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LEPTOSPIROSIS IN FREE-LIVING ANIMALS
IN NEW ZEALAND, WITH PARTICULAR
REFERENCE TO THE POSSUM
(TRICHOEURUS VULPECULA)

A thesis presented in partial fulfilment of the requirements
for the degree of Doctor of Philosophy in Veterinary Pathology and
Public Health at Massey University.

Stephen Clive Hathaway
1978
ABSTRACT

A serological survey of 600 possums (Trichosurus vulpecula) from farmland environments in the southern half of the North Island of New Zealand revealed that titres against leptospires of the Hebdomadis serogroup were present in 52% of sera. Bacteriological studies identified the causative organism as Leptospira interrogans serovar balcanica. This serovar had previously been isolated only in Eastern Europe; from man, cattle and pigs.

Isolation of leptospires from kidneys was aided by the use of a system involving whole kidney homogenisation in γ-sterilised plastic bags in a 'Coleworth Stomacher'. Comparison of cultural and serological results demonstrated that, when titres were read at low minimum serum dilutions, the serological prevalence was an accurate indicator of the bacteriological prevalence.

Field surveys and experimental studies demonstrated that the possum was a typical maintenance host for balcanica. Experimental infection was easily established and 50% of animals were still leptospiruric one year after infection. Experimental infection with hardjo could not be established, and it is considered that previous reports of endemic hardjo infection in possums in New Zealand could be incorrect.

There was a marked difference in the age-specific prevalence of balcanica infection in possum populations, with infection being restricted to sexually-mature animals. Evidence is presented to support the hypothesis that infection becomes established following behavioural changes associated with the onset of sexual maturity. It is suggested that the transmission of balcanica within a population is dependant on direct contact between animals rather than environmental contamination. No correlation could be shown between the prevalence of infection in different populations and the nature of the habitat.

A consistent paradoxical reaction to hardjo was found in sera from possums infected with balcanica. Chromatographic studies revealed that this was due to heterologous agglutinating activity of antibodies of the IgM class. Chromatographic studies also indicated that, following
infection, the transition of the predominant agglutinating activity in sera from antibodies of the IgM class to antibodies of the IgG class was considerably slower than in eutherian mammals.

*Balcanica* was found to haemolyse red blood cells of several species. An *in vitro* haemolysin test for the differentiation of *balcanica* and *hardjo* isolates is described. Haemolytic activity has not been previously demonstrated in other members of the Hebdomadis serogroup.

Investigations of other small free-living mammals revealed that serogroup Ballum infection was endemic in ship rats (*Rattus rattus*), house mice (*Mus musculus*) and hedgehogs (*Erinaceus europaeus*) in natural and syanthetic biotopes. The Norway rat (*Rattus norvegicus*) was also shown to be capable of maintaining a focus of Ballum serogroup infection when the population density was high. No leptospires from other than the Ballum serogroup were isolated from the rodents examined.

Field evidence suggested that there was no predator-chain transmission of leptospiral infection from rodents to free-living carnivores. Birds were similarly found to be unimportant in the epidemiology of leptospirosis in the ecosystems studied.

The nidality of leptospiriosis was investigated in an intensive farming environment for a period of two years, and well-defined maintenance-host parasite relationships for different serovars were defined in both domestic and free-living species. No cultural and very little serological evidence of interspecies transfer was found, despite the apparent opportunity for transfer of infection.

The concept of a maintenance host for a particular leptospiral serovar was investigated using a laboratory mouse model. As a consequence of this investigation and field studies, the characteristics of a maintenance host for a leptospiral serovar are redefined.
ACKNOWLEDGEMENTS

The research project described in this thesis was funded primarily by the Womens Division of Federated Farmers and I would like to gratefully acknowledge their support. The continued interest shown by the members of this organisation throughout the project was very gratifying. I would also like to acknowledge the financial support of the Accident Compensation Commission.

Special thanks are due to my supervisors, Professor D. K. Blackmore and Dr R. B. Marshall, for unbridled enthusiasm and encouragement at all times, both in the laboratory and in the field. The advice and assistance of Professor B. W. Manktelow, Professor R. E. Munford, Dr W. A. G. Charleston, Dr R. E. Harris and Dr K. M. Moriarty has also been greatly appreciated.

The capture of free-living species in the field was an important part of this research project and many people provided assistance and shelter, both during favourable and adverse conditions. I would like to collectively thank all these people. In particular, I would like to mention the late Mr N. Lee, Supervisor of the South Hawke's Bay Pest Destruction Board, and O. Harris, his successor. Night-shooting operations without their help would not have been possible. Particular thanks are due to Mr J. Harris, Mr R. Perry, Mr R. Ferris and Mr J. Innes. Permission to sample possums in forest areas was given by Mr I. Logan of the New Zealand Forest Service and Mr J. Maryatt of the Wellington Regional Water Board. The many hours spent sharpshooting of Norway rats at rubbish tips by Professor D. K. Blackmore is also acknowledged.

Cheerful and competent technical assistance was given by Mrs Lyn Bell and Ms Barbara Wilton. I am indebted to them for their co-operation and willingness at all times. I would also like to thank Ms Sandra Roxburgh and Ms Lynley Fray for preparation of media, Mrs Jan Schramma for preparation of glassware, Mr P. Wildbore for administrative assistance, Mr T. Law for photographic work and Mr R. Faulding for servicing of technical equipment.
The typing of this thesis was carried out by Mrs Allain Scott, Mrs Fay Wicherts and Ms Kathie White, and their help is much appreciated.

The research described in this thesis has undoubtedly been enriched by the companionship and constructive criticism of my co-workers, John Hellström and Terry Ryan. The moral support provided in time of need is greatly appreciated.

Finally, I would like to thank my wife Julie and daughter Thea, to whom a debt of time will hopefully be repaid.
TABLE OF CONTENTS

Abstract

Acknowledgements

Table of Contents

List of Figures

List of Plates

Chapter I  : Leptospirosis in wildlife, epidemiological considerations and a summary of leptospirosis in New Zealand.

Chapter II  : The natural history of the possum, *Trichosurus vulpecula*.

Chapter III  : General methods.

Chapter IV  : Serological survey of pastoral possum populations.

Chapter V  : Development of cultural techniques.

Chapter VI  : Cultural and serological investigations of pastoral possum populations.

Chapter VII  : Experimental infection in possums.

Chapter VIII  : Some aspects of the epidemiology of *balcanica* infection in possums.

Chapter IX  : The immunological response of possums to leptospiral infection.

Chapter X  : An *in vitro* test for the differentiation of serovars *balcanica* and *hardjo*.

Chapter XI  : Natural history of small mammals in New Zealand and the methods of capture used in the present study.

Chapter XII  : Leptospirosis in rats.
Chapter XIII: Leptospirosis in small mammalian species, feral
ungulates and pukeko's (*Porphyrio melanotus*) in
New Zealand.

Chapter XIV: The nidality of leptospirosis in an intensive
farming environment.

Chapter XV: The maintenance host.

Chapter XVI: General discussion.

References

Appendices

"Leptospira interrogans serovar balcanica from
a possum".

"The serologic and cultural prevalence of *Leptospira*
interrogans serovar balcanica in possums (*Trichosurus*
vulpecula) in New Zealand".
### LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page number</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Locations from which pastoral possum samples were taken.</td>
<td>65</td>
</tr>
<tr>
<td>4.2</td>
<td>Prevalence of hardjo titres and geometric mean titres, by age group and sex,</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>in pastoral possums.</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Frequency distribution of hardjo titres by age group in pastoral possums.</td>
<td>77</td>
</tr>
<tr>
<td>6.1</td>
<td>Prevalence of balcanica and hardjo titres, G.M.T.'s and bacteriological</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>prevalences for mature adult and transitional-stage adult possums.</td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>Frequency distribution of hardjo titres in mature adult possums.</td>
<td>124</td>
</tr>
<tr>
<td>6.3</td>
<td>Frequency distribution of balcanica titres in mature adult possums.</td>
<td>124</td>
</tr>
<tr>
<td>6.4</td>
<td>Frequency distribution of hardjo titres in transitional-stage adult possums.</td>
<td>124</td>
</tr>
<tr>
<td>6.5</td>
<td>Frequency distribution of balcanica titres in transitional-stage adult possums.</td>
<td>124</td>
</tr>
<tr>
<td>6.6</td>
<td>Frequency of isolations from mature adult possums with different hardjo titres.</td>
<td>127</td>
</tr>
<tr>
<td>6.7</td>
<td>Frequency of isolations from mature adult possums with different balcanica titres.</td>
<td>127</td>
</tr>
<tr>
<td>6.8</td>
<td>Frequency of isolations from transitional-stage adult possums with different hardjo titres.</td>
<td>127</td>
</tr>
<tr>
<td>6.9</td>
<td>Frequency of isolations from transitional-stage adult possums with different balcanica titres.</td>
<td>127</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>7.1</td>
<td>Hebdomadis serogroup titres in possums experimentally infected with <em>balcanica</em> (Experiment 2).</td>
<td>152</td>
</tr>
<tr>
<td>7.2</td>
<td>Experimental infection with <em>balcanica</em> in possum E4.2.</td>
<td>156</td>
</tr>
<tr>
<td>7.3</td>
<td>Experimental infection with <em>balcanica</em> in possum E4.4.</td>
<td>157</td>
</tr>
<tr>
<td>7.4</td>
<td>Experimental infection with <em>balcanica</em> in possum E4.5.</td>
<td>158</td>
</tr>
<tr>
<td>7.5</td>
<td>Experimental infection with <em>balcanica</em> in possum E4.6.</td>
<td>159</td>
</tr>
<tr>
<td>7.6</td>
<td>Experimental infection with <em>balcanica</em> in possum E4.7.</td>
<td>160</td>
</tr>
<tr>
<td>7.7</td>
<td>Experimental infection with <em>balcanica</em> in possum E4.8.</td>
<td>161</td>
</tr>
<tr>
<td>7.8</td>
<td>Log GMT of <em>hardjo</em> and <em>balcanica</em> titres in experimentally-infected possums (Experiment 4).</td>
<td>164</td>
</tr>
<tr>
<td>7.9</td>
<td>Parameters of infection with <em>balcanica</em> in hamsters inoculated with serial samples of possum urine in Experiment 4.</td>
<td>170</td>
</tr>
<tr>
<td>8.1</td>
<td>Geographical locations from which possums inhabiting deep forest, forest-pasture boundary and coastal seaface ecosystems were sampled.</td>
<td>188</td>
</tr>
<tr>
<td>8.2</td>
<td>Growth curve of juvenile possums and prevalences of <em>balcanica</em> titres in different age groups.</td>
<td>201</td>
</tr>
<tr>
<td>8.3</td>
<td><em>Balcanica</em> titres in juvenile possums of less than 190 days of age.</td>
<td>202</td>
</tr>
<tr>
<td>9.1</td>
<td>Distribution of <em>balcanica</em> and <em>hardjo</em> agglutinins in fractionated sera from Joey 205, Joey 254 and the dam of Joey 254.</td>
<td>224</td>
</tr>
<tr>
<td>9.2</td>
<td>Mean percentage distribution and standard errors of <em>balcanica</em> and <em>hardjo</em> agglutinating antibodies of the IgM and IgG class in experimentally-infected possums.</td>
<td>234</td>
</tr>
</tbody>
</table>
9.3 : Mean distribution of *balaenica* and *hardjo* agglutinins in fractionated sera from experimentally-infected possums.

9.4 : Changes in mean agglutinating activity of anti-*balaenica* and anti-*hardjo* IgM and IgG immunoglobulins with time in possums experimentally infected with *balaenica*.

10.1 : Haemolytic activity of three, six and twelve day *balaenica* cultures for washed human and bovine red blood cells.

10.2 : Haemolytic activity of three, six and twelve day *balaenica* cultures for unwashed human and bovine red blood cells.

12.1 : Percentage distribution of weight-range groups of Norway rats from rubbish tips and the prevalence of Ballum serogroup infection in different weight-range groups.

12.2 : Percentage distribution of weight-range groups of ship rats and the prevalence of Ballum serogroup infection in different weight-range groups.

12.3 : Regression of prevalence of Ballum serogroup infection in Norway rats on subjective estimate of relative abundance.

12.4 : Epidemiology of Ballum serogroup infection in the Norway and ship rat.

14.1 : Massey Pig Research Centre and No.1 Dairy Farm showing trapping and environmental sampling locations.

14.2 : Geographical distribution of leptospirosis in domestic animals at the Massey Pig Research Centre and No.1 Dairy Farm.
15.1: Serial passage of *ballum*, *pomona*, and *balkanica* in weanling hamsters.

15.2: Prevalence of leptospiruria in groups of six mice infected with *ballum*, *pomona* and *balkanica* at a dose rate of $10^8$ leptospires.

15.3: Prevalence and intensity of leptospiruria at different times post-inoculation in groups of six mice infected with *ballum* and *pomona*.

15.4: Transmission of *ballum* within family groups of laboratory mice.

15.5: Transmission of *pomona* within family groups of laboratory mice.
LIST OF PLATES

Frontpiece: The Australian brush-tailed possum (*Trichosurus vulpecula*).

3.1 : Steel trap of the type used for the sampling of some possum populations. 45

3.2 : Cyanide paste bait eaten by a possum. 45

3.3 : Modified Cornwall syringe for the dispensing of antigen. 53

8.1 : Coastal seaface ecosystem. 191

8.2 : Deep forest ecosystem. 191

8.3 : Forest-pasture boundary ecosystem. 191

9.1 : Immunoelectrophoretic reaction of concentrated gel filtration fractions of possum serum with rabbit antipossum IgM and IgG. 220

11.1 : Ship rat captured in a snap trap. 283

11.2 : Cage trap for capture of rats. 283

11.3 : "Katch All" automatic mouse trap. 284

12.1 : High density population of Norway rats at Feilding dump. 313

14.1 : Double-chambered duck trap in use at the Massey Pig Research Centre. 339