Summary Article

The circadian periodicity of oocyst shedding in *Eimeria spp*. affecting brown kiwi

During the later part of the hatching and rearing season of ONE seven motion sensing cameras were set up within the outside creches of an ONE institute. These creches are notorious for coccidia infections and weekly testing is required to determine the need for treatment. This research used camera footage to determine the exact time of excrement during the night of each faecal sample and each sample was allocated into a 1 hour time period. Following individual faecal oocyst counts (FOCs) on the samples it was possible to determine the varied rate of oocyst excrement throughout the night.

In total 82 samples were collected across 18 nights and four different kiwi. Oocyst counts ranged from 0 to >328000opg. Atleast one positive FOC was found on 17 of the 18 nights and about three quarters of all samples were positive suggesting high prevalence of *Eimeria* infection. Three of the four previously described species of *Eimeria* were observed during the sampling period. The results show that high oocyst counts are dependent on time and the *Eimeria spp*. affecting brown kiwi exhibit peak shedding between 3am and 7am with few or no oocysts shed between 8pm and 12pm. The time slot of 12pm to 3am contained no consistent pattern of statistically significant differences and it appears this time is a transition period from non-shedding to peak shedding.

These results increase our current understanding of the biology of *Eimeria* spp. affecting brown kiwi and have important implications for the management of ONE kiwi, particularly regarding the interpretation and accuracy of faecal oocyst counts. It is important to note that even kiwi with large *Eimeria* burdens did not consistently shed oocysts between 8pm and 12pm. This means any samples that were excreted during this time are prone to give false negative results. If the time of excrement of a sample is unknown accurate interpretation is difficult, with the time of excrement likely to have a large effect on the results. This is important when making decisions on the necessity of treatment and in quarantine or pre-release situations. The presence of high numbers of oocysts following toltrazuril administration also questions the efficacy and ongoing sustainability of toltrazuril use for coccidia control at ONE institutes, an area that requires urgent further research.

The results also suggests that different populations of ONE kiwi have different species of *Eimeria* present. This is an important consideration when releasing birds into wild kiwi populations as exposure to new species of *Eimeria* may have significant effects on a niave population.

Further to these management implications, these results appear unable to be explained by the current hypothesis theorising the evolutionary forces behind the development of this adaptive trait suggesting other, unknown factors are responsible. The results also provide information regarding the possible triggers for oocyst shedding in avian species.

Continuing to improve our understanding of host-parasite interactions is vital to enable appropriate disease management in order to reduce coccidia's detrimental impact on ONE and ensure the ongoing success and sustainability of this vital recovery programme.

I would like to sincerely thank BoNZ for their funding, which made this important research possible.

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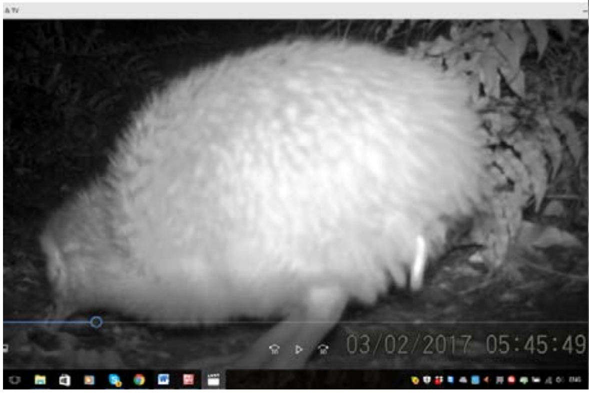
Stills from night vision cameras showing the moment of sample excrement (ie a kiwi pooing!).



From L to R; 1) Close up of a sporulated *E. apteryxii* oocyst, 2) 2x *E. apteryxii* oocysts, 3) 2x E. *kiwii oocysts*