



HIGHLIGHTS

Zoonotic infections

Yersiniosis due to *Yersinia pseudotuberculosis* was diagnosed as a cause of ileitis and colitis in a young reindeer.

Endemic, new & emerging diseases

1. Hypocuprosis was diagnosed as a contributing cause to ill-thrift in North American bison.
2. The death of an imported moose was attributed to malignant catarrhal fever due to infection with ovine herpes virus type-2.
3. Lymphosarcoma grossly affecting thymus and pre-scapular lymph nodes was diagnosed in a six-week-old alpaca cria, which had clinical signs of swelling at the base of the neck and dyspnoea.

Submission Information for England & Wales

Submission numbers	2009 Q2	2008 Q2	2007 Q2
All species (carcasses)	485 (135)	410 (122)	384 (96)
Alpaca	235 (45)	176 (40)	176 (32)
Llama	16 (3)	20 (5)	13 (0)
Deer	32 (10)	46 (16)	33 (7)

1. Notifiable Diseases

TUBERCULOSIS

From January to the end of September 2009, *Mycobacterium bovis* has been isolated from 18 submissions from seven alpaca herds, including two with infection initially

detected in 2008. There were single submissions in which *M. microti* and *M. avium* were isolated from alpacas.

2. Zoonotic Diseases

Salmonellosis

Salmonella Newport was isolated from a 15-month-old alpaca with ill-thrift, diarrhoea, tongue ulcers and recumbency prior to death. Post mortem examination was carried out by a practitioner and it is therefore unclear if this infection accounted for all the clinical signs. Advice was given regarding the zoonotic implications of this finding.

Yersiniosis

The death of a three month old reindeer was attributed to ***Yersinia pseudotuberculosis*** infection. The reindeer was kept in a group of five and fed reindeer pellets, sugar beet, haylage and oats; it became acutely ill and died within 24 hours. At necropsy the animal was in very poor body condition, the rumen was full of green fibre, and there was little milk in the abomasum. There was a severe necrotizing ileitis and small ulcers visible in the colon. *Yersinia pseudotuberculosis* was the predominant growth from the ileum. Gastro-intestinal parasitism was considered likely to have contributed to the calf's poor condition (200 *Trichostrongyle*-type eggs per gram and 200 *Trichuris* spp. e.p.g. detected in large intestine content). It was recommended that the body condition of the other reindeer, particularly the calf's mother, was checked. Enteritis due to *Yersinia pseudotuberculosis* infection typically occurs in debilitated animals.



The zoonotic risk of exposure to *Yersinia* was highlighted to the owners.

For further information about zoonotic conditions please see the FZ2100 project summary reports on the VLA website :

http://www.defra.gov.uk/vla/reports/rep_surv_zoonoses.htm.

3. Endemic New and Emerging Diseases: South American Camelids

PARASITIC DISEASES

Gastroenteric nematode infection was diagnosed in adult animals on three premises. Two of these had cases of anaemia in alpacas associated with *Haemonchus* species, with one premises having eight affected animals in the periparturient period, six of which died shortly after giving birth. Post mortem examination confirmed severe anaemia and pulmonary oedema. The problem appeared to resolve following anthelmintic treatment. On the third holding, a guanaco died after a period of weight loss and anaemia. Post mortem findings included widespread gelatinous oedema, ascites, thickening of the wall of the third stomach compartment (C3), and parasitic granulomata in the mesenteric lymph nodes; normal faecal pellets were present in the rectum. Total worm counts identified 2,100 *Teladorsagia circumcincta* in C3, with

800 *Nematodirus battus* and 1,100 *Cooperia curticei* in the small intestine. In addition, 450 *Trichuris* eggs were detected per gram of caecal contents.

Coccidiosis was diagnosed twice, in an alpaca of unknown age with a history of ill-thrift and diarrhoea and a faecal oocyst count of 2,110 *Eimeria macusaniensis* per gram, and in a ten-year-old alpaca in poor body condition with anaemia and an unspiciated coccidial oocyst count of 30,800 oocysts per gram of faeces.

Fasciolosis was confirmed on two premises in adult alpacas. Infestation was also suspected in an adult alpaca that had been euthanased following chronic weight loss. Post mortem findings in the latter case included a large fluid-filled cystic structure involving the omentum, a small volume of free peritoneal fluid, hepatic abscessation, spherical black enteroliths in the C2 stomach compartment, gastric ulceration of the C2 compartment (see Miscellaneous section below), and lymphadenopathy. Histopathology confirmed severe chronic fibrosing hepatitis with many of the changes suggestive of chronic fasciolosis. Liver fluke had previously been diagnosed on the premises.

SEPTICAEMIA AND RELATED DISEASES IN CRIAS

Colisepticaemia was diagnosed four times in neonates. Poor colostral uptake and premature birth were suspected predisposing factors in some of the affected crias. Congenital problems were also seen in two cases, including renal anomalies and flexor tendon contracture of the forelimbs (see congenital section below).

Poor colostral antibody transfer was also suspected in a three-day-old alpaca cria which had been born prematurely and was slow to suck. Blood biochemistry demonstrated a total protein of 44.1 (reference range 51-79 g/l), globulin level of 14.9 (reference range 17-40 g/l) and ZST of 13.9 units (reference range >40 units). Overall, the interpretation was that these results were consistent with hypogammaglobulinaemia.

SEPTICAEMIA AND RELATED DISEASES IN ADULTS

Sudden death was investigated in a two-year-old female alpaca. The animal had shared pasture with another alpaca, two Shetland ponies and an Arab horse. A severe purulent, bacterial meningitis and pneumonia were confirmed at histopathology. A *Streptococcus* species was isolated from the lung and 16S RNA sequence analysis demonstrated that it was most consistent with *S. equi* spp *ruminatorum*.

A ten-year-old alpaca deteriorated and was euthanased following exploratory laparotomy to determine the cause of sudden onset lethargy and abdominal pain. The most significant pathology was seen in the thorax with pleural effusion, diffuse pulmonary congestion and multifocal, 1-2mm, white pulmonary lesions. Culture of lung and heart produced heavy pure growths of *E. coli* and histopathology confirmed an acute interstitial pneumonia consistent with terminal septicaemia, toxæmia or disseminated intravascular coagulation.

Multiple abdominal abscesses and extensive adhesions between abdominal viscera were found in the carcase of a nine-year-old alpaca with a history of chronic weight loss and lethargy. There had been some response to antibiotic treatment, but relapses occurred once treatment was removed. The original predisposing cause of these lesions could not be identified at necropsy.

NEOPLASIA

Lymphosarcoma grossly affecting thymus and pre-scapular lymph nodes was diagnosed in a six-week-old alpaca cria, which had clinical signs of swelling at the base of the neck and dyspnoea for one week prior to death. However, death was caused by thoracic trauma (exact cause unknown) resulting in four fractured ribs and a large blood clot in the pleural cavity (see Miscellaneous section below).

A seven-year-old alpaca had been losing body condition over several weeks and then developed diarrhoea. An intussusception was detected by ultrasound examination of the ascending colon. During surgical reduction, multiple nodules were detected in the omentum and the animal was euthanased. Post mortem examination revealed multiple white firm nodules up to 1cm in diameter in the omentum and mesentery. Similar lesions were also found in the liver. Histopathology identified cholangiocellular carcinoma as the most likely cause.

CONGENITAL PROBLEMS

A two-day-old alpaca cria died having shown mouth breathing and an inability to feed. Choanal atresia and atresia ani were identified at necropsy. Choanal atresia is one of the most frequently detected congenital anomalies in alpacas. On another premises, a two-day-old alpaca cria had sudden onset of weakness. Clinical diagnosis of a congenital heart defect was made because of reduced capillary refill time, the presence of a heart murmur and abnormal ultrasonography findings. Post mortem examination confirmed the presence of three cardiac defects: a ventricular septal defect; a persistent foramen ovale; and tricuspid atresia. Pulmonary oedema and congestion of the liver were also present and were likely secondary to the circulatory deficits.

Congenital anomalies were also seen in two septicaemic crias that had been born prematurely (see septicaemia in crias section above), including marked abnormality of the urinary system in one case with hypoplasia of one kidney and hydronephrosis of both, and flexor tendon contracture affecting the forelimbs of another.

MISCELLANEOUS

Gastric ulceration affecting the C3 compartment was diagnosed four times. Three of these had resulted in peritonitis and death, one of which was assumed to have been precipitated by stress when a young male had difficulty adapting to a new group of animals. The fourth case which had not perforated was seen in an alpaca that had a suspected liver fluke infestation (as mentioned in Parasitic disease section above).

A six-year-old male alpaca died suddenly. Post mortem findings included diffuse and irregular thickening of the three stomach compartments with caseous, necrotic

material covering the mucosa. Histopathology revealed mucosal necrosis suggestive of possible acidosis.

A six-year-old alpaca developed lethargy and recumbency shortly after parturition and died. At post mortem examination, a mural endocarditis was identified in the right ventricle. The liver was largely unremarkable but did show some areas of calcification; there was no evidence of fluke infestation. The VLA has investigated a number of similar heart lesions recently, often in association with a concurrent fasciolosis – see poster reference below.

A thirteen-month-old alpaca with a history of chronic ill-thrift had marked spinal curvature in the thoracic region with decreased neurological reflexes, wide-based stance and slight ataxia. Kyphosis of the vertebrae T5-T6 with compression of the spinal cord was confirmed on radiography and post mortem examination.

A nine-year-old female post parturient alpaca developed severe watery diarrhoea followed by gradual weight loss. There was widespread gelatinous oedema in the carcase and approximately ten litres of pale fluid in the abdominal cavity. Liver copper was 12,142 $\mu\text{mol/kg DM}$ (reference range 3,000-5,000) $\mu\text{mol/kg DM}$ and kidney copper was 548 $\mu\text{mol/kg DM}$ (reference range not established). Histopathology showed an acute multifocal necrotising hepatitis. Overall the findings were similar to previous observations of copper toxicity in alpacas.

Hepatic lipidosis was suspected in a four-year-old female alpaca. It had been euthanased following rapid onset of lethargy, inappetance, shaking, passing mucoid faeces, and recumbency. Necropsy findings included a pale, swollen, fatty liver with a pronounced 'nutmeg' pattern. A potential predisposing factor was overfeeding for pregnancy, although a foetus was not identified at necropsy.

Hyposelenaemia (low GSH-Px) was demonstrated in an 11-year old alpaca. The animal had been shorn the day previously and then showed sudden onset twitching and shaking prior to the blood sample being taken. The clinical signs could not necessarily be directly ascribed to the blood biochemistry result.

Mycoplasma haemolamae was detected by PCR and DGGE in a blood sample from a two-year-old alpaca (see The VLA Mycoplasma Quarterly Report July-September 2009). Typical blood parasites were not seen on microscopic examination of a smear and the animal was not anaemic. The alpaca was underweight and hypoproteinaemic. The significance of *M. haemolamae* in this case is unclear, although it has been associated with anaemia in South American camelids.

Trauma resulting in four fractured ribs and a large blood clot in the pleural cavity was the cause of death in a young cria, although lymphosarcoma (see neoplasia section above) was also present at necropsy.

4. Endemic New and Emerging Disease - Zoological Collections

MAMMALS

Bison

A 15-month-old North American Bison (*Bison bison*) was presented for necropsy following a history of diarrhoea and wasting in five animals from the group. At necropsy subcutaneous and intramuscular haemorrhages were found over the thorax and forelimbs. Turbid, serous fluid was found in the abdominal cavity and the mesentery and walls of the intestines were oedematous. The mucosal surface of the abomasum appeared as 'Moroccan leather'. A total worm count of the abomasum demonstrated 12,300 *Ostertagia ostertagia* worms (<50 e.p.g. were detected on faecal egg count), which is likely to have resulted in condition loss and diarrhoea. The liver copper levels were 159µmol/kg DM and, although reference ranges for bison are not available, <300µmol/kg DM in cattle is suggestive of hypocupraemia. Bison are known for their bullying of weaker individuals and it is thought that this may be the ultimate cause of death. Advice was given regarding worming and copper supplementation.

Marked hypocupraemia was also found in two adult North American bison which had been culled due to recent and dramatic wasting. Liver copper concentrations of 87 and 97 µmol/kg DM were found in the two animals. An additional finding was traumatic reticuloperitonitis associated with a 4cm long wire fragment.

Hypocupraemia in bison appears to have been first reported in the literature in 1999 (Woodbury *et al.* 1999), but has been anecdotally reported in these species for many years.

Woodbury MR, Feist MS, Clark EG, Haigh JC (1999) Osteochondrosis and epiphyseal bone abnormalities associated with copper deficiency in bison calves. Canadian Veterinary Journal 40: 878-880.

Ungulates

Intermittent diarrhoea and poor condition was reported in a seven-year-old Barbary sheep (*Ammotragus lervia*). The carcass had white mucous membranes and there was dry faecal soiling and alopecia affecting the caudal thighs, tail and perineum. Serous atrophy of fat was noticed around the heart and in the bone marrow. A worm egg count on rectal contents revealed 1,300 Trichostrongyle-type eggs per gram, and a total worm count of the abomasal contents revealed 8,200 *Teladorsagia circumcincta*, consistent with endoparasitism leading to emaciation and anaemia.

A faecal sample from a second Barbary sheep was also examined. The ewe was ten years old and had been suffering from diarrhoea and wasting. The faeces were positive for *Mycobacterium avium* subsp. *paratuberculosis* by PCR consistent with a diagnosis of Johne's disease.

Lungworm infestation was diagnosed in two eland (*Taurotragus oryx*) from a zoological collection. One case was an incidental finding in the distal trachea and bronchi of a four-month-old calf which had been euthanased with hind limb paralysis.

The second case was an adult female which died after a brief period of malaise. *Dictyocaulus filaria* worms were present in moderate numbers in the trachea and bronchi. Additionally, there was a “morocco leather” appearance to the abomasal mucosa, indicating a chronic endoparasite problem. Cases such as this highlight the difficulty of controlling parasitic gastroenteritis in zoological collections. Administering known doses of anthelmintics may not be possible, treatments are often delivered in concentrate feed and animals most at risk, such as youngstock, may be displaced by adults.

Macropods

Pneumonia associated with *Fusobacterium necrophorum* was diagnosed in one out of two adult Bennett’s wallabies (*Macropus rufogriseus rufogriseus*) which had recently been introduced to a collection. Clinical signs were lethargy, excessive drinking, loss of weight and inappetence. Gross pathology revealed a necrotising pneumonia and fibrinous pleurisy. *F. necrophorum* was isolated on culture and histological findings confirmed multifocal necrotising pneumonia associated with numerous Gram-negative bacilli typical of *Fusobacterium* species. The recent transport may have been a risk factor for necrobacillosis in this wallaby, a condition to which they are prone when stressed.

A 10-month-old female Bennett’s wallaby was submitted for post mortem examination having been found dead with no premonitory signs noted. Signs of an enteropathy were found at post mortem, along with a coccidial oocyst count of 36,900 o.p.g. Coccidiosis is a recognized differential diagnosis for sudden death and diarrhoea in macropods in this age group. On speciation, these were found to be 100% *E. prionotemni*, a species previously associated with coccidiosis in macropods, although an unequivocal link between the infecting *Eimeria* species found in wallabies and pathogenicity has not yet been established (Twomey *et al.* 2008).

Twomey DF, Boon JD, Hume MJ, Schock A, Wood R. (2008) Concurrent coccidiosis and listeriosis in a Bennett’s wallaby (*Macropus rufogriseus*). *Veterinary Record* 163: 635-636.

BIRDS

The death of a four-month-old peafowl (*Pavo cristatus*) was due to *Capillaria* spp. infection and impaction of the gizzard and small intestine with fibrous material. The birds had been treated with fenbendazole approximately six weeks before the death of the bird submitted. At necropsy, the bird had no fat reserves and moderate numbers of *Capillaria* species worms and eggs were seen on mucosal scraping of the proximal and mid small intestine. It was thought that poor condition and the worm burden might have predisposed the bird to the impaction.

Post mortem examination of a 20 day-old East African Crowned Crane (*Balearicum reguloum*) from a zoological collection confirmed a diagnosis of syngamiasis, with a

plug of *Syngamus* nematodes in the proximal trachea likely to have caused significant obstruction. No clinical signs had been observed prior to death.

The carcase of a four-year-old female rhea was submitted with a history of lethargy and anorexia prior to death. Post mortem examination showed widespread egg peritonitis with a large formed egg free within the peritoneal cavity. In keeping with this condition which is seen predominantly in adult laying hens, *Escherichia coli* was isolated in a heavy mixed growth from oviduct, ovary and liver tissue.

A 9-year-old Black necked Aracari Toucan (*Pteroglossus aracari*) was presented from a local zoological collection. The most striking finding on post mortem examination was a bronze coloured liver with multifocal pinpoint pale foci on lobe surfaces. Histopathology detected brown pigment within macrophages and hepatocytes suspected to be haemosiderin and this was confirmed with a Pearls Prussian Blue stain. The cause of death therefore was suspected to be haemosiderosis (haemochromatosis), characterised by accumulation of iron in body tissues particularly the liver. Such accumulations initially may be subclinical but in time lead to iron storage disease. Species susceptible to this condition, such as Toucans, tend to be fruit eating birds that, in the wild, feed on a diet that is relatively low in iron. Diets fed in captivity therefore may lead to dietary iron excess.

An 8-year-old Kea parrot (*Nestor notabilis*) was presented from a local zoological collection having died following a period of sneezing and malaise. On post mortem examination the lungs contained miliary white foci and an extensive gelatinous white mass overlay them, effacing the air sacs. Four similar masses, 1-3 cm in diameter, were present within the coelom and the only discernible renal tissue was a small cranial remnant of the left kidney. On histopathology the mass was identified as a probable carcinoma with metastatic spread to lung tissue. The origin of the carcinoma could not be specifically identified but a renal tumour was considered a possibility, e.g. a nephroblastoma.

An African grey parrot (*Psittacus erithacus*), more than 40 years old, was submitted having died shortly after arrival at a local zoological collection. The bird had been a pet for 30 years and fed a diet primarily of sunflower seeds. On post mortem examination the walls of the vena cava, aorta and pulmonary artery were thickened and ridged in texture and histopathology was consistent with atherosclerosis. Furthermore, the liver was pale and friable, consistent with hepatic lipidosis. Atherosclerosis is a known cause of sudden death in parrots and is thought to be dietary related; the feeding of predominantly sunflower seeds with a high fat content may have contributed to this and to the hepatic lipidosis. In addition, the air sacs were thickened and contained multifocal black foci particularly over the lungs, consistent with anthracosis, caused by the build up of coal, smoke or dust particles in the lungs and air spaces.

5. Endemic New and Emerging Disease – Deer

Reindeer

A small group of castrated reindeer developed wart like nodules on the antlers and these were diagnosed as firbeopapillomas likely to be due to papillomavirus (PV)

infection. It was presumed that PV infection had been introduced to the group which included recently imported reindeer.

Moose

A 14-month-old female moose, imported from Sweden with a male of the same age in 2008, was found dead in the field which they had shared with one red deer, for one week. The moose had been inappetent for a few days but had shown no other signs of clinical disease. The two moose were fed potatoes, sugar beet and beef cattle nuts and were brought browse regularly and fruit and vegetables occasionally. The pair had been vaccinated against Bluetongue virus and clostridial diseases 9 months earlier, on introduction. Also on this holding, all bred in the UK, were reindeer, fallow deer, roe and sika deer and pygmy goats. These last had been present for only 4-6 weeks, but were separated from the moose by 500 metres. Sheep on a neighbouring farm had no direct contact with any of these animals. Necropsy showed a very autolysed carcass. PCR detected DNA of OvHV-2 in submandibular lymph node and histopathology of brain confirmed a diagnosis of Malignant Catarrhal Fever, in spite of significant autolysis.

A vasectomised male **fallow deer** over the age of ten was euthanased after being recumbent for over 24 hours. He was the only male in a group with 12 females, and was regularly ostracised from the group. The owners had noticed the week previously that he would stop in the middle of the field and 'appear startled'. Gross post mortem examination was unremarkable. Histopathology of the brain revealed a moderate leucomyelopathy characterised by vacuolation and occasional myeloblastic vacuoles in the dorsal and lateral funiculi. These findings indicate a toxic or metabolic cause, in this case it most likely represented enzootic ataxia syndrome of deer. The aetiology of this disease is multifactorial and may be associated with copper metabolism. Liver and plasma/serum copper concentrations will be low. Copper supplementation appears to be preventative even if copper levels in the feed are reportedly sufficient.

A high mortality in newborn **red deer** fawns prompted the submission of the carcasses of a one-day and two-day-old fawns for post-mortem examination. Affected fawns born to a herd of red and fallow deer were either born dead or struggled to rise following birth, with deaths occurring at anytime up to two days of age. Post-mortem examination was generally unremarkable but it was noted that neither fawn had suckled. Cultures of lung and liver of each carcass revealed heavy pure growths of non-haemolytic *E. coli* confirming colisepticaemia was probably secondary to neonatal hypothermia. There was no evidence of other underlying problems and advice was given to reduce stress in heavily pregnant and calving does to encourage maternal bonding and easy parturition.

PUBLICATIONS

- 1 Schock *et al.* (2009) Mural endocarditis in British Alpacas (*Vicugna pacos*). Poster & abstract at the 27th annual meeting of the European Society of Veterinary Pathology and European College of Veterinary Pathology, Krakow, Poland.

Available through the ESVP website: <http://www.esvp.eu/>

- 2 Hogg *et al.* (2009) Clostridial myocarditis in a scimitar-horned oryx. (Letter) *Veterinary Record* 165: 356.