COCCIDIA (PROTOZOA: APICOMPLEXA) OF THE DOMESTICATED GOAT *CAPRA HIRCUS* IN NEW ZEALAND

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ABSTRACT

The literature on the history of the identification of *Eimeria* species infecting domesticated goats, and their morphological characteristics, the general life cycle of coccidia and epidemiology of infections, together with clinical signs, diagnosis and treatment is reviewed. In total 13 *Eimeria* species which are generally considered valid have been described from goats but relatively little has been published on their biology or significance.

Studies on the identification and seasonal prevalence of *Eimeria* species infecting domesticated goats were conducted on three farms in the Palmerston North area of New Zealand from August 1987 to August 1988. On one farm (Old West Road), 20 kids & 20 adult Saanen goats were sampled at 14 day intervals and monthly intervals, respectively; on a second farm (Ballantrae) 17 kids and 20 adult New Zealand 'feral' type were sampled at monthly intervals; on a third farm (Kimbolton) 23 Angora kids were sampled at 14 day intervals.

Faecal samples collected directly from the rectum were used for oocyst counts and to provide oocysts for sporulation for identification of species. More than 98% of the faecal samples from each group of kids and adults contained coccidial oocysts. Mixed infections were the rule, 59% of the faecal samples contained 6-8 species. The *Eimeria* species identified in this study were: ten previously described species - *E. christenseni*, *E. tunisiensis*, *E. jolchejevi s.s.*, *E. arloingi*, *E. hirci*, *E. caprina*, *E. caprovina*, *E. apsheronica*, *E. ninakohlyakimovae* and *E. alijevi*; two others whose species status is uncertain - temporarily designated *E. jolchejevi 'large form'* and *E. hirci 'small form'*; three previously undescribed species - temporarily designated *E. n1*, *E. n2* and *E. n3*. The morphological characteristics of sporulated oocysts of the *Eimeria* species found in the present survey are described in detail and illustrated by microphotographs and schematic diagrams. Statistical analysis of oocyst and sporocyst dimensions of these species and, where necessary for differentiation of species, statistical comparisons are also given. In addition to these species, a single oocyst of *E. punctata* which was not recorded during the study period, was found later later in a pooled sample kept as reference material.

E. jolchejevi 'large form' had many of the characteristics of *E. jolchejevi* as described in the literature but differed in size and shape from it. Comparisons of the large form with published data indicate that it represents a previously overlooked species infecting goats and that there may be an equivalent species in sheep. *E. hirci* oocysts observed did not differ from published descriptions but analysis showed that they were divisible into two distinct groups on the basis of size and shape. These may represent separate species but

further investigation is needed to verify this.

The species designated *E. n1*, *E. n2* and *E. n3* are shown to be clearly distinguishable from previously described species from goats. *E. n1* may represent the equivalent of *E. weybridgensis* from sheep but the other two species do not appear to have an ovine equivalent. Further work is needed to confirm their species status and investigate their biology.

Kids less than 1 year old had considerably higher oocyst counts than adults. Mean oocyst counts were at their highest from 2-6 months of age but they tended to decrease with time and from May on were at relatively low levels. The seasonal patterns of oocyst counts in the groups of kids differed between farms. This was associated with different management systems and breeds. The highest oocyst counts occurred in Saanen kids raised on milk-replacer in a heavily contaminated pen; the predominant species were *E. christenseni* and *E. arloingi*. Counts were lower in Angora kids reared on milk-replacer in pens that were cleaned daily and which opened onto a small paddock. Counts were lowest in 'feral' kids reared by natural suckling at pasture. In adults, on one farm there was no detectable seasonal trend in oocyst counts and on the other there was a tendency for mean counts to rise from December on. On both farms there were, in addition, some short-term fluctuations in mean counts with peaks associated with high counts in a few individuals.

Seasonal variations in the occurrence of individual *Eimeria* species were examined by considering the oocyst counts for each species, the percentage of the total oocyst counts represented and the prevalence of positive faecal samples. The mean percentages of total oocyst counts represented by each species over the whole year were compared. *E. arloingi* was found to be the most predominant species. Other species which were dominant in the coccidial population were *E. hirci* and *E. n2*. The seasonal patterns differed between species although the patterns on the different farms were, on the whole, very similar. This indicates substantial differences between species in host-parasite relationships and it is suggested that these may chiefly involve the prolificacy and immunogenicity of the various species. Further work is needed to investigate this. All of the species recorded were found in all the groups of goats examined.

The sporulation of *E. christenseni* oocysts at various constant temperatures was examined. The log temperature:log development time relationship yielded a correlation coefficient of $r = -0.99$. The time required for 90 % of the oocysts to complete each development stage was taken as the endpoint. Sporulation was completed in 7 days at $27^{o}C$, in 10 days at $20^{o}C$, in 11 days at $15^{o}C$, 14 days at $10^{o}C$ and in 32 days at $4^{o}C$.

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