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**THE EPIDEMIOLOGY OF *YERSINIA* INFECTIONS
IN GOAT FLOCKS**

*A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF PHILOSOPHY
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EUGENE BATICADOS LAÑADA

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ABSTRACT

Due to the increasing frequency of yersiniosis in goats, it was considered necessary to study the behaviour of *Yersinia* species in goat flocks. The aim of this study, carried out in several phases among goat farms in the Manawatu, was to identify factors involved in the epidemiology of *Yersinia* infections, which might eventually lead to the formulation of effective control measures.

The first phase of the study was the screening of goat flocks for the presence or absence of *Yersinia* species infections. This phase was considered necessary, since prior to the study the prevalence of such infections among apparently healthy goats were unknown. The results of this phase showed that 18 of the 30 farms screened (60%) were positive for the infection.

Concurrent with the screening phase, a postal survey was undertaken involving the farmers of the thirty goat farms. This survey gave an indication of the production and health management practices implemented on goat farms in the region, and how these related to the presence of *Yersinia* species infections in the goat flocks. The results of the survey (97% response rate) showed that farmers generally managed goats in the same manner as sheep, and that the farmers' knowledge of the presence of gastrointestinal bacterial infections such as yersiniosis was almost nonexistent. Stress-related management practices which might be associated with the presence of *Yersinia* species infections were also identified in this phase of the study.

The farms found positive during screening were included in the next phase of the study, the prevalence survey. This phase involved the sampling of three age groups from each flock: kids (less than one year old), hoggets (one to two years old), and adults (two to five years old). The results of this phase showed that the mean level of *Yersinia* prevalence of all the combined age groups from the 18 farms was 15%. In kids, the prevalence was 24.7%, in hoggets 11.8%, and in adults 9.6%. The predominant *Yersinia* species recovered from kids was *Y. enterocolitica* biotype 5, comprising 94.5% of all the isolates. Among hoggets, *Y. enterocolitica* biotype 5 and the environmental strains (*Y. frederiksenii*, *Y. kristensenii* and *Y. intermedia*) were about equal in prevalence, while among the adults, the environmental strains predominated, comprising 92.7% of all the isolates in that group.

The prevalence survey also revealed that infection levels among the different goat flocks were extremely variable, and since sampling was conducted only once, the results were obviously only minimum estimates of flock infection levels.

In order to explain the inherent drawbacks associated with a single sampling event, it was decided to carry out repeated samplings on the same group of animals over time, particularly as *Yersinia* species infections had been reported in the past to be commonest during the colder months of the year. Thus a cohort study was implemented, where selected groups of goats stratified into three age groups (kids, hoggets and adults) were subjected to repeated monthly samplings for at least 12 months.

Several key points were brought to light by the cohort study. It was shown that the incidence of potentially pathogenic *Yersinia* species (*Y. pseudotuberculosis* and *Y. enterocolitica* biotypes 2, 3 and 5) appeared to have a distinct seasonal variation, a characteristic which was absent in the incidence of the majority of the environmental strains (*Y. enterocolitica* biotype 1A, *Y. frederiksenii*, *Y. kristensenii*, *Y. intermedia* and *Y. rohdei*). Of the climatic factors studied, low daily minimum temperatures were particularly influential on the incidence of the potentially pathogenic strains, while increased monthly precipitation levels were highly influential on the incidence of the environmental strains. Age was also an important factor in the incidence of the infections, with the younger age groups showing a higher incidence of the potentially pathogenic strains and the older age groups showing a higher incidence of the environmental strains. The ability of the animals to develop apparent immunity against subsequent reinfection by the potentially pathogenic *Yersinia* species was another finding of the cohort study.

The numerous strains of *Yersinia* isolated throughout the study exhibited heterogeneity in their reactions to biochemical testing, even among strains within the same species. An attempt was therefore made to classify these strains using numerical taxonomy. This procedure indicated that the pathogenic and environmental *Yersinia* strains were quite different, as shown by a number of distinct clusters.

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