Animal & Plant Health Agency

SRUC

Great Britain small ruminant quarterly disease surveillance and emerging threats report

Volume 24: Quarter 2 – April to June 2021

Highlights

- **Tick-associated disease page 11**
- **Thin Ewe Project - page 29**

Contents

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Introduction and overview

This quarterly report reviews disease trends and disease threats for the quarter 2 of 2021 (April to June). It contains analyses carried out on disease data gathered for Great Britain (GB) from the Animal and Plant Health Agency (APHA), Veterinary Services divisionof Scotland's Rural College (SRUC) and partner post-mortem providers and intelligence gathered through the Small Ruminant Species Expert networks.

In addition, links to other sources of information including reports from other parts of the APHA and Defra agencies are included.

A full explanation of how data is analysed is provided in the annexe available on GOV.UK.

Issues and trends

Postmortem examination providers of APHA's Scanning Surveillance Network in England and Wales

The APHA Surveillance Intelligence Unit (SIU) and Surveillance and Laboratory Services Department (SLSD) work with a network of postmortem examination (PME) providers including Royal Veterinary College, Universities of Surrey, Bristol, Cambridge, Nottingham and Liverpool, the Wales Veterinary Science Centre, and SRUC Veterinary Services St. Boswells together with the six APHA Veterinary Investigation Centres.

Key points about accessing PME in APHA's scanning surveillance network:

- each PME provider has an assigned area as shown in colour on the map on vet gateway
- within each assigned area, the hatched area shows where premises are eligible for free carcase collection delivery of animals to the PME site
- premises within non-hatched areas need to arrange to deliver animals themselves
- the postcode search tool on the vet gateway identifies and provides contact details for the allocated PME provider and indicates if the premises is eligible for free carcase collection. This is based on the postcode of the premises from where an animal is to be submitted rather than a veterinary practice
- to arrange a PME, the vet calls the relevant PME provider to speak to the duty vet

More information about APHA's scanning surveillance and diagnostic services is available on Vet Gateway.

Weather

During the period April to June the main cause for concern was having sufficient grazing for early lamb growth and in terms of parasite burdens in lambs, the risk of Nematodirus battus and coccidiosis.

April began settled, but soon turned very cold, with some significant air frosts.
Many areas were very dry, with only parts of Wiltshire and northern Scotland exceeding 50% of average rainfall, making it the UK's fourth driest April in a series from 1862.

May was very unsettled and unseasonably cold, with frosts in many places and continued with frequent rain in most areas making it provisionally the UK's fourth wettest May in a series from 1862, with 171% of average (see figure 1).

The provisional UK mean temperature was 9.1 °C, which is 1.3 °C below the 1981 to 2010 long-term average, making it the coldest May since 1996 (see figure 2). Sunshine was below average for most areas which suppressed grass growth.

June was largely dry and warm, areas from Wales and north of the Midlands experienced less than a third of the usual rainfall in some areas, but south-east England was very wet with more than double the average rainfall for some locations.

Negative impacts from dry weather and cold nights, on grass growth and forage availability, for livestock farmers have been common. In July APHA re-issued the information note Hot weather and potential risks to livestock health and welfare on Vetgateway.

A recent study by the University of Exeter entitled Managing extreme weather and climate change in UK agriculture: Impacts, attitudes and action among farmers and stakeholders.

(Wheeler and Lobley 2021), concluded that the main concerns for farmers included the impact of heat and drought on crop and grass growth, with knock-on impacts for yield and winter animal feed, and the implications of heavy rainfall and or flooding for soil run-off and erosion and for field operations such as drilling and harvesting.

However, some farmers felt there are more urgent issues to consider and/or that there is too much uncertainty around climate change to plan for it now.

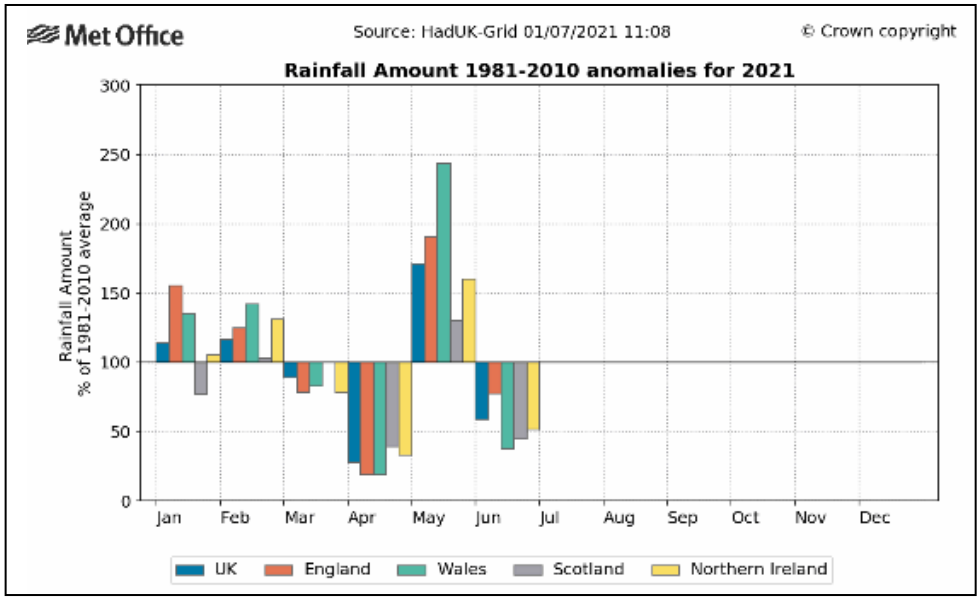

Figure 1: rainfall amount 1981 to 2010 anomalies for 2021

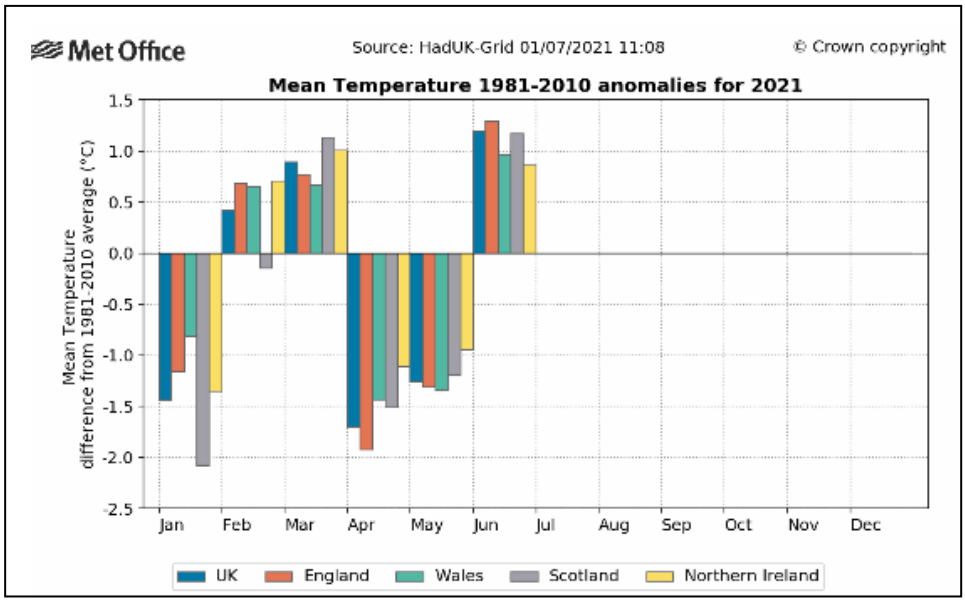

Figure 2: mean temperature 1981 to 2010 anomalies for 2021

Industry

During the second quarter of the year, lamb farm gate prices were significantly elevated above any price previously recorded. However, prices did follow a downwards pattern through the quarter, reflecting the usual seasonal change in the supply and demand balance.

Easter and peak demand being over, and the availability of lambs for slaughter increasing. Retail sales of lambs have continued to be under pressure and recorded a 6% decline in volume year-on-year during the 12 weeks ending 11 July. Meanwhile, lamb takeaways have continued to be popular.

Domestic production during the quarter was down 7%, at 60,300 tonnes. Fewer lambs and ewes coming forwards for slaughter drove this trend. The kill is expected to remain down year on year through the rest of 2021. The kill is expected to pick up again, at least in the short term, during the first half of 2022.

UK sheep meat imports recorded a 23% decline this year, to 13,300 tonnes shipped weight. Higher shipping costs are likely to have reduced the attractiveness of the UK market despite the high prices. The export market has continued to be challenging in the post-Brexit environment, with volumes this quarter recording a 26% decline to 14,700 tonnes.

Author: Rebecca Wright from Agriculture and Horticulture Development Board (AHDB)

New and re-emerging diseases and threats

Unusual diagnoses

Unusual plant poisoning case – Dog’s Mercury

An interesting plant poisoning case involved the submission of two adult pedigree Dartmoor ewe carcases for postmortem examination (PME). These were the third and fourth ewes from a group of 13, with lambs at foot, to die, with no premonitory clinical signs noted before death.

Gross findings in one ewe were indicative of acute haemolytic crisis with jaundiced subcutaneous tissue, a bronze coloured liver, dark brown kidneys, and dark red urine. Severe autolysis hindered examination of the other ewe.

Copper toxicity was suspected but ruled out on liver and kidney biochemistry. Liver histopathology confirmed diffuse, acute, centrilobular hepatic necrosis and tentative tubular injury in the kidney suggestive of either hypoxia or acute toxicity.

Inspection of the grazing by the submitting private vet found dog's mercury (*Mercurialis perennis*); and leaf fragments found in the rumen contents of both ewes had a stomatal pattern similar to *M. perennis.* Dog's mercury toxicity can present with similar pathology to that described above and although not definitively confirmed, was deemed the most likely differential in this case.

Generally, *M. perennis* is unpalatable, however it may be ingested by ruminants either when grass is scarce, or when grass is lush as a source of dry matter. All parts of the plant are toxic and contain a number of toxins at different growth stages.

These include saponins, which can cause haemolytic anaemia and mercurialine which can lead to gastrointestinal and kidney inflammation.

As these ewes were grazing rough pasture the ingestion of bracken could also not be ruled out and may have been a contributory factor in these deaths. The remaining group were removed from the field and no further deaths occurred. The lambs remained unaffected.

Similar dog's mercury cases have been described in the literature (Baker 1968) (Welchman and others 1995).

Oesophagitis secondary to consumption of soya bean oil

Six out of 140 mid-gestation housed ewes died over a weekend. The diet had recently changed from oat silage to fodder beet and molasses. Fifty litres of soya bean oil had been added to the molasses lick feeder a week earlier, with 10 litres consumed over three days.

The two submitted ewes were in fair body condition, had green fluid staining around the mouths and sunken eyes. The rumens contained green fibre herbage with a pH of 7.0 and 7.2.

One ewe had ulceration of the distal oesophagus and brown fluid in the abomasum. Histopathology of the oesophagus identified complete loss of the mucosa with necrosis and fibrinosuppurative exudates, thought to be secondary to the dietary disturbance due to the consumption of an excessive amount of soya bean oil.

Spinal cord cyst in a neonatal lamb

A neonatal lamb was submitted having shown weakness of the hind legs shortly after birth. It was one of twins and its sibling was unaffected. On gross PME it was noted that the lumbar spine was flexed to the left and rotated approximately 90^{o} ventrally.

Other PME findings included an enlarged liver and a markedly distended bladder, although urine could be expressed using manual pressure. One kidney had a dilated pelvis.

The terminal lumbar spinal cord was misshapen and enlarged with a ‘stellate’ terminal portion. Testing for Schmallenberg virus by PCR was negative.

Histopathology identified a cystic mass adjacent to the lumbar spinal cord (see figure 3). The mass was likely to have developed in utero and may have been a remnant of ectoderm following closure of the neural tube or possibly a benign tissue growth.

The mass had caused focal myelodysplasia of the spinal cord and would have accounted for the scoliosis of the lumbar spine seen grossly.

The associated spinal cord compression had resulted in neurogenic paralysis and urine retention. In addition, histopathology also identified a superimposed diffuse suppurative meningoencephalitis, probably due to a bacterial infection acquired postnatally and was considered secondary to the other changes.

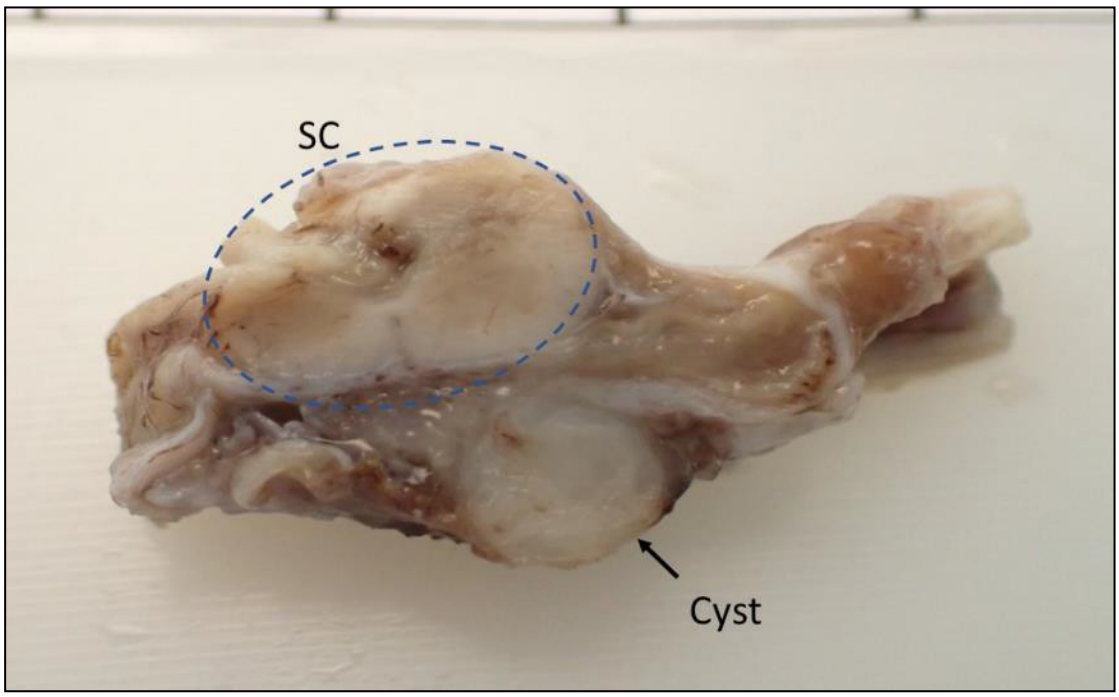

Figure 3: Cross section of spinal cord at L3, showing the extradural cyst ventral to the cord and destruction of the dorsal part of the overlying spinal cord.

Wobbler syndrome in a shearling ram

Following an on-farm PME of a shearling Charolais ram, which had displayed hind limb weakness over approximately 12 months, spinal cord was submitted for examination.

The clinical signs had worsened when the ram was handled, and proprioceptive defects were reported in the right hind leg. Histopathology revealed moderate, multifocal Wallerian type degeneration in the ventral and lateral funiculi.

Small multifocal haemorrhages were visible in the grey matter. These changes suggested a focal compressive lesion.

Due to the age and sex of the affected animal, and type of focal compression detected, it was likely that lesion was secondary to cervical instability and wobbler syndrome. A useful review on Compressive Cervical Myelopathy in Young Texel and Beltex Sheep (Penny and others 2007).

Kangaroo gait in ewes

APHA Carmarthen VIC diagnosed Kangaroo gait in a group of 15 Hill Radnor ewes. Four ewes developed forelimb paresis post-lambing. A video of the typically affected ewes was submitted by e-mail and the signs were consistent with Kangaroo gait (Clements and others 2002). The clinical signs are associated with radial nerve neuropathy, but the aetiology of the condition is unknown.

The condition primarily affects lactating ewes, often several weeks after lambing.

Ewes are generally only affected once in their lifetime and sporadic cases may be seen on an annual basis in some flocks. There are no flock health implications and spontaneous recovery is usually seen after natural weaning of the lambs (Pritchard and others 2006).

Forced weaning may prolong recovery due to the stress associated with early lamb removal. Severely affected ewes may need separating from the rest of the flock and managing individually.

Changes in disease patterns and risk factors

Syndromic analysis

Syndromic alerts were raised this quarter for the following diseases:

- Border disease
- Hypomagnesaemia
- Clostridium perfringens type D
- Tick Borne Fever
- Orf
- Mycoplasma ovipneumoniae

Parasitology

Liver Fluke

There have been increasing diagnoses of chronic fluke in the second quarter of 2021, when compared to the previous two years. This increase has been particularly noticeable in Scotland, with 9 cases in England and Wales and 16 in Scotland, and cases at a higher level than seen for several years, at nearly 9% of diagnosable submissions (see figure 4).

The weather this year has been variable, with an abrupt swing from an exceptionally dry April to markedly wet May, making predictions into the risk of liver fluke this autumn tricky. It is likely that there will be noticeable and regional variation in both incidence and impact in flocks.

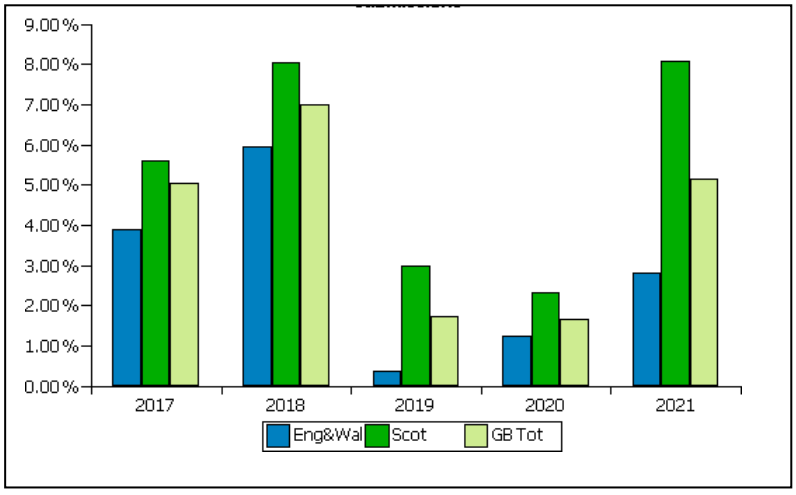

Figure 4: GB incidents of chronic fasciolosis in sheep as a % diagnosable submissions in quarter 2 of 2021

In one case an ewe was submitted for PME to APHA VIC Thirsk, to investigate weight loss and intermittent submandibular oedema. The farmer had lost 14 ewes from a total of around 85 in the previous eight months with similar signs. Only older ewes were affected. Some improved shortly after receiving a Triclabendazole and Levamisole combination product. The submitted ewe was treated at lambing time 3 weeks before submission.

The liver was abnormally small, pale and the surface was diffusely rough. On incision there was dozens of adult Fasciola hepatica throughout the parenchyma and many more in the bile duct.

This ewe had chronic fasciolosis, which had undoubtedly contributed to the poor body condition, anaemia, intermittent diarrhoea, and submandibular oedema seen in the animal.

It is likely that significant burdens of Fasciola hepatica were contributing to the losses of other older sheep on the farm and urgent anthelmintic treatment was required for all sheep on the farm, preferably with flukicide that does not contain Triclabendazole, such as Albendazole, Oxyclozanide, Closantel or Nitroxynil.

The fact that the ewe was treated with a product containing Triclabendazole three weeks previously, raised concern about treatment failure. This could have been due to incorrect administration, or expired product and these should be explored first.

If no obvious issues are found, then suspect failure should be reported to the Veterinary Medicine Directorate (Report an animal's reaction to animal medicine). The possibility of treatment failure due to product resistance must be considered in this flock going forward.

Sustainable Control of Parasites in Sheep has more information regarding faecal egg testing and resistance of liver fluke. A Faecal Egg Count reduction test can be carried out by the University of Liverpool, or alternatively a Coproantigen Reduction Test can be used to check for efficacy.

The flock health plan should be reviewed to assess the use of fluke products going forward and environmental management of liver fluke on the farm's pastures.

PGE Nematodirosis

There were significantly more diagnoses, as a percentage of diagnoseable submissions, of PGE Nematodirus in quarter 2 of 2021 compared to the similar period last year in GB, (see figure 5). This is likely to have been due to the warmer weather during June allowing infective larvae onto pasture to be ingested by susceptible lambs.

The increase in number of diagnoses was more marked in Scotland (37 diagnoses), than that from England and Wales (19 diagnoses), but both showed a increase (Overall 58 incidents were recorded in GB quarter 2 of 2021 compared to to 25 in Quarter 2 of 2020).

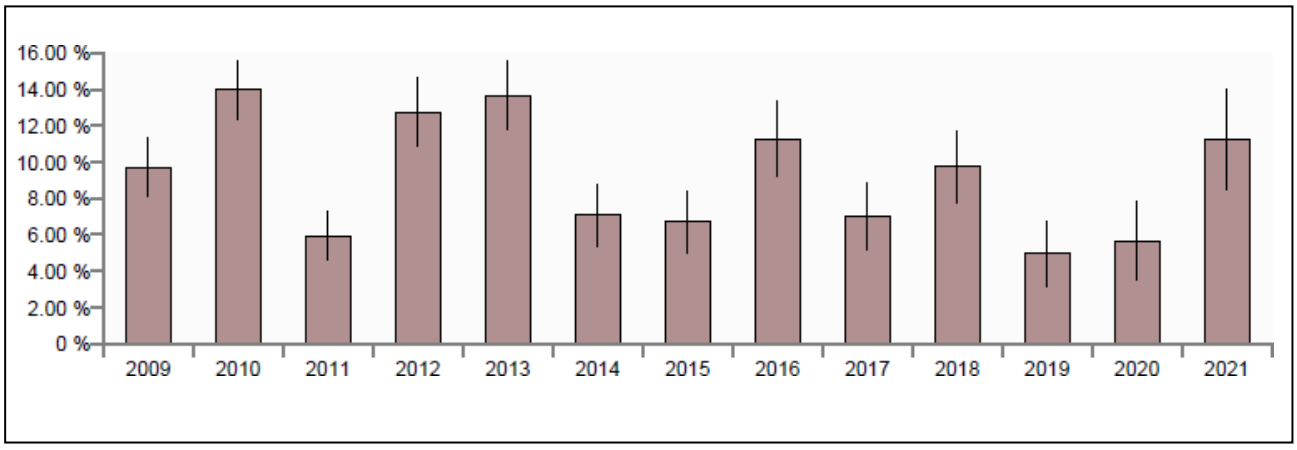

Figure 5: Great Britain incidents of PGE Nematodirus in sheep as a % of diagnosable submissions quarter 2 of 2009 to 2021

Nematodirosis in 10 week old lambs

Ten lambs had died and approximately 12 were affected with diarrhoea, out of a group of 400 lambs. The lambs were treated with moxidectin, and for blowfly, three days earlier. Lambs were at grass with no creep feed and there was plenty of grass.

At PME:

- Both lambs were in poor or emaciated body condition.
- The eyes were sunken and there was green diarrhoea on the tail
- There were tapeworms in the small intestine of lamb 1. The large intestinal content was watery and green. Worm and egg counts shown in Table 1.

Table 1: Faecal egg and total worm counts

Test	Lamb 1 (Faeces)	Lamb 1 (GI tract)	Lamb 2 (Faeces)	Lamb 2 (GI tract)
Sample consistency	Liquid		Liquid	
Trichostrongyle-type eggs (per g)	Less than 50		Less than 50	
Nematodirus battus eggs (per g)	100		Less than 50	
Coccidial oocysts (per g)	3700		5550	
Abo/C3 *Teladorsagia/Ostertagia spp.* twc		900		100
SI - *Nematodirus battus* twc		71000		No worms seen
SI - Immature / L4 twc		6000		No worms seen

The diarrhoea in lamb 1 was due to Nematodirus battus infection. The cause of the diarrhoea in lamb 2 was not confirmed, but it seemed likely this was also due to Nematodirus battus infection, but the worms had been cleared by the anthelmintic treatment.

There is no reason to think the treatment was not effective, as it was given shortly before death, but it was recommended that it was checked that the dose was correctly administered.

For information on Nematodirus in lambs on SCOPS. The coccidial burden detected was considered not likely to be significant.

Tick-associated disease

There have been various media alerts this year about likely high UK tick numbers this summer, due to a mild winter followed by warm humid summer weather, which is conducive for high tick survival.

In total there were 18 diagnoses of Tick-borne fever (TBF) due to *Anaplasma phagocytophila* during quarter 2, 9 diagnoses each recorded by APHA and SRUC.

As TBF predominantly presents with an increased susceptibility to other infections, diagnoses were typically made after animals had died and presented with a range of different concurrent infections such as *Bibersteinia trehalosi* septicaemia, 'pulpy kidney', *Mannheimia* pneumonia, *Mannheimia* septicaemia and *Streptococcus dysgalactiae dysgalactiae* septicaemia.

Louping Ill was associated in two cases and the more classic 'tick pyaemia' were also diagnosed. Particularly marked splenic enlargement was noted as a feature in several PME's. Cases have occurred in both adults (9 cases), and pre-weaned lambs of between 10 days and 2 months of age.

However, the majority of affected lambs were 5 to 6 weeks of age. Lambs are considered particularly vulnerable to the effects of TBF between 3 and 6 weeks of age.

Cases of Tick borne disease have been more typically associated with animals grazing moorland areas however, APHA are starting to encounter cases in animals grazing lower, improved grassland.

On these pastures the ticks will often be found in higher numbers around hedgerow borders where climatic conditions are more suited to their survival.

Tick-borne disease can be introduced onto farm via attachment of an infected tick on a bird or mammal (including bought in sheep and or cattle which are not treated as part of a quarantine plan), or via sub-clinically infected stock.

Tick-borne fever and extensive Staphylococcal dermatitis in a post weaned lamb

An eleven month old lamb was submitted to APHA VIC Starcross after being found in very poor condition with extensive dermatitis. One other animal in the group of 240 had presented similarly last year, however no itching or fleece loss was noted in other sheep in the flock.

On PME extensive crusting of the skin, in areas not covered by fleece, was noted, and with the entirety of the head and legs affected (see figure 6). In places, sloughing of the skin had left wet, red underlying tissue with a brown necrotic exudate.

The fleece contained a large volume of seborrheic flaky material. Microscopy of skin scrapes and hair plucks revealed *Bovicola* spp. lice, and aerobic skin cultures isolated *Staphylococcus aureus*. Parasitic gastroenteritis, border disease and Johnes were ruled out by testing as underlying immunosuppressive factors.

Orf was ruled out via electron microscopy and histopathology. PCR testing of spleen detected *Anaplasma phagocytophilum* DNA.

It is unusual for *Staphylococcus aureus* dermatitis to affect a single animal in a large group, and to present as severely as in this case. It was suspected that tick borne fever causing immunosuppression contributed to the severity of disease seen here, as potentially did lice hypersensitivity.

As *Staphylococcus aureus* is the causative agent of tick pyaemia, which is spread from ticks during biting, it is likely tick bites were the primary cause of this dermatitis.

Figure 6: extensive crusting of the skin of the hind limbs.

Skin disease

Orf

During quarter 2 of 2021 there were 10 diagnoses of orf (parapoxvirus infection), compared to 4 in the same quarter in 2020.

Oral proliferative lesions, typical of orf were seen in a three week old lamb submitted from a hill farm. Six out of 150 lambs in the group had similar gum lesions. Proliferative skin lesions over the face, legs and ears were also reported in the group of one year old ewes.

As shown in Figure 7 proliferative lesion typical of orf was observed over the incisor teeth of this submitted emaciated lamb. It is likely that the lamb had difficulty suckling and this may explain its body condition and the lack of milk observed in the stomach.

Lesions frequently develop on the medial aspect of the ewe's teats; this area of the teat, having been traumatised by the lamb's incisor teeth, permits entry of virus. These teat lesions are painful, and the ewe will typically not allow the lambs to suckle.

For this reason, it was recommended that the ewes' body condition and udders were checked, for milk, mastitis and Orf.

Information about the clinical presentation, diagnosis, control and prevention of orf infection in sheep can be found on the NADIS website.

Figure 7: proliferative lesion typical of orf over the incisor teeth of a three week old lamb

Sheep Scab

Mobile Sheep Dipping Code of Practice

A new Code of Practice has been launched by the Sustainable Control of Parasites in Sheep (SCOPS) group, in conjunction with the National Association of Agricultural Contractors (NAAC), to ensure access to the best advice on effective treatment of sheep scab with organophosphate (OP) sheep dip, minimising risks to users and the environment.

The code is downloadable from the SCOPs website other information is also available:

- OV Instructions on APHA Vet Gateway
- Sheep Veterinary Society - Sheep Scab guidance for vets
- APHA Information note on Sheep Scab resistance (English). it also available in (Welsh)

Respiratory disease

SRUC recorded relatively high numbers of *Mannheimia* pneumonia cases this quarter, with 19 cases, representing 9.79% of the diagnoses when previous diagnoses have been between 5.37 and 9.69% of diagnosable submissions. SRUC cases have had an increasing trend for this quarter since 2019.

The cause is unclear but factors such as a change in the predominating circulating *Mannheimia* species may require further investigation, which could have potential implications for current vaccine efficacy.

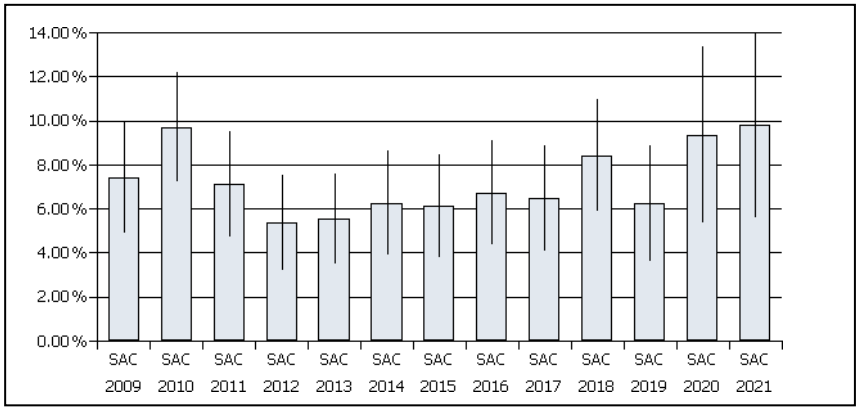

Figure 8: SRUC incidents of *Mannheimia* haemolytica in sheep as a % of diagnosable submissions quarter 2 of 2009 to 2021

Mycoplasma ovipneumoniae

APHA diagnosed relatively high numbers of *Mycoplasma ovipneumoniae* cases, with the recorded numbers equivalent to *Mannheimia* pneumonia diagnoses for this quarter. There were 22 diagnoses, when diagnoses have ranged from 2 to 15 during this period in previous years.

The increased diagnoses were in preweaned and adult sheep, both in lowland and in hill and upland flocks, with most diagnoses in the sheep prolific areas of northern England and Wales. Respiratory, wasting and found dead were typical presenting signs.

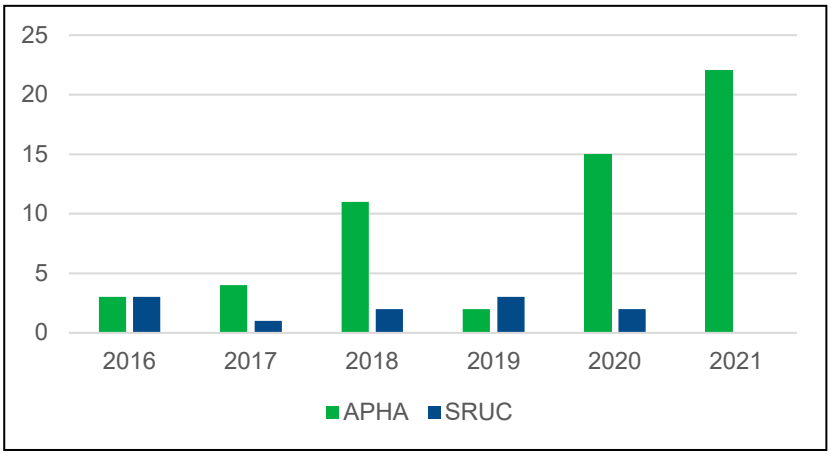

Figure 9: count of *Mycoplasma ovipneumoniae* diagnoses 2016 to 2021 APHA and SRUC

The disease has previously on occasion been identified in lambs as young as 2 weeks old however, the majority of cases usually occur in post weaned lambs. One case reported in June 2021 by APHA VIC Thirsk involved 10 day old lambs with marked respiratory disease.

Mycoplasma pneumonia in housed lambs

Two live 10 day old lambs were presented for investigation into signs of respiratory disease affecting large numbers. The farm had 12 breeding ewes, lambing indoors in three batches, from January to March, and all animals were still housed at the time of submission. Losses in the youngest group of lambs were estimated to be around 7% and some lambs were reported to have increased respiratory effort and pyrexia.

At postmortem examination, in both lambs, the peripheral borders of the caudal lobes and both cranial lobes were a deep pink in colour and had a firm texture (see figure 10). The remaining 75% of the lung parenchyma was a cream colour and had a spongy texture. Similar lesions were seen in an older lamb previously examined from this farm.

Mycoplasma ovipneumoniae was diagnosed in both lambs by DGGE-PCR. *Pseudomonas aeruginosa* was also isolated in a pure growth from both lambs, although this was an opportunistic infection.

As all stock were housed, high stocking density, poor ventilation, and animals of different ages housed in close proximity, were potentially increasing the morbidity and the infective challenge, whilst increasing the severity of lesions in the affected lambs.

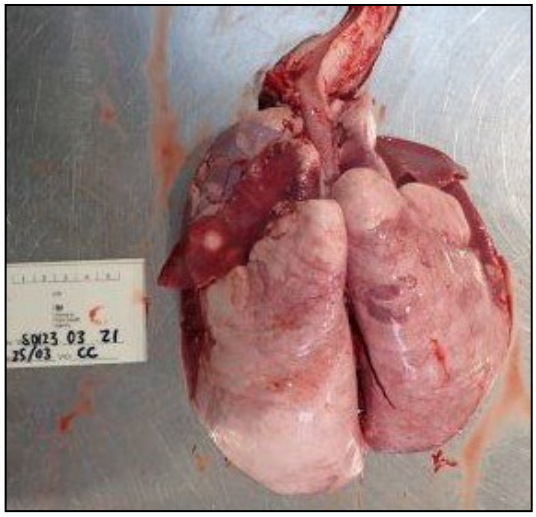

Figure 10: well demarcated consolidation of the cranial lung lobes due to *Mycoplasma ovipneumoniae* infection in a 10 day old lamb.

Possible sarcocystosis in a 5 week old lamb

A 5 week old lamb, from a small backyard flock, was submitted for PME to investigate the cause of sudden death. The lamb was noted to be tachypnoeic four days previously but appeared to recover and was unremarkable over the following 48 hours. The lamb was then found dead on the morning of submission.

At PME, the lamb had generalised congestion of the lower respiratory tract, but little else was evident and further testing was unremarkable, with no bacteriological growth; the presence of border disease and mycoplasma were also ruled out.

However, histology found evidence of a moderate to severe, subacute, eosinophilic myocarditis, which was thought to be the cause of death in this animal. There was also an eosinophilic pneumonia, nephritis and encephalitis when additional organs were examined. The exact cause of the systemic insult was unclear, but sarcocyst involvement was considered to be a possibility.

The prevalence of this parasite in the UK is unknown, but it is thought to be a common but underdiagnosed problem and is usually only noted at slaughter.

The Sarcocystis species, associated with potentially significant brain and muscle lesions in sheep in the UK, is Sarcocystis tenella. Occasionally other tissues can be affected, as demonstrated by a case of S.tenella associated pneumonia, identified by APHA in a lamb in the UK in 2012 (Schock and others 2012).

Experimental infections have demonstrated the potential for this parasite to produce lesions in some sheep, although the majority of infections produce no signs. The sheep is an intermediate host, becoming infected after ingesting sporocysts that have been shed in the faeces of an infected dog (the definitive host), the dog having originally acquired the infection from eating infected raw sheep meat.

Preventing dogs eating raw sheep meat therefore effectively breaks the transmission cycle.

Nervous disease

Listerial encephalitis

Continuing the trend reported in quarter 1, increased diagnoses of Listerial encephalitis were also recorded during this quarter (see figure 11). 25 cases (4.16%) were reported in 2021 compared to 12 cases (2.27%) in 2020. In comparison to quarter 1, the number of diagnoses between APHA and SRUC were reversed.

This time APHA recorded a marked increase in cases with 18 incidents reported in 2021 compared to 4 in 2020. Diagnoses recorded by SRUC remained relatively static with only minor changes in case numbers.

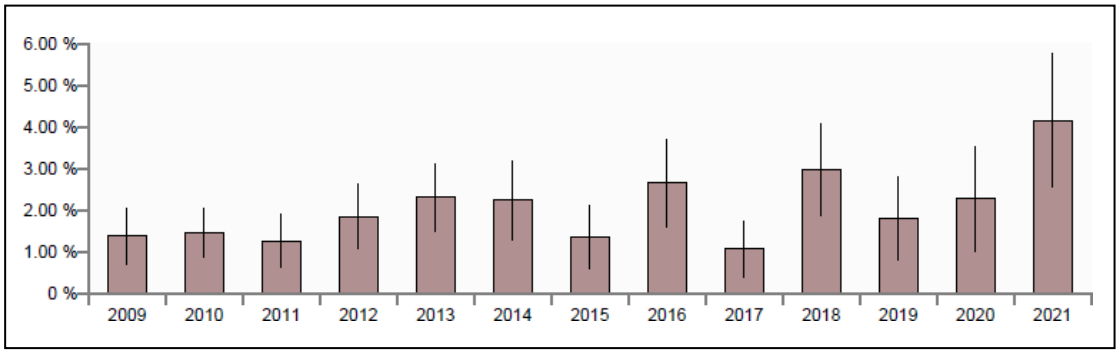

Figure 11: GB incidents of encephalitis listeria in sheep as a % of diagnosable submissions quarter 2 2009 to 2021

Unusual manifestation of Listerial infection

Listerial myelitis was diagnosed by the University of Bristol in a two week old Suffolk lamb, submitted with a history of recumbency and malaise. Four other lambs in the group had shown clinical signs including blindness, recumbency, loss of suck reflex and terminal paddling.

Semi-liquid deposits of presumed purulent material were seen around the thoracic spinal cord on postmortem examination.

Listerial myelitis was confirmed on histopathology. This is an uncommon diagnosis with *Listeria* organisms more typically infecting the brain. Proposed routes of infection include ascending infection from ringing, muddy lower legs and castration wounds.

Reproductive disease

During the lambing period January 2021 to June 2021 there were 622 diagnostic submissions in GB with abortion listed as the presenting sign.

Abortion due to Chlamydia abortus continues to be most commonly diagnosed as shown in Figure 12.

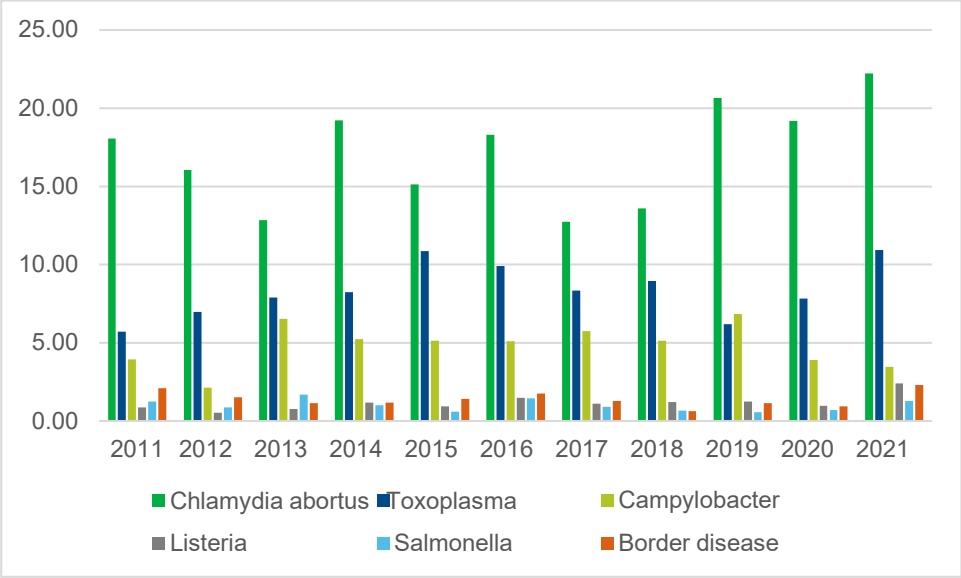

Figure 12: Incidents of sheep abortion as % of diagnosable submissions in GB 2011 to 2021

Fetopathy associated with Schmallenberg virus

Fetopathy associated with Schmallenberg virus infection were diagnosed on 9 submissions from January to June this year, compared to none for the same period in 2020.

Q fever

Coxiella burnetii (Q fever) was added to the Zoonoses Order on 22 February 2021 in England, and in April in Wales and Scotland; The Zoonoses Order has been amended to make *Coxiella burnetii* (Q fever) reportable in England, Scotland and Wales. Reporting is required for diagnoses in cattle (including water buffalo and bison), sheep, goats and camelids.

Border Disease (BD)

Border disease virus was detected in 32 GB submissions during the first two quarters of 2021. Eighteen of the cases were submitted to investigate abortions. Enhanced surveillance for BD virus were in place for sheep abortion submissions. In many abortion cases BD virus infection was not suspected to be present.

Toxoplasmosis and concurrent BVD type 1

Toxoplasmosis and concurrent Border Disease Virus (BVD) type 1 were recorded in aborted twin fetuses. The group of 130 ewes were not vaccinated against abortifacients. The placenta had reddened cotyledons with focal areas of necrosis.

Toxoplasmosis was diagnosed on laboratory testing, along with BVD type I detected through PCR testing. It transpired that the farmer kept both sheep and cattle. No BVD testing had been carried out in the cattle herd.

Abortions due to *Salmonella* Indiana.

Three sets of aborted twins and placentae were submitted for abortion investigation from a flock of 1,750 breeding ewes. The ewes were lambed indoors in three batches. One batch had lambed with no significant issues, but in the second batch, due to lamb imminently, 15 ewes had aborted, eight over the two days prior to submission. Affected ewes were unwell.

Gross examination of the submitted foetuses and placentae was unremarkable. Laboratory testing of the placentae was negative for the most common causes of abortion Enzootic Abortion of Ewes (EAE), toxoplasmosis and campylobacter.

Bacteriological culture of the foetal stomach contents confirmed Salmonellosis as the cause of abortion, with *Salmonella* Indiana isolated in purity. This *Salmonella* serotype is typically associated with ducks and there have been very few recorded isolations from sheep.

The exact source of the *Salmonella* in this case was undetermined, however the farm was very close to a large reservoir, and wild waterfowl were often seen in large numbers on the grazing paddocks, suggesting this may have been a potential source.

Advice on biosecurity, reducing the spread of infection, personal hygiene and cleansing and disinfection of the lambing shed between the second and third batch of ewes was provided.

Gastroenteritis was reported in a member of the farming family during this incident, however the involvement of *Salmonella* in this illness had not been confirmed at the time of writing. *Salmonella* Indiana is potentially zoonotic.

A large human outbreak of the serotype was reported associated with egg mayonnaise sandwiches in an NHS hospital in 2001 (Mason and others 2001).

Systemic disease

Enterotoxaemia due to *Clostridium perfringens* type B

This disease is seen every season, but generally only in low numbers. It can however have significant impact in some flocks, as in this case; it was diagnosed in a four day old lamb, where fifteen out of 100 lambs born outdoors had died at the time of submission. Ewes were not vaccinated.

Signs reported in the affected lambs were that they could not get up, then began to experience seizures and die within hours. Twins and singles were affected and from different aged ewes.

At PME

- There was diarrhoea on the tail.
- There were a few patches of reddening of jejunum. The ileum was pale and friable. There was a small amount of soft, brown large intestinal content.
- There was a large gelatinous clot in pericardium with clear fluid (see figure 13).
- The cerebellum showed coning (herniation through the foramen magna).

An ELISA on small intestinal content was positive for *Clostridium perfringens* alpha, beta and epsilon toxin, confirming *Clostridium perfringens* type B infection. *Clostridium perfringens* type B causes lamb dysentery and haemorrhagic enteritis in lambs up to 3 weeks of age. Ulcers typical of lamb dysentery were not seen in this case.

Control of clostridial enterotoxaemia in young lambs is by vaccination of ewes prior to lambing, which provides colostral immunity to the lambs, providing adequate colostrum is ingested. Management changes to prevent overcrowding may also be helpful in attempting to reduce the impact of disease**.**

Figure 13: large gelatinous clot in the pericardial sac of a lamb that died from *Clostridium perfringens* type B infection

Hypomagnesaemia or Hypomagnesosis

A syndromic alert was raised this quarter for hypomagnesaemia or hypomagnesosis, which was diagnosed in 6% of submissions for this syndrome (14 incidents) in quarter 2 of 2021, compared to 2% in quarter 2 of the previous 5 years (2016 to 2020).

The majority of diagnoses of hypomagnesaemia or hypomagnesosis were made in Scotland, compared to the previous 5 years where the distribution was more spread across all regions (see figure 14).

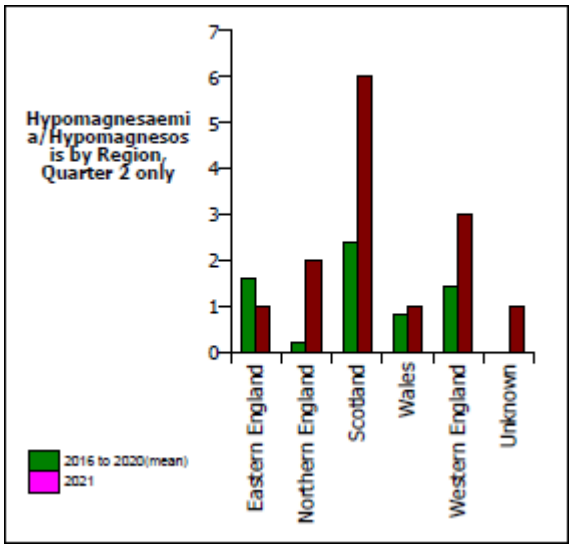

Figure 14: distribution of hypomagnesaemia or hypomagnesosis diagnoses in quarter 2 2021 by region.

SRUC confirmed hypomagnesaemia as the cause of death in lambed ewes from three flocks during April. Three or more sudden deaths, involving ewes at grass rearing one to two week old twin lambs, were reported in each case. Vitreous humour magnesium results ranged from 0.31 mmol/l to 0.56 mmol/l (reference range of less than 0.65 mmol/l). Withdrawal of concentrate feed two days earlier was considered to have predisposed to the losses in one flock.

Hypomagnesemia was diagnosed on two separate occasions by the University of Bristol, both in ewes with the typical signalment of one-month post-lambing and feeding growing lambs. Often markedly congested lungs with excessive amounts of froth, and lush grass in the rumen (occasionally with low pH) are the only findings at PME, and these were seen in both submissions.

In one flock of 130 ewes, at least 17 had either been found dead, or showed opisthotonus, tremors, and hyperaesthesia leading to recumbency. Hypomagnesemia was confirmed on both occasions by aqueous or vitreous humour magnesium levels less than the sera reference value (less than 0.7mmol/l).

Providing an alternate source of magnesium (boluses, water) is recommended, as is providing some alternate forage (hay or straw) though the ewes may not eat this. Alternatively moving the ewes off the paddock may be necessary.

Vascular diseases

Septicaemia and proliferative endocarditis in an ewe

A four year old ewe from an outdoor flock of 114 ewes was found dead. In the previous two weeks six other ewes had died. Signs were of malaise, weakness, anorexia and loss of condition. No treatment was given. The gross PME findings in one found dead ewe were:

- pneumonia
- proliferative valvular endocarditis
- multiple, probable infarcts, in one kidney (see figure 15)

Streptococcus gallolyticus ssp *gallolyticus* was isolated from multiple sites including the valvular lesion, confirming a diagnosis of streptococcal septicaemia and endocarditis. This bacterium is ubiquitous and has been isolated from sporadic cases of endocarditis and septicemia in pigs and other species.

Whilst a primary infection site was not identified, possible sources include foot disease, skin wounds, post lambing infections, medical or surgical interventions and subclinical rumenitis.

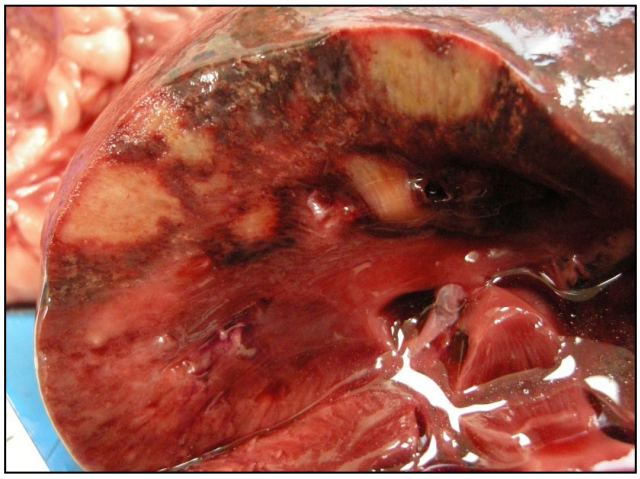

Figure 15: Renal infarcts in an ewe due to *Streptococcus gallolyticus*.

Endocarditis is diagnosed sporadically in sheep, two thirds of the cases are adult sheep, and infection more typically occurs following spread of bacteria from another location, with infections within the Streptococcal group of bacteria involved in numerous cases.

Up to seven cases are diagnosed at regional laboratories annually, and the cases are usually ‘one-off’ issues in an individual animal. *Streptococcus gallolyticus* ssp *gallolyticus,* formerly known as *Streptococcus bovis* type 1, has been previously isolated from sheep, including from at least one case of endocarditis and in another case causing an opportunistic septicaemia.

It has also been associated with septicaemia and endocarditis in humans. The organism is commonly found as part of the rumen flora, meaning systemic infection could follow a rumenitis, or after faecal contamination of any wounds.

Urinary disease, Enteric disease, Musculoskeletal disease

No significant trends were identified this Quarter.

Goats

For the period April to June 2021 there were 145 diagnostic scanning surveillance submissions in goats in GB. The age category and submission type are described in Figure 16.

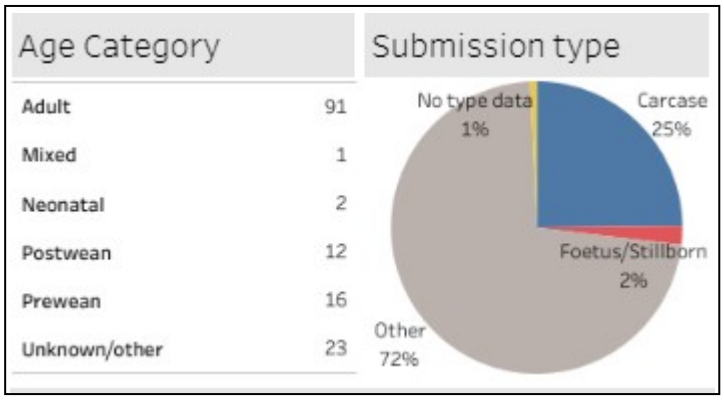

Figure 16: age category and submission type for goats quarter 2 of 2021

Presenting signs described on the submission form are shown in Figure17 with diarrhoea and wasting the most common.

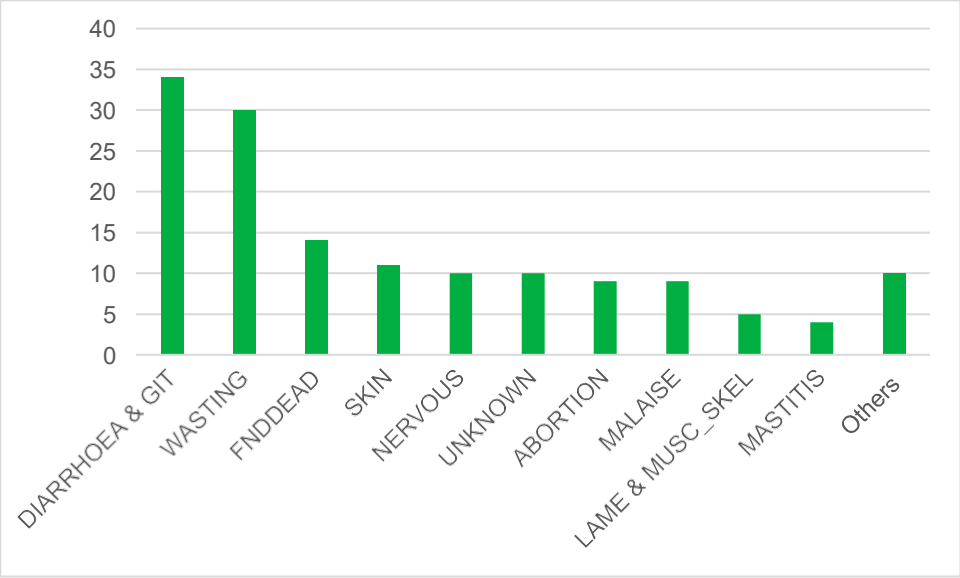

Figure 17: presenting signs for goat submissions quarter 2 of 2012

The ten most common diagnoses during quarter 2 of 2021 are shown in Figure 18.

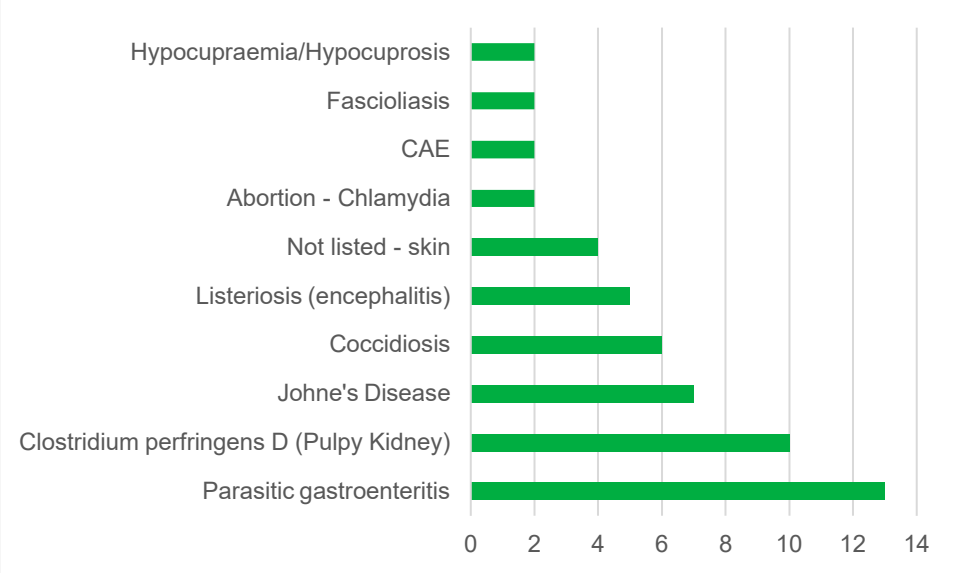

Figure 18: ten most common diagnoses in goats during quarter 2 of 2021

Clostridium perfringens Type D enterotoxaemia in an adult goat

A pet pygmy goat was submitted for PME. It was the second animal to die from a small herd of 15. Both of the affected goats were pregnant. The goats were outdoors in a paddock, with access to a field shelter where they were fed hay and a concentrate ration. Vaccination for clostridial disease was up to date.

Significant findings at PME included a low rumen pH, liquid intestinal contents and haemorrhages on the endocardium of the left ventricle. Parasitological testing of caecal content identified 1,400 trichostrongyle-type worm eggs per gram, and a gut wash revealed the presence of *Haemonchus* spp worms.

The cause of death was identified on *Clostridium perfringens* toxin testing of gut content, which proved positive for both alpha and epsilon toxin, confirming a diagnosis of pulpy kidney disease (*Clostridium perfringens* Type D enterotoxaemia).

It was suggested the possible change in gut microflora, as a result of the ruminal acidosis, predisposed to disease development, and being in late gestation may have also made this animal more susceptible despite vaccination.

A review of concentrate feeding was advised, in particular to avoid gorging by more dominant members of the group. Parasitology of a pooled faecal sample from the remaining goats was also recommended, to investigate the parasite burden across the group.

Abortion due to Chlamydia

Twin foetuses and placenta were submitted for abortion investigation, following three recent abortions in a group of 50 dry goats from a large milking herd.

Dams had remained clinically well. Abortion vaccines are not used on farm. A severe placentitis was seen on gross examination of the placenta, with diffuse thickening and reddening of the intercotyledonary spaces and congestion of the cotyledons. The fetuses were grossly unremarkable.

Acid-fast intracellular organisms resembling *Chlamydia* spp were seen on an MZN stained smear of the placenta. However, the involvement of Q fever could not be definitively ruled out on the smear alone. Samples of placenta were subsequently submitted for PCR testing.

A negative result for Q fever and a positive result for *Chlamydia abortus* were obtained. This confirmed the diagnosis of Chlamydia abortion.

Streptococcus dysgalactiae found at disbudding site

An increased number of infected dis-budding sites was reported in pre-weaned goat kids on a dairy unit. Culture of a swab taken from the disbudding site of one goat, revealed the involvement of *Streptococcus dysgalactiae.*

This is more typically found in association with joint ill. However, can also be found in skin infections including those that develop around ear tag sites. This isolate was also found to be resistant to tetracycline.

Poisoning

The latest Chemical Food Safety report can be found on GOV.UK

Lead incidents in sheep

Chronic lead toxicity was confirmed in a group of sixteen sheep, comprising five ewes and lambs. Only two lambs aged 7 to 9 weeks were affected. The first clinical sign was of a lamb unable to bear weight on the front legs. She later became weak behind and died. No postmortem was carried out. A second lamb was affected a few days later. He was unable to bear weight on his back legs.

He was able to sit in sternal recumbency and hold his head up, was quite bright and wanted to suck milk. He also had ventral strabismus in the left eye. A PME was carried out following euthanasia. Clinical signs were of a distended bladder and bilateral hydronephrosis.

There was a comminuted fracture of L1 vertebra, causing compression of spinal cord and subdural haemorrhage. A blood lead concentration was 2.13µmol/l, suggestive that lead was involved in the aetiology.

The source of lead is suspected to be geochemical associated with old lead mines present at the grazing site. The owner indicated that they will likely keep the remaining sheep as pets and not sell them on or slaughter them into the food chain.

Further reading on managing pasture with high soil lead: Payne, J. and Livesey, C. (2010), Lead poisoning in cattle and sheep. In Practice, 32: 64-69. https://doi.org/10.1136/inp.b5672. FSA Wales are informed of all such cases.

Centre of Expertise for Extensively Managed Livestock (COEEML)

Interesting cases associated with Extensively Managed Sheep

Tick borne fever and *Streptococcus dysgalactiae dysgalactiae* in ewes with abortions, metritis and ewe deaths

Abortions and ewe deaths were reported in another flock on the edge of Dartmoor. The flock of 200 Dorset ewes had been on the holding for three months. At the time of submission, 12 ewes had aborted and 10 had died after developing malaise, recumbency and neurological signs post-abortion.

The ewes were housed for lambing and fed haylage, fodder beet and straw. No cause for abortion had been identified on foetuses submitted for abortion investigation.

To investigate further, the carcases of two typical dead ewes were submitted to APHA VIC Starcross.

At PME an extensive fibrinous peritonitis was identified as the cause of death; the origin of which appeared to be a severe, necrotic metritis in both ewes.

Other gross findings included excess pericardial fluid, haemorrhages over the epicardium and kidneys and friable livers, typical of an associated septicaemia/toxaemia/endotoxaemia. *Streptococcus dysgalactiae dysgalactiae* was isolated on culture of the liver and peritoneum from one ewe.

Testing for underlying metabolic disease was unrewarding however, Anaplasma *phagocytophilum* DNA was detected by PCR in both ewes confirming a diagnosis of Tick Borne Fever. Infection can result in abortion, but the immunosuppressive effects can predispose infected animals to other concurrent infections, including metritis and peritonitis.

A typical history associated with TBF is the movement of naïve animals to a new area as occurred in this case.

A newly established flock in Scotland, consisting of 160 mixed breed gimmers purchased from multiple sources submitted two foetuses for postmortem examination after seven ewes aborted. Lambing was due to start in ten days' time and ticks had been noted on the ewes. The group had been grazed on hill ground since tupping and had been moved closer to home one week previously.

Diffuse subcutaneous oedema together with pleural and peritoneal effusions were found in both foetuses. Neuropathology detected multifocal necrosis of cerebral white matter and *Anaplasma phagocytophilum* DNA was detected in fetal spleen.

Transplacental transmission of A phagocytophilum has been recorded in sheep, and abortion linked to *A. phagocytophilum* has been recorded in association with exposure of naïve ewes in late pregnancy to high tick burdens (Stuen and others 2018) (Jones and Davies 1995). Periventricular leucomalacia has been described in previous cases of tick borne fever abortion (Chianini and others 2004).

Tick-borne fever in a 4 to 6 week old lamb

Four lambs had died out of 200, in a group of single lambs with their dams. Lambs were born outside and on hill grazing, where ticks were known to be a problem.

Significant PME findings:

- The lamb was in fair body condition.
- There were small number of ticks seen on the skin, particularly the head, identified as *Ixodes ricinus.*
- The spleen was enlarged (see figure 19).
- There was cranioventral lung consolidation with approximately 20% of the lung consolidated.
- There was fibrinous exudate on the surface of the consolidated lung and in the pericardium with the pericardium adherent to the epicardium (see figure 20).

Splenic enlargement was due to tick borne fever (Anaplasma phagocytophilum infection), which was confirmed by PCR. Pneumonia and pericarditis were also seen, but no bacteria isolated. It is possible the pneumonia was due to infection with a bacteria and/or *Mycoplasma* which did not grow on routine culture.

The pericarditis could be more historic, possibly as a sequelae to an umbilical (navel) infection, and the bacteria no longer viable. The main way to control tick borne disease is to treat susceptible sheep with an acaricide.

Figure 19: Enlarged spleen in a 4 to 6 week-old lamb with tick borne fever

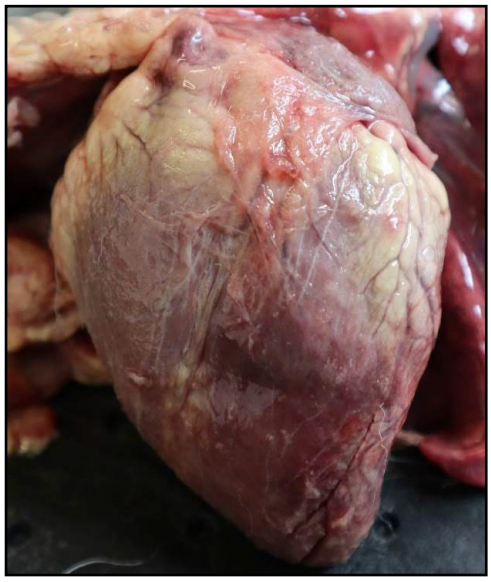

Figure 20: Organised fibrinous exudate over the epicardium of a four to six week old lamb with TBF

The COEEML was developed by APHA to address potential surveillance gaps for extensively-managed animals. Extensive-management of livestock potentially makes regular or close inspection for disease detection more challenging.

The Centre is based at APHA VIC Carmarthen, however it is a Great Britain wide resource and forms part of the wider veterinary surveillance system operated by APHA. Further information can be found in previous APHA Science Blogs:

- Caring for extensively managed livestock
- The threat of tick-borne diseases in the United Kingdom
- An insight into the world of ticks
- For more information on tick borne disease and control see:
- SCOPS information on ticks
- Ticks and Tickborne Diseases Moredun Newssheet

Horizon scanning

Bluetongue (BTV) update

APHA no longer has access to the EU's Animal Disease Notification System (ADNS), hence we are now only using World Organisation for Animal Health (OIE) data (for mapping) and continue to monitor the weekly outbreak summary data published by the new EU Animal Diseases Information System (ADIS). Recent OIE reports include one report of BTV-4 by Spain (Mallorca) reported on 27 July 2021.

This outbreak, along with nine others in the same area, where cattle and sheep were both affected, the first case was picked up by sentinel surveillance in cattle followed by a further nine clinical cases in sheep. France and Belgium still remain as restricted areas as of 7 July 2021, according to the European Commission. BTV in Europe February to August 2021 is shown in Figure 21.

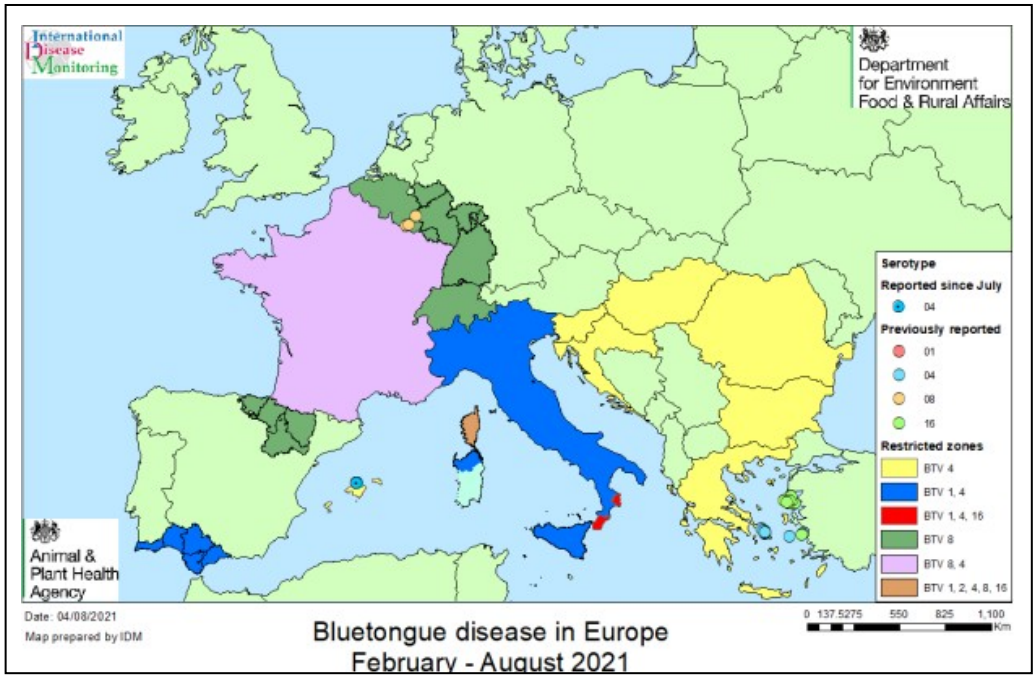

Figure 21: BTV in Europe February to August 2021

For more information, see our BTV Outbreak Assessment on GOV.UK

APHA have released a series of animations on Facebook and Twitter to inform keepers of BTV.

Sheep Pox Goat Pox (SPGP) Europe

Russia OIE reported seven outbreaks of SPGP in July. All outbreaks were in backyard premises.

Thin Ewe Project England and Wales

In autumn 2020 APHA invited Private Veterinary Surgeons (PVS) to recruit farms in England and Wales to investigate the cause of thin ewes.

They were asked to submit three thin ewes for PME at APHA VICs and our partner PME providers, and tests for the 'iceberg diseases' (Johne's disease, Maedi Visna (MV), caseous lymphadenitis (CLA), ovine pulmonary adenomatosis (OPA) and border disease).

In addition, other conditions seen on gross examination such as, pneumonia, dental problems were recorded although faecal egg counts, total worm counts in the gastrointestinal contents and trace element analyses were not included.

A protocol for PME, sampling and testing was developed:

Record

- Breed, condition, age and identification.
- Lesions in feet, udder and dentition.
- Presence of external parasites.
- Any significant lesions identified on a full PME including examination of the brain.

Testing for all

- Pooled Faeces for Johne's PCR.
- Serum or spleen for border disease PCR.
- Serum samples for Maedi-Visna (MV) agar gel immunodiffusion (AGID) testing.
- Bacteriology of any significant lesion.
- Histopathology - a range of tissues were collected, fixed and examined if appropriate.

Additional Testing

The need for additional testing depends on the preliminary findings

Scenario 1

- Lung pathology identified
- Bacteriology on lung swab
- Lung tissue for OPA PCR
- Histopathology – lung and mammary gland

Scenario 2

- Gastro intestinal (GI) pathology identified
- Histopathology – abomasum, small intestine, ileum and ileocaecal lymph node

Scenario 3

- Other significant gross pathology
- Arthritis - joint fluid for culture, erysipelas serum agglutination testing (SAT)
- Mastitis - bacterial culture, *Mycoplasma* species denaturing gradient gel electrophoresis (DGGE) or PCR
- Histopathology as required

In total 198 sheep from 76 holdings were examined across the surveillance network between November 2020 and May 2021. The regional distribution is shown in Table 2.

The purpose of the farms were recorded as 49 lowland, 18 upland and hill and nine other or unknown.

Table 2: Location of holdings by region

Area	Count of holdings
East England	1
East Midlands	8
North-West England	14
South-East England	6
South-West England	16
West Midlands	5
Yorkshire and the Humber	12
Wales	14

The age of animals examined ranged from two to seven years. The presenting sign was wasting in all but one submission where respiratory signs were recorded.

The body condition described at PME ranged from emaciated to good with the majority considered to be poor.

In one flock multiple purulent to caseous, gritty yellow foci of variable size were found throughout the lungs in one ewe, suspicious of tuberculosis. This was reported as a suspected notifiable disease and subsequently confirmed as *Mycobacterium bovis* by culture and histopathology. No other testing was undertaken.

Summary of iceberg diseases identified from 75 flocks

Johne's disease

Johne's disease was identified in 24 flocks (31%). In 23 flocks this was by PCR on pooled faeces.

Typically, Johne's may present grossly with thickening of the jejunal mucosa with a corrugated appearance and yellow discolouration (see figure 22).

Figure 22: typical yellow discoloration of the jejunal mucosa seen in Johnes disease

In the one PCR-negative flock the gross findings were suspicious of Johnes disease with thickening and corrugation of the mucosa of the jejunum and ileum although lacking any yellow discolouration.

In accordance with the protocol, histology was carried out. Moderate, multifocal, chronic, granulomatous enteritis of the small intestine was found along with the presence of acid-fast bacilli confirming the tuberculoid extreme form (paucibacillary lesion) of Johne's disease.

Border disease

Seventy-four flocks were tested for border disease. No border disease virus was detected using PCR in pooled serum from these flocks.

Caseous lymphadenitis

The protocol allowed for bacteriology to be carried out on any lesion the Veterinary Investigation Officer (VIO) considered might be significant. CLA was identified in one flock, in which a ram was included in the submission. PME showed multifocal abscesses throughout all lung lobes, most likely due to embolic spread following a bacteraemia and additional abscesses were seen in the bronchial lymph nodes, kidney and liver.

Corynebacterium pseudotuberculosis was cultured in moderate pure growth confirming the diagnosis of CLA. While this finding was significant for the individual ram it could be less significant for the remainder of the flock if the animal had been bought in, depending whether it had been mixed with the rest of flock.

Maedi Visna (MV)

MV testing using the AGID test was performed on individual samples from sheep submitted from 73 flocks. Six flocks gave positive results (one clear positive and five weak positive).

Two ewes examined from the flock with the clear positive AGIDT had lungs that were oedematous, heavy and non-collapsed. The lungs weighed 2.1kg and 2.6kg. Histological changes observed in the lungs of both ewes were consistent with infection due to MV, however no pathology was seen in the mammary glands. Interestingly this flock had a known history of sporadic cases of MV.

Histopathological examination of the lungs and mammary glands from three sheep submitted from one of the flocks giving the weak positive result also confirmed MV.

Follow up histopathology on lungs and mammary glands was performed in the four remaining weak positive flocks and did not support a diagnosis of MV, however early disease lesions may be microscopic and unevenly distributed throughout the lungs. In one case OPA was diagnosed where the gross lesions seen were indistinguishable between OPA and MV.

An assessment of the flock status by additional serology of a targeted group of ewes is the recommended next step in establishing the potential impact and influence of MV on ewe condition on these farms.

OPA

OPA was suspected in sheep submitted from 10 flocks where the gross pathology described creamy white, very firm tissue within the lung lobes as shown in figure 23.

In eight cases this was confirmed by histopathology which demonstrated neoplastic proliferations consistent with pulmonary adenocarcinoma. Testing for Jaagsiekte small ruminant virus (JSRV) by PCR was positive in six of these cases. This test is still in development and not yet commercially available.

The JSRV PCR in four cases was negative but OPA was confirmed by histology in two of these cases with Maedi Visna confirmed in a third and chronic pneumonia in the fourth.

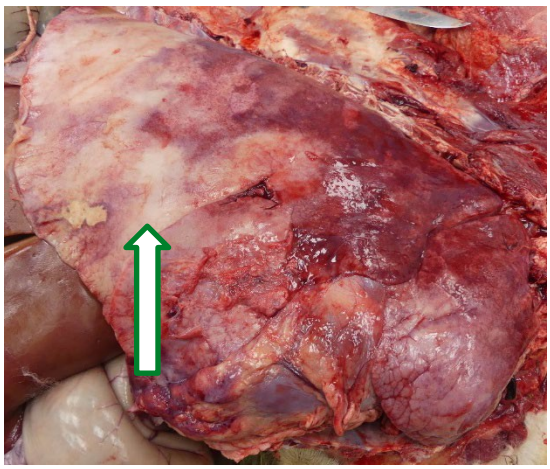

Figure 23: lungs markedly expanded by homogenously cream white, very firm tissue (typical of OPA) (arrow). (image courtesy of University of Bristol).

MV and OPA can appear similar on gross examination, especially in chronic cases where there are extensive lesions and fibrosis. To enable a structured plan for control on farm a definitive diagnosis by histopathology is required.

Other conditions observed

Evidence of chronic endoparasitism of the alimentary tract was described histologically in sheep from 33 flocks and would have been contributing to the ill thrift reported. In one case liver lesions consistent with exposure to large numbers of *Taenia hydatigena* larvae were found.

Parasitic pneumonia was found in sheep from 24 flocks. These cases typically had multifocal, chronic, granulomatous interstitial pneumonia, with nematodes described histologically and lungworms were visible in the airways (see figure 24).

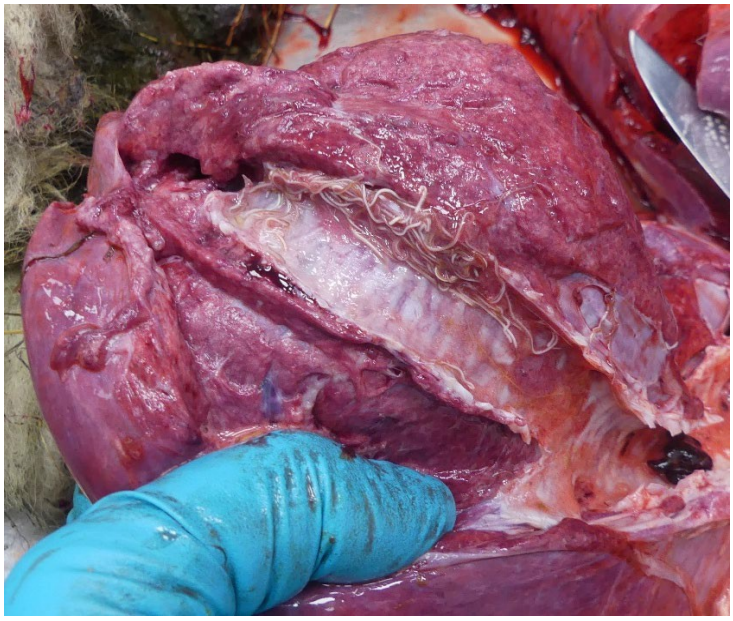

Figure 24: Lungworm (Dictyocaulus species) in bronchi of a sheep (image courtesy of University of Bristol).

Significant dental disease was observed in sheep submitted from 19 flocks. This included missing and malalignment of the molars (see figure 25), absent and worn incisor teeth and osteomyelitis (see figure 26) secondary to dental disease.

Figure 25: malalignment of the caudal upper molars.

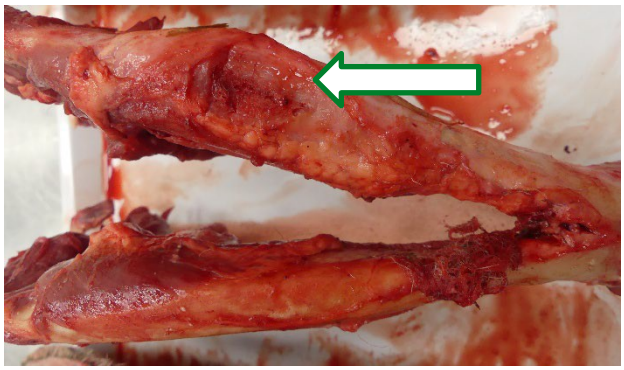

Figure 26: Osteomyelitis associated with dental disease (arrow). (image courtesy of University of Bristol).

Finally, five flocks had no significant flock level cause of ill thrift identified although some sporadic problems were identified, for example abomasal emptying defects or intestinal adenocarcinoma.

Conclusion

This project has demonstrated the value of PME in identifying causes of chronic disease by allowing for gross examination of all body systems, with targeted testing and histopathology to provide confirmation.

Out of the 75 flocks investigated 31 had evidence of one or more of the iceberg diseases, Johne's, CLA, OPA and MV but no border disease was detected (see figure 27). Five flocks had more than one Iceberg disease identified, three had Johne's and OPA, and two had Johne's and MV.

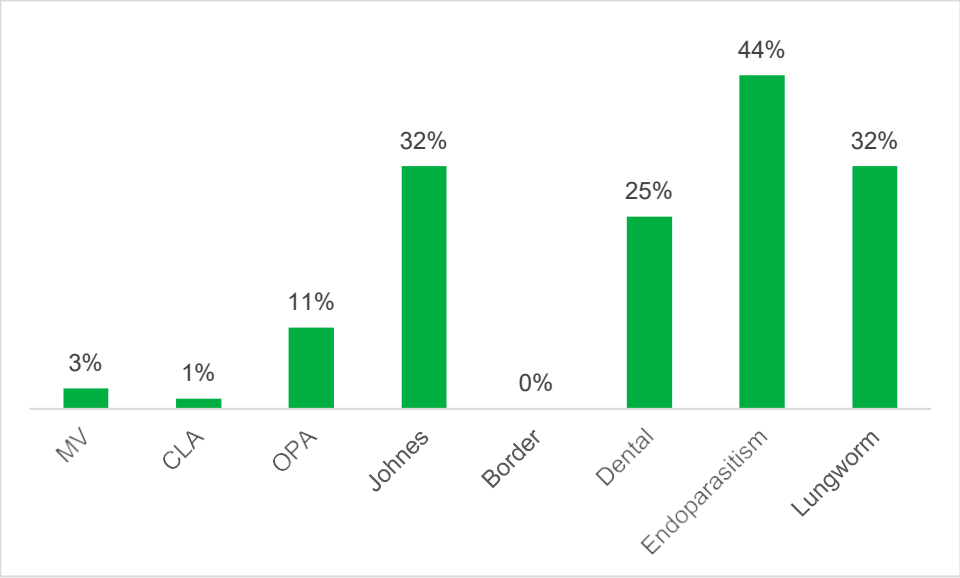

Figure 21: diseases identified by percentage of holdings.

When presented with a flock problem on farm it can be problematic to target test appropriately.

Serology can be convenient where there are no deaths but to determine flock prevalence requires testing many animals which can be expensive. For some diseases such as OPA there is no diagnostic test in the live animal although ultrasound scanning can be useful

Modification of this protocol might prove a useful tool for flocks for example as an annual flock screen on a proportion of cull ewes for disease monitoring and to provide evidence of flock health status.

Publications

APHA staff

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