

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

EPIDEMIOLOGICAL ASPECTS OF INFECTIOUS  
BOVINE KERATOCONJUNCTIVITIS IN  
NEW ZEALAND

This thesis is presented in partial fulfilment  
of the requirements of the degree of  
Master of Veterinary Science  
at Massey University.

JANE ANN SINCLAIR

December, 1982

## ABSTRACT

Infectious bovine keratoconjunctivitis (IBK) has been recognised in New Zealand only in the past 7 years and there is little information available concerning epidemiological features of the disease under local conditions. There was an urgent need for rational control measures to be formulated and for a preliminary investigation which might indicate particular aspects of the disease deserving more detailed study.

The first of two projects was a postal survey involving 400 beef farmers in the Hunterville and Gisborne districts. A questionnaire was sent out to determine management practices which might influence the occurrence of IBK and to obtain an impression of the impact of the disease on the farming industry. The survey results (72% response rate) showed that IBK is widespread in both areas, appears to have been noticed only within recent years and the annual incidence is still rising (1% in 1975 to 28% in 1980 in the Gisborne area).

Outbreaks follow a seasonal pattern with most occurring in late summer. All age groups of cattle may be affected, but morbidity rates differ (young stock 18%; adults 10%). A greater susceptibility of the Hereford breed to the disease was observed only in the Gisborne district. Difficulties with stock management and lower sale prices were two major consequences of IBK reported and concern was expressed over control measures. Only 11% of farmers routinely treated cattle and yet they reported that treatment improved the recovery rate.

The other project involved a study of haemolytic strains of *Moraxella bovis* isolated from cattle eyes and the relationship of infection rates to clinical IBK cases.

Three local beef farming properties were chosen because of their previous history of IBK and over a 1 year period identified animals were observed for clinical signs and conjunctival sac samples were collected for culture. *Moraxella bovis* was identified by its  $\beta$ -haemolysis, colony and organism morphology, and Gram negative staining characteristics, and confirmed biochemically using five tests including alkaline peptonization of litmus milk.

Only one farm experienced an outbreak of IBK. The latter property operated a feedlot system, and early results implicated "carrier animals" in the initiation of a new outbreak. The prevalence of *M.bovis* isolations increased approximately one month before any clinical signs were apparent and infections remained at a higher level throughout the outbreak. A large number of animals which became infected never developed signs of the disease. (Peak figures in one pen 87% infected and 55% IBK). Seventy-eight percent of those cattle were infected with *M.bovis* in both eyes at some time, whereas only 23% of the cases of IBK were bilateral. *Moraxella bovis* infections decreased slowly after the peak, but many cattle remained infected for at least 5 months.

The widespread nature of *M.bovis* infections indicated the desirability for treatment of both eyes of all animals in a group if control of an IBK outbreak is to be attempted, but such treatment is sometimes impracticable.

More detailed investigation is needed into the local factors that are responsible for converting a latent infection of *M.bovis* into IBK.

## ACKNOWLEDGEMENTS

I would like to thank my supervisors, Mr I.J. Steffert and Dr B.S. Cooper for their help, interest and encouragement throughout this project. In particular I would like to thank Dr B.S. Cooper for his special interest in the problem of IBK in New Zealand, which led to the opportunity to undertake this study.

I wish to thank the farmers who willingly gave of their time and permitted their stock to be used for the project.

I gratefully acknowledge the able technical assistance of Lyn Cullinane on microbiological matters, Doug Hopcroft's help with the electron microscopy section of this study and Tom Law for the advice given on photographic technique and the preparation of final prints.

I am very grateful to Joy Pearce, Alison Cleaver and Sue Shirriffs for the typing of this thesis and to Darby West for his never failing encouragement.

Finally, my very deepest thanks must go to the Gisborne Veterinary Club for their initiative in stimulating research to be undertaken on IBK and for their organisation of the campaign to raise funds. Gratitude is extended to those organisations and individuals who made contributions, some of them most generous. Without such support this study would not have been possible.

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	ii
ACKNOWLEDGEMENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	ix
GENERAL INTRODUCTION	1
CHAPTER 1. REVIEW OF THE LITERATURE	2
CHAPTER 2. EPIDEMIOLOGICAL ASPECTS OF INFECTIOUS BOVINE KERATOCONJUNCTIVITIS IN THE HUNTERVILLE AND GISBORNE DISTRICTS AS REPORTED BY FARMERS IN A POSTAL SURVEY	20
CHAPTER 3. GENERAL MATERIALS AND METHODS	45
CHAPTER 4. PREVALENCE OF <i>MORAXELLA BOVIS</i> INFECTIONS AND INFECTIOUS BOVINE KERATOCONJUNCTIVITIS ON TWO MANAWATU BEEF FARMS (FARMS I AND II)	63
CHAPTER 5. INVESTIGATIONS INTO THE EPIDEMIOLOGICAL FACTORS OF AN INFECTIOUS BOVINE KERATOCONJUNCTIVITIS OUTBREAK UNDER FEEDLOT CONDITIONS (FARM III)	75
CHAPTER 6. GENERAL DISCUSSION	94
APPENDICES	
REFERENCES	

LIST OF TABLES

<u>Table</u>		<u>Page</u>
I.1	Proportion of haemolytic <i>Moraxella bovis</i> strains isolated	6
I.II	The influence of age on the peak prevalences of <i>Moraxella bovis</i> infections and clinical infectious bovine keratoconjunctivitis during outbreaks of the disease	8
I.III	Incidence of infectious bovine keratoconjunctivitis in New Zealand	12
I.IV	The influence of infectious bovine keratoconjunctivitis before weaning on the liveweight of calves	19
II.I	Mean size of farms in Hunterville and Gisborne	32
II.II	Mean stock numbers and stock ratios in Hunterville and Gisborne	32
II.III	Mean stock numbers and stock ratios relative to the occurrence of infectious bovine keratoconjunctivitis	33
II.IV	Age structure of the cattle populations in Hunterville and Gisborne	34
II.V	Breed distribution of cattle in Hunterville and Gisborne	35
II.VI	Cattle purchases per annum by farmers in Hunterville and Gisborne	35

<u>Table</u>		<u>Page</u>
II.VII	Yearly incidence of infectious bovine keratoconjunctivitis over the past five years	36
II.VIII	Yearly incidence of eye problems in cattle: other than infectious bovine keratoconjunctivitis	36
II.IX	Occurrence of infectious bovine keratoconjunctivitis according to breed of cattle involved	37
II.X	Age group of cattle affected by infectious bovine keratoconjunctivitis	38
II.XI	Clinical signs first noticed by farmers during an outbreak of infectious bovine keratoconjunctivitis	39
II.XII	Treatment of cases of infectious bovine keratoconjunctivitis by farmers	40
II.XIII	Farmer's association of an outbreak of infectious bovine keratoconjunctivitis with the introduction of new cattle on to their farms	40
II.XIV	Cattle purchases by farmers in Hunterville and Gisborne relative to the occurrence of infectious bovine keratoconjunctivitis	41
II.XV	Mean number of cattle purchased in Hunterville and Gisborne relative to the occurrence of infectious bovine keratoconjunctivitis	42
II.XVI	Farmer opinion on the effect of infectious bovine keratoconjunctivitis on production	42



<u>Table</u>	<u>Page</u>	
IV.I	Prevalence of <i>Moraxella bovis</i> and infectious bovine keratoconjunctivitis on Farm I during the winter and spring of 1981	72
IV.II	Prevalence of <i>Moraxella bovis</i> and infectious bovine keratoconjunctivitis on Farm II during 1981	73
IV.III	Prevalence of <i>Moraxella bovis</i> and infectious bovine keratoconjunctivitis amongst young bulls on Farm II during a spontaneous outbreak and following treatment	74
V.I	Point prevalence of <i>Moraxella bovis</i> infections and infectious bovine keratoconjunctivitis in cattle arriving on Farm III	86
V.II.(a)	Isolations of <i>Moraxella bovis</i> from cattle in the feedlot: Pen A	87
V.II.(b)	Isolations of <i>Moraxella bovis</i> from cattle in the feedlot: Pen B	87
V.III	Isolations of <i>Moraxella bovis</i> from cattle not exhibiting signs of infectious bovine keratoconjunctivitis	88
V.IV	Prevalence and severity of infectious bovine keratoconjunctivitis according to breed	89
V.V	Occurrence of unilateral cases of infectious bovine keratoconjunctivitis	90
V.VI	Frequency of <i>Moraxella bovis</i> isolations from cattle eyes during the outbreak of infectious bovine keratoconjunctivitis in Pen A	90

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
II.1	Seasonal occurrence of outbreaks of infectious bovine keratoconjunctivitis	43
II.2	Outcome of infectious bovine keratoconjunctivitis with regard to administration of treatment	44
III.1	$\beta$ -haemolytic colonies of <i>Moraxella bovis</i> grown on 2% sheep blood agar at 37 <sup>0</sup> C for 24 hours	49
III.2	Rough and smooth colony types of <i>Moraxella bovis</i> grown on 2% sheep blood agar at 37 <sup>0</sup> C for 24 hours	49
III.3	<i>Moraxella bovis</i> from a rough colony using negative staining	50
III.4	<i>Moraxella bovis</i> from a smooth colony using negative staining	50
III.5	<i>Moraxella bovis</i> from a rough colony using a block sectioning method	51
III.6	<i>Moraxella bovis</i> from a smooth colony using a block sectioning method	51
III.7	Non-fermentation of carbohydrates by <i>Moraxella bovis</i> as demonstrated by the inoculation and incubation of dextrose medium	54
III.8	Oxidase production by <i>Moraxella bovis</i> colonies indicated by the purple colouration after the addition of the oxidase reagent	54
III.9	(a) & (b) Digestion of litmus milk by <i>Moraxella bovis</i>	55

<u>Figure</u>		<u>Page</u>
III.10	The non-utilization of nitrate by <i>Moraxella bovis</i>	56
III.11	A mild lesion of infectious bovine keratoconjunctivitis involving a small ulcer of the cornea	58
III.12	A mild lesion of infectious bovine keratoconjunctivitis involving a small area of corneal opacity	58
III.13	The use of fluorescein to demonstrate a small shallow corneal ulcer	59
III.14	The progression of a mild lesion of infectious bovine keratoconjunctivitis to a severe form with increasing corneal opacity	59
III.15	A severe case of infectious bovine keratoconjunctivitis	60
III.16	A severe case of infectious bovine keratoconjunctivitis	60
III.17	A severe case of infectious bovine keratoconjunctivitis in the process of healing	61
III.18	A residual corneal scar resulting from a severe case of infectious bovine keratoconjunctivitis	61
V.1	Distribution of weaner cattle into feedlot pens showing arrangements for feeding, observation and sampling	91
V.2	Flow chart of events on Farm III	92
V.3	Prevalence of <i>Moraxella bovis</i> and eye lesions during an outbreak of infectious bovine keratoconjunctivitis	93