

DISTRIBUTION OF *BOOPHILUS MICROPLUS* AND
BOOPHILUS DECOLORATUS AND ASSOCIATED
OCCURRENCE OF *BABESIA* SPECIES IN CATTLE IN
THE SOUTPANSBERG REGION, NORTHERN
PROVINCE, SOUTH AFRICA

by

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Declaration

Apart from the assistance received that has been reported in the Acknowledgements and in the appropriate places in the text, this Dissertation represents the original work of the author.

No part of the Dissertation has been presented for any other degree at any other University.

CANDIDATE

DATE

SUMMARY

DISTRIBUTION OF *BOOPHILUS MICROPLUS* AND *BOOPHILUS DECOLORATUS* AND ASSOCIATED OCCURRENCE OF *BABESIA* SPECIES IN CATTLE IN THE SOUTPANSBERG REGION, NORTHERN PROVINCE, SOUTH AFRICA

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Bovine babesiosis occurs worldwide and is one of the most costly tick-borne cattle diseases in the tropics. The Soutpansberg region of the Northern Province in South Africa is endemic for *Babesia bigemina*, but *Babesia bovis* was only reported from this area in the 1980s when some farmers experienced heavy losses due to Asiatic redwater.

The main objectives of the study were to confirm the presence of the tick vector *Boophilus microplus* in the Soutpansberg region where it had not been reported previously, and to determine the seroprevalence of *Babesia bovis* and *Babesia bigemina* in cattle in these areas. Other objectives were to assess the relative numbers of *Boophilus microplus* in relation to *Boophilus decoloratus* and to determine a possible displacement of *Boophilus decoloratus* by *Boophilus microplus*. It was also the intention to map the potential distribution of the *Boophilus* ticks in the area and to more accurately predict the further spread of *Boophilus microplus*.

Tick collections and serological surveys were carried out during 1999 and 2000 on cattle at 30 communal dip tanks and on 5 commercial farms in the Soutpansberg, Dzanani, Mutale, Thohoyandou and Vuwani Districts. Of the 25,042 *Boophilus* ticks collected, 93.9 % were *Boophilus microplus* and 6.1 % were *Boophilus decoloratus*. At 8 of the dip tanks/farms both *Boophilus* species were found, and the displacement of *Boophilus decoloratus* by *Boophilus microplus* was monitored at 4 of these sites. There was a distinct displacement of *Boophilus decoloratus* at those dip tanks/farms where repeated tick collection was possible.

Cattle at the communal dip tanks carried larger *Boophilus* tick numbers than cattle on the commercial farms. *Boophilus microplus* was the most common *Boophilus* tick collected at the dip tanks, and during the survey it also became the *Boophilus* tick most commonly found on the commercial farms.

CLIMEX was used to map the potential distribution of *Boophilus microplus* and *Boophilus decoloratus* in the survey area during years with average as well as double average rainfall. Ecoclimatic Indices were computed for each sampling location, using 30 years of climatic information. The displacement patterns of *Boophilus* species were also discussed.

Blood samples (n = 2201) were collected for Indirect Fluorescent Antibody (IFA) testing. Serological evidence of *Babesia bovis* was detected in 97 % of the communal dip tank herds and in 100 % of the commercial farm herds. The overall seroprevalence of *Babesia bovis* in the dip tank herds during 1999 and 2000 was 63 %. The seroprevalence of *Babesia bovis* in the commercial herds increased significantly from 19 % in 1999 to

57.5 % in 2000. There was a slight increase in endemic stability in comparable herds from 1999 to 2000. The increase in seroprevalence and endemic stability probably came as a result of the influx of *Boophilus microplus* into the survey area. There was a significant correlation between the presence of *Boophilus microplus* in the survey area and the increasing seroprevalence of *Babesia bovis*, which confirms that *Boophilus microplus* is the main and probably the only vector of *Babesia bovis* in South Africa.

Serological evidence of *Babesia bigemina* was detected in 100 % of communal dip tank and commercial farm herds. The overall seroprevalence of *Babesia bigemina* in the dip tank herds decreased significantly from 56.1 % in 1999 to 49.3 % in 2000. There was a marked decrease in endemic stability for *Babesia bigemina* in comparable dip tank herds from 1999 to 2000. The decrease in seroprevalence and endemic stability to *Babesia bigemina* in these herds was probably due to the substantial increase of *Boophilus microplus* in the survey area. This may indicate that *Babesia bigemina* was transmitted less effectively by *Boophilus microplus* than by *Boophilus decoloratus*.

The seroprevalence of *Babesia bovis* was significantly higher than that of *Babesia bigemina* at those dip tanks/farms where only *Boophilus microplus* was present during 1999 and 2000. This may be explained by the possibility that *Boophilus microplus* transmits *Babesia bigemina* less effectively than it transmits *Babesia bovis*.

This survey raises several questions on the ability of the African strain of *Boophilus microplus* to transmit African *Babesia* strains. There are indications that the African *Boophilus microplus* is different to the Australian *Boophilus microplus*. More research needs to be done to investigate how the *Babesia* species are transmitted in Africa.

SAMEVATTING

VERSPREIDING VAN *BOOPHILUS MICROPLUS* EN *BOOPHILUS DECOLORATUS* EN DIE GEASSOSIEERDE VOORKOMS VAN *BABESIA* SPESIES IN BEESTE IN DIE SOUTPANSBERGSTREEK, NOORDELIKE PROVINSIE, SUID-AFRIKA

deur

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Babesiose van beeste kom wêreldwyd voor en van groot ekonomiese belang in tropiese streke. *Babesia bigemina* kom endemies voor in die Soutpansbergstreek van die Noordelike Provinsie van Suid-Afrika, maar *Babesia bovis* is eers gedurende die 1980s aangeteken, toe sommige boere swaar verliese gely het.

Die hoofdoel van hierdie ondersoek was om die teenwoordigheid van die oordraerbosluisk *Boophilus microplus* in die Soutpansbergstreek te bevestig en om die seroprevalensie van *Babesia bovis* en *Babesia bigemina* in beeste in die streek te bepaal. Verder is gepoog om die aantal *Boophilus microplus* in verhouding tot *Boophilus decoloratus* vas te stel en om die moontlike verplasing van *Boophilus decoloratus* deur *Boophilus microplus* te dokumenteer. Laastens is gepoog om die potensiële verspreiding van *Boophilus* spesies te karteer sodat die verdere verspreiding *Boophilus microplus* meer noukeurig voorspel kan word.

Bosluiise en serummonsters is tydens 1999 en 2000 van beeste by 30 gemeenskaplike dipbakke en op 5 plase in die Soutpansberg-, Dzanani-, Mutale-, Thohoyandou- en Vuwanidistrik versamel. Van die 23,042 *Boophilus* bosluis wat versamel is, was **93.9** % *Boophilus microplus* en **6.1** % *Boophilus decoloratus*. Albei *Boophilus* spesies het by 8 dipbakke/plase voorgekom en die verplasing van *Boophilus decoloratus* deur *Boophilus microplus* is by 4 van hulle gevolg. Verplasing van *Boophilus decoloratus* was 'n duidelike neiging by dié dipbakke/plase waar opeenvolgende versameling moontlik was.

Bosluisladings van beeste by die gemeenskaplike dipbakke was hoër as dié op plase. *Boophilus microplus* was die algemeenste bosluis wat by die dipbakke versamel is, en tydens die ondersoek het dit ook die algemeenste *Boophilus* spesie op die plase geword.

CLIMEX is gebruik om die potensiële verspreiding van *Boophilus microplus* en *Boophilus decoloratus* in die studiegebied te voorspel, in gemiddelde reënjare asook wanneer die reënval sou verdubbel. Ekoklimatiese indekse is vir elke monsterpunt bereken, aan die hand van klimaatgegevens van die afgelope 30 jaar. Die patroon van verplasing van die onderskeie *Boophilus* spesies is bespreek.

Bloedmonsters (n = 2201) is versamel vir Indirect Fluorescent Antibody (IFA)-toetse. Serologiese getuienis van die voorkoms van *Babesia bovis* is by **97** % van die gemeenskaplike dipbakke en op **100** % van die plase gevind. Tydens 1999 en 2002 was die algehele seroprevalensie van *Babesia bovis* in kuddes by gemeenskaplike dipbakke **63** %. Die seroprevalensie van *Babesia bovis* op plase het betekenisvol gestyg van **19** % in 1999 tot **57.5** % in 2000. Daar was 'n effense toename in endemiese stabiliteit in vergelykbare kuddes van 1999 tot 2000. Die toename in seroprevalensie en endemiese

stabiliteit hou waarskynlik verband met 'n instroming van *Boophilus microplus* in die studiegebied. Daar was 'n beteknisvolle korrelasie tussen die teenwoordigheid van *Boophilus microplus* en die toenemende seroprevalensie van *Babesia bovis*, wat bevestig dat *Boophilus microplus* die hoof en waarskynlik die enigste oordraer van *Babesia bovis* in Suid-Afrika is.

By die dipbakke / plase waar slegs *Boophilus microplus* in 1999 en 2000 voorgekom het, was die seroprevalensie van *Babesia bovis* betekenisvol hoër as dié van *Babesia bigemina*. Die verduideliking mag daarin lê dat *Babesia bigemina* minder doeltreffend as *Babesia bovis* deur *Boophilus microplus* oorgedra word.

Serologiese bewys van *Babesia bigemina* is by al die kuddes by dipbakke en op plase gevind. Die seroprevalensie van *Babesia bigemina* onder kuddes by dipbakke het betekenisvol gedaal van **56.1** % in 1999 tot **49.3** % in 2000. Daar was 'n aanmerklike afname in endemiese stabiliteit vir *Babesia bigemina* in ooreenstemmende dipbakkuddes tussen 1999 en 2000. Die afname in seroprevalensie en endemiese stabiliteit van *Babesia bigemina* mag verband hou met die oorwig *Boophilus microplus* in die studiegebied. Dit mag daarop dui dat *Babesia bigemina* nie so doeltreffend deur *Boophilus microplus* as deur *Boophilus decoloratus* oorgedra word nie.

Hierdie studie laat verskeie vrae ontstaan oor die vermoë van die Afrika-stamme van *Boophilus microplus* om Afrika-stamme van *Babesia* oor te dra. Daar is aanduidings dat *Boophilus microplus* in Afrika verskil van *Boophilus microplus* in Australië; meer navorsing word geveeg om vas te stel hoe *Babesia bovis* en *Babesia bigemina* in Afrika oorgedra word.

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