Gastrointestinal Parasites In New Zealand Native Songbirds With Special Emphasis On Coccidian Parasites

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The relationship between host and parasite is a very old one and like any other birds in the world, New Zealand native passerine birds are hosts to a variety of gastrointestinal parasites. Although these parasites have a high importance, particularly for captive populations of native New Zealand songbird species, their prevalence, epidemiology, life cycles and even taxonomic relationships are still widely unknown. The number of parasite species affecting a native passerine species and the possibility that these parasites might also be introduced by non- native passerines remains uncertain. Under natural conditions, gastrointestinal parasites seldom pose a threat. Stressors such as quarantine for translocation, overcrowding, nutrition or habitat changes as well as low genetic diversity may increase susceptibility to infection and thus severely affect many passerines (Harrison, 2006; Ritchie, 1994). For example, a captive population of Hihi (stitchbird, *Notiomystis cincta*) kept for breeding purposes suffered severe infection by an *Isospora*- type coccidian which has caused mortalities in several birds (Cork *et al*., 1999; Twentyman, 2001). In addition, studies have shown the increased parasite levels within a passerine directly correlated to increased breeding mortality, reduced annual growth rate of the host population and reduced host body mass and body condition (Holmstad *et al*., 2005). In general, most infected birds remain asymptomatic, but in severe cases they can show signs of anorexia and depression through weight loss, melaena, diarrhoea and death (Harrison, 2006; Ritchie, 1994).

The purpose of this study was to examine the gastrointestinal parasites affecting the New Zealand native and introduced passerine birds with an emphasis on the coccidian parasites. Coccidian parasites are generally host specific, obligate intracellular protozoan parasites and members of the phylum *Apicomplexa.* The most common *Apicomplexan* affect passerine birds are members of the genus *Isospora*. *Isospora* spp. can cause severe acute infections in songbirds, with proliferative visceral infection being common in captive passerine birds, while free-ranging passerines more often show the asymptomatic chronic form of infection unless stressed (Giacomo *et al*., 1997; Gill and Paperna, 2008; Harrison, 2006; Ritchie, 1994).

Most of the samples for this study were obtained from birds captured by mist nets, although faecal examination, pathology and histology were also undertaken on available dead birds. The faecal samples were examined using the flotation method, coccidia were sporulated to identify their genus and PCR analysis was also undertaken. 301 samples from seven native and introduced species have

been examined so far. Preliminary results show that 32.23 % (97) of birds were parasitized by at least one species of gastrointestinal parasite and 2.78% (8) by two or more. The most common gastrointestinal parasite was *Coccidium* sp with 24.25 % (73) of the samples positive. We found at least five different species of coccidian parasite of the genus *Isospora* in tui (*Prosthemadera novaeseelaniae*), saddleback (Tieke; *Philesturnus carunculatus*), silvereye (*Zosterops lateralis*) and North Island robin (Toutouwai; *Petroica australis longpipes*). Although this study focused on protozoan parasites in passerine birds, a new occurrence of a trematode (*Dicrocoelioidea*) and *Sarcocystis* in the North Island saddleback, a new trematode and cestode in tui and the unusual finding of *Caryospora* in a fantail were also discovered in faecal and histological samples.

Among the examined birds, tui are generally more severely infected with coccidia and appeared to be in worse body condition than robins and saddlebacks.

The taxonomic classification of the coccidia remains controversial, especially the existence of a separate genus "*Atoxoplasma*", the name that was given to "*Isospora*"- type coccidia with extra intestinal stages (Adkesson, Zdziarski, and Little, 2005; Ball *et al*., 1998; Barta *et al*., 2005; Gill and Paperna, 2008; Martinez and Munoz, 1998; Remple, 2004; Sanchez-Cordon *et al*., 2007; Schrenzel *et al*., 2005; Twentyman, 2001; Upton *et al*., 2001).

Classically, coccidian parasites containing two sporocysts with four sporozoites each were classified together in the genus *Isospora* - phylum *Apicomplexa*, class *Sporozoa*, subclass *Coccidia*, order *Eimieriina*, family *Sarcocystidae* (Carreno *et al*., 1998; Morrison *et al*., 2004; Schrenzel *et al*., 2005). Formerly, the taxonomic groups were classified entirely on their microscopic morphology after sporulation, with the genus *Eimeria* possessing 4 sporocysts with 2 sporozoites each in the oocyst, *Isospora* possessing 2 sporocysts with 4 sporozoites each and *Caryospora* possessing one sporocyst with 4 to 8 sporozoites (Barta *et al*., 2005).

Recent work on the small subunit rRNA of the coccidian parasites, has proven the genus *Isospora* is a polyphyletic group and should be divided into 2 separate genuses belonging to two different families. *Isospora* in mammals is more closely related to *Neospora, Toxoplasma* and *Sarcocystis sp* than *Eimeria*, while *Caryospora* is closely related to *Eimeria* (Carreno *et al*., 1998; Morrison *et al*., 2004). Genetic evidence in avian *Isospora* sp shows that they are more closely related to *Eimeria* and should therefore belong to the family *Eimeriidae*.

The preliminary sequencing results of the current study supports these findings.

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