OCCURRENCE AND DIVERSITY OF BOVINE COCCIDIA
AT THREE LOCALITIES IN SOUTH AFRICA

by

PAUL TSHEPO MATJILA

Submitted in fulfilment of the requirements of the degree
Magister Scientiae (Veterinary Sciences)
in the
Department of Veterinary Tropical Diseases
Faculty of Veterinary Science
University of Pretoria
Pretoria
2000

© University of Pretoria
I declare that the dissertation, which I hereby submit for the degree Magister Scientiae (Veterinary Sciences) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at another university.

P.T. MATJILA

Pretoria 2000
ACKNOWLEDGEMENTS

I wish to express my appreciation and thanks to:

- Prof. B.L. Penzhorn, my supervisor.
- The owners and managers at Mallesons, Pienaars River and Kaalplaas for making their animals available for sampling.
- The labourers at Pienaars River and Kaalplaas for assisting in bringing and driving the animals into crush pens.
- Ms. Rina Owen, of the Department of Information Technology and Prof. Deon van Zyl, of the Department of Statistics of the University of Pretoria, for their help in the statistical analysis of the results.
- The FRD for their financial assistance.
- The laboratory technicians of the Department of Veterinary Tropical Diseases, Mr. Nils Bergh, Johan Gouws, Johan Carstens and Morkel Boshoff, for helping me to collect the samples.
- My family and Mmabatho Moeketsi for their love and support.
There is no information on the *Eimeria* species of cattle that occur in South Africa in different management systems. This information is important to the management and control of coccidiosis.

The study was expected to provide baseline data on the *Eimeria* species that occur at the selected study sites. The objectives of the study were to determine the *Eimeria* species that are present in the animals and to assess the infection levels of the parasites in the animals.

Three locations were used for sampling: Mallesons in Pretoria East, a Nguni stud farm in Pienaars River and Kaalplaas. Samples were collected monthly from November 1997 to November 1998. Age was taken into account when analysing the results by differentiating between young calves and older animals.

The McMaster technique was used to determine oocysts per gram of faeces (OPG). Specimens with OPG's of >2000 were sporulated for species identification.

There were significant differences in the occurrence of positive specimens from the three localities, with Pienaars River having the highest number (52%).
There were significant differences in the occurrence of positive specimens from adults at the three localities, with Pienaars River having the highest number (29%).

There were significant differences in the occurrence of positive specimens from calves at the three localities, with Kaalplaas having the highest number (82%).

At each locality, the occurrence of positive specimens was significantly greater in calves than in adults. Calves also had higher coccidial counts than adult animals.

Eight *Eimeria* species were identified at Mallesons from sporulated calf specimens. The most prevalent species were *E. zuernii* and *E. ellipsoidalis*.

Four *Eimeria* species were identified at Pienaars River from two sporulated adult animal specimens. The two most important species, *E. bovis* and *E. zuernii*, were present in both specimens. Six *Eimeria* species were identified at Pienaars River from sporulated calf specimens. The most prevalent species were *E. bovis* and *E. zuernii*.

Twelve *Eimeria* species were identified at Kaalplaas from sporulated calf specimens. The most prevalent species were *E. zuernii* and *E. bovis*.

Veterinary important species of *Eimeria* were compared and there were significant differences in their abundance at the three localities, with Kaalplaas having the highest counts.
The study has shown that proper management systems can prevent outbreaks of coccidiosis in intensively managed farms (Mallesons). Although species like *E. zuernii* are present in the animals, they are not a threat as long as management standards are not lowered.

Coccidiosis was not a problem at Pienaars River and Kaalplaas. Our study has shown that although animals on pastures carry pathogenic species of *Eimeria*, the animals did not necessarily suffer from the disease, hence careful monitoring of the animals is important during times of possible stress.
Inligting ontbreek oor die voorkoms van *Eimeria* spesies van beeste onder verskillende bestuurstelsels in Suid-Afrika. Sodanige inligting is belangrik vir die bestuur en beheer van koksidiose.

Na verwagting sou die studie basisdata oplewer oor die *Eimeria* spesies wat in die studiegebiede voorkom. Die oogmerk van die studie was om vas te stel watter *Eimeria* spesies in die diere teenwoordig is, asook wat die besmettingsvlak is.

Monsters is op drie plekke versamel: Malleson se plaas (Pretoria-Oos), 'n Ngunistoetplaas by Pienaarsrivier en op Kaalplaas. Monsters is maandeliks versamel van November 1997 tot November 1998. Ouderdom is in ag geneem toe die resultate ontleed is deurdat tussen kalwers en volwasse diere onderskei is.

Die McMaster-tegniek is gebruik om oosiste per gram faeces (OPG) te bepaal. Monsters met OPG > 2000 is laat sporuleer vir die uitkenning van spesies.

Die verskille tussen die voorkoms van positiewe monsters op die drie plekke was betekenisvol, met die hoogste aantal (52%) by Pienaarsrivier.

Die verskille tussen die voorkoms van positiewe monsters van volwasse diere op die drie plekke was betekenisvol, met die hoogste aantal (29%) by Pienaarsrivier.
Die verskille tussen die voorkoms van positiewe monsters van kalwers op die drie plekke was betekenisvol, met die hoogste aantal (82%) op Kaalplaas.

By elke plek was die voorkoms van positiewe monsters by kalwers betekenisvol hoër as by volwassenes. Oösistellings by kalwers was ook hoër as by volwassenes.

Agt *Eimeria* spesies is uit gesporuleerde kalfmismonster by Malleson geïdentifiseer. Die algemeenste spesies was *E. zuernii* en *E. ellipsoidalis*.

Vier *Eimeria* spesies is uit twee gesporuleerde mismonster van volwasse beeste by Pienaarsrivier geïdentifiseer. Die twee belangrikste spesies, *E. bovis* en *E. zuernii*, was in albei monsters teenwoordig. Ses *Eimeria* spesies is uit gesporuleerde kalfmismonster by Pienaarsrivier geïdentifiseer. Die algemeenste spesies was *E. bovis* en *E. zuernii*.

Twaalf *Eimeria* spesies is uit gesporuleerde kalfmismonster by Kaalplaas geïdentifiseer. Die algemeenste spesies was *E. zuernii* en *E. bovis*.

Die verskille in die voorkoms van *Eimeria* spesies van veeartsenykundige belang op die drie plekke was betekenisvol; die hoogste tellings was op Kaalplaas.

Die studie het duidelik getoon dat 'n doeltreffende bestuurstelsel die uitbreek van koksidiose op 'n intensief bestuurde plaas (Malleson) kan verhoed. Alhoewel
belangrikse spesies soos *E. zuernii* daar teenwoordig is, blyk hulle nie 'n bedreiging te wees nie, mits die bestuurstandaard nie verlaag word nie.

Koksidiose was nie 'n probleem op Pienaarsrivier of Kaalplaas nie. Hierdie studie het getoon dat diere op veldweiding wat met patogene *Eimeria* spesies besmet is nie noodwending kliniese tekens van koksidiose toon nie. Sorgvuldige monitering van die diere tydens strestye sou egter raadsaam wees.
CHAPTER 1

1 Introduction : 1
1.1 justification : 2
1 (a) Life cycle : 3
1 (b) Clinical signs : 3
1 (c) Diagnosis : 5
1 (d) *Eimeria* species : 5
1.2 Problem : 10
1.3 Benefits of research : 10
1.4 Objectives : 11

Chapter 2

Materials and methods

2.1 Model system and justification : 12
(a) Mallesons : 12
(b) Pienaars River : 13
(c) Kaalplaas : 15

2.2 Experimental design : 19
(a) Mallesons : 19
(b) Pienaars River : 19
2.3 Experimental procedures
2.4 Observations and analytical procedures
2.5 Data analysis

Chapter 3

Results
3.1 Introduction

3.2 Comparing Mallesons, Pienaars River and Kaalplaas
adult cattle and calves (general values)
3.2.1 General values per area
Mallesons
Pienaars River
Kaalplaas

3.2.2 Comparative analysis of values for Mallesons, Pienaars River and Kaalplaas
adult cattle (general values)
calves (general values)

3.3 Comparing Mallesons, Pienaars River and Kaalplaas
monthly values
adult cattle
calves

3.3.1 Comparative analysis, Mallesons, Pienaars River and Kaalplaas
adult cattle : 38
Calves : 38

3.3.2 Comparative analysis

November 1997 and November 1998 : 43

3.4 Comparative analysis of adult oocysts per season : 43

3.4.1 Dry and wet season : 43

3.5 The identification of *Eimeria* species : 48

3.6 Comparative analysis of species abundance in the three localities : 54

Chapter 4

Discussion

4.1 Prevalence of *Eimeria* oocysts in faecal samples: general : 55

Mallesons : 58

Pienaars River : 61

Kaalplaas : 62

4.1.1 Comparative analysis of breeds : 64

4.1.2 Comparative analysis of November 1997 and November 1998 : 66

4.1.3 Comparative analysis of seasonal oocysts shedding : 66

4.2 *Eimeria* species present in faecal samples

Mallesons : 68

Pienaars River : 68

Kaalplaas : 69
LIST OF FIGURES

Fig. 1:
Life cycle of a typical *Eimeria* : 4

Fig. 2:
Sporulated oocysts of *Eimeria* species from cattle : 6

Fig. 3:
Monthly rainfall (in mm) recorded at Mallesons,
November 1997 to November 1998. : 14

Fig. 4:
Monthly rainfall (in mm) recorded at Pienaars River,
November 1997 to November 1998. : 16

Fig. 5:
Monthly rainfall (in mm) recorded at Kaalplaas,
November 1997 to November 1998. : 18
**LIST OF TABLES**

Table 1:
The percentage of faecal specimens from adult cattle and calves positive for *Eimeria* oocysts in the three localities from November 1997 to November 1998. The figures for November 1997 to October 1998 are shown in brackets.  

Table 2:
The percentage of faecal specimens from adult cattle positive for *Eimeria* oocysts collected in the three localities from November 1997 to November 1998. The figures for November 1997 to October 1998 are shown in brackets.  

Table 3:
The percentage of faecal specimens from calves positive for *Eimeria* oocysts collected in the three localities from November 1997 to November 1998. The figures for November 1997 to October 1998 are given in brackets.  

Table 4:
Mean and maximum oocysts per gram of faeces (OPG), as well as standard deviation (SD) for adults and calves at Mallesons (November 1997-November 1998).
Table 5:
The number and percentage of specimens from adults and calves at Mallesons falling within specific OPG ranges (November 1997-November 1998).

Table 6:
The number and percentage of adults and calves at Mallesons for the 12-month sampling period (November 1997-October 1998) falling within specific OPG ranges.

Table 7:
Mean and maximum oocysts per gram of faeces (OPG), as well as standard deviation (SD) for adults and calves at Pienaars River (November 1997-November 1998). All values are given as counted in the first part of the table and only values under 100 000+ are given in the second part.

Table 8:
The number and percentage of adults and calves at Pienaars River falling within specific OPG ranges (November 1997-November 1998).

Table 9:
The number and percentage of specimens from adults and calves at Pienaars River for the 12-month sampling period (November 1997-October 1998) falling within specific OPG ranges.

Table 10:
Mean and maximum oocysts per gram (OPG) of faeces, as well as standard deviation (SD) for adults and calves at Kaalplaas.
Table 11:
The number and percentage of specimens from adults and calves at Kaalplaas falling within specific OPG ranges (November 1997-November 1998).

Table 12:
The number and percentage of specimens from adults and calves at Kaalplaas for the 12-month sampling period (November 1997-October 1998) falling within specific OPG ranges.

Table 13:
The mean monthly OPG values of specimens from adult cattle at the three localities.

Table 14:
The mean monthly OPG values of specimens from calves at the three localities.

Table 15:
Monthly occurrence of positive specimens from adult cattle at the three localities for the 12-month period (November 1997-October 1998).

Table 16:
Monthly occurrence of positive specimens from calves at the three localities for the 12-month period (November 1997-October 1998).
Table 17:
Mean oocysts per gram of faeces (OPG) and standard deviation (SD) for specimens from adults and calves at the three localities (lumped), for November 1997 and November 1998.

Table 18:
Mean oocysts per gram of faeces (OPG) and standard deviation (SD) for specimens from adults and calves from the three localities (lumped), for November 1997 and November 1998.

Table 19:
Number and percentage of specimens from adult cattle at Mallesons falling within specific OPG ranges for the dry and wet seasons.

Table 20:
Number and percentage of specimens from calves at Mallesons falling within specific OPG ranges for the dry and wet seasons.

Table 21:
Number and percentage of specimens from adult cattle at Pienaars River falling within specific OPG ranges for the dry and wet seasons.
Table 22:
Number and percentage of specimens from calves at Pienaars River falling within specific OPG ranges for the dry and wet seasons.

Table 23:
Number and percentage of specimens from adult cattle at Kaalplaas falling within specific OPG ranges for the dry and wet seasons.

Table 24:
Number and percentage of specimens from calves at Kaalplaas falling within specific OPG ranges for the dry and wet seasons.

Table 25:
The number of calf specimens positive for *Eimeria* species at the three localities. Species identification was done only from specimens with OPG's > 2000. From Mallesons n=4; Pienaars River n=20; Kaalplaas n=38.