NEW ZEALAND SOCIETY FOR PARASITOLOGY

49^{th} CONFERENCE & ANNUAL MEETING

26 OCTOBER 2022

Massey University Sport and Rugby Institute, Palmerston North

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About

Welcome

The Executive Committee of the New Zealand Society for Parasitology (NZSP) would like to welcome you to the 2022 conference and AGM here at the Massey University Sport and Rugby Institute.

Due to Covid-19 restrictions, the 2021 conference was cancelled and the AGM was held virtually. It's therefore a pleasure to be able to see you here in person.

The NZSP was formed in 1972, with the aim to promote the advancement of parasitology; maintain liaison with other scientific societies; and encourage the dissemination of information and new developments in parasitology. We hope you find this conference fulfils these aims, as intended.

The NZSP now has a new website https://nzs4p.org.nz/home, which hosts general information about the society, a library of society newsletters, and copies of previous conference proceedings. A copy of these proceedings will be available on the website after the conference[1].

The committee wishes to extend a huge thank-you to John Moffat for his work in putting these proceedings together.

For those of you on social media, follow the society on Facebook (https://www.facebook.com/parasitologynz/) and Twitter (https://twitter.com/society_nz) for more exciting content!

Organising committee

Ash Keown
Tania Waghorn
Emma Poole
Auguusto Simoe-Barbosa
Saleh Umair

[1]This online version contains corrections and the actual order of presentations. It therefore differs from the original printed copy.

Timetable

8:00–8:30		**Registration**
8:30–8:35		**Welcome**
8:35–9:15	**Jan Slapeta** Sydney, Australia	Playing hide and seek with *Tritrichomonas foetus* in 'all' creatures great and small
9:15–9:45	**Ginny Dodunski** Turangi, NZ	Wormwise update
9:45–10:10	**Meg Moffat** Wellington, NZ	Reflections from a regulator
10:10–10:30		**Morning tea**
10:30–10:50	**Anne Ridler** Palmerston North, NZ	Parasite control on sheep and beef farms with low or reduced drench use
10:50–11:10	**Andrew Dowling** Palmerston North, NZ	Liver fluke diagnostics in farmed deer
11:10–11:30	**Tania Waghorn** Palmerston North, NZ	An egg count is an egg count, right?
11:30–11:50	**Christian Sauermann** Palmerston North, NZ	–NOT PRESENTED–Multiresistant *Cooperia oncophora* and *Ostertagia ostertagi* on New Zealand cattle farms
11:50–12:10	**Tania Waghorn** Palmerston North, NZ	Dung beetles and parasites
12:10–13:00		**Lunch**
13:00–13:20	**Remy Morad** Dunedin, NZ	Cryptosporidium: Understanding the lifecycle for drug discovery
13:20–13:40	**Bridget Lamont** Dunedin, NZ	Novel Peptoids as Treatment for Cryptosporidiosis
13:40–14:00	**Augusto Simoes-Barbosa** Auckland, NZ	Lessons from a parasite and commensals: bacterial extracellular vesicles modulate the pathogenicity of *Trichomonas vaginalis* mirroring protozoan-bacterial interactions
14:00–14:20	**Emma Scheltema** Palmerston North, NZ	Development and application of molecular diagnostics to determine microecology of coccidia species in the kiwi (*Apteryx* spp.)
14:20–14:40	**Mike Gieseg** Sydney, Australia	The conduct of acaricide efficacy trials in Australia with highlight on the Australian Paralysis Tick (*Ixodes holocyclus*)
14:40–15:00		**Afternoon tea**
15:00–15:20	**Ian Scott** Palmerston North, NZ	40 years of faecal sample testing for dogs and cats
15:20–15:40	**Ian Scott** Palmerston North, NZ	Shedding of parasite eggs and other structures in the faeces of cats in Shelters
15:40–16:00	**Mel Hempstead** Palmerston North, NZ	Level of challenge of *Haemonchus contortus* on the behaviour and physiology of lambs on pasture
16:00–16:20	**Mel Hempstead** Palmerston North, NZ	What effect do anthelmintic drugs have on the behaviour of ewes and their new-born lambs?
16:20–17:00		**AGM**
18:30–Late		**Conference Dinner at Wharerata**

Keynote Speaker

Jan Slapeta

MVDr PhD GradCertEd (Higher Ed)
Professor of Veterinary and Molecular Parasitology

University of Sydney, Sydney, Australia

Jan has a broad understanding of the biology of parasites of both medical and veterinary importance, as well as the diseases caused by them. He combines state-of-the-art molecular applications with a deep historical knowledge of parasitology, to redefine existing parasitic species, to describe new parasitic species, and to understand their origin. More recently he focuses on recognising a role of parasites on host through their role in microbiome community within a host or vector to achieve understanding of host-parasite relationships. His diagnostic techniques and biodiversity studies have received worldwide acceptance. He has a particular interest in applications of molecular biology towards elucidating the unique properties of parasites of medical and veterinary importance. Jan is keen educator and aims to exploit available technologies. He championed *Virtual Microscopy* at the University of Sydney and oversees the Professionally Focused Projects in DVM that are managed by *ScholarOne* management solution.

List of Abstracts

Key: KL keynote lecture, IS invited speaker, or CT contributed talk

Playing hide and seek with *Tritrichomonas foetus* in 'all' creatures great and small

Jan Slapeta KL

Sydney School of Veterinary Science, Faculty of Science, The University of Sydney , Australia

Parasitism is an extreme case of symbioses. Oddly enough an infamous venereal cattle parasite *Tritrichomonas foetus* – the cause reproduction failure – is found harmlessly in most pigs' noses! For decades, in fact a century, this relationship has puzzled generations of parasitologists. More recently, *T. foetus* has been shown to cause large bowel diarrhoea in cats. This frustrating cat parasitosis is complicated not only by its chronicity but also how difficult is to treat, with no registered or effective products available.

In this talk, I will outline the often serendipitous, decade-long quest to understand *T. foetus*. With an Australian focus, I while illuminate the host pathogen relationship and epidemiology. There will be its re-discovery in cattle, confirmation of widespread presence in cats and discovery in farmed pigs, and unfortunately the existence of drug-resistance.

Wormwise update

Ginny Dodunski IS

Wormwise Programme Manager, Beef + Lamb New Zealand Ltd, Turangi, NZ

The Wormwise programme, a collaboration between various industry groups and the sole funder, B+L NZ, was initiated after the 2005 National Drench Resistance Survey revealed 'unexpected' levels of drench resistance on NZ sheep and beef farms[1,2].
Wormwise consists of a farmer representative, plus a technical advisory group of parasitologists from the major research groups in New Zealand. The Wormwise website hosts a manual and several fact-sheets. The primary ongoing activity has been ad-hoc regional workshops facilitated by veterinarians. A 2021 review (in light of the worrying levels of combination resistance being reported nationally) concluded that the programme had had limited impact on farmer and industry behaviour. The major outcome of this review was the employment of a programme manager- Ginny Dodunski - who commenced in May 2022.
To date, the focus has been on looking for 'easy wins' to lift Wormwise visibility and highlight messages from the existing resource:

Wormwise social media mostly short video posts on Facebook (also shared to Instagram). Wormwise's followers have grown by 300% since the beginning of May and each post is reaching between 1000 and 1500 people versus under 100 previously.
Increased Wormwise messages via rural media 8 articles in rural publications since May 2022.

Other ongoing work includes:

Wormwise workshops These are evolving - a number of regions have run 'beyond the basics' Wormwise workshops with a focus on 'living with resistance', and cattle-specific workshops.
Facilitator messaging, training and collaboration A programme of regular E-meetings for the Wormwise facilitator group was initiated in 2021; these continue and are helping to upskill our facilitators and cross-pollinate with ideas and practical experience.
Wormwise for dairy This will be a series of hard copy and E-booklets for dairy farmers. The first in the series (calf edition) will go out to dairy farmers near the end of 2022. Improvement of the Wormwise website: Scheduled to happen in 2023 as B+L NZ migrates its content and 'daughter' websites onto a new platform. Utilising existing data to define the 'State of the nation' regrading drench resistance; how big is the problem and how quickly is it changing?

Looking ahead, workstreams include:
Looking at how Wormwise principles (especially management to minimise the impact of worms) could be included in farm plans under NZ Farm Assurance Plus.
Working with AAPHNZ (formerly AGCARM) to improve the way drench products are marketed to farmers.
Working across the rural supply industry to help upskill staff involved with sales and recommendations around drench.
Collaborating with B+L NZ Research in parasite-related work.

References

[1] Waghorn, T. et. al. Prevalence of anthelmintic resistance on sheep farms in NZ. NZVJ 54 (6): 271–77, 2006.

[2] Waghorn, T. et. al. Prevalence of anthelmintic resistance on 62 beef cattle farms in the North Island of NZ. NZVJ 54 (6): 278–82, 2006.

Reflections from a regulator

Meg Moffat IS

Senior Adviser, Veterinary Medicines Team, ACVM, Wellington, NZ

I present a very brief outline of NZ Food Safety's Agricultural Compound and Veterinary Medicines (ACVM) team's role in the regulation of parasiticides in NZ, including risks that are managed under the ACVM act (trade, animal welfare, agricultural security, public health, domestic food standards, and provision of sufficient consumer information) and information required to be supplied by registrants to support registration.

Also a short discussion on veterinary medicine trial approvals required under different pieces of NZ legislation and what is being done to streamline this process. An update on how the international regulation of parasiticides is changing, and the impact of anthelmintic resistance in this area.

Parasite control on sheep and beef farms with low or reduced drench use

Anne Ridler[1], ***K Hytten***[1], ***JI Reid***[1], ***DI Gray***[1] **CT**

[1]Tāwharau Ora – School of Veterinary Science, Massey University, Palmerston North, NZ

The objectives of this study were to gain insights into the motivators, skills and knowledge, impacts and operational processes of sheep and beef cattle farmers who manage nematode parasites using low or reduced drench use, relative to similar farming systems in their area.

Participating farmers were identified via veterinary and advisor networks. Semi-structured interviews were conducted with 17 sheep and/or beef cattle farmers located throughout New Zealand. Farms comprised a range of sheep and cattle systems including breeding, finishing, trading and stud operations. Within the cattle systems, dairy heifer grazing and intensive bull beef were also represented. Average effective farm size was 1150 hectares with a range from $260 - 2500ha$.

Farmer reasons for having low or reduced drench use included anthelmintic resistance diagnosed in their sheep flock, wanting to avoid resistance developing, wanting to farm animals that can handle their farming conditions without too much chemical input, and to reduce workload.

For factors considered important to manage parasites with reduced drench, three clear themes were apparent: 1. feeding stock well; 2. attention to detail; 3. monitoring to make informed decisions, either through observation or through FECs, or both.

Key aspects of parasite management included cross-grazing, feeding stock well, maintaining high grazing residuals, and monitoring. Eleven farmers used crops, although only two specifically cited parasite control as a reason for growing them. Nine of the 15 sheep farmers with breeding flocks utilised parasite-tolerant genetics.

All farmers used anthelmintics to varying degrees as part of their parasite control programme, particularly for lambs. All 15 farmers with breeding ewes, who retained lambs post-weaning, gave them a weaning drench and six then drenched lambs at 28-30 day intervals for 3-5 drenches. Beyond that, drench use in sheep and cattle was primarily based on perceived need determined by age and species, grazing history, climatic factors, animal monitoring and, in some cases, use of FECs.

The majority of farmers did not perceive that there had been any negative production or financial impacts due to reduced drench use.

In conclusion, these farmers demonstrated that regardless of farm location, size or system it is possible to farm sheep and beef cattle with low or reduced drench use, but it requires a mindful and integrated approach to parasite management and a high level of attention to detail.

This research was initiated and funded by Beef + Lamb New Zealand Ltd.

Liver fluke diagnostics in farmed deer

Andrew Dowling[1], ***Ian Scott***[2], ***Brittnee Southland***[2] **CT**

[1]PGG Wrightson, Palmerston North, NZ; [2]Massey University, Palmerston North, NZ

Total liver fluke counts, faecal egg counting, and coproantigen ELISA were used to identify evidence of liver fluke (i.e the trematode parasite *Fasciola hepatica*) in livers and faecal samples collected from ($n = 25$) slaughtered deer that had been grazed on a property in North Otago. Here we report our findings and evidence of infection with the rumen fluke *Calicophoron callicophorum*.

An egg count is an egg count, right?

Tania Waghorn **CT**

AgResearch, Palmerston North, NZ

The number of Faecal egg counts (FECs) labs and vet practices do these days is increasing. Getting good data out in a timely manner is important. Everyone seems to do the counts slightly differently, automating bits where they can, plus they try to minimise the tedious tasks, such as spending hours staring down a microscope. Here I will look at some of the work we have done in our lab at Grasslands around variation, sensitivity, specificity and our move to the Parasight system.

– NOT PRESENTED– Multiresistant *Cooperia oncophora* and *Ostertagia ostertagi* on New Zealand cattle farms

Christian Sauermann[1]**,** ***Tania Waghorn***[1]**,** ***Chris Miller***[1]**,** ***Dave Leathwick***[1] **CT**

[1] AgResearch, Palmerston North, NZ

Over recent years multiple cases of simultaneous resistance to the older anthelmintic classes i.e., the macrocyclic lactones (ML), the benzimidazoles (BZ) and levamisole (LEV), have been identified in *Ostertagia ostertagi* and *Cooperia oncophora* to various degrees on four New Zealand farms. Initially, all were identified by the farmers due to the poor appearance and growth rates of calves and investigated by the farmers' veterinarian. These cases were followed by a more detailed examination using faecal egg count reduction tests (FECRTs), in which various anthelmintics were used as either single actives or in combination products. For the FECRTs, calves were randomised into treatment groups of 15 animals, including an untreated control. Faecal egg counts (FECs) were taken for all animals pre- and post-treatment and within each treatment and the control group, $4g$ of post-treatment faeces from each animal was pooled for larval culture. Following bearmannisation of the cultures, 100-200 L3 were identified to the level of genus by visual identification. Efficacy was calculated using the pre- and post-treatment FECs allocated to genera based on the larval proportions of *Ostertagia* and *Cooperia spp.* counted in the larval cultures.

For *Cooperia spp.* resistance to all three classes (ML, BZ, LEV) of anthelmintics, including the combination products, was identified on every farm. For *Ostertagia spp.* reduced efficacy was observed in all cases to one or multiple classes to various degrees. However, in one case *Ostertagia spp.* showed severe simultaneous resistance to all three anthelmintic classes, including the combination products. These results indicate that the high-risk factors of importation and intensive grazing of a monoculture of young stock, which was a common characteristic of the tested farms, cannot be maintained for much longer due to the development of resistance to all three of the older anthelmintic classes.

Dung beetles and parasites

Tania Waghorn[1,2]**, *Nicole Schon***[1,3]**, *Derrick Wilson***[1,4] **CT**

[1]AgResearch, NZ, [2]Palmerston North, [3]Lincoln, [4]Ruakura

Livestock dung is susceptible to sediment, nutrient and bacterial losses into waterways prior to decomposition, whilst also harbouring internal parasites of livestock, fly larvae and other insects and nematodes. Increasing the rate of dung decomposition has the potential to improve environmental, soil, animal and human health outcomes. In New Zealand, important agricultural dung decomposition fauna are exotic, having been either accidentally (earthworms) or deliberately introduced (dung beetles) into the country. The various dung inhabitants are active at different times of the year, and little is known about their interactions throughout the year and the associated impacts in a New Zealand context. Some dung beetle species have recently been introduced near Katikati as part of Project Parore, with the aim of reducing sediment and *E. coli* loadings into the nearby Uretara estuary.

This project aimed to explore the impact of dung beetles within the environment. Field trials were established in spring, summer and autumn to determine the impact of dung beetles. Replicated treatments with different abundances of dung beetles (*Copris incertus*) were established in 30 cm diameter enclosures on a property, near Katikati. Each enclosure had fresh dung containing gastrointestinal nematode eggs applied along with three dung earthworms (*Lumbricus rubellus*), before being covered in mesh. Weekly scoring of dung decomposition was undertaken. Plots were destructively sampled after 4 weeks for dung remaining and abundance of dung beetles, earthworms, and parasitic nematodes. Results for soil fertility and macroporosity were also collected but are not presented here.

Dung that was removed from the soil surface was buried in dung balls by the beetles. The size and amount of dung buried varied with season, with the largest size dung balls, and greatest amount of dung buried in spring. This corresponded with the least amount of dung left on the soil surface. There was little effect of treatment on soil properties, with soil depth having a greater influence. There were no significant differences in parasite loading between treatments in the remaining faeces, soil or dung balls, although there were some seasonal differences. In contrast, parasite loading on herbage was influenced by treatment, with results changing between seasons. In spring when the greatest amount of dung was removed from the soil surface and buried in dung balls, there was a significant increase in L3 loading at the highest dung beetle treatment. In summer, no parasites were recovered from the herbage. In autumn, the parasite loading was lower but not significantly different on the natural and high dung beetle treatments (which corresponded to the treatments having the greatest dung removed from the soil surface). It was only in the autumn that L3 were detected from the buried dung balls. It may be that rainfall in spring provided suitable conditions for the movement of L3 onto the herbage, with conditions being less favourable in summer and autumn when there was less rainfall.

We would like to thank Bay of Plenty Regional Council, Ministry of Primary Industry SFFF fund, Dung Beetle Innovations and Otago University for their support and funding.

Cryptosporidium: Understanding the lifecycle for drug discovery

Morad-Remy Muhsin-Sharafaldine[1], ***Bridget Lamont***[1], ***Saffron Whitta***[1], ***Bruce M Russell***[1] **CT**

[1] Otago University, Dunedin, North, NZ

Ever since its discovery early last century, the Apicomplexan intestinal parasite, *Cryptosporidium spp.*, has been largely neglected, despite a growing recognition of its impact on human and animal health. Certainly, no vaccine nor effective treatments against cryptosporidiosis (crypto) are available, especially for the acute and often fatal gastroenteritis it can cause in neonates or immunosuppressed hosts. One of the challenges facing the development of new therapeutics targeting crypto, is the lack of a continuous *in vitro* model; leading to many gaps in knowledge including important information on the triggers regulating its lifecycle. In particular, the mechanism behind Cryptosporidium alternating asexual and sexual phases.

The primary aim of our study was to establish and optimise a high throughput *in vitro* culturing platform for screening novel therapeutics targeting *Cryptosporidium spp.*. Here we show how we have optimised experiments to test compounds against asexual and sexual stages using specific detection assays (qPCR and fluorescent microscopy) and specific gene expression. Furthermore, we present data on our investigation into the effect of novel and traditional anti-cypto compounds on meront invasion, DNA replication, merozoite egress, sexual gene switch including the effects against specific male and female gametes. We also provide an overview on the challenges associated the development of an *in vitro* continuous model both host-free (i.e. axenic) and host-cell-based (COLO-680N and the hollow fibre technology). Although difficult to establish, a successful *in vitro* continuous model for Cryptosporidium will greatly help in the development of new sensitive diagnostic, safe effective therapeutics and disinfectants targeting the highly infective oocysts of this important parasitic disease.

Novel Peptoids as Treatment for Cryptosporidiosis

Bridget Lamont[1]**,*Dr Daniel Pletzer***[1]**, *Professor Bruce Russell***[1]**, *Dr Remy Muhsin***[1] **CT**

[1] Otago University, Dunedin, NZ

Cryptosporidium spp. is a genus of intestinal apicomplexan parasites, capable of infecting a wide range of mammals (including humans), often causing an acute diarrhoeal disease known as cryptosporidiosis (crypto). In developing nations, poor sanitation, malnourishment, and high rates of HIV infection, have created the ideal niche for Cryptosporidium spp. to thrive. Interestingly, Aotearoa has comparatively higher rates of cryptosporidiosis than over developed countries, with these mostly zoonotic outbreaks coinciding with the spring lambing/calving season. Despite its importance, crypto remains a neglected disease, with fundamental research on Cryptosporidium spp. stymied by the absence of a tractable in vitro continuous culture of this parasite. Nonetheless, recent advances in the short-term in vitro culture of *Cryptosporidium spp.* allows for the high throughput sensitivity testing of novel therapeutics targeting crypto. In this study, we leverage a newly optimised in vitro drug screening platform to investigate, for the first time, the anti-cryptosporidial activity of newly developed synthetic peptoids with potent antimicrobial activity. Unlike naturally occurring antimicrobial peptides, novel peptoids have increased in vivo stability and enhanced membrane permeability.

Using our in vitro *Cryptosporidium spp.* testing platform, we have screened a library of 18 novel peptoids and have shortlisted two peptoids, TM9 and TM19, that have nM level activity against the asexual stages of *C. parvum* with no cytotoxic effects detectable against mammalian host cells. Due to the complex nature of the parasitic life cycle, the peptoids must be screened against various life cycle stages. This includes assays to determine the peptoids effect on the parasites ability to invade host cells and merozoite egress assays to determine the peptoids ability to block the egress of merozoites (intracellular parasitic stage) from host cells. As *Cryptosporidium spp.* have both asexual and sexual life cycle stages, future studies are needed to measure the sexual gene expression to determine the ability of these peptoids to interrupt the sexual cycle. Once the cell culture studies have been completed these peptoids will then be tested in an *in vivo* mouse model. This study will provide the basis for development of a specific peptoid treatment against cryptosporidiosis in NZ farms, with the overall hope it can be used in a One-Health approach to combat cryptosporidiosis in Aotearoa.

Lessons from a parasite and commensals: bacterial extracellular vesicles modulate the pathogenicity of *Trichomonas vaginalis* mirroring protozoan-bacterial interactions

Anastasiia Artuyants[1], ***Jiwon Hong***[1], ***Priscila Dauros-Singorenko***[1], ***Anthony Phillips***[1], ***Augusto Simoes-Barbosa***[1] **CT**

[1] University of Auckland, Auckland, NZ

Trichomonas vaginalis is the causative agent of human trichomoniasis which is the most common, non-viral sexually transmitted infection worldwide. Studies from our group and others have shown that bacterial commensal of the vagina are highly influential to the pathogenesis of *T. vaginalis*. The human vaginal microbiome is represented by a reduced number of bacterial species, mostly culturable, defining two categorical statuses of this microbiome: eubiosis and dysbiosis. It is known that clinically, and confirmed by DNA sequencing, that most women with trichomoniasis carry a dysbiotic vaginal microbiome.

Here, we report that two key bacterial species representing the opposite functional status of this microbiome (*Lactobacillus gasseri* in eubiosis versus *Gardnerella vaginalis* in dysbiosis) produce extracellular vesicles (EVs) with a specific protein cargo. SWATH-MS proteomics revealed species-specific protein cargoes which can be assigned to the ecological roles that these bacteria play to the vaginal biome. Cytotoxic factors and bacteriocins were found within hundreds to thousands of folds of enrichment in the EVs of *G. vaginalis* and *L. gasseri* respectively. Furthermore, we show that these bacterial EVs are capable of manipulating responses of the urogenital protozoan parasite Trichomonas vaginalis and human vaginal cells in a species-specific manner, either protecting against the pathogen or enhancing disease. Our findings support the concept that EVs are central to the activities that these bacteria have on the function of the host biome, highlighting the potential therapeutic use of bacterial EVs for understanding pathogenesis of parasitic diseases and helping with novel treatments.

Development and application of molecular diagnostics to determine microecology of coccidia species in the kiwi (*Apteryx* spp.).

Emma Scheltema[1], ***Kerri Morgan***[1], ***Laryssa Howe***[1], ***Preet Singh***[1] **CT**

[1]Massey University, Palmerston North, NZ

Parasitism by coccidia is ubiquitous in wild and captive kiwi and coccidiosis is one of the primary diseases affecting juvenile birds in captive rearing programmes. Previous morphological and molecular analysis has identified at least five species of *Eimeria* from kiwi droppings, often present as mixed-species infections[1,2]. Unusually, infection has been described not only from the intestine but also multiple extra-intestinal organs[3,4]. However, species-specific knowledge of the microecology (lifecycle, tissue-specificity) of the intracellular stages of these parasites in kiwi is limited, in part due to the endangered status of their wild host. This lack of ability to identify coccidia species-specific biological characteristics limits diagnostic capability, development of methods of control and potentially, treatment decision-making.

Recent application of molecular tools, in combination with microscopic techniques, to non-invasively determine tissue-specificity of different coccidia species in kiwi and match species genotypes to known morphotypes will be reported. Extraction of DNA from individual morphologically identified oocysts is in the process of being trialed to match known genotypes, including those isolated from infected tissues, to described morphotypes. Isolation of individual kiwi Eimeria genotypes will allow information about biology of different species of kiwi coccidia to be gathered and will be critical for the further development of a reliable, quantitative molecular diagnostic tool for the identification and enumeration of coccidia species in kiwi. This molecular diagnostic tool will be applied for the assessment of anticoccidial drug efficacy in kiwi, which will be carried out in the latter part of this research project.

References

[1] Morgan K. et. al. Description of four new species of *Coccidia* (Apicomplexa: Eimeriidae) from brown kiwi, *Apteryx Mantelli*, in New Zealand. Parasitology Research 116:5, 1433-41, 2014.

[2] Coker S. Morphological and molecular characterisation of coccidia (*Eimeria spp.*) in kiwi (*Apteryx spp.*). Thesis, Massey University, Palmerston North, NZ, 2021.

[3] Morgan K.J. et. al. Enteric coccidiosis in the brown kiwi (*Apteryx mantelli*). Parasitology Research. 111:4, 1689-1699, 2012.

[4] Morgan K.J. et. al. Extra-intestinal coccidiosis in the kiwi (*Apteryx spp.*). Avian Pathology. 42:2, 137-146, 2013.

The conduct of acaricide efficacy trials in Australia with highlight on the Australian Paralysis Tick (*Ixodes holocyclus*)

Florian Roeber[1,2], ***Mike Gieseg***[1,3] **CT**

[1]Invetus Ltd, [2]Alstonville, New South Wales, Australia, [3]Hamilton, NZ

Data generated during acaricide efficacy trials, including dose confirmation and field studies, are essential for the registration of new ectoparasiticides in most developed countries. Specific guidelines for the conduct of such studies have been described by the W.A.A.V.P. and are being used by government regulators around the world. In Australia, the tick species *Rhipicephalus microplus* (Cattle Tick), *R. sanguineus* (Brown Dog Tick), *Haemaphysalis longicornis* (Bush Tick), and *Ixodes holocyclus* (Australian Paralysis Tick) are of the greatest veterinary significance. *Ixodes holocyclus* is of particular importance because it has very high pathogenic potential and every year $\approx$ 10,000 domestic animals are presented to veterinarians with symptoms of tick toxicosis. This tick is exclusive to the Australian environment and has a specialised life cycle that involves native wildlife hosts, which complicates the laboratory propagation of this species and currently no laboratory colony exists. For animal welfare reasons, and to reduce the incidence of tick toxicosis in untreated control animals during these trials, animals need to be 'immunised' with increasing numbers of ticks in the lead-up to such studies.

Here we describe the conduct of specialised *I. holocyclus* efficacy trials at our Australian research facility. Furthermore, we discuss the challenges associated with the supply, storage and infestation procedure during *I. holocyclus* efficacy trials.

Shedding of parasite eggs and other structures in the faeces of cats in Shelters

Ian Scott[1]**, *Barbara Adlington***[1]**, *Brittnee Southland***[1] **CT**

[1]Tāwharau Ora – School of Veterinary Science, Massey University, Palmerston North, NZ

There are thought to be approximately 1.2 million owned pet cats in Aotearoa New Zealand, up to 200,000 strays, and as many as 2.5 million feral cats. Cats make up about about 80% of the animals in SPCAs, and most are kittens/young adults, largely the result of uncontrolled breeding by strays as well as by unneutered pets, and these young age groups have often been shown to be at greater risk of infection with gastrointestinal parasites. Shelter populations are therefore a better indicator of which parasites are present and cycling in any specific region, than are owned, well cared for pet cats for which parasitism has now become the exception. To evaluate the prevalence of shedding of the dispersal and infective stages (eggs, larvae, oocysts and cysts) of a variety of helminth and protozoan parasites of cats, 737 faecal samples were submitted from 3 local SPCA centres: Palmerston North, Levin and Whanganui, all in the lower North Island. Samples were submitted in general soon after acquisition of the cat by the centre at least in part to assess need for anthelmintic treatment. In most instances a case ID was recorded, but other details such as age and sex were generally not provided. The samples were processed by a centrifugation/floatation test using 33% Zinc Sulphate and the dispersal stages were identified microscopically.

31.9% of the samples were positive for at least one parasite stage. The most common findings were oocysts of the coccidial organisms *Cystoisospora spp*. (prevalence 17.0%, lower and upper 95%CI, 14.4 to 19.8), followed by *Toxocara cati* eggs (11.1%, 9.1 to 13.6) and Giardia spp. cysts (3.7%, 2.5 to 5.3). Oocysts with a morphology consistent with either *Toxoplasma gondii* or *Hammondia hammondi* were uncommon (1.2%, 0.6 to 2.3). Although the methodology is considered unreliable for the detection of tapeworm and lungworm infections, prevalences of 1.2% (0.6 to 2.3) and 0.9% (0.5 to 1.9) were recorded respectively. Out of 9 cats identified as infected with tapeworms, 8 were infected with *Spirometra erinaceieuropaei* (= *S. mansoni*). In an average year, about 1 in 3 new pet cats are sourced as pets from shelters and SPCAs. Ensuring that these new pets are adequately treated / free of infection will be an important part of the adoption process..

40 years of faecal sample testing of dogs and cats

Ian Scott[1], ***Bill Pomroy***[1,2], ***Tony Charleston***[1,2], ***Barbara Adlington***[1], ***Brittnee Southland***[1] **CT**

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Over 40 years the Parasitology Laboratory has processed over 2000 canine and 1000 feline faecal samples submitted from the University Teaching Hospital. The methodology used to process the samples has changed over the years, but all methods relied on the floatation of eggs and other parasite stages using solutions with a high specific gravity. In the last 20 years, a centrifugation/floatation test using 33% zinc sulphate has been used exclusively. Three decades ago, approximately one in three canine samples (30.2%, n = 609, 95% CI 26.7 to 34.0) contained parasite stages, with the vast majority of those infected with a nematode (28.9%, 25.4 to 32.6). For cats, 1 in 4 were positive (25.2%, n = 202, 19.8 to 31.7), three quarters of which were infected with the nematode *Toxocara cati*.

In the last decade, the overall prevalence figures for dogs and cats were 20.6% (n = 683, 17.8 to 23.8) and 19.7% (n = 315, 15.7 to 24.4) respectively. For both cats and dogs, protozoal infections now outnumber nematode infections, 14.9% versus 6.9% for dogs and 11.4% versus 8.9% for cats. In the eighties/early nineties, *Trichuris vulpis* was the commonest nematode egg found in canine samples with a prevalence of 19.7% (16.7 to 23.0), whereas more recently it has become a rare finding – 1.3% (0.6 to 2.5). For cats the prevalence of *T. cati* has declined from 19.3% (14.5 to 25.3) to 8.6% (6.0 to 12.2), with 92% of infected cats in the last decade being less than one year old. Prevalence of *T. cati* in cats > 1 year old has declined from 14% to 1.5%. In contrast, the prevalence of *Toxocara canis* in older dogs has remained remarkably consistent (2.9% versus 3.2%). There is growing evidence that nematode parasites are now an uncommon cause of ill health in pets, and even those animals likelier to be infected, are more often clinically normal. In addition, at this point in time, the majority of well-cared for adult pet dogs and cats are likely to not be shedding nematode eggs in their faeces, potentially living largely helminth-free lives. Thus the question is whether current recommendations for anthelmintic use in these species are appropriate? One current trend would appear to be the recommendation for blanket use of anthelmintic treatments to all pets at even monthly intervals. It must be acknowledged that most of these treatments will almost certainly be given to pets that did not need them.

What effect do anthelmintic drugs have on the behaviour of ewes and their new-born lambs?

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Parasitism with gastrointestinal nematodes significantly impacts sheep health, welfare, and productivity. Routine treatment using anthelmintic drugs can alleviate these negative impacts. Routine treatment of pregnant ewes 3-4 weeks prior to parturition is common on New Zealand farms. However, research from the AgResearch parasitology team has shown that pre-lambing treatment of ewes with long-acting anthelmintics (moxidectin or controlled-release capsules containing abamectin and albendazole) can be associated with highly variable, and unpredictable, differences in lamb survival[1].

The objective of this study was to evaluate the effect of anthelmintic drugs on the behaviour of ewes and their new-born lambs. Sixty mixed-age pregnant ewes (with twins) were used in this study and randomly allocated to one of three groups ($n = 20$/group): 1) treated with a long-acting injection containing moxidectin (Cydectin) 2-4 weeks prior to lambing, 2) treated with a controlled-release capsule containing abamectin and albendazole (Bionic) 2-4 weeks prior to lambing, and 3) control group that was not treated or handled other than routine care (if required). The ewes were housed indoors one month pre-lambing and stayed in the same pens ($n = 2$ ewes/treatment/pen) until one week after lambing. Behaviour of the ewes and lambs was monitored continuously using security cameras positioned above each pen. Ewes were spray-marked using numbers and lambs were given corresponding-coloured collars for individual identification during video analysis. Lamb and ewe behaviours were evaluated over three hours post-lambing and additional two-hour scan sampling over 7 days post-lambing. Many behaviours were assessed including standing, lying, suckling, and grooming. Liveweight and sex of the lambs was recorded within 6 h after birth, and at 7 days of age.

Data analysis is ongoing; based on published data we consider the possibility that the presence of macrocyclic lactone compounds in the tissues of neonatal lambs may affect their behaviour, potentially contributing to a reduced or more variable survival[2,3]. If this is found to be the case, it will help explain results of earlier studies and may give farmers cause to reconsider their use of these products.

References

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Level of challenge of *Haemonchus contortus* on the behaviour and physiology of lambs on pasture

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The objective of this study was to investigate the relationship between the level of *Haemonchus contortus* challenge and the behaviour and physiology of sheep. The 40 enrolled 6-month-old Romney-cross wethers were randomly assigned to one of four treatments ($n = 10$/treatment). Animals receiving treatments 1-3, were trickle dosed with 8000 (High; H), 4000 (Medium, M), or 1000 (Low, L) infective L3 larvae, respectively, over three days. Treatment 4 was a trickle dose of water. The lambs, in groups of eight per pen ($n = 2$ lambs/treatment/pen), were strip grazed and moved into new pens (of equal size) weekly to reduce the risk of pasture contamination. The following were collected one-week pre-treatment and weekly for 6 weeks post-treatment: faecal samples to count faecal eggs as a relative measure of worm burden, live weight, and blood samples to assess complete blood counts and evaluate cytokines. Behaviours were monitored continuously over the trial period; analyses of these measures are ongoing. Response variables were analysed using a linear mixed model, fitted using restricted maximum likelihood.

Faecal egg counts were elevated in H and M lambs (1025 epg and 1084 epg) above C and L lambs (4 epg and 134 epg) from 4 weeks after treatment ($P \leq 0.05$). There was an overall effect of treatment on liveweight change from baseline, as H, M and L lambs showed a smaller increase in liveweight than C lambs (3.8 kg, 4.3 kg, 4.5 kg and 6.0 kg for H, M, L and C lambs, respectively; $P \leq 0.05$). At week 3 post-treatment, haemoglobin was lower in H lambs than in the other treatments ($P < 0.006$). At week 3 post-treatment, H lambs had lower haematocrits than all other treatments ($P < 0.02$) and from week 4 until the end of the study H lambs had lower haematocrits than C and L lambs ($P < 0.02$). From week 3, mean cell volume was higher in H lambs compared with C and L lambs ($P < 0.02$). From week 4, H and M lambs had reduced red blood cells than C and L lambs ($P < 0.02$).

Together these results indicate that the high dose of 8000 *H. contortus* L3 larvae resulted in changes in blood composition and that may negatively affect the welfare of lambs.

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Useful Information

Coffee breaks and lunches will be offered in the main entrance of the conference venue.

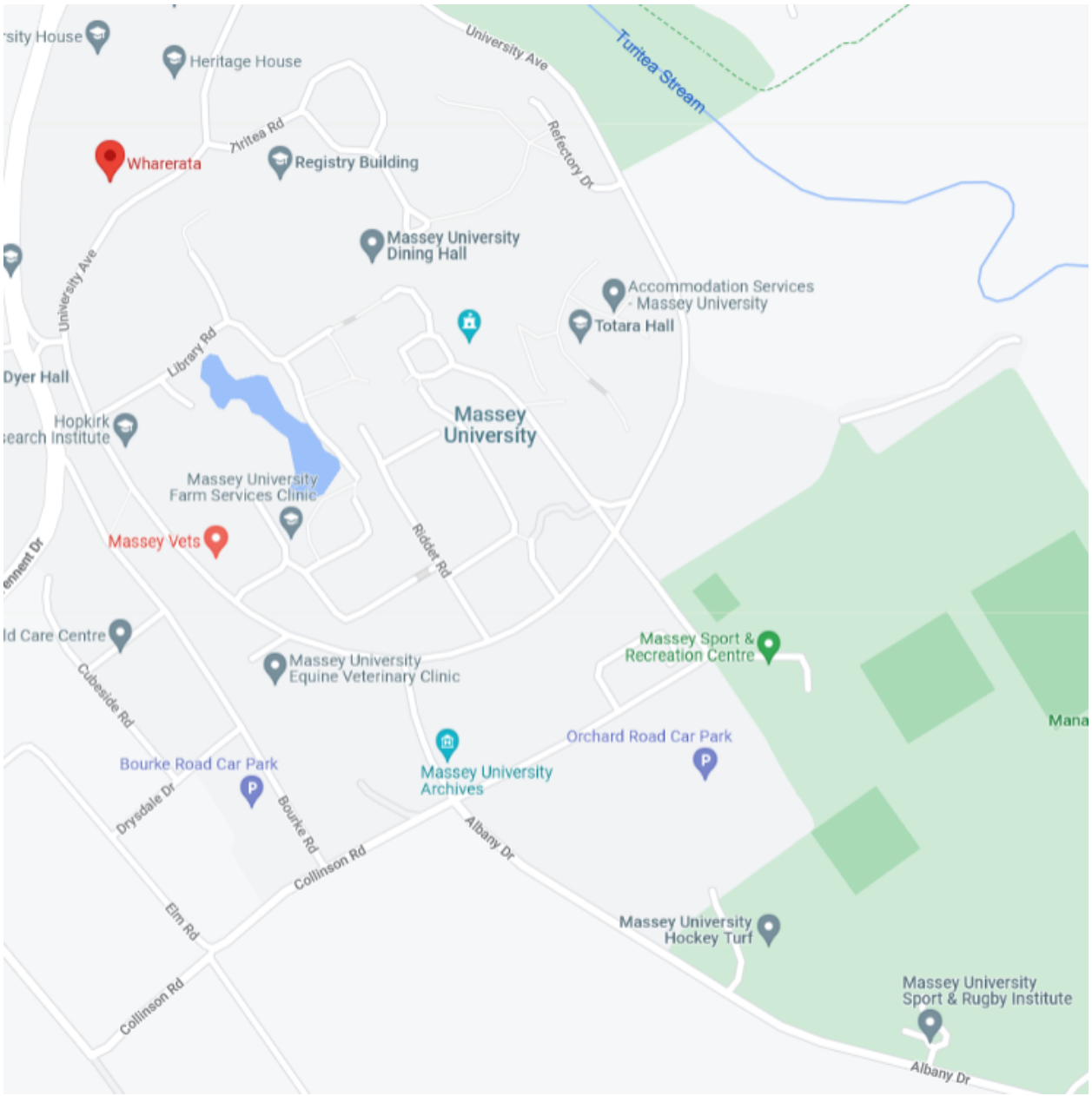
Wi-Fi

Wi-Fi will be available during the conference.
Network: **sportandrugby**
Password: **ShadowXV**

Conference dinner

The **conference dinner** will be held at the "Wharerata", at Massey University Main Drive Palmerston North.

The venue for dinner is a 10 minute walk (2-3 min. drive) across the campus as shown on the map below.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