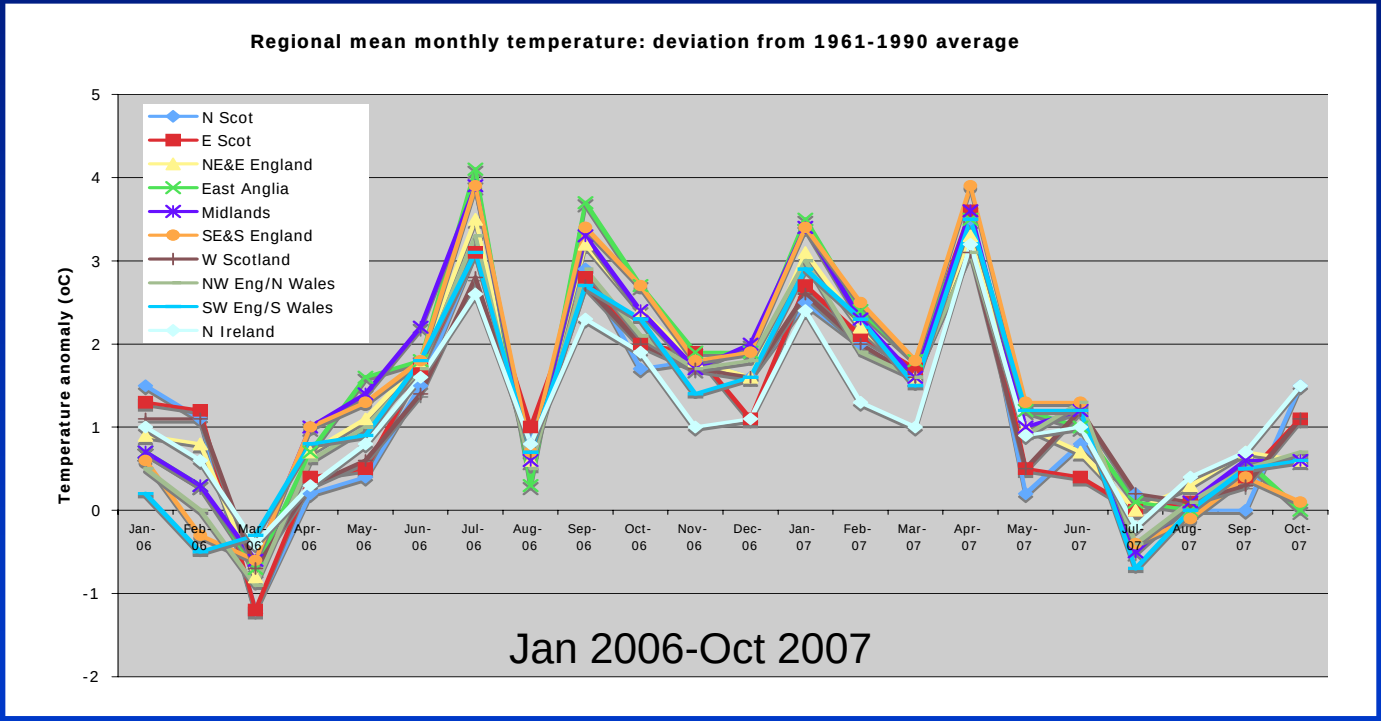
- Climate Change? – impact on disease transmission, epidemiology etc…

  - vector-borne diseases e.g. Bluetongue (midge) & Louping Ill, Babesiosis (tick)

  - parasitic helminths (worms)?

Evidence of Climate Change?

- In Scotland, recent weather consistently 1-4^{o}C warmer than monthly average for previous 30 years – rainfall variable with some extreme events



D Wilson, NADIS
Data provided by UK Met Office

- Predicted weather pattern is for milder/wetter winters and warmer/drier summers

Consequences for parasitic disease?

- Little/no data or active surveillance

- Combination of clinical observations & submissions to VI Centres over past ~5-10 years

- Climate = Microclimate inhabited by free-living stages of these parasites and/or their intermediate hosts

- Result ? - extended parasite seasons – earlier infection from overwintering larvae and prolonged grazing seasons

Sheep/cattle liver fluke, *Fasciola hepatica*

- Parasite lives in liver and/or bile ducts of sheep & cattle

- Disease costs the agricultural industry ~$3bn per year worldwide

- Losses due to poor performance (often death) & livers trimmed or condemned at slaughter

- Incidence up 12-fold in EU member states in past 10 years

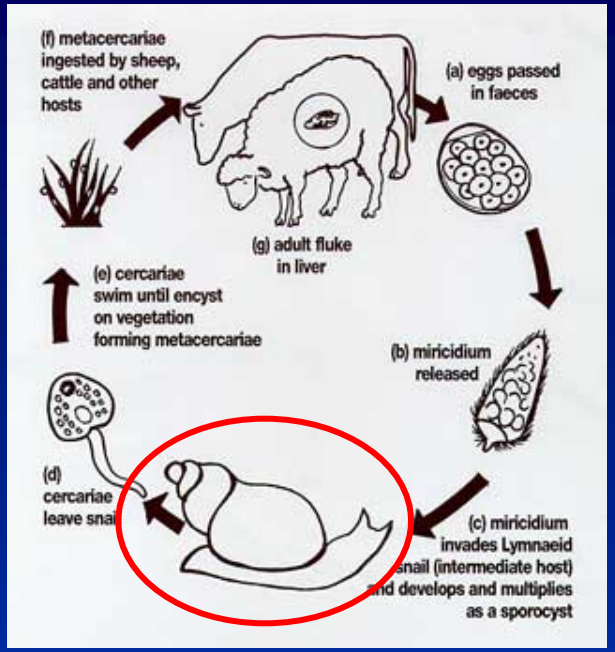
Fasciola hepatica

- complicated 2-host life-cycle

➢ Intermediate host snail :

- warmer/wetter conditions favour snail survival & multiplication – direct effects on snail numbers

- huge amplification of fluke numbers (~ x 600) developing within snail – indirect & disproportionately large effect



Direct effects on the parasite?

- Miracidia within fluke egg only develop when ambient temperature >10^{o}C

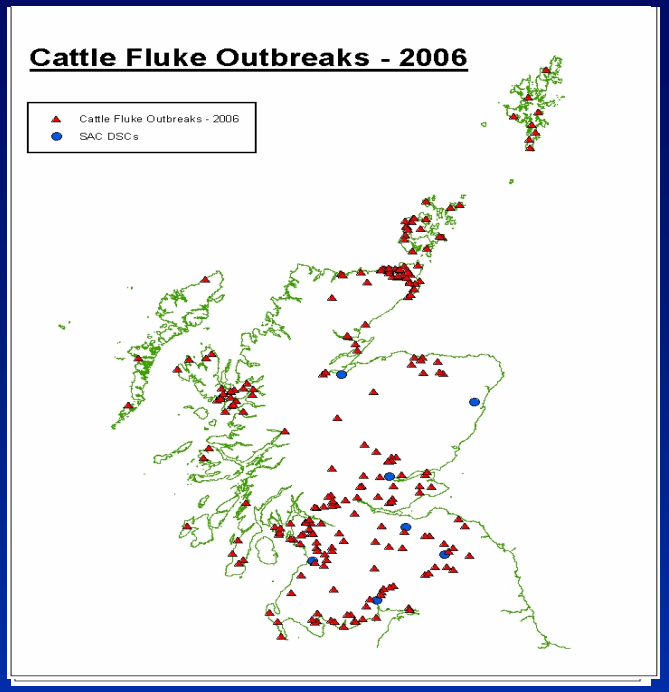
- Normally hatch ~6 weeks after eggs shed when temperature >15^{o}C

- Can hatch within 10 days if temperature >22^{o}C

↑ Temperature = accelerated parasite development

- Historically a disease of wetter/milder west of Scotland & Ireland – now common in E. & N.E. of Scotland

- Increase in prevalence – 5% to 13% in cattle, 2% to 9% in sheep in last 5 years



SAC VETERINARY SERVICES

Acute fasciolosis diagnosed in young Scottish calves

- Acute fasciolosis in eight- and 14-week-old calves
- Pasteurellosis in suckled calves at grass reported by most centres
- Fewer than average outbreaks of nematodirosis in lambs
- Caseous lymphadenitis spreads to flocks in north of Scotland
- Coccidiosis in pheasant chicks precipitated by wet weather
- *Tritrichomonas foetus* detected in diarrhoeic samples from domestic cats in a rescue cattery

– These are among matters discussed in the disease surveillance report for June from Scottish Agricultural College Veterinary Services (SAC VS)

ALTHOUGH Scotland did not experience the flooding seen in parts of England during June, the month was dull and wet over much of the country. The exceptions were

old cow from Argyll that was anaemic, became recumbent and subsequently died. An on-farm postmortem examination revealed a jaundiced, anaemic

where machinery could not travel and grass was plentiful. These areas would be particularly suited to snail activity, with high levels of challenge by metacercariae. The owners of both farms were considering methods to fence off the worst affected areas of fields. SAC VS notes that grazing recently cleared silage fields is a common practice, particularly in suckler herds, and the risks highlighted by these cases need to brought to the attention of farmers.

Alimentary tract disorders

An Aberdeen Angus bullock from Aberdeenshire was euthanased after a clinical history of depression, a crusting

SAC VETERINARY SERVICES

Increase in chronic fasciolosis in sheep in Scotland

- Twenty-one outbreaks of chronic fasciolosis diagnosed in sheep compared with only three outbreaks in December 2006. Only one outbreak of acute fasciolosis recorded
- Seasonal increase in outbreaks of bovine respiratory disease
- Evidence of an upward trend in the diagnosis of louping ill in Scottish sheep flocks over the past 15 years
- Eight per cent of twin-bearing ewes in an early lambing flock abort and die in an outbreak of salmonellosis due to *Salmonella* Derby infection
- Pneumonic aspergillosis diagnosed as cause of death of six Bewick's swans (*Cygnus columbianus*) in East Lothian
- Acute fasciolosis diagnosed in an 18-month-old alpaca

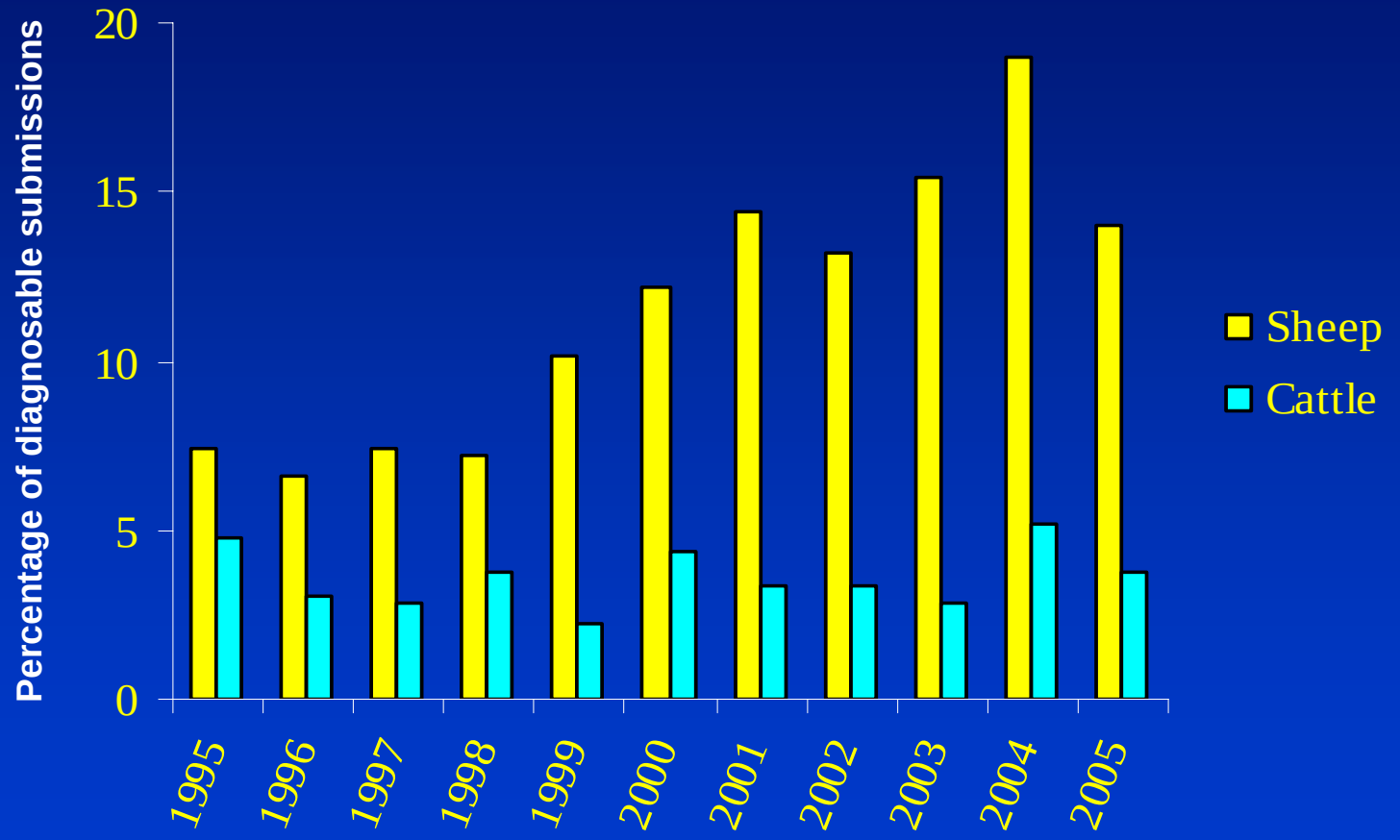
– These are among matters discussed in the disease surveillance report for December 2007 from Scottish Agricultural College Veterinary Services (SAC VS)

A four-year-old high-yielding Holstein cow from a Wigtownshire farm collapsed in the parlour one month after calving. It appeared to be in severe abdominal pain and died within one hour. The post-mortem findings were unremarkable. Histopathology revealed acute necrosis and degeneration of the renal proximal convoluted tubules and severe focal symmetrical encephalomalacia. These findings were consistent with a diagnosis of clostridial enterotoxaemia due to *Clostridium perfringens* type D.

Respiratory tract conditions

Nationally, 76 outbreaks of respiratory disease were investigated in December. At Aberdeen, bovine respiratory disease

Cases of parasitic gastroenteritis in Scotland

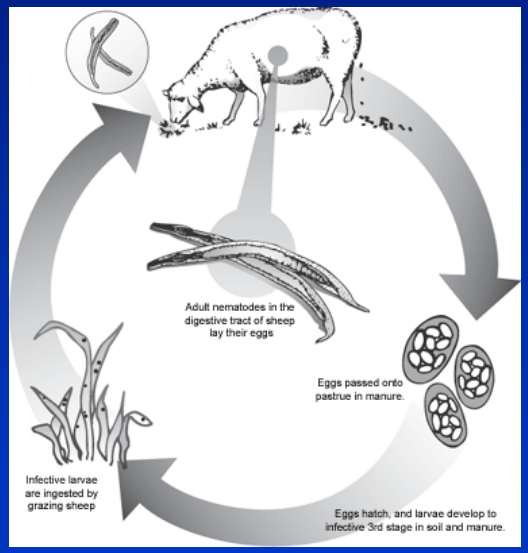


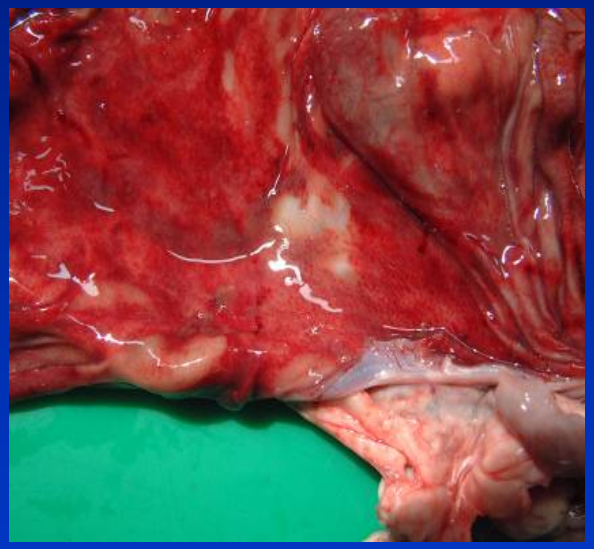
Source SAC VIS

Haemonchus contortus

- Most important nematode parasite of sheep worldwide

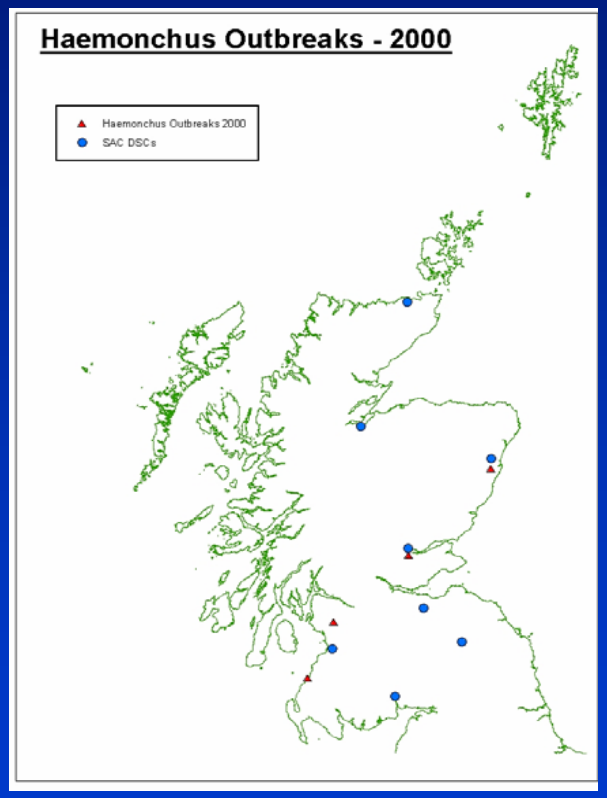
- Simple, direct life-cycle – highly fecund

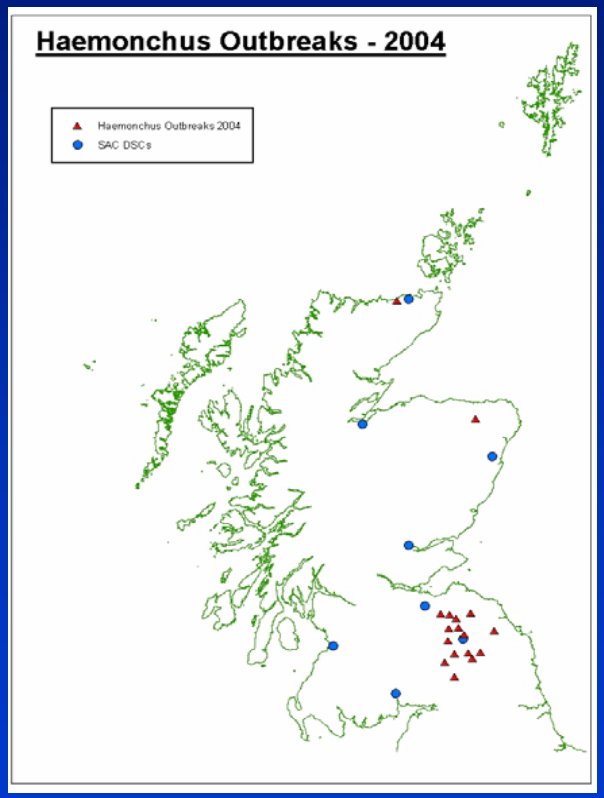


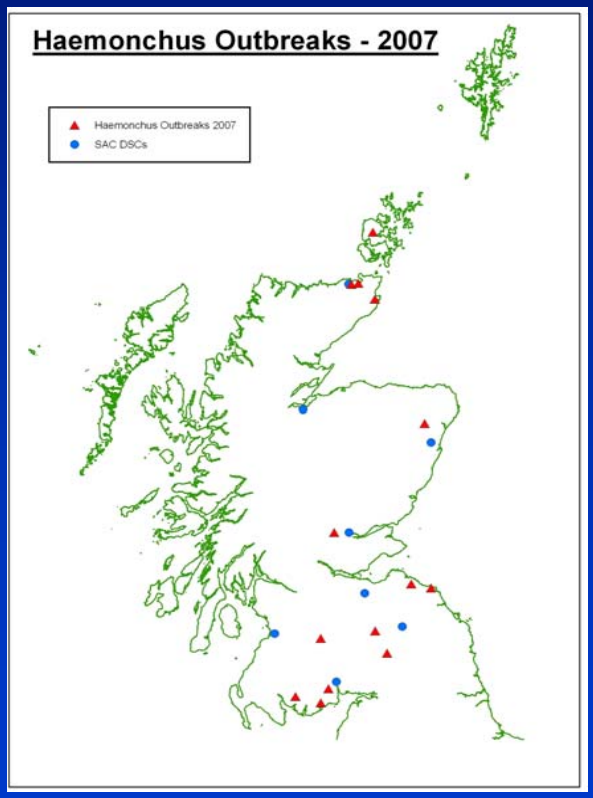


- Adults live in abomasum of sheep - highly pathogenic, voracious blood-feeder

- Traditionally found in warmer, tropical climates e.g. Australia, South Africa, S.America – rare in Scotland

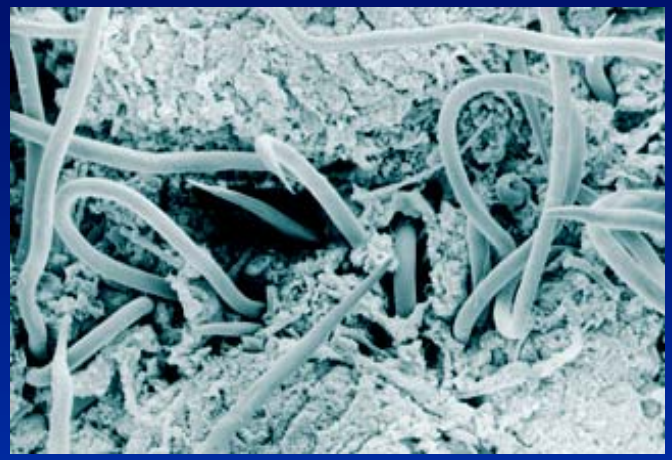






Teladorsagia (Brown stomach worm)

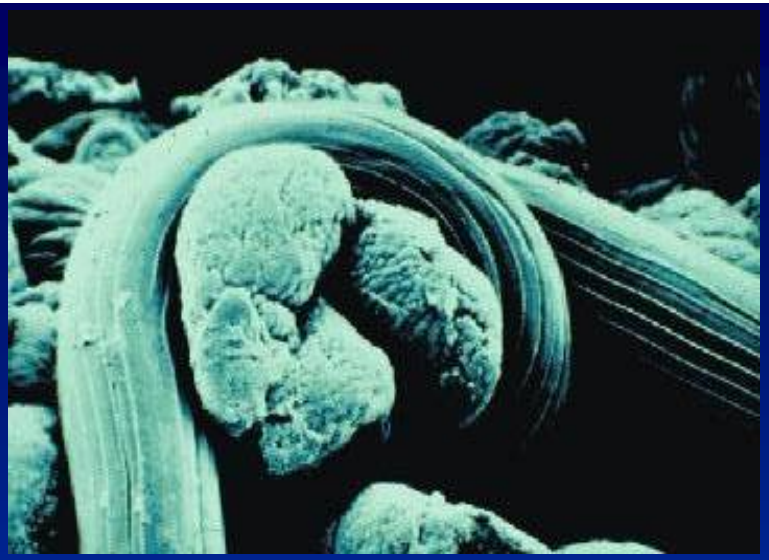
- Most important nematode parasite of sheep in UK



- Change in seasonality - heavy infestations now routinely diagnosed in young lambs in spring in S.E. Scotland

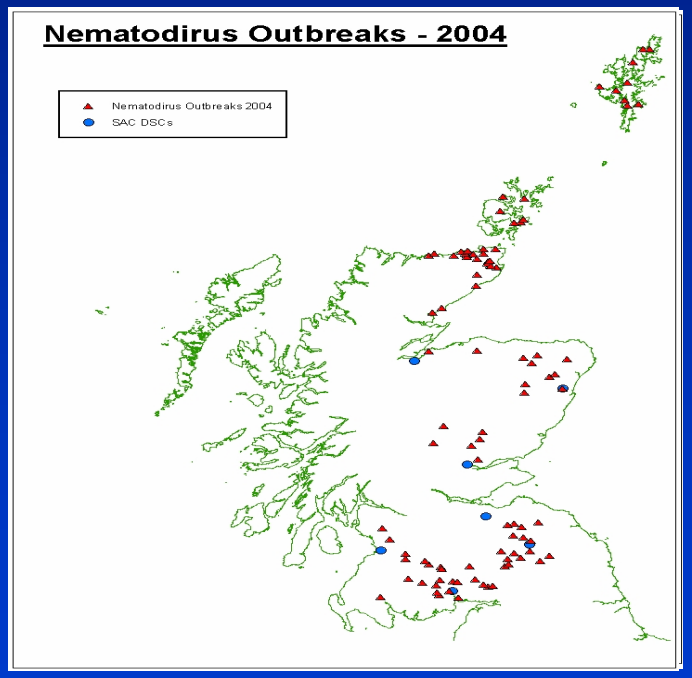
- Historically considered extremely rare & due to poor over-winter survival of infective larvae on pasture

Nematodirus battus



- Intestinal parasite of sheep
- Seasonal pattern of infection has changed :

  – traditionally a parasite of young lambs in early summer, *Nematodirus* now commonly seen in older lambs into autumn & winter



- Geographical spread has changed :

  - Arctic parasite traditionally needed period of chilling for its eggs to hatch – evidence for isolates that no longer need cold exposure – parasite evolution?

Changes all due to Climate Change ? – confounding factors

- Anthelmintic resistance – now widespread :

>80% have BZ-R & numerous cases of MDR

- exacerbated by extended parasite seasons & higher treatment frequency

- Animal movements – potential to introduce diseases endemic in other areas e.g. *Haemonchus* introduced to Scotland from S.E. of England – quarantine drenching?

- Farm management practices – changes in EU subsidy support have generally resulted in larger flock/herd sizes, reduced manpower on farms, inadequate handling facilities – parasite control suffers

- Parasite evolution – helminths typically have enormous biotic potential & are inherently genetically diverse. Can adapt very quickly to exploit new opportunities presented by e.g. climate change

Current & future work

- Need improved surveillance – baseline monitoring
- Survey of GI nematode species prevalence, management practices and AR status in UK

  - may help unravel some of the key factors ?

- Continue research towards :

- improved diagnosis & management of anthelmintic resistance

- vaccination against *Haemonchus*, *Teladorsagia* & *Fasciola*

Acknowledgements

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