BEVA / DEFRA
Equine Quarterly Disease Surveillance Report

Volume: 16, No. 4
Oct. – Dec. 2020

HIGHLIGHTS IN THIS ISSUE

News Articles

- Update from the former Animal Health Trust teams
- Horserace Betting Levy Board publishes International Codes of Practice for 2021
- UK Disease Update for 2021

Focus Article

- A focus article: 'On the use of worm egg count data to both detect and counteract UK trends in equine helminth abundance'

Important note:
The data presented in this report must be interpreted with caution, as there is likely to be some bias in the way that samples are submitted for laboratory testing. For example they are influenced by factors such as owner attitude or financial constraints or are being conducted for routine screening as well as clinical investigation purposes. Consequently these data do not necessarily reflect true disease frequency within the equine population of Great Britain.

BEVA

Department for Environment Food & Rural Affairs

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INTRODUCTION

Welcome to the fourth quarterly equine disease surveillance report for 2020 produced by the Department for Food, Environment and Rural Affairs (DEFRA), British Equine Veterinary Association (BEVA) and Animal & Plant Health Agency (APHA).

National disease data is collated through multiple diagnostic laboratories and veterinary practices throughout the United Kingdom, providing a more focused insight into the occurrence of equine infectious disease. Due to the global mixing of the equine population through international trade and travel, collaboration on infectious disease surveillance between countries occurs on a frequent basis to inform and alert. Both national and international information will be summarised within this report.

To receive reports free of charge, via e-mail, on a quarterly basis, please contact equinesurveillance@gmail.com

Any comments and feedback on the report is welcomed and we encourage contributions on focus articles Please contact equinesurveillance@gmail.com

NEWS ARTICLES

News from the former Animal Health Trust teams

As an update to key laboratory work previously carried out at the AHT, some of the former AHT diagnostic team are now running serological testing for equine herpesviruses (EHV) by complement fixation (CF) test, equine influenza by haemagglutination inhibition (HI) test and equine viral arteritis (EVA) by virus neutralisation (VN) test in temporary facilities within the Rossdales Laboratory. The experienced virology team are also able to provide virus isolation testing to support PCR testing should this be required.

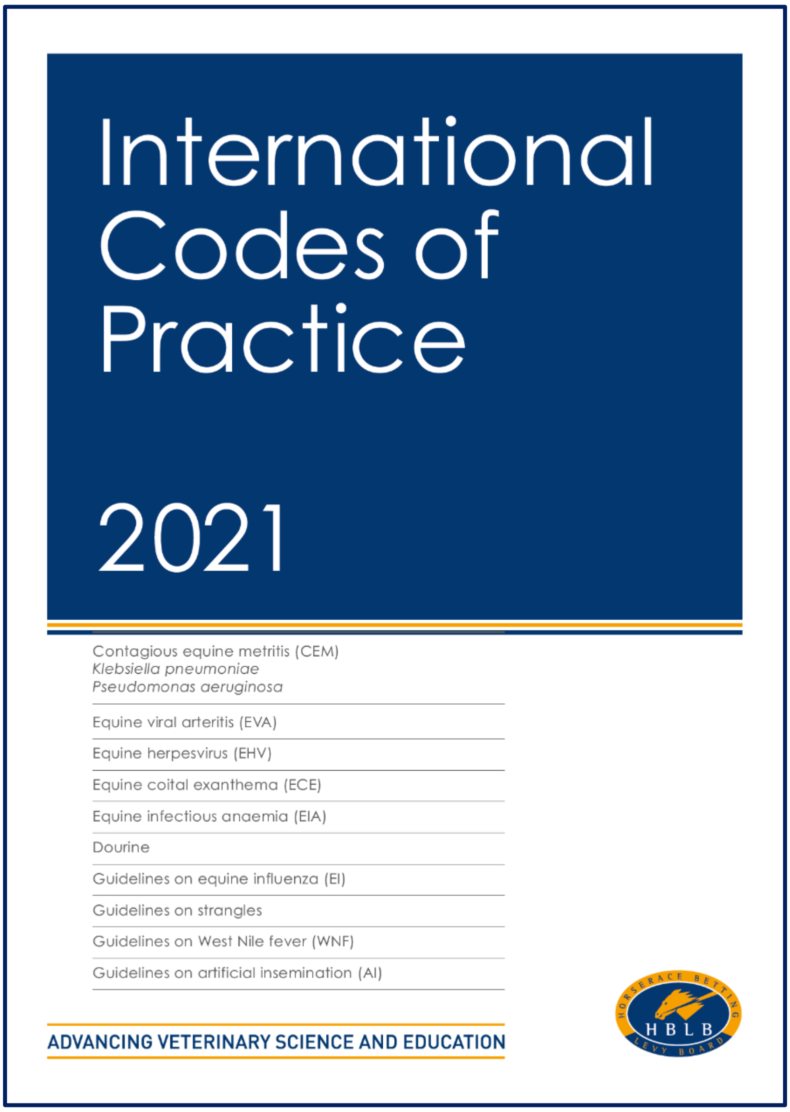
We should let you know that we are still able to supply horse and pony/foal swabs along with transport media. They are available now to purchase via equinesurveillance@gmail.com.

We are delighted to announce that Defra have kindly extended our contract to produce the Defra/BEVA Equine Quarterly Disease Surveillance Report for a further two quarters until the Q2 2021 has been produced.

Horserace Betting Levy Board Publishes International Codes of Practice for 2021

The Horserace Betting Levy Board (HBLB) has published the 43rd edition of the now International Codes of Practice on equine disease, in preparation for the 2021 equine breeding season following its annual review by an expert Sub Committee of HBLB's Veterinary Advisory Committee. The Codes are available online at codes.hblb.org.uk and may be accessed as a full document or as separate sections and may be downloaded in pdf format for printing or viewing offline. The updated free app, EquiBioSafe, which covers both breeding and horses in training will be released on iOS and Android subsequently.

Applying to all breeds of horse and pony, and to both natural mating and artificial insemination, the Codes are an essential guide for the prevention and control of equine diseases which represent a potential major threat to equine breeding. For each disease there are sections which describe transmission and clinical signs, as well as advice on prevention, diagnosis and control of infection. The Codes also explain the notification requirements that apply for diseases that are notifiable by law in the UK.



The 2021 version of the Codes includes a major new section giving guidelines on how to recognise, diagnose and manage West Nile fever (WNF), which as this report has previously highlighted is expanding its geographical coverage into northern Europe and it may only be a matter of time before WNF is seen in the UK (see 1Q 2020 Report under Resources and Archives https://app.jshiny.com/jdata/icc/iccview/). The revisions for this year also include updates to the swabbing protocol for declaring freedom from infection in animals notified as infected with Taylorella equigenitalis, the cause of contagious equine metritis (CEM). These changes are evidence based and have been introduced based on experience with clearing an infected stallion in Scotland in 2020, for further information on this case ***click here***. A number of small updates have also been made elsewhere throughout the document, including revision of simplified Defra contact details.

Further information about the Codes and the changes made for 2021 are available from Annie Dodd, HBLB Grants Manager, by email at annie.dodd@hblb.org.uk or by direct telephone on 020 7504 4014.

UK Disease update for 2021

Equine Herpes Virus (EHV-1) Neonatal Foal Death

On 19 January 2021, Rossdales Laboratories reported a case of EHV-1 neonatal foal death that occurred on a premises in Berkshire. The affected mare is a fully vaccinated Thoroughbred that was covered in France returned to the UK in May 2020 with a negative EHV PCR and was grouped with one other mare on the stud, which has foaled a live healthy foal. The positive diagnosis was made based on gross post mortem findings and PCR. Biosecurity measures are in place and the HBLB International Codes of Practice have been implemented.

Equine Herpes Virus-1 (EHV-1) Abortion

On 21 January 2021, Rossdales Laboratories reported a case of EHV-1 abortion that occurred on a premises in Norfolk. The affected mare is a six-year-old non-vaccinated Thoroughbred that has been purchased from the 2019 December sales. There are five other pregnant mares on the premises, although these mares were physically distanced from the affected mare in another part of the premises, when the abortion occurred. The positive diagnosis was made based on gross post mortem findings and PCR. Biosecurity measures are in place and the HBLB International Codes of Practice have been implemented.

UK Infectious Disease Reports

(1 October to 31 December 2020)

This section summaries **laboratory confirmed** infectious disease outbreaks reported in the United Kingdom during the fourth quarter 2020. Each reported outbreak may involve more than one animal. To view current outbreak reports, see http://jdata.co.za/iccviewer/. No reported outbreaks in a region does not necessarily equate to the area being free from the disease. When a particular disease is reported as 'endemic', disease outbreaks are common and are at an expected level.

Reproductive Diseases

Equine Herpes Virus-1 (EHV-1) Abortion

On 29 December 2020, Rossdales Laboratories reported a case of EHV-1 abortion that occurred on a premises in Suffolk on 25 December 2020. The affected mare was a vaccinated four-year-old Thoroughbred with six direct in-contacts. The positive diagnosis was made based on gross post-mortem findings and PCR. Biosecurity measures were put in place and the HBLB International Codes of Practice implemented.

Respiratory Diseases

Equine Influenza (EI)

On 1 December 2020, Rainbow Equine Laboratory confirmed a case of EI on a private premises with six resident horses in Lancashire, England. The laboratory confirmed case was a non-vaccinated two-year-old non-Thoroughbred filly that had been recently imported from the Netherlands and presented several days later with clinical signs that included fever, cough, mucopurulent nasal discharge and conjunctivitis. The positive diagnosis was confirmed by qPCR on a nasopharyngeal swab.

On 4 December 2020, Rossdales Laboratories confirmed a case of EI on a private premises in Cheshire, England. The laboratory confirmed case was one of two non-vaccinated, non-Thoroughbreds that has recently arrived on the premises and within several days the first animal started to show mild clinical signs of nasal discharge and coughing, the other horse then developed signs. A vaccinated horse housed close to the two affected horses has remained healthy. The positive diagnosis was confirmed by qPCR on a nasopharyngeal swab. There are approximately 35 animals on the premises, of which around 10 were reported as vaccinated.

On 9 December 2020, Rossdales Laboratories confirmed a case of EI on a private premises in North London, England. The laboratory confirmed case was one of two non-vaccinated, non-Thoroughbreds that had recently arrived on the premises and within two days started to show clinical signs of mild pyrexia, nasal discharge and coughing. The positive diagnosis was confirmed by qPCR on a nasopharyngeal swab. There were approximately 10 other animals on the premises, none of which were vaccinated or reported as affected so far. The premises instituted voluntary movement restrictions and heightened clinical monitoring.

HBLB Surveillance Scheme

Please note the HBLB Surveillance Scheme is currently on hold for diagnosis of equine influenza diagnosis. We will update our readers as and when further information is available.

Tell-Tail Text Message Alert Scheme

In the case of an outbreak, notification will be reported by the text alert service (Tell-Tail) for UK equine practitioners sponsored by Boehringer Ingelheim. This free of charge service alerts practitioners to outbreaks of equine influenza, equine herpes abortion and equine herpes neurological disease in the UK via text message. Sign up to receive alerts at www.telltail.co.uk

SURVEILLANCE OF EQUINE STRANGLES

(1 October to 31 December 2020)

2020Q4
SES laboratory

Surveillance of Equine Strangles (SES) is a Horse Trust funded surveillance project based at the Royal Veterinary College. The SES Laboratory network is comprised of nine diagnostic laboratories based across the UK.

A total of **37 positive diagnoses of *S. equi*** were reported by SES Laboratory during October to December 2020 from samples submitted by 18 veterinary practices in the UK. Information regarding reported samples is summarised in Table 1.

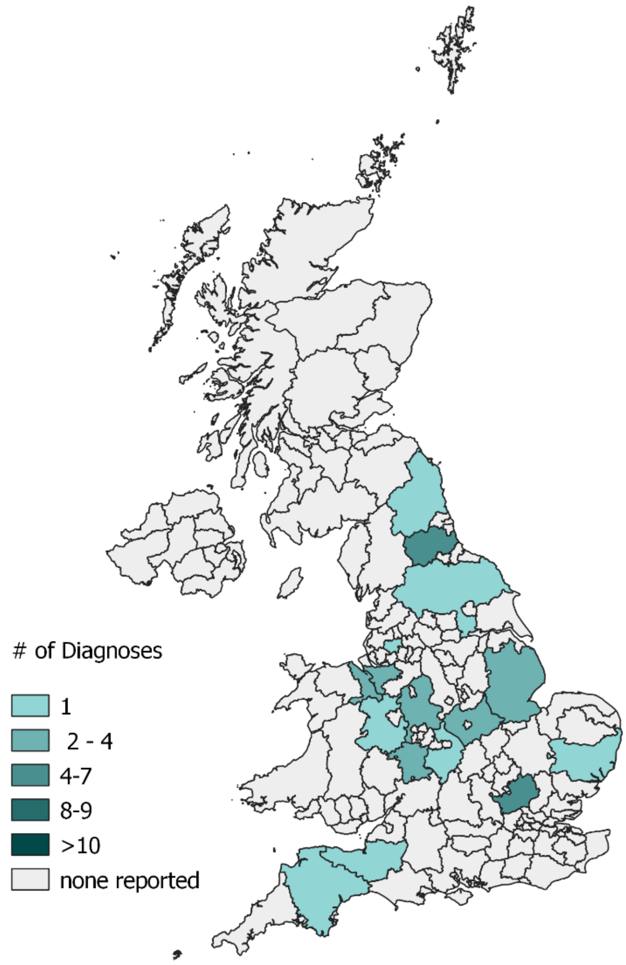


Figure 1: Frequency of reported laboratory diagnoses of *S. equi* across divisions of the UK from SES Laboratory during 2020 Q4. Diagnoses are mapped by submitting vet practice location.

Table 1: *S. equi* samples reported Oct. – Dec. 2020

	n	%
Total horses sampled	37	100%
Sample type*	40	
Swab	19	48%
Nasopharyngeal	8	42%
Abscess material	3	16%
Nasal	5	26%
Unspecified	1	5%
Other	2	11%
Guttural pouch lavage	20	50%
Other	1	2%
Diagnostic tests		
PCR only requested	25	68%
PCR and culture requested	8	22%
Culture only requested	4	11%
LAMP**	0	0%
Signalment		
Sex of horse indicated	24	65%
Female	11	46%
Male	13	54%
Breed of horse	18	49%
Native UK pony	5	28%
Native UK horse	2	11%
Sports horse	8	44%
Non-UK native horse/pony	1	6%
Crossbreed	2	11%
Age of Horse	16	43%
Range (IQR)	6m - 21yrs (5-13yrs)	
Median	7 years	
Clinical signs reported***	30	
Nasal discharge	11	37%
Pyrexia	7	23%
Coughing	1	3%
Other	0	0%
Abscess	2	7%
Inappetence	1	3%
Glandular swelling	7	23%
Guttural pouch empyema	1	3%
Reason for sampling reported	25	68%
Total reasons*	28	
Clinically ill horse	14	50%
Respiratory infection screening	1	4%
Seropositive strangles ELISA	2	7%
In contact	1	4%
Post infection screening	8	29%
Strangles suspected	1	4%
Pre/post movement screen	1	4%
Premises type	0	0%

**can include multiple entries per submission*
***Loop-mediated isothermal amplification*
****From 15 samples*

UK LABORATORY REPORT

(1 October to 31 December 2020)

Virology

The results of virological testing for October to December 2020 are summarised in Table 2. Please note, APHA's sample population is different to the other contributing laboratories as their tests are principally in relation to international trade.

Table 2: Results of virological testing, October to December 2020

	Samples tested (n)	Positive (n)	CLs (n)
Serological Tests			
Reproductive/Systemic diseases			
EVA ELISA	1895	21*	7
EVA VN	31	6*	2
EVA (APHA) VN	710	26*	1
EIA ELISA	592	0	7
EIA Coggins	19	0	4
EIA (APHA) ELISA	21	0	1
EIA (APHA) Coggins	1299	0	1
EHV-3 VN	0	0	1
Reproductive/Respiratory/Neurological disease			
EHV-1/-4 CFT	67	0†	1
EHV-1/-4 (APHA) CFT	128	0†	1
Respiratory diseases			
ERV-A/-B CFT	0	0†	1
Influenza HI	0	0†	0
Gastrointestinal disease			
Rotavirus ELISA	37	0	5
Neurological disease			
WNV (APHA) cELISA	1	0	1
WNV (APHA) IgM ELISA	2	0	1
Virus Detection			
Reproductive diseases			
EHV-3 PCR	0	0	1
EVA VI/PCR	0	0	1
EVA (APHA) VI/PCR	4	0	1
Reproductive/Respiratory/Neurological diseases			
EHV-1 PCR	623	3	7
EHV-1 LAMP	6	0	2
EHV-4 PCR	622	26	7
EHV-4 LAMP	6	0	2
EHV-1 VI	0	0	1
EHV-4 VI	0	0	1
Respiratory diseases			
EHV-2 PCR	18	3	3
EHV-5 PCR	19	1	3
ERV PCR	0	0	3
Influenza PCR	668	5	7
Influenza (APHA) PCR	267	0	1
Influenza LAMP	5	0	2
Gastrointestinal diseases			
Equine coronavirus PCR	36	2	2
Rotavirus (Strip Test)	0	0	4
Neurological disease			
WNV (APHA) PCR+	0	0	1

*Seropositives include vaccinated stallions, †Diagnosed positive on the basis of seroconversion between paired sera, +APHA now provides testing for West Nile Virus as part of clinical work up of neurological cases, to exclude infection on specific request, provided the local regional APHA office has been informed. CFT Complement fixation test, CLs Contributing laboratories, EHV Equine herpes virus, EIA Equine infectious anaemia, ERV Equine rhinitis virus, EVA Equine viral arteritis, HI Haemagglutination inhibition, VI Virus isolation, VN Virus neutralisation, WNV West Nile virus, LAMP loop mediated isothermal amplification

Bacteriology

A summary of the diagnostic bacteriology testing undertaken by different contributing laboratories is presented in Table 3. The BEVA laboratory registering scheme is for the testing of CEMO, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Granting and maintenance of approval depends on a laboratory achieving correct results in quality assurance tests and reporting data to this report. BEVA publishes a list of approved laboratories annually. All 21 of the BEVA approved laboratories in the UK contributed data to this report. No equine bacterial notifiable diseases have been confirmed in the UK during the fourth quarter of 2020.

Table 3: Results of bacteriological testing, October to December 2020

	Samples tested (n)	Positive (n)	CLs (n)
Reproductive diseases			
CEMO (BEVA) PCR	457	0	9
CEMO (BEVA) culture	1120	0	19
CEMO (APHA) PCR	2017	0	1
CEMO (APHA) culture	138	0	1
Klebsiella pneumoniae PCR*	457	9†	9
Klebsiella pneumoniae culture*	1120	6†	19
Pseudomonas aeruginosa PCR*	457	12	9
Pseudomonas aeruginosa culture*	1121	3	19
Respiratory diseases			
Streptococcus equi PCR	1108	66	8
Streptococcus equi LAMP	6	0	2
Streptococcus equi culture	521	24	16
Streptococcus equi ELISA Antigen A/C (AHT)	4156	266§	5
Streptococcus equi ELISA M-protein (IDVET)	58	0	2
Rhodococcus equi culture	44	0	7
Rhodococcus equi PCR	29	3#	4
Rhodococcus equi immunochromatography	0	0	2
Gastrointestinal diseases			
Campylobacter	8	1	8
Clostridium perfringens PCR	10	1	5
Clostridium perfringens Toxin ELISA	238	11	6
Clostridium difficile PCR	10	1	4
Clostridium difficile Toxin ELISA	248	14	6
*Lawsonia intracellularis*** PCR	111	16	4
Lawsonia intracellularis IPMA	125	50[1]	2
Salmonella Typhimurum culture	324	10¶	9
Salmonella Typhimurum PCR	108	7¶	5
Salmonella Other *spp* culture	363	9¶	10
Salmonella Other *spp*¶ PCR	74	2¶	5
Salmonella Typhimurum (APHA)	12	2¶	1
Salmonella Other *spp*¶ (APHA)	12	8¶	1
Miscellaneous diseases			
MRSA culture	473	14	12
Borrelia burgdorferi PCR	0	0	4
Borrelia burgdorferi ELISA	25	6	5
Burkholderia mallei (Glanders) (APHA) CFT	621	0	1

***** reproductive tract samples only,† capsule type 1,2,5, **§** seropositivity may be attributed to disease exposure, vaccination, infection or carrier states, # seropositives include exposure to the virulent form of *R equi* or the presence of maternally derived antibodies, ****** identified using PCR applied to faeces, **1** seropositives include vaccinated animals, ¶ Under the Zoonoses Order 1989, it is a statutory requirement to report and serotype positive cases for *Salmonella spp*. A positive case may have repeat samples taken.

BEVA British Equine Veterinary Association approved laboratories, CEMO contagious equine metritis (*Taylorella equigenitalis*), CFT complement fixation test, CLs Contributing laboratories, IPMA immunoperoxidase monolayer assay, MRSA methicillin resistant *Staphylococcus aureus,* LAMP loop mediated isothermal amplification

APHA *Salmonella* results

Twelve samples were submitted this quarter to the Animal and Plant Health Agency (APHA) and ten were positive for *Salmonella*. From the incidents involving isolates typed by the APHA, the serovars/phagetypes reported were *S.* Newport (3 isolates), *S.* Typhimurium (2 isolates), *S.* Kingston (2 isolates), and single incidents each of *S.* Agama, *S.* Anatum and *S.* Javiana.

S. Newport and *S.* Agama are usually associated with badgers, whereas *Salmonella* Typhimiurium (DT193 and U320) is primarily found in pigs and *S.* Anatum is likely to be of wild bird origin. For more information from APHA about *Salmonella* in Great Britain, please see the *Salmonella* in livestock surveillance report https://www.gov.uk/government/publications/salmonella-in-livestock-production-in-great-britain

Toxicosis

A summary of diagnostic toxicosis testing undertaken by contributing laboratories is presented in Table 4. Results for toxicosis are based on histopathologically confirmed evidence of disease only (where applicable).

Table 4: Results of toxicosis testing, October to December2020

	Samples tested (n)	Positive (n)	CLs (n)
Grass Sickness	13	1	5
Hepatic toxicosis	20	3	5
Atypical myopathy/Seasonal Pasture Associated Myopathy	1	0	5

Parasitology

A summary of parasitology testing undertaken by contributing laboratories is presented in Table 5.

Table 5: Results of Endoparasitology testing, October to December 2020

	Samples tested (n)	Positive (n)	CLs (n)
Endoparasites			
Ascarids	3612	67	16
Strongyles (large/small)	4401	1566	17
Strongyloides	3958	158	14
Tapeworms ELISA serum	771	214	1
Tapeworms ELISA saliva	12963	4382	1
Tapeworm Fecal exam	3007	21	11
Oxyuris equi Fecal exam	1143	1	8
Oxyuris equi Tape Strip	20	1	9
Dictyocaulus arnfieldi	54	2	7
Fasciola hepatica Fecal exam	105	3	9
Fasciola hepatica ELISA serum	3	0	1
Cryptosporidia Fecal exam	15	0	5
Cryptosporidia Snap test	44	0	3
Giardia Snap test	15	3	3
Coccidia	825	3	10
Theileria equi cELISA	212	3	4
Babesia caballi cELISA	212	0	4
Theileria equi (APHA) CFT	136	4	1
Theileria equi (APHA) IFAT	383	4	1
Theileria equi (APHA) cELISA	222	3	1
Babesia caballi (APHA) CFT	136	0	1
Babesia caballi (APHA) IFAT	381	2	1
Babesia caballi (APHA) cELISA	222	1	1
Dourine (APHA) CFT*	536	1	1
Dourine (APHA) IFAT	5	0	1

* CFT suspect/positive samples are then tested by IFAT and all were negative, CFT Complement fixation test, CLs Contributing laboratories, IFAT Immunofluorescent antibody test

Table 6: Results of Ectoparasitology testing, October to December 2020

	Samples tested (n)	Positive (n)	CLs (n)
Ectoparasites			
Mites	195	4	12
Lice	175	0	10
Ringworm culture	59	3	12
Ringworm microscopy	182	51	10
Ringworm PCR	110	44	3
Dermatophilosis culture	45	2	8
Candida culture	38	1	7
Candida microscopy	15	0	5
Leptospira PCR	7	2	5

EQUINE GRASS SICKNESS

(1 October to 31 December 2020)

An equine grass sickness (EGS) surveillance scheme was established in spring 2008 to facilitate the investigation of changes in geographical distribution and incidence of the disease in Great Britain. Data gathered by this scheme is collated in a strictly confidential database.

Having up to date reports from across the country will help provide an accurate representation of numbers of EGS cases nationwide and is vital to help continue epidemiological research into the disease. Reporting cases of EGS can be done by either the attending veterinary surgeon or the owner, by following www.grasssickness.org.uk/research/reporting-grass-sickness-cases.

Between October and December 2020 one case of EGS was reported to The Equine Grass Sickness Fund. The case took place in December, in Aberdeenshire, Scotland. It was a sub-acute case, diagnosed on clinical signs by the attending veterinary surgeon. The horse was a 34-year-old gelding of unknown breed.

International Infectious Disease Reports

(1 October to 30 December 2020)

International Collating Centre

Fourth Quarter Summary Report: October - December 2020

ITBF International Thoroughbred Breeders' Federation

This article provides a summary of international disease outbreaks during October to December 2020. It should also be noted that additional summary reports were kindly received that included further information on disease occurrence for that country but which had not been reported in previous real-time ICC reports. This additional information is identified by * in the tables and text where relevant throughout this report. The information from the ICC interim (real-time) reports are available on the interactive ICC website, which can be found at http://jdata.co.za/iccviewer/.

The data presented in this report *must be interpreted with caution*, as there is likely to be some bias in the way that samples are submitted for laboratory testing and subsequently reported. Consequently these data do not necessarily reflect true infectious disease frequency within the international equine population. A country with no reported outbreaks of a disease does not necessarily equate to the disease not being present in that country. Each table below summarises the number of disease outbreaks reported by a country. Each reported outbreak may involve more than one animal.

Reproductive Diseases

Country	CEM	EHV-1	EVA	Leptospirosis	Nocardiosis	PHF
France	-	3	-	1	-	-
Germany	*	3	*	-	-	-
Japan	-	*	-	-	-	-
Netherlands	-	2	-	-	-	-
UK	-	1	-	-	-	-
USA	-	*	-	*	*	*

*relates to additional summary information reported at the end of the quarter, but which was not reported via ICC interim reports

Contagious Equine Metritis (CEM)

Germany

*Three cases of CEM in Icelandic stallions were reported. Positive diagnoses were confirmed by PCR and reported after the quarter end.

Equine Herpes Virus-1 (EHV-1) Abortion

France

Three outbreaks of EHV-1 abortion with single cases in each were reported - including one in a Thoroughbred and one in a French Trotter. Positive diagnoses were confirmed by PCR on fetal tissues or placenta.

Germany

Three outbreaks of EHV-1 abortion with single cases in each were reported – all in vaccinated Thoroughbreds. Positive diagnoses were confirmed by PCR on fetal tissues.

Japan

*Five outbreaks of EHV-1 abortion involving seven Thoroughbreds were reported after the quarter end. Positive diagnoses were confirmed by PCR. Six of the seven animals were vaccinated.

Netherlands

Two outbreaks of EHV-1 abortion with single cases in each in unvaccinated animals were reported. Abortion took place in seventh or eighth months of gestation. Positive diagnoses were confirmed by PCR on fetal tissues or vaginal swab.

UK

One case of EHV-1 abortion was confirmed in a vaccinated Thoroughbred on a premises in Suffolk. Positive diagnosis was made based on gross post-mortem findings and PCR.

USA

*Four cases of EHV-1 abortion were recorded in Kentucky and reported after the quarter end.

Equine Viral Arteritis (EVA)

Germany

*One case of EVA in a Warmblood stallion was reported. Positive diagnosis was confirmed by PCR and virus isolation and reported after the quarter end.

Leptospiral Abortion

France

One case of leptospiral abortion was reported in a six-year-old French Trotter. Positive diagnosis was confirmed by PCR on placenta.

USA

*Two cases of leptospiral abortion were diagnosed in Kentucky and reported after the quarter end.

Nocardiosis

USA

**Amycolatopsis* and/or *Crossiella equi* were detected in several cases of nocardioform placentitis and abortion and reported after the quarter end.

Potomac Horse Fever (PHF)

USA

*One case of PHF with clinical signs of abortion was reported in Kentucky after the quarter end.

Respiratory Conditions

Country	EHV-1	EHV-4	EHV-1 &-4	EHV-2 &-5	EHV-4/ Strangles	Flu	Flu/ EHV-4	*R. equi*	Strangles
Belgium	-	2	-	-	1	-	-	-	1
Canada	-	-	-	-	-	2	-	-	1
France	2	14	2	-	-	3	-	-	5
Germany	*	*	-	*	-	3*	-	*	*
Netherlands	2	2	-	-	-	2*	-	-	13*
UK	-	-	-	-	-	3	-	-	-
USA	-	-	*	*	-	16	1	*	13

*relates to additional summary information reported at the end of the quarter, but which was not reported via ICC interim reports

Equine Herpes Virus-1 (EHV-1) Respiratory Infection

France

Two outbreaks of EHV-1 respiratory infection were reported with single cases in each. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

Germany

*One case of EHV-1 respiratory infection was reported. Positive diagnosis was confirmed by PCR and reported after the quarter end.

Netherlands

Two outbreaks of EHV-1 respiratory infection were reported with two unvaccinated cases in one outbreak and five unvaccinated cases in the other. Clinical signs included pyrexia, nasal discharge, cough and leg oedema. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

Equine Herpes Virus-4 (EHV-4) Respiratory Infection

Belgium

Two outbreaks of EHV-4 respiratory infection were confirmed with single cases in each. One case had a co-infection of EHV-2 &-5. Clinical signs included pyrexia and cough. The other case, in a three-year-old, had a co-infection of EHV-2. Positive diagnoses were confirmed by PCR on nasal swabs.

France

Fourteen outbreaks of EHV-4 respiratory infection were confirmed with single cases in 11 outbreaks and two cases in three outbreaks. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs in 12 outbreaks. The other two outbreaks were confirmed either by PCR on blood or by PCR on tracheal lavage.

Germany

*One case of EHV-4 was confirmed in a pyrexic animal. Positive diagnosis was confirmed by PCR and reported after the quarter end.

Netherlands

Two outbreaks of EHV-4 respiratory infection were reported. One in a group of four unvaccinated foals with positive diagnoses by PCR on a pool of two nasopharyngeal swabs. The other outbreak was in a five-month-old foal with clinical signs of lethargy, increased breathing and oedematous legs. Positive diagnosis was confirmed by PCR on a nasopharyngeal swab.

*One additional outbreak was reported that took place in December, but reported after the quarter end involving one case in Friesland. Clinical signs include nasal discharge. Positive diagnoses was confirmed by PCR on a nasopharyngeal swab.

Equine Herpes Virus-1 & -4 (EHV-1 & -4) Respiratory Infection

USA

*EHV-1 & -4 co-infection occurred in numerous states, primarily associated with respiratory illness in foals and were reported after the quarter end.

France

Two outbreaks of EHV-1 &-4 were reported with a single case in each. Clinical signs included pyrexia, nasal discharge and lymphadenopathy. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

Equine Herpes Virus-2 & -5 (EHV-2 &-5)

Germany

*Five cases of EHV-2 & EHV-5 in foals showing respiratory signs were confirmed by PCR after the quarter end.

USA

*Numerous cases of infection with or both viruses were diagnosed in several states some, associated with upper respiratory disease, and were reported after the quarter end.

Equine Herpes Virus-4 (EHV-4) Respiratory Infection/Strangles

Belgium

One outbreak of EHV-4 respiratory infection and *Streptococcus equi* (strangles) co-infection in a number of unvaccinated foals was reported. Clinical signs included pyrexia, cough, nasal discharge and lymphadenopathy. Positive diagnoses were confirmed by PCR on nasal swabs.

Equine Influenza (EI)

Canada

Two outbreaks of EI were reported. One outbreak with two cases in unvaccinated Welsh Crosses and the other outbreak with a single five-year-old gelding. Clinical signs included cough, pyrexia and nasal discharge.

France

Three outbreaks of EI were confirmed with single cases in two outbreaks and two cases in one outbreak. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

Germany

Three outbreaks of EI were reported with single cases in each, however, two of the cases were from the same premises, but reported separately. Clinical signs included pyrexia and nasal discharge. Positive diagnoses were confirmed by PCR on nasal swabs.

*One additional outbreak was reported that took place in December, but was reported after the quarter end involving seven mostly unvaccinated animals on a single premises. Clinical signs included cough, pyrexia and nasal discharge. The animals ranged in ages from yearlings to 11-years-old. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

Netherlands

Two outbreaks of EI were confirmed, the first with a single case with clinical signs of pyrexia and inappetence. Positive diagnosis was confirmed by PCR on a nasopharyngeal swab. The second outbreak involved six unvaccinated foals with clinical signs including cough and one presenting with purulent conjunctivitis. Positive diagnoses were confirmed by PCR on a pool of three nasopharyngeal swabs.

UK

Three outbreaks of EI were confirmed with single cases in each. All animals were unvaccinated including one Thoroughbred (non-racing). Clinical signs included pyrexia, nasal discharge, cough and conjunctivitis. Positive diagnoses were confimred by PCR on nasopharyngeal swabs.

USA

Sixteen outbreaks of EI were confirmed during 4Q 2020, 10 involved single cases, three involved two cases, two involved three cases and one involved 40 cases. The outbreak involving 40 cases was in California where it was reported that nearly 40 donkeys had died from an outbreak of EI. The deaths were first seen in mid-October and occurred mostly in the Reche Canyon area near Moreno Valley and Colton with approximately six deaths occurring in Moreno Valley.

Equine Influenza (EI)/Equine Herpes Virus-4 (EHV-4)

USA

A single case of EI with a co-infection of EHV-4 was reported.

Rhodococcus equi

Germany

**Rhodococcus equi* was reported in two foals with abscessating bronchopneumonia, which were reported after the quarter end. Positive diagnoses were confirmed by PCR and culture.

USA

**Rhodococcus equi* infection is endemic and widespread in the USA. A single outbreak was confirmed in Kentucky after the quarter end.

Strangles

Belgium

A single case of strangles was reported in an unvaccinated 15-year-old with clinical signs of nasal discharge and lymphadenopathy. Positive diagnosis was confirmed by PCR on a nasal swab.

Canada

A single case of strangles was reported in a Standardbred yearling in a premises on Prince Edward Island.

France

Five outbreaks of strangles were reported, four involving single cases and one involving five cases. Clinical signs included depression, pyrexia, nasal discharge, cough and lymphadenopathy. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

Germany

*Eight cases of strangles were reported after the quarter end. Positive diagnoses were confirmed by PCR and culture for five cases and culture only for three cases. Clinical signs included pyrexia, swelling and submandibular lymph node abscessation and nasal discharge.

Netherlands

Thirteen outbreaks of strangles were reported, 11 involving single cases, one involving two cases and one involving three cases. Clinical signs included pyrexia, nasal discharge, cough, swollen throat, submandibular lymphadenopathy and abscessation and poor appetite. Positive diagnoses, in the majority of outbreaks, were confirmed by PCR on nasopharyngeal swabs, however, one outbreak was confirmed by PCR on guttural pouch lavage and one other confirmed by PCR on abscess material.
*Two additional outbreaks were reported that took place in December 2020, but reported after the quarter end; both involving single cases on separate premises in Gelderland and North Holland. Clinical signs included enlarged submandibular lymph nodes, pyrexia and nasal discharge. Positive diagnoses were confirmed by PCR on nasopharyngeal swabs.

USA

Thirteen outbreaks of strangles were reported, all involving single cases. Clinical signs included pyrexia, nasal discharge, submandibular lymphadenopathy and abscessation, lethargy, cough and decreased appetite.

Gastrointestinal Diseases

Country	Clostridial Enterocolitis	Lawsonia	Rotavirus	Salmonellosis
Argentina	-	-	1	-
USA	*	*	*	*

*relates to additional summary information reported at the end of the quarter, but which was not reported via ICC interim reports

Clostridial Enterocolitis
USA

Clostridium perfringens was detected in nine cases of *C. difficile* and in two cases of enterocolitis, which were reported after the quarter end.

Lawsonia Enteropathy
USA

*Thirteen cases of infection with *Lawsonia intracellularis* were recorded in Kentucky and reported after the quarter end.

Rotavirus
Argentina

An outbreak of rotavirus was confirmed in 40 vaccinated foals aged between 20-40 days, on a single-premises during November and December. The disease was clinically mild and after two or three days of symptomatic treatment and hydration the foals recovered well.

USA

*One case of rotavirus infection was confirmed in Kentucky and reported after the quarter end.

Salmonellosis

USA

*Three cases of salmonellosis were reported after the quarter end; two of *Salmonella* Group C1 and one of an ungrouped *Salmonella* species.

Neurological Diseases

Country	EEE	EEE/WNV	EHV-1	WNV
Austria	-	-	-	2
Canada	2	-	-	-
France	-	-	-	1
Germany	-	-	-	4
Italy	-	-	-	2
Netherlands	-	-	1	-
Spain	-	-	-	11
USA	22	1	7	16

*relates to additional summary information reported at the end of the quarter, but which was not reported via ICC interim reports

Eastern Equine Encephalitis (EEE)

Canada

Two outbreaks of EEE, one with a single case and one involving two cases in unvaccinated animals were confirmed. Clinical signs included seizures, paddling of limbs, profuse sweating, muscle fasciculations, ataxia, drooling, deviated muzzle and recumbency. One animal died and the two others were euthanased.

USA

Twenty-two outbreaks of EEE, all single cases, were confirmed in states including Florida, Michigan, Minnesota, North Carolina, South Carolina and Wisconsin.

Eastern Equine Encephalitis (EEE)/West Nile Virus (WNV)

USA

One case of EEE with WNV co-infection was reported in Florida in a vaccinated two-year-old. Clinical signs included vision impairment, in-coordination and laminitic signs in the front limbs.

Equine Herpes Virus-1 (EHV-1) Neurological Disease

Netherlands

A single case of EHV-1 neurological disease was reported in an unvaccinated animal on a premises in Friesland. Clinical signs included pyrexia and hind limb paresis. Positive diagnosis was confirmed by PCR on a nasopharyngeal swab.

USA

Seven outbreaks of EHV-1 neurological disease, all involving single cases, with the majority vaccinated, were reported including in the following states - California (three outbreaks with 11 cases), Florida, Michigan and Oregon with single cases in each. Clinical signs included ataxia, hind end weakness, respiratory signs, urine retention and urine dribbling.

West Nile Virus (WNV)

Austria

Two outbreaks of WNV with single cases in each were reported. One of the animals was euthanased.

France

On 16 October 2020, RESPE reported separate cases of WNV on separate premises in Corse du Sud.

Germany

Four outbreaks of WNV were reported.

Italy

Two outbreaks of WNV were reported with a single case in each.

Spain

Eleven outbreaks of WNV were reported with further outbreaks confirmed within each report.

USA

Sixteen outbreaks of WNV were reported, all with single cases, in the following states - California, Colorado, Florida, Idaho, Kansas, South Carolina and Utah.

Miscellaneous Diseases

Country	AHS	EHV-2	EIA	Lepto	Pigeon Fever	Piro	PHF	Tetanus	VS
Canada	-	-	-	-	1	-	-	-	-
France	-	-	-	2	-	-	-	-	-
Germany	-	*	-	-	-	-	-	-	-
Japan	-	-	-	-	-	-	-	*	-
Romania	-	-	1	-	-	-	-	-	-
South Africa	*	-	-	-	-	*	-	-	-
Switzerland	-	-	-	1	-	-	-	-	-
USA	-	-	6	-	11	-	3	-	1

*relates to additional summary information reported at the end of the quarter, but which was not reported via ICC interim reports

African Horse Sickness (AHS)
South Africa

*AHS is endemic in South Africa except in the AHS controlled area in the Western Cape Province. AHS cases have occurred sporadically within the endemic area of South Africa, in two of the nine Provinces (Gauteng and Mpumalanga), totalling three cases. There were no cases of AHS in the Western Cape Province, either in the infected part of the province or in the AHS controlled area.

Equine Herpes Virus-2 (EHV-2)
Germany

*A mare with keratitis was confirmed as EHV-2 positive by PCR after the quarter end.

Equine Infectious Anaemia (EIA)
Romania

One outbreak of EIA affecting two animals on one premises was reported in Romania.

USA

Six outbreaks of EIA were reported, five involving one case and one involving two cases, all on premises in Texas.

Leptospirosis
France

Two outbreaks of leptospirosis were confirmed with a single case in each on premises in Finistère and Loire Atlantique. Positive diagnoses were confirmed by PCR on aqueous humor.

Switzerland

One outbreak of leptospirosis was confirmed with a single case in the canton of Glarus. Positive diagnosis was confirmed by PCR on urine.

Pigeon Fever

Canada

One outbreak of pigeon fever was confirmed in a vaccinated two-year-old on a premises in British Columbia.

USA

Eleven reports of pigeon fever were received with further confirmed outbreaks within each report. All outbreaks were in the state of Washington.

Piroplasmosis

South Africa

*Piroplasmosis is regarded as endemic in South Africa and sporadic cases were reported from 8 of the 9 provinces of South Africa after the quarter end. These included two in Eastern Cape, one in Free State, 21 in Gauteng, two in Kwa-Zulu Natal, five in Mpumalanga, one in Northern Cape, two in North West Province and nine in Western Cape.

Potomac Horse Fever (PHF)

USA

Three outbreaks of PHF were confirmed, two involving one case and one involving two cases in Kentucky and Washington. Clinical signs included anorexia, lethargy, diarrhoea and inappetence.

Tetanus

Japan

*One case of tetanus strain type *Clostridium tetani* was reported after the quarter end.

Vesicular Stomatitis (VS)

USA

One outbreak of VS on a premises in Texas was confirmed.
*A further outbreak was confirmed at an equine facility in Missouri after the quarter end.

Use of worm egg count data to both detect and counteract UK trends in equine helminth abundance

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Introduction

The UK equine industry may currently find itself on a ticking parasite time bomb. Having largely relied on a very limited number of different anthelmintic compounds to control helminths, anthelmintic resistance (AR) appears to have established in all pathogenic species. Whereas Faecal Egg Count Reduction Tests (FECRT) used to be carried out to find out whether any AR was present, their use is now advocated to check whether a wormer can be relied upon to control worm burdens at all (Rendle et al, 2019), i.e. AR has become 'the norm'. At the same time, climate change, shown to have the potential to significantly increase transmission rates at pasture (Rose et al, 2015), may further drive worm burdens up to unsustainable levels. Despite these problems having been highlighted for some time, there is a paucity of data (potentially) capturing trends in equine worm abundance. In the field, worm abundance diagnostics still rely heavily on the use of Worm Egg Counts (WEC), which are also used to indicate whether anthelmintic treatment is indicated in individual horses. This article firstly explores the suitability of the data within the Defra/BEVA Equine Quarterly Disease Surveillance Reports to capture trends in helminth abundance and to develop hypotheses for the trends observed. It then assesses the likely effects of using WEC to guide better treatments of individual animals.

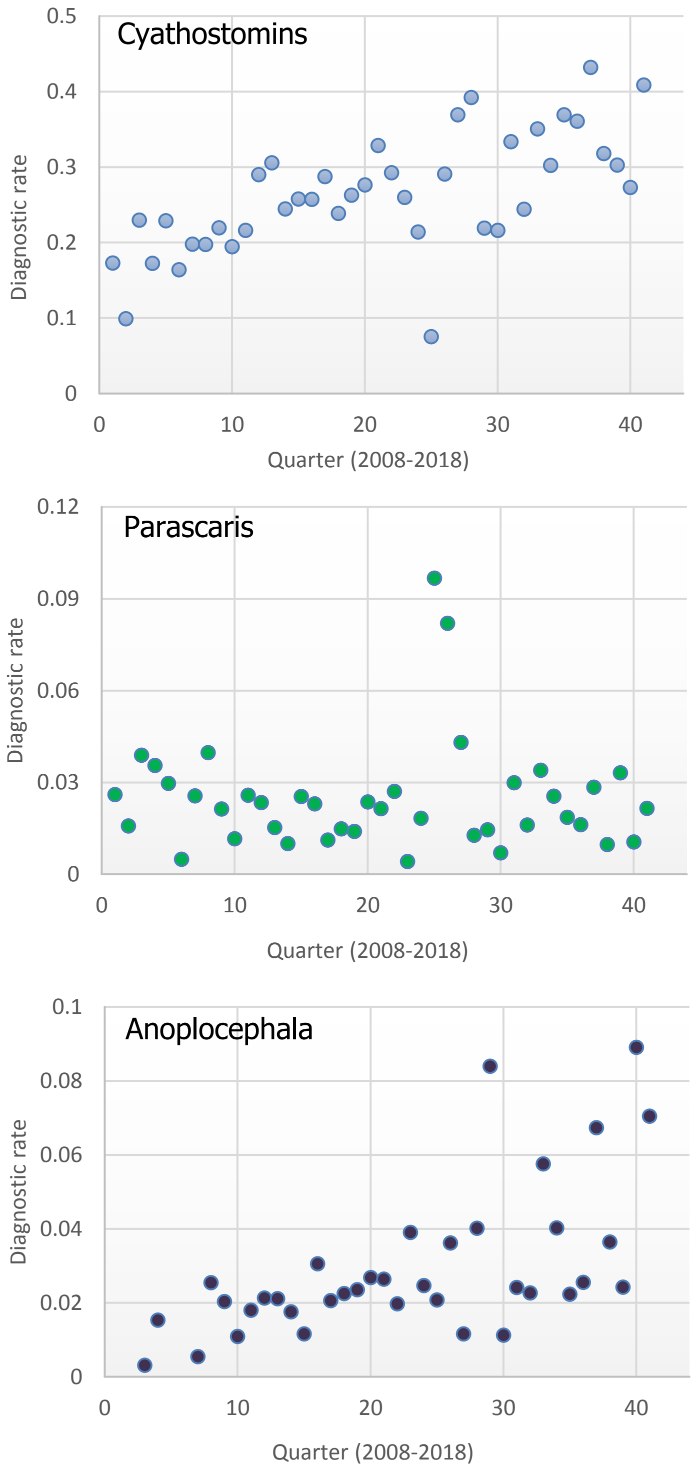

Figure 2. Diagnostic rate (percentage of samples positive) of equine samples submitted to DEFRA-report contributing laboratories for examination of presence of *Cyathostomin* (top figure), *Parascaris* (middle figure) and *Anoplocephala* (bottom figure), 2008-2018. Each data point is a quarterly summary diagnostic rate.

NB: *Parascaris* and *Anoplocephala* samples were recorded as 'positive or negative' whereas, in the *Cyathostomin* category, samples were scored as positive at a threshold of 200 Eggs Per Gram.

Part 1: Using the Defra/BEVA Equine Quarterly Disease Surveillance Database to capture trends

The database

Summaries of WEC data (>10,000 submissions/annum), collected by UK veterinary laboratories, are submitted quarterly for publication in the Defra equine disease surveillance report. The protocols used as the basis of the data, normally based on the McMaster's technique, are relatively standardised across laboratories. Data are deposited for 'strongyle-type eggs' (cyathostomins), ascarid eggs (*Parascaris equorum*) and tapeworm eggs (*Anoplocephala perfoliata*). Apart from WEC diagnoses, for *A. perfoliata*, positive ELISA diagnoses contribute to the data. Although an ELISA test indicating the presence of the species has been available for many years, a commercial saliva test ELISA was developed more recently (Lightbody et al, 2018) and is likely to have influenced the number of submissions. For all three species, the samples are simply scored as either 'positive' (eggs present) or 'negative' (eggs absent). However, for strongyle-type eggs, most of the contributing labs score samples as 'positive' when the number of eggs per gram (EPG) equals or exceeds 200, with a few labs using a threshold of 50 or 100 EPG

Results

Initially, the quarterly data for the years 2008-2018, were expressed as the proportion of submissions testing positive and plotted as a function of time. The results are shown in Figure 2**.**

The proportion of samples containing ≥200 EPG strongyle eggs was positively correlated with time ($r_s = 0.69$, $p < 0.0001$). Regression analysis showed that, over the years analysed, the proportion of samples testing positive had gone up by 20%, indicating more animals had higher-level burdens every year. In contrast, the *Parascaris* database revealed no such significant temporal trends ($r_s = 0.009$, $p = 0.56$). The proportion of samples testing positive for *Anoplocephala* presence was also positively correlated with time ($r_s = 0.65$, $p < 0.0001$).

The *Cyathostomin* data were also then investigated for seasonality by examining diagnostic rates between quarters (Figure 3). This showed that the diagnostic rate did not differ significantly between quarters ($H(3) = 2.674$, $p = 0.445$).

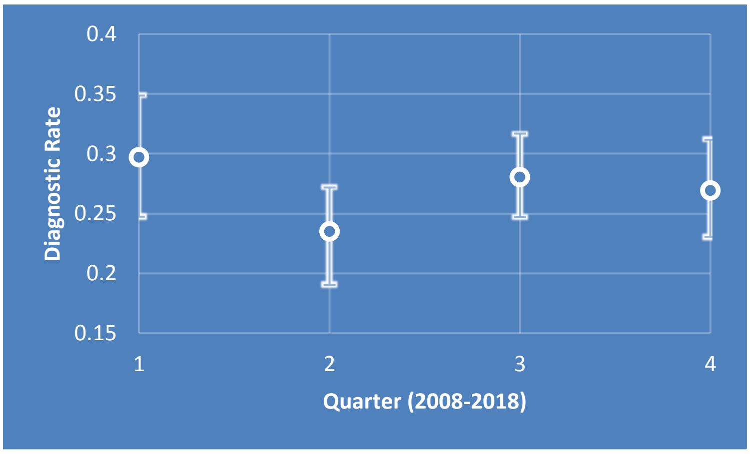

Figure 3: Bootstrapped mean diagnostic rate (number of samples ≥ 200EPG / total number of samples received) of *Cyasthostomin* Worm Egg Counts, broken down per reporting quarter, 2008-2018. Error bars represent bootstrapped 95% Confidence Limits.

Discussion

The apparent rise in *Cyathostomin* burdens may be due to increasing worm burdens at pasture caused by anthelmintic resistance and/ or climatic conditions favouring these species. Although the weather clearly causes seasonality in infectious strongyle worm abundance at pasture (Nielsen et al, 2007), this is not reflected in significant seasonality in the dataset. While this is likely to demonstrate a buffering capacity of the host, it also demonstrates that substantial proportions of horses tested are likely to have to be treated each time a population is tested.

While AR in *Parascaris* is widespread, the proportion of samples testing positive is not increasing over time. This may reflect that host-age related immunity is generally strong for this parasite. However, although, at UK level, the number of horses infected may be constant, the burdens in individual infected horses may be rising. A correlation between egg counts and worm burdens has not been demonstrated for this species (Reinemeyer, 2009). The parasite is also thought to be less dependent on climatic conditions for survival / successful development.

The apparent rise in the proportion of *Anoplocephala* diagnoses is perhaps surprising. New diagnostic tools were introduced, and the diagnostic rate appears more erratic in recent years, but the trend appears to have started well before this. While the development of these tapeworms is thought to be largely independent of climatic conditions, the abundance of their oribatid mite intermediate host shows a distinct seasonality (Nielsen, 2016). In the UK, only anecdotal evidence exists for AR in this species.

Despite the crudeness of the dataset, it appears to be both informative and reflect important features of epidemiology of the three different species, while generating new research questions. Furthermore, the data presented is an important baseline against which future changes can be measured.

Part 2: Applying Worm Egg Counts to slow down the build-up of anthelmintic resistance

Introduction

In an attempt to slow down the rapid development of anthelmintic resistance (AR) in cyathostomins, the use of WEC, e.g. to determine whether a horse needs worming, has been advocated (Lester and Matthews, 2014) and widely adopted. Generally, from March to September, individual horse samples are taken every 8-12 weeks (Rendle et al, 2019) and only horses with EPGs ≥200-250 are treated. Thus, worms present within horses presenting with lower WECs are not exposed to anthelmintic treatment and their offspring serves to dilute the presence of early stages of resistant worms at pasture. Practicing this principle of *refugia* indeed seems very important in the earliest stages of development of AR. In this situation, in treated horses, the vast majority of 'sensitive' worms, will be knocked out and only a very small proportion of resistant worms will survive; it is then paramount to dilute resistant alleles they pass on with non-resistant alleles present in untreated horses. However, when this is practiced once the resistant allele frequency in the population has gone up, the relative contribution of resistant worms to the next worm generation becomes much larger and therefore the dilution factor diminishes rapidly. In other words: *refugia* itself is compromised by AR. Box 1 gives a working example illustrating this for 5 horses sharing a pasture plot.

Box 1: Working example of the effect of selectively worming horses to a threshold of 200 Eggs Per Gram (EPG) *once resistance to wormers has established*.

Horse	EPG before worming	Remaining REPG in wormed horses	Remaining REPG in non-wormed horses	Remaining SEPG in non-wormed horses
A	100		10	90
B	1000	100		
C	50		5	45
D	50		5	45
E	500	50		

Data: A simplified mechanistic *illustration* of the potential 'diluting' effect of selectively worming horses to a threshold value of 200 EPG in a small group of horses. Assume a previous Faecal Egg Count Reduction Test had revealed a 90% reduction in EPG with wormer X and that the resistant worms are evenly distributed over the 5 horses. **REPG** = EPG consisting of 'resistant' eggs; **SEPG** = EPG consisting of 'susceptible' eggs.

Interpretation: Before worming, the *proportion* of 'resistant eggs' shed in dung is 0.10. After worming, the estimated *proportion* of 'resistant eggs' shed is (10+100+5+5+50) / {(10+100+5+5+50) + (90+45+45)} = 0.48. (Per gram of faeces, between them, the horses shed an estimated 1700 x 0.10 = 170 REPG before worming and 350 x 0.48 = 168 REPG after worming.) Despite the effort, nearly half of eggs shed after worming are estimated to carry the resistant alleles.

The above working example provides merely a simple illustration and the true relationship between levels of resistance and the estimated resistant-allele carrying eggs, as a proportion of total egg output remaining after worming, and levels of resistance in the worm population needs to be explored using a robust dataset. Moreover, the effect of the advocated upward shift of the threshold for worming for low-risk animals (e.g. to 500 EPG; Rendle et al, 2019) on the proportion of resistant eggs shed, needs to be investigated.

Methods

During 2017, WECs (McMaster, 50 EPG sensitivity) were performed on a herd of 96 horses in Eastern England. The herd grazed permanent 'summer pasture' from April to September and 'winter pasture' from October to March. Individual samples were taken and processed during a one-week period, 4 times per year, during the months January, April, July and October. The farm rotated wormers annually; during 2017, Pyrantel was used, with a Moxidectin treatment applied in October. Horses were wormed at or above a threshold of 200 EPG. The WEC results, which show a non-significant seasonality pattern similar to that of the dataset presented above, are given in Figure 4. The proportions of horses requiring treatment as indicated by the threshold were 0.31 (January), 0.36 (April), 0.39 (July) and 0.44 (October), respectively. A robust FECRT (involving 25 horses) revealed a mean reduction of 73% (Bootstrapped 95% CI: 62-82%).

Negative binomial distributions were fitted to the WEC data and 1000 random populations of 96 animals were drawn. At susceptibility levels 0.90 and 0.75 (i.e. '10% and 25% resistance') the mean (95% CI) resulting proportion of eggs, shed after treatment, predicted to carry resistant alleles was calculated in a similar fashion to Box 1 calculations. The threshold value for worming was varied between 0 and 800 EPG.

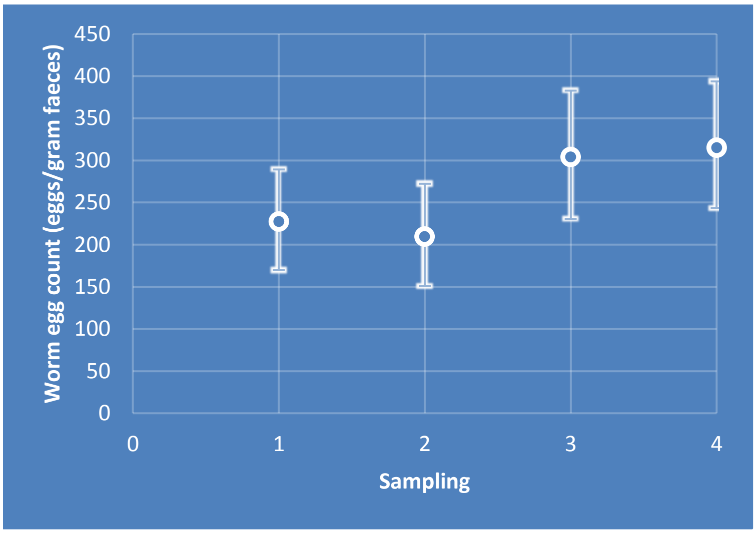

Figure 4: Mean bootstrapped faecal egg counts (95% Confidence Limits) of a herd of 96 horses. Sampling 1=January, 2=April, 3=July and 4=October 2017.

Results

The results are summarised in Figure 5.

At usceptibility level 0.90, worming horses at a threshold of ≥200 EPG is predicted to dilute the resistant worm eggs to 55% (down from 100% when the threshold is not applied). Moving the threshold for worming to 500 EPG dilutes resistant eggs further, to 33%, while increasing the threshold to even higher levels has a diminishing effect. However, at susceptibility level 0.75, when worming to a threshold of 200 EPG, resistant worm eggs are predicted to still make up over 80% of the resulting eggs shed at pasture whereas bringing the threshold up to 500 EPG has very little effect on this. Meanwhile, the total number of worm eggs shed at pasture by the herd increases very substantially as resistance levels go up. It appears that, at realistic worm resistance levels (as indicated by the FECRT), worming to a threshold level rapidly answers to the law of diminishing returns; the practice of worming to a threshold may only be useful when a FECRT indicates it still is. Given the amount of effort the industry is collectively putting into this worming protocol, it appears more research is indicated.

Discussion

This article explored some of the uses, and limitations, of WEC data in the battle against equine helminths. The data captured both that worms are on the rise and why it is hard to control them. It appears that the days of keeping a herd of horses on permanent pasture, while relying on anthelmintics to keep their parasites at bay, are numbered. At the current levels of anthelmintic resistance, testing for levels of worm abundance - although it may have a role to play in highlighting the scale of the problem and quantifying trends - is unlikely to do enough to make equine worm control sustainable. Test-indicated treatment will indicate that a consistently large proportion of horses will need to be wormed, while, at the same time, its positive effects diminish with each treatment. Now is the time to invest in research exploring alternatives to current protocols. For example, more extensive grazing has been advocated (Rendle et al, 2019) but it is currently unclear whether there is such a thing as a 'safe' stocking level. Strategic pasture rotation is likely to have to become an integral part of worm control but protocols are lacking. Taking into account the effects of climatic conditions on free-living stages as well as egg shedding patterns, mathematical models of pasture worm abundance are likely to have a crucial role to play in the design of such protocols, which could subsequently be tested at pasture. More research is also needed into 'alternative treatments'. Unfortunately, 'test and trace' alone is not going to make this problem go away.

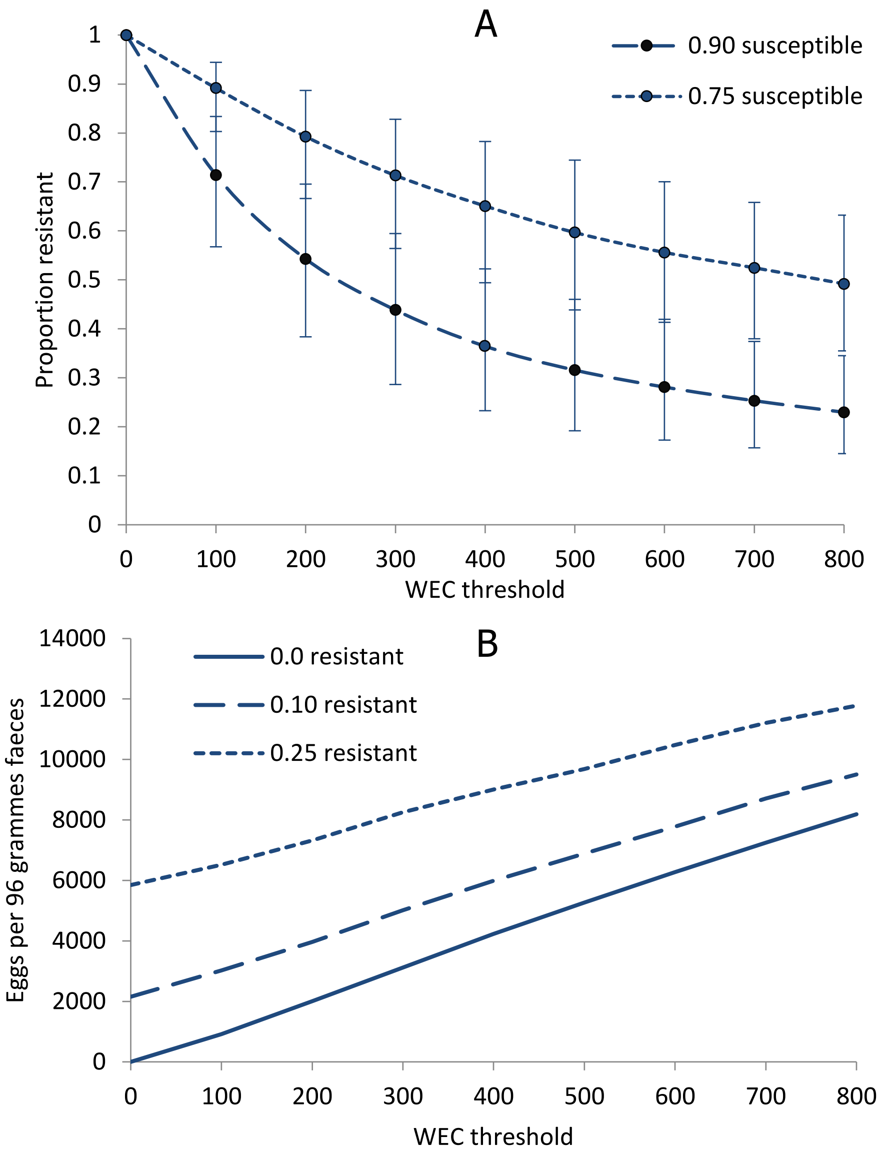

Figure 5: The estimated proportion of eggs, present in dung after worming, carrying resistant alleles after applying a wormer reducing FEC by 90 and 75%, as a function of the WEC threshold at which the horses are wormed (Figure A) and the estimated total number of eggs in 1 gram of all the 96 horses' dung shed at pasture after worming, as a function of the WEC threshold at which the horses are wormed (Figure B).

References:

Lester HE, Matthews JB. (2014) Faecal worm egg count analysis for targeting anthelmintic treatment in horses: points to consider. *Equine Vet J.* 2014; 46(2):139-45. doi: 10.1111/ evj.12199

Lightbody KL, Matthews JB, Kemp-Symonds JG, Lambert PA, Austin CJ (2018) Use of a saliva-based diagnostic test to identify tapeworm infection in horses in the UK. *Equine Vet J.* 50(2):213-19. doi: 10.1111/evj.12742

Nielsen MK. Equine tapeworm infections: Disease, diagnosis and control. (2016) *Equine Veterinary Education* 28(7):388-95. doi: 10.1111/eve.12394

Nielsen MK, Kaplan RM, Thamsborg SM, Monrad J, Olsen SN (2007) Climatic influences on development and survival of free-living stages of equine strongyles: implications for worm control strategies and managing anthelmintic resistance. *Vet J.* 174(1):23-32

Reinemeyer CR (2009) Diagnosis and control of anthelmintic-resistant *Parascaris equorum*. Parasites and Vectors 2 (Supl 2) S8, doi:10.1186/1756-3305-2-S2-S8

Rendle D, Austin C, Bowen M, Cameron I, Furtado T, Hodgkinson J, McGorum B, Matthews J (2019) Equine de-worming: a consensus on current best practice. *UK-Vet Equine*, Volume 3 No 1, https://doi.org/10.12968/ukve.2019.3.S.3

Rose R, Wang T, van Dijk J, Morgan E.R. (2015) GLOWORM-FL: A simulation model of the effects of climate and climate change on the free-living stages of gastro-intestinal nematode parasites of ruminants. *Ecological Modelling* 297, 232–245

Important Note

The views expressed in this focus article are the author's own and should not be interpreted as official statements of Defra or BEVA.

UK Report on Post-Mortem Examinations

(1 October to 31 December 2020)

Details about post-mortem examinations were reported by two UK Veterinary Schools and three other contributing laboratories. Data from each laboratory is organised by the laboratories regional location. There may be more than one laboratory reporting information for each region.

East and South East of England

Sixty-two **aborted fetuses** were examined. Thirty-four were found to be umbilical cord torsions and the other 27 were reported as follows:

- Five cases presented as placentitisThe first case confirmed as acute placentitis, with amnionitis and allantoitis, staphylococcal species isolated. The second case as chronic placentitis with intralesional colonies of fungal hyphae (aspergillus isolated) and associated nodular allantoic hyperplasia. The third case chronic placentitis, with associated nodular allantoic hyperplasia; *E.coli* and Proteus species isolated. The fourth case as acute placentitis of the cervical pole with funisitis; maternal illness/infection reported; *E.coli* isolated. The fifth as bacterial cervical pole placentitis
- One case presented as Equine Herpes Virus-1 (EHV-1) abortion confirmed by PCR and histology for further information click here
- Seven cases were reported as ischaemic necrosis of the cervical pole with associated long cord.
- One case reported as long umbilical cord with extensive placental mineralisation, suspected ischaemic injury.
- One case was reported as maternal factors (severe colic).
- One case was reported as suspected ruptured yolk sac remnant with granulomatous funisitis/amnionitis.

Eleven cases were reported as non-diagnostic/uncertain.

Three **cardiovascular** cases were reported. The first case presented as sudden death had suspected acute cardiac/cardiopulmonary failure, with traumatic fracture of the right humerus. Two cases were reported as sudden death, of uncertain cause but presumed acute cardiac dysfunction.

Two **gastrointestinal** cases were reported. The first case involving the stomach confirmed idiopathic gastric rupture with associated acute peritonitis. The second case involved the large colon confirmed by peracute haemorrhagic typhlocolitis, but a specific aetiology was not identified

Fifteen **musculoskeletal** cases were reported. Cases included traumatic comminuted cervical vertebral fracture (C3-C4), complete comminuted traumatic fracture of the left humerus, traumatic vertebral (L4-L6) fracture, traumatic comminuted fracture of the right fore medial proximal sesamoid bone, with suspensory ligament and flexor tendon rupture/laceration, traumatic laceration of the distal superficial digital flexor tendon, distal deep digital flexor tendon and lateral branch of the suspensory ligament (left forelimb), complete oblique comminuted fracture of the left humerus, traumatic bilateral acute comminuted carpal fractures, traumatic lumbar vertebral fracture (L2-3), chronic septic and fibrinous synovitis of the carpal tendon sheath, complete traumatic vertebral fracture (L6), traumatic vertebral/dorsal spinous process fractures (T4 -9) with spinal compression, acute skull base (presphenoid/basisphenoid) fracture, with sphenopalatine sinus and intracranial haemorrhage, severe thoracic blunt trauma with pericardial rupture, catastrophic pelvic fracture, with the bilateral ilial and acetabular fractures and pelvic (right ilial shaft) fracture.

Two **respiratory** cases preseenting as sudden death were confirmed as marked acute pulmonary haemorrhage/oedema and suspected cardiopulmonary failure.

Two cases of **welfare/neglect** were reported. The first case was confirmed with emaciation, chronic cardiac pathology, moderate/locally heavy encysted cyathostome burden and deep gingival ulceration. The second case was confirmed with chronic dental disease, mild hepatic fibrosis and cyathostominosis.

One **neurological** case was confirmed with nephritis and myeloencephalitis caused by *Halicephalobus* *gingivalis*

Four **other** cases were reported. The first case confirmed uterine artery rupture and haemabdomen. The second case confirmed chronic anaemia (suspected autoimmune cause) with post transfusion haemolytic crisis and nephropathy. The third case confirmed *Actinobacillus* septicaemia, with bilateral severe acute nephritis. The fourth case confirmed rupture of the ventral body wall (rectus abdominis) secondary to hydrops amnion and there was associated fetal cleft palate.

South West

Three **gastrointestinal** cases were reported. The first was confirmed as a stomach impaction. The second was confirmed as impaction/tympany of the large colon. The third case was confirmed as a fibrinoulcerative typhlitis of the caecum in the large colon. Histology showed subacute, diffuse, severe transmural fibrinosuppurative and ulcerative typhlitis with moderate fibroplasia. A colitis panel was performed and was negative for all main infectious agents (*Salmonella spp*., *Clostridium perfrigens* type A & C, *Clostridium difficile,* Equine Coronavirus, *Cryptosporidium sp*., other intestinal parasites).

One **musculoskeletal** case was examined, which confirmed chronic laminitis.

Northern Ireland

Two **gastrointestinal** cases were examined. The first case was found to have a tear in the greater curvature of the stomach. The second was a gastric impaction of the stomach.

Two **autolytic** carcases were examined, but no diagnoses were able to be made.

Scotland

One **cardiovascular** case was submitted. Macroscopic findings confirmed a transmural tear of left carotid artery with severe mediastinal haemorrhage.

Seven **gastrointestinal** cases were confirmed. The first case was an enteropathy of the small intestine confirmed as eosinophilic and granulomatous enteritis on histology. The second case was a fibrinous enteritis of the small intestine; histology was precluded by autolysis. The third case was diagnosed as a right dorsal colonic displacement of the large intestine. The fourth case was chronic hepatopathy in a donkey confirmed by histology. The fifth case was epiploic foramen entrapment of the small intestine. The sixth case was idiopathic focal eosinophilic enteritis of the small intestine confirmed on histology. The seventh case was typhlocolitis of unknown aetiology in the large colon.

One case of **neoplasia** was submitted. Macroscopic findings confirmed metast[atic melanoma in liver, spleen, mammary gland, lung and multicavitary effusions.

One **neurological** case of meningoencephalitis was submitted. Histological examination resembled listeria in sheep however no culture was performed and it was noted that this presented more like a muscular disease. No viral inclusions were observed.

Four **other** cases were confirmed. The first case had multiple dental abnormalities. The second and third cases were investigated on gross post-mortem only, with no abnormalities detected. The fourth case was confirmed as a retroperitoneal/peri-spinal abscess.

ACKNOWLEDGEMENTS

We are extremely grateful to the following 26 laboratories for contributing data for this report.

All laboratories contributing to this report operate Quality Assurance schemes. These schemes differ between laboratories however all the contagious equine metritis testing reported was accredited by BEVA with the exception of the APHA, which acts as the reference laboratory.

Agri-Food and Biosciences Institute of Northern Ireland
Animal and Plant Health Agency
Austin Davis Biologics Ltd
Axiom Veterinary Laboratories Ltd.
Biobest Laboratories Ltd.
BioTe
B & W. Equine Group Ltd.
Chine House Veterinary Hospital
The Donkey Sanctuary
Donnington Grove Veterinary Group
Endell Veterinary Group Equine Hospital
Hampden Veterinary Hospital
IDEXX Laboratories
Liphook Equine Hospital
NationWide Laboratories
Newmarket Equine Hospital
Oakham Veterinary Hospital
Rainbow Equine Hospital
Rossdales Laboratories
Sussex Equine Hospital
Synlab VPG Exeter
Synlab VPG Leeds
Three Counties Equine Hospital
University of Glasgow
University of Edinburgh
Valley Equine Hospital

We are extremely grateful to the Horserace Betting Levy Board (HBLB), Racehorse Owners Association (ROA) and Thoroughbred Breeders' Association (TBA) for their continued combined contribution to the Equine Infectious Disease Service.

We would welcome feedback including contributions on focus articles to the following address:

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