The distribution of tsetse (Diptera: Glossinidae) and bovine trypanosomosis in the Matutuine District, Maputo Province, Mozambique

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ABSTRACT

SIGAUQUE, I., VAN DEN BOSSCHE, P., MOIANA, M., JAMAL, S. & NEVES, L. 2000. The distribution of tsetse (Diptera: Glossinidae) and bovine trypanosomosis in the Matutuine District, Maputo Province, Mozambique. *Onderstepoort Journal of Veterinary Research,* 67:167–172

A tsetse and bovine trypanosomosis survey was conducted during 1998 and 1999 in the Matutuine District of Maputo Province (Mozambique). A total of 59 *Glossina brevipalpis* and 17 *Glossina austeni* were captured throughout the district. Survey results suggest that *Glossina brevipalpis* is mainly concentrated in dense vegetation along the Maputo River and in the wetlands east of the river. *G. austeni*, on the other hand, was captured mainly in dense thickets in drier areas. Both tsetse species are suspected to be vectors of bovine trypanosomosis. Bovine trypanosomosis (75,5 % *Trypanosoma congolense*) was diagnosed in 53 animals (13,9 %) from seven sampling sites distributed throughout the district. The prevalence of cattle with anti-trypanosomal antibodies was high (29,9 %). The incidence of trypanosomal infections in sentinel cattle was also high. The widespread distribution of bovine trypanosomosis and the high prevalence of infection are likely to have a significant impact on cattle production and, hence, the cattle restocking exercise in the district.

Keywords: Bovine trypanosomosis, Diptera: Glossinidae, *Glossina austeni, Glossina brevipalpis,* Matutuine District, Mozambique, tsetse, *Trypanosoma congolense*

INTRODUCTION

After 20 years of civil war, updated information on the distribution and density of tsetse in Mozambique is not available. Such information is of major importance in areas where cattle are present or where cattle are likely to be re-introduced. The Matutuine District, is situated in the southern part of the country in Maputo Province. Bovine trypansomosis was first reported in 1908. The distribution of tsetse in the District was first established in the late 1930s. In 1982, a tsetse survey revealed the presence of *Glossina austeni* and *Glossina brevipalpis* near the Maputo river and the Maputo Game Reserve as well as in Changalene (Jamal, Moiana & Sigauque, in press). In the 1950s, bovine trypanosomosis was controlled using bush clearing and game destruction but control opertions ceased in the late 1960s (Jamal, Moiana & Sigauque, in press). Before the civil war started in 1985, *c.* 60 000 head of cattle were present in the district. The civil war reduced the cattle density to *c.* 600 animals. Currently, the district contains approximately 2 000 head of cattle, *c.* 6 % of the total cattle population in the Maputo Province. It has been selected as one of the zones where restocking will take place (DINAP 1998). To update the scanty information on tsetse and trypanosomosis in southern Mozambique, a tsetse and trypanosomosis survey was conducted. Use was made of parasitological and serological diagnostic methods. Data from the survey were used to produce an updated map of the distribution of tsetse and bovine trypanosomosis in the district. The possible repercussions of the presence of tsetse and bovine trypanosomosis on the cattle restocking exercise are discussed.

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Accepted for publication 31 May 2000—Editor

MATERIALS AND METHODS

Tsetse surveys and surveillance

Tsetse survey

A tsetse survey was carried out in November and December 1998. At least five epsilon traps (Hargrove & Langley 1990) were deployed, for five consecutive days, at 12 trapping sites distributed over the Matutuine District (Fig. 1). Traps were baited with acetone dispensed from 500 mℓ brown glass bottles, its vapour diffusing through a 6 mm aperture in the lid resulting in an average dose of 500 mg/h, as well as with a mixture of 3-*n*-propylphenol/1-octen-3-oℓ/4-methylphenol (ratio of mixture: 1/4/8) contained in polyethylene sachet dispensers (150 µm thick, surface area 30 cm^2) (Vale & Hall 1985). The bottle and sachet were placed in a pocket in each trap. The index of abundance of tsetse (IA) at each trapping site was calculated as the total number of tsetse captured per trap per day.

Tsetse surveillance

Between March 1999 and August 1999, eight odour-baited epsilon traps were used to monitor the tsetse population. Four traps were deployed in the Shipissice area and four in the Sadula area (Fig. 1). Traps were emptied at two weekly intervals.

Bovine trypanosomosis surveys and surveillance

Diagnostic tests

Parasitological and serological methods were used for diagnosis. Blood was collected from an ear vein into heparinized microhaematocrit centrifuge capillary tubes and onto glass slides as thick and thin blood smears. The capillary tubes were sealed with "Cristaseal" (Hawksley) and centrifuged immediately in a microhaematocrit centrifuge for 5 min at 9 000 rpm. After centrifugation, the packed cell volume (PCV) was determined. Animals with a PCV ≤ 24 % were considered to be anaemic. The buffy coat and the uppermost layer of red blood cells of each specimen were extruded onto a microscope slide, covered with a cover-slip, and examined for the presence of motile trypanosomes. Samples were examined with a phase-contrast microscope with a x 40 objective lens. Giemsa-stained thick and thin blood smears were examined under x 100 oil immersion objective lens for the presence of *Trypanosoma* spp.

From most of the animals, blood contained in one heparinized microhaematocrit centrifuge capillary tube was extruded onto a filter paper (Whatman no. 4, Whatman®). Eluted blood spots were screened for the presence of trypanosomal antibodies using an indirect ELISA (Hopkins, Chitambo, Machila *et al.* 1998). A rigorous system of quality assurance was adopted. The Optical Density (OD) of each ELISA-sample tested was expressed as a percentage (percentage positivity, PP) of the strong positive reference standard (Wright, Nilsson, Van Rooij, Lelenta & Jeggo 1993). A cut-off of 28 % positivity was used. At this cut-off, the assay had a sensitivity of 88,5 % and a specificity of 99,0 %.

Trypanosomosis survey

In November and December 1998, a total of 380 adult cattle were examined at eight sampling sites (Fig. 1). Sampling was restricted to areas where cattle were present and attempts were made to distribute the sampling sites evenly over the district. A cross-sectional sampling method was applied. Sample sizes were calculated according to Cannon & Roe

TABLE 1 Number of male and female *G. brevipalpis* and *G. austeni* captured at each sampling site between November and December 1998

Sampling site	Number of traps	*G. brevipalpis*	*G. austeni*			IA* of tsetse
		Male	Female	Male	Female	
Chucha	6	0	0	0	1	0,03
Shipissice	5	0	0	0	1	0,04
Lubemba	5	0	0	1	0	0,04
Zitundo	6	0	1	0	0	0,03
Manhoca	5	0	1	0	5	0,24
Mudada	5	2	1	0	0	0,12
Tinonganine	5	0	0	4	5	0,36
Rio Futi	6	21	29	0	0	1,67
Quinta	6	1	0	0	0	0,03
Indane	6	0	0	0	0	0,00
Chihangalasse	5	1	2	0	0	0,12
Catembe	6	0	0	0	0	0,00

* Index of abundance of tsetse = number of tsetse/trap/day

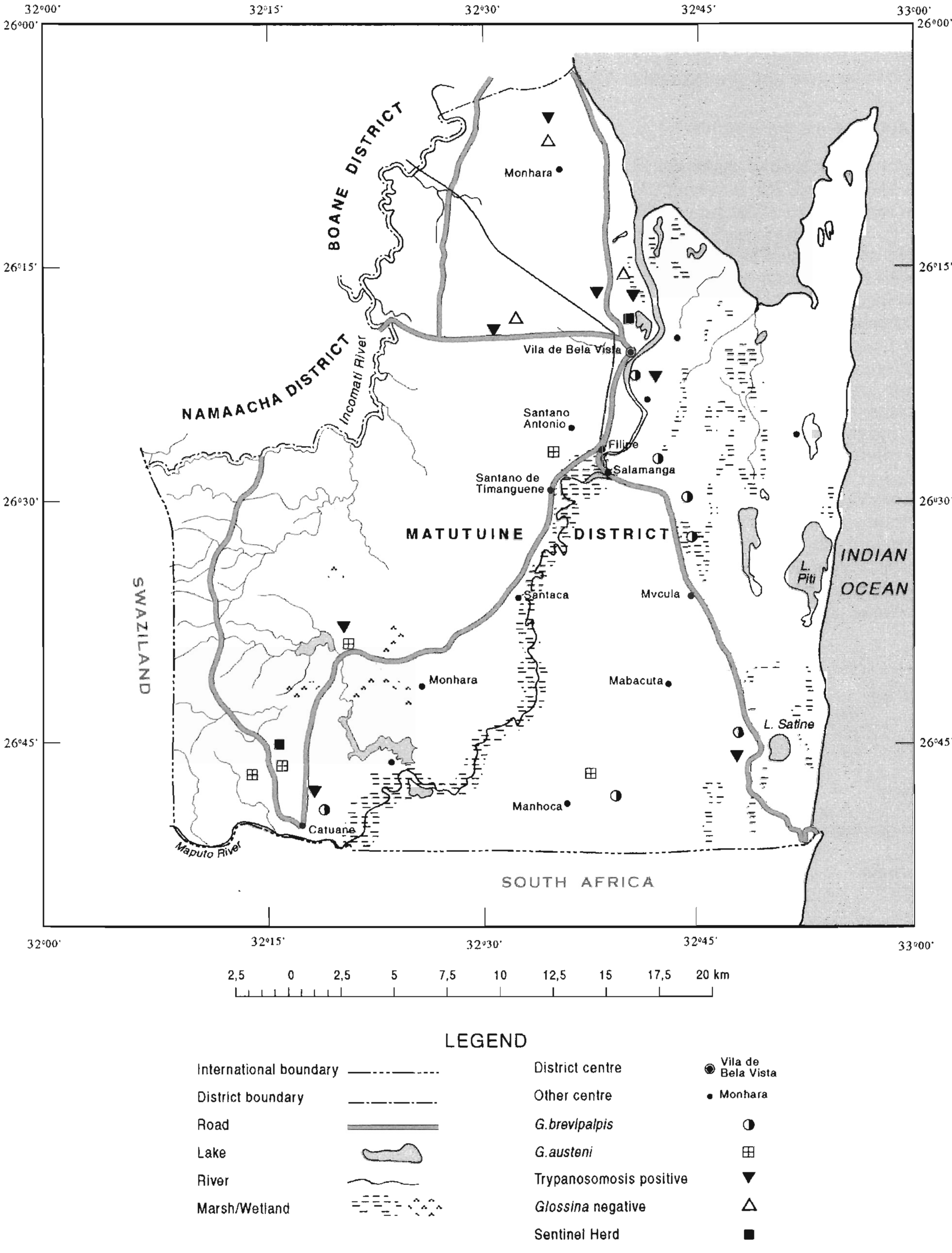

FIG. 1 Location of tsetse and trypanosomosis sampling sites and sentinel herds in the Matutuine District, Maputo Province, Mozambique

(1982). They depended on the total cattle population at a particular sampling site. Sample sizes were calculated to provide 95 % certainty of detecting at least one positive case at a prevalence of 5 %.

Trypanosomosis surveillance

To estimate the level of challenge, two sentinel herds were established. The first herd of 39 head of adult cattle was located at Sadula Farm near Bela Vista (Fig. 1). The second herd of 31 adult animals was located at Shipissice near Catuane close to the border with South Africa (Fig. 1). All animals were kept under local village management and were sampled at two weekly intervals between March and August 1999. Only parasitological diagnostic methods were used (see above). A total of 12 samplings were conducted. Trypanosomal infections were treated with diminazene aceturate at the dosage rate of 7 mg/kg body mass for *Trypanosoma brucei* or 3,5 mg/kg body mass for *T. congolense* and *T. vivax* if the PCV was lower or equal to 20 %. Parasitologically negative animals with a PCV lower or equal to 20 % were also treated with diminazene aceturate at the rate of 3,5 mg/kg body mass. For both sentinel herds, the cumulative proportion of cattle that was or had been infected with trypanosomes during the observation period was calculated.

TABLE 2 Number of *G. brevipalpis* and *G. austeni* captured in the Sadula and Shipissice area between March and August 1999

Location	*G. brevipalpis*		*G. austeni*	
	Male	Female	Male	Female
Sadula	1	1	0	0
Shipissice	0	0	1	3

RESULTS

Tsetse survey

A total of 59 *G. brevipalpis* (25 males and 34 females) and 17 *G. austeni* (5 males and 12 females) were captured during 330 trap days (Table 1). In most of the trapping sites only one tsetse species was captured (Fig. 1).

Tsetse surveillance

Between March and August 1999, six tsetse flies were captured. *Glossina brevipalpis* was captured in the Sadula area and *G. austeni* in the Shipissice area (Table 2).

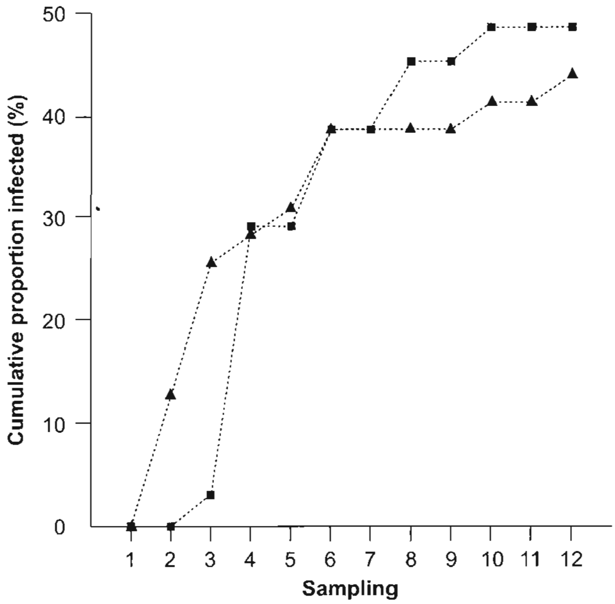

FIG. 2 Cumulative proportion of the sentinel cattle infected with trypanosomes at Sadula (▲) and at Shipissice (■), between March and August 1999

TABLE 3 Parasitological prevalence of trypanosomosis, prevalence of anti-trypanosomal antibodies and average PCV (± 1 s.e.) at various sampling sites in the Matutuine District between November and December 1998

Sampling site	Parasitological		Serological		Average
	Number		Number		PCV (%)
	Samples	Positive (%)	Samples	Positive (%)	± 1 s.e.
Catuane	71	10 (14,1)	72	20 (27,8)	26,8 ± 0,4
Shipissice	41	0 (0,0)	41	1 (2,4)	28,5 ± 0,6
Zitundo	28	3 (10,7)	26	18 (69,2)	30,3 ± 0,7
Mudada	62	1 (1,6)	57	6 (10,5)	32,3 ± 0,6
Sadula	53	4 (7,5)	44	10 (22,7)	29,0 ± 0,5
Lima	32	19 (59,4)	36	31 (86,1)	29,5 ± 0,5
Indane	36	9 (25,0)	35	6 (17,1)	31,9 ± 0,9
Filipe	57	7 (12,3)	50	16 (32,0)	28,3 ± 0,6

TABLE 4 Prevalence of trypanosome species in the survey area between November and December 1998

Species	Number of infections	Species prevalence (%)
T. congolense	40	75,5
T. vivax	5	9,4
T. brucei	3	5,7
Mixed*	5	9,4

* *T. congolense* and *T. vivax*

Trypanosomosis survey

A total of 380 animals from eight sampling sites in the Matutuine District were sampled. Fifty-three trypanosomal infections (13,9 %) were detected in animals from seven sampling sites (Table 3). The majority of the infections (75,5 %) was due to *T. congolense* (Table 4).

Of the 361 blood spots collected, 108 (29,9 %) had anti-trypanosomal antibodies. The prevalence of cattle with anti-trypanosomal antibodies varied substantially between sampling sites (Table 3). It was highest in the herd sampled at Lima (86,1 %) and lowest in the herd sampled at Shipissice (2,4 %). The correlation between the parasitological prevalence of trypanosomosis and the proportion of animals with anti-trypanosomal antibodies was significant (r = 0,74, $P < 0,05$).

The herd average PCV varied significantly between sampling sites ($F = 12,0$, $P < 0,001$) (Table 3). It was not correlated with the parasitological prevalence of trypanosomosis ($r = 0,004$, $P = 0,1$).

Trypanosomosis surveillance

During the six months observation period, a total of 39 trypanosomal infections were detected in the sentinel cattle. They were mainly due to *T. congolense* (73,0 %). *Trypanosoma vivax* was detected in 13,5 % of the cases. The remainder were mixed infections (*T. congolense* and *T. vivax*) and one *T. brucei* infection. The trypanosome species prevalence did not differ much between the two sentinel herds.

Over the six months observation period, 43,6 % of the sentinel cattle at Shipissice and 48,4 % of the sentinel cattle at Sadula became infected with trypanosomes at least once (Fig. 2).

DISCUSSION AND CONCLUSIONS

Distribution of tsetse

The survey results show that both *G. austeni* and *G. brevipalpis* are present in the Matutuine District of Maputo Province. Both tsetse species have been recorded in the district before (Potts 1954; Takken 1984). Moreover, the tsetse catches close to the Mozambique/South Africa border indicate that the Matutuine fly-belt is linked to the tsetse-belt in the KwaZulu-Natal Province of South Africa where both species are also present (Du Toit 1954; Kappmeier, Nevill & Bagnall 1998). These observations are in accordance with information on the historical distribution of tsetse in the distict (Jamal, Moiana & Sigauque, in press).

It is difficult to draw conclusions on the population densities of tsetse. Both tsetse species respond differently to the epsilon traps and the odour attractants used in the surveys (Vreysen, Khamis & Van der Vloedt 1996; Kappmeier & Nevill 1999a). However, survey results do suggest that *G. brevipalpis* is mainly concentrated in dense vegetation along the Maputo River and in the wetlands east of the river. *G. austeni*, on the other hand, was captured mainly in dense thickets in drier areas. This distribution is in accordance with the observed habitat preference of both species in KwaZulu-Natal (Du Toit 1947).

Prevalence and incidence of bovine trypanosomosis

Notwithstanding the differences in the distribution of both tsetse species, trypanosomal infections were detected in cattle from almost all survey areas. This indicates that both *G. austeni* and *G. brevipalpis* transmit the disease in the Matutuine District. This is in accordance with observations made in KwaZulu-Natal where both *G. austeni* and *G. brevipalpis* are sources of infection for cattle (Kappmeier, Nevill & Bagnall 1998). The average prevalence of trypanosomal infections in cattle was high and differed significantly between sampling sites. It is not clear if this difference in prevalence reflects differences in challenge or different levels of trypanocidal drug use. The effective treatment of trypanosomal infections would, however, not prevent the development of anti-trypanosomal antibodies. Hence, areas where the parasitological prevalence of trypanosomosis is low because of the effective use of trypanocidal drug should have a high proportion of animals with antibodies. This is not the case. It is, therefore, likely that the differences in prevalence of trypanosomal infections do reflect differences in the level of challenge. Surveillance results from both sentinel herds clearly show that challenge can be very high. During the six months observation period, almost 50 % of the sentinel animals became infected with pathogenic trypanosomes. As is the case in other countries in southern Africa, the dominant trypanosome species was *T. congolense* (Van den Bossche, Shumba & Makhambera 2000). The incidence of trypanosomal infections was highest during the first three months (March to May) of the observation period indicating that tsetse challenge is probably highest during the rainy season.

Expected socio-economic impact of bovine trypanosomosis

The results emanating from this survey have important implications. The widespread distribution of bovine trypanosomosis and the high prevalence of infection in some of the areas are likely to affect cattle production. Data on the productivity of indigenous cattle breeds kept in tsetse-infested areas in other countries in southern Africa show that, even if trypanosomosis-related mortality is reduced by using curative trypanocidal drugs, calving rates are usually low as a result of the disease (Doran & Van den Bossche, in press). This may have important repercussions on herd growth and, hence, the effectiveness of the cattle restocking exercise in the Matutuine District.

Options for the control of bovine trypanosomosis

Except for the rather erratic use of trypanocides, no trypanosomosis control measures are in place in the district. Although no data are available on the productivity of cattle in the district, it is likely that under the observed level of challenge optimal productivity will only be achieved by applying strict treatment regimes with chemotherapeutic, but especially, chemoprophylactic drugs (Boyt 1979). Such an approach will only be effective if resistance in trypanosomes to the trypanocidal drugs is absent. Tsetse control, if sustained, would provide the ultimate solution to the bovine trypanosomosis problem. Recently, odour-baited targets have been developed for *G. austeni* and *G. brevipalpis* in South Africa (Kappmeier & Nevill 1999b). The transboundary nature of the tsetse problem should be taken into account when planning for such an operation.

ACKNOWLEDGEMENT

This survey was conducted by the Diraccáo Nacional de Pecuária. The results presented are part of a thesis, submitted by the first author, as partial requirement for an M.Sc degree at the University of Zimbabwe. Dr W. Shumba (RTTCP, Harare) assisted with the analysis of the ELISA samples. Mr O. Tembe and Mr Mendes are acknowledged for their assistance in the field, and Mrs N. Ngoque and Mr B. Jeque for laboratory assistance. The work was funded by the Food and Agricultural Organization (TCP/MOZ/4555) and the 6th European Development fund through the Regional Tsetse and Trypanosomosis Control Programme (Accounting numbers 6 ACP RPR 468 and 7 ACP MOZ 001).

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