

**Strategy for monitoring and sustainable integrated control or
eradication of *Glossina brevipalpis* and *G. austeni*
(Diptera: Glossinidae) in South Africa**

by

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SUMMARY

Glossina brevipalpis Newstead and *G. austeni* Newstead (Diptera: Glossinidae) are the vectors of trypanosomiasis or nagana in cattle in N.E. KwaZulu-Natal, South Africa. Before intervention by means of target technology could be applied successfully to control these species, studies were still needed on the two species' attraction to natural host odours, trapping, their movement and dispersal, feeding responses towards hosts and their geographical distribution. Studies that were conducted with host odours to find an attractive odour for *G. austeni*, proved that CO₂ was seemingly the main attractive component of host odour for this species. The existing chemicals of the best SA odour, comprising of octenol released at c. 9,1 mg/h, 4-methylphenol released at c.15,5 mg/h and acetone released at c. 350 mg/h, still remained to be the main attractive components for *G. brevipalpis*. A sticky trap, namely a bicoloured electric blue/black XT, was refined to use in tsetse distribution surveys. A new trap, the H trap, was developed and proved to be effective in catching relatively high numbers of both species. This trap was used to capture live tsetse for mark-release-recapture studies to assess the population size and movement of a tsetse population. These studies revealed that target densities of about 4 targets/km² for *G. brevipalpis* and 7 targets/km² for *G. austeni* should be effective to control these species successfully with odour-baited insecticide-impregnated targets. *G. austeni* was confined to densely shaded areas but it still traversed short distances of up to 345 m of "unsuitable" habitat between pockets of vegetation. *G. brevipalpis* was considered a much more mobile fly and traversed wide areas of 1,345 m. Both species were readily attracted to cattle, but not to goats nor bushpig. They also fed more readily on cattle. Both species would also feed at night. It was recommended that insecticide-treated cattle could be used as mobile targets to control both *G. brevipalpis* and *G. austeni* in areas where cattle predominate.

Tsetse surveys through the northeastern parts of KwaZulu-Natal showed that there were two distinct bands of distribution for *G. brevipalpis*. The main sources of this species seemed to be the game reserves and other natural areas. *G. austeni* was more widespread with a continuous north to south distribution. A Geographic Information System was used to map tsetse distribution and their apparent densities. This was collated with trypanosomiasis incidence and prevalence, diptank (cattle) distribution,

land tenure/designation, landcover and vegetation types, which were also mapped. Finally, a strategy was proposed for the monitoring and sustainable integrated control and eventual eradication of both *G. brevipalpis* and *G. austeni* throughout N.E. KwaZulu-Natal. This involves the subdivision of the area into five manageable zones with successive pre-suppression, suppression and eradication operations following in each of the zones. With this proposed strategy eradication of both species could be achieved within 8 - 12 years after initiation.

SAMEVATTING

Glossina brevipalpis Newstead en *G. austeni* Newstead (Diptera: Glossinidae) is vektore van trypanosomose (nagana) in beeste in noordoos KwaZulu-Natal, Suid-Afrika. Voordat ingryping deur middel van teiken-tegnologie suksesvol toegepas kan word om hierdie spesies te beheer, was dit nodig om die spesies se aanlokking na natuurlike gasheerreuke, vangmetodes, hulle beweging en verspreiding, voergedrag ten opsigte van gashere en hulle geografiese verspreiding, te bestudeer. Studies wat met gasheerreuke uitgevoer was om 'n aanloklike geur vir *G. austeni* te vind, het bewys dat CO₂ bleikbaar die hoof aanlokkingskomponent vir hierdie spesie is. Dit is bevestig dat die bestaande chemikalieë van die beste SA geur, wat bestaan uit oktenol vrygelaat teen *c.* 9,1 mg/h, 4-metielfenol vrygelaat teen *c.* 15,5 mg/h en aseton vrygelaat teen *c.* 350 mg/h, die hoof aanlokkingskomponente vir *G. brevipalpis* is. 'n Gomval ("sticky trap"), naamlik 'n tweekleurige blou/swart XT, was aangepas om in tsetse verspreidingsopnames te gebruik. Die nuutontwikkelde H-val was bewys om doeltreffend te wees om relatiewe hoë getalle van beide tsetse spesies te kan versamel. Hierdie val was gebruik om lewende vlieë vir vang-merk-vrylaat studies te versamel om die populasie grootte en beweging van 'n tsetse populasie te bepaal. Laasgenoemde studies het getoon dat teikendighede van omtrent 4 en 7 teikens/km² vir *G. brevipalpis* en *G. austeni* ondeskeidelik voldoende behoort te wees om hierdie spesies suksesvol met geurlokaas en insekmiddel-geïmpregneerde teikens te beheer. *G. austeni* is beperk tot digte skaduryke areas maar kan kort afstande, tot 345 m, van ongunstige habitat, tussen plate van digte plantegroei oorbrug. *G. brevipalpis* was beskou as 'n baie meer mobiele vlieg en het wye areas van 1,345 m oorbrug. Albei spesies word geredelik aangelok na beeste, maar nie na boerbokke of bosvarke nie. Hulle het ook meer geredelik op bees gevoed. Beide spesies kan ook in die nag voed. Dit word aanbeveel dat beeste wat met 'n insekmiddel behandel is as mobiele teikens gebruik word om beide *G. brevipalpis* en *G. austeni* te beheer, in areas waar beeste die oorheersende gasheer is.

Tsetse verspreidingsopnames in die noordoostelike KwaZulu-Natal het gewys dat *G. brevipalpis* in twee hoofverspreidings-bande voorkom. Die belangrikste bron van hierdie spesie skyn natuur-reservate asook ander natuurlike gebiede te wees. *G. austeni* is meer wydverspreid met 'n aaneenlopende noord tot suid verspreiding. 'n

Geografiese Inligtingstelsel was gebruik om tsetse verspreiding en oënskynlike digthede te karteer. Trypanosomose-gevalle en -voorkoms, diptenkverspreiding, grondgebruik, gronbedekking en plantegroeitipes is ook gekarteer en met tsetse verspreiding en digthede vergelyk. Laastens, was 'n strategie vir die monitering en onderhoubare geïntegreerde beheer en uiteindelijke totale uitwissing van beide *G. brevipalpis* en *G. austeni* in die hele N.O. KwaZulu-Natal voorgestel. Dit behels die onderverdeling van die gebied in vyf bestuurbare zones met opeenvolgende pre-suppressie, suppressie and uitroei operasies wat in elk van die zones volg. Met hierdie voorgestelde strategie kan beide tsetse spesies binne 8 - 12 jaar uitgeroei word.

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CONTENTS

Summary	i
Samevatting	iii
Acknowledgements	v
Contents	vii
List of Tables	ix
List of Figures	xii
List of acronyms and abbreviations	xv
CHAPTER 1:INTRODUCTION	
1.1 Literature review	1
1.2 Justification	9
1.3 Problem and hypothesis	12
1.4 Objectives	13
1.5 Expected benefits arising from this study	14
CHAPTER 2:GENERAL MATERIALS AND METHODS	
2.1 Study Area	15
2.2 General techniques and equipment	16
2.3 Experimental design and analysis	19
CHAPTER 3:STUDIES TO FIND AN ATTRACTIVE ODOUR BAIT	
3.1 Abstract	21
3.2 Introduction	21
3.3 Materials and Methods	24
3.4 Experiments and Results	32
3.5 Discussion	55
CHAPTER 4:DEVELOPMENT OF SUITABLE TRAPS	
4.1 Abstract	61
4.2 Introduction	62
4.3 Materials and Methods	64
4.4 Experiments and results	72
4.5 Discussion	86
CHAPTER 5:POPULATION DISPERSAL AND MOVEMENT	
5.1 Abstract	91
5.2 Introduction	91

5.3 Materials and Methods	97
5.4 Results	104
5.5 Discussion	120
CHAPTER 6: FEEDING RESPONSES	
6.1 Abstract	125
6.2 Introduction	125
6.3 Materials and Methods	127
6.4 Experiments and Results	129
6.5 Discussion	135
CHAPTER 7: TSETSE DISTRIBUTION AND ABUNDANCE	
7.1 Abstract	139
7.2 Introduction	139
7.3 Materials and Methods	143
7.4 Results	148
7.5 Discussion	170
CHAPTER 8: DISCUSSION AND STRATEGY FORMULATION	
8.1 Tsetse monitoring and control options	186
8.2 Research needs addressed	188
8.3 Strategy formulation	189
CHAPTER 9: CONCLUSIONS, CONSEQUENCES AND FUTURE PRIORITIES	
9.1 Conclusions	204
9.2 Consequences	206
9.3 Future priorities	207
REFERENCES	208
APPENDIX 1	229

LIST OF TABLES

Chapter 3

3.1 Attractiveness of targets baited with various release rates of CO ₂ and the best SA blend	33
3.2 Indices of catches of targets baited with CO ₂ , phenols and acetone relative to the control treatment	35
3.3 Indices of catches of targets baited with CO ₂ , the SA blend and a combination of CO ₂ added to the blends relative to the control treatment	35
3.4 Summary of the results to evaluate the importance of natural cow odour vs. visual stimuli	38
3.5 Summary of CO ₂ measurements taken during October 1997	40
3.6 Mean catches of targets baited with natural cow odour and with CO ₂ released at the same rate as produced by the cow	42
3.7 Summary of the results showing the importance of the remaining odour components other than octenol, 4-methylphenol, acetone and carbon dioxide	44
3.8a Rates of production of acetone and butanone from cow and synthetic source (AOP)	45
3.8b Analyses of volatiles collected on Porapak (ratio relative to 4-methylphenol = 100)	46
3.8c Rates of production of carboxylic acids in cattle odour	46
3.8d Estimates of the mean rates of production of various tsetse attractants as obtained for the second run of chemical absorption (1998) and analyses	47
3.9 List of synthetic cow (SC) components used to simulate the natural cow and the recommended release rates. The sachet sizes, which gave more or less the correct dosages are indicated	49
3.10 Indices of mean catches of flies attracted to natural and synthetic cow (SC) odour relative to the control	50
3.11 Indices of mean catches attracted to cow, bushpig and goat odours relative to 'no odour'	51
3.12 Indices of mean catches obtained with odours released from cow, man and a combination of cow and man relative to the control	53
3.13 Summary of indices of the attractiveness of natural cow odour vs. 'no odour' for five experiments (A-E)	54

Chapter 4

4.1 Comparisons of various shapes and colours of sticky traps in four experiments	74
4.2 Comparisons of e.blue/black 3-dimensional XTs with 2-dimensional Monopanel of various sizes	76
4.3 Behavioural responses of a) <i>G. brevipalpis</i> and b) <i>G. austeni</i> in and around the H3, H4 and H5 trap modifications as determined with electric nets	79
4.4 Final comparisons of the H4 and H5 modifications with the B4, B5 and Nzi traps	82

Chapter 5

5.1 Indices of increase of the recommended target relative to the H trap	104
5.2 Summary of details on the number of flies released and recaptured at the various trap sites – 13 January to 5 March 1999	106
5.3 Summary of estimates on population density and expected target densities needed for various options of killing percentages	116
5.4 Summary of mark-release-recapture results for Blocks B, C, D and E to investigate the use of open areas as natural barriers to the movement of <i>G. brevipalpis</i> and <i>G. austeni</i> – 3 September to 17 December 1998	118

Chapter 6

6.1 Relative attraction of <i>G. brevipalpis</i> and <i>G. austeni</i> males and females to cow, bushpig and goats (in two experiments within sand forest)	131
6.2 Feeding percentages of <i>G. brevipalpis</i> and <i>G. austeni</i> males and females on cow, bushpig and goats (in two experiments within sand forest)	131
6.3 Relative attraction of <i>G. brevipalpis</i> and <i>G. austeni</i> males and females at various times of day inside sand forest (Site 1) and in the adjacent open grassland area (Site 2)	134
6.4 Feeding percentages of <i>G. brevipalpis</i> and <i>G. austeni</i> males and females at various times of day inside sand forest (Site 1) and in the adjacent open grassland area (Site 2)	134

Chapter 7

7.1 Summary of survey units surveyed in natural and commercial areas	150
--	-----

7.2 Summary of survey units (diptank localities) surveyed in communal farming areas 155

Chapter 8

8.1 Detailed information of Zones I - V listed according to natural and commercial areas and communal areas. The species present and the approximate size of each zone is given 198

8.2 Technical work plan of project phases to be applied in each of the zones (I - V) as projected during indicated timeframe (1 - 8) 200

Appendix 1

A.1 Details of survey sampling site coordinates and trap catches 229

LIST OF FIGURES

Chapter 2

- 2.1 Visual (1 x 1 m phthalogen blue) and non-visual (0,5 x 1 m net) electric grids incorporated to form a flanked target (i.e. p.blue/net) 17

Chapter 3

- 3.1 Schematic representation of cow in underground ventilated pit 26
- 3.2 Extractor fan outlet placed c. 50 cm downwind of a flanked p/blue electric target 27
- 3.3a Odour extraction and sampling setup. Extracted air from the pit (housing an animal) was sampled via tubing with air pumps (shown right). Filters were inserted through the sampling ports in the ventilation shaft of the pit (center). Carbon dioxide was measured similarly by means of an infrared gas analyzer (shown left) 29
- 3.3b Collections of carboxylic acids were made by sampling through filters containing Chromasorb P AW filters (left), volatiles (i.e. phenols and octenol) were collected on Porapak® filters (centre) and ketones and aldehydes (carbonyl compounds) were trapped with silica SepPak® cartridges (right) ..30
- 3.4 Front view of ramp of pit. Setup shows 1,5 x 1 m electric net at far side of pit where ventilation shaft exits. Note fibre-glass sheet in roof of pit allowing light into pit 37
- 3.5 CO₂ release rates of cow during the mornings and afternoons as determined by means of the regression between measured concentration (ppm minus background) against nominal CO₂ rates (l/min) obtained in Table 3.5 40

Chapter 4

- 4.1 Sticky traps for *G. austeni*: (a) Rectangular sticky screen; (b) 3-DT; (c) cross-shaped target (XT) 65
- 4.2 Diagrammatic representations of the prototype H trap (a) with its H1, H2 and H3 modifications (b-d) and details of collecting device (e) 70
- 4.3 Photograph of the final H trap design for the capture of *G. brevipalpis* and *G. austeni* (the trap is held upright by fastening the corners to four rigid metal poles (1,2 m long) and the cones are suspended from two flexible steel rods (1,4 m long) 84

4.4 Diagrammatic representation of the final H trap with details of materials and measurements for trap construction	85
--	----

Chapter 5

5.1 Copy of airphoto of Ndlozi peninsula, Lake St. Lucia, showing the vegetation of the Hellsgate study area. The positions of various Blocks (A-E) used in mark-release-recapture trials are shown	102
5.2a Yellow artists' oilpaint was used to colour-code flies on positions of thorax as also indicated in Fig 5.2 b	103
5.2b Positions on thorax used for marking (e.g. for position 18, positions 10 + 8 are marked)	103
5.3a Summary of the dispersal rates for <i>G. brevipalpis</i> males	108
5.3b Summary of the dispersal rates for <i>G. brevipalpis</i> females	109
5.3c Summary of the dispersal rates for <i>G. austeni</i> males	110
5.3d Summary of the dispersal rates for <i>G. austeni</i> females	111
5.4 Daily recapture rate at various days after release for <i>G. brevipalpis</i> a) males and b) females	114
5.5 Daily recapture rate at various days after release for <i>G. austeni</i> a) males and b) females	115

Chapter 6

6.1 Cow in the centre of an incomplete ring of electric nets (8 m diam.) covering 35 % of the circumference of the ring	128
---	-----

Chapter 7

7.1 Historical distribution of the tsetse flies <i>Glossina pallidipes</i> , <i>G. austeni</i> and <i>G. brevipalpis</i> (after Du Toit 1954)	141
7.2 Reference map to indicate localities of magisterial districts, major game reserves and conservation areas, lakes and major rivers	147
7.3 Distribution of <i>Glossina brevipalpis</i> and <i>G. austeni</i> expressed as positive and negative trap catches.....	158
7.4 Apparent density of <i>Glossina brevipalpis</i> expressed as the number of flies/trap/day	160

7.5 Apparent density of <i>Glossina austeni</i> expressed as the number of flies/trap/day	161
7.6 Diptank positions in magisterial districts of Ingwavuma, Ubombo, Hlabisa, Nongoma and Mhlabathini indicating the distribution of cattle of communal farmers (diptank areas positive for tsetse during surveys are numbered)	163
7.7 Approximate distribution of cattle affected by trypanosomosis during 1990-1992 in N.E. KwaZulu-Natal	165
7.8 Prevalence of trypanosomosis in N.E. KwaZulu-Natal as determined by BCT and Ag-ELISA	166
7.9 Landcover map	168
7.10 Vegetation type map	169

Chapter 8

8.1 Summary of research needs addressed during this study necessary to develop a strategy for the monitoring and control of <i>Glossina brevipalpis</i> and <i>G. austeni</i> in N.E. KwaZulu-Natal, linked to tsetse monitoring and control options	185
8.2 Distribution of <i>G. brevipalpis</i> and <i>G. austeni</i> according to positive trap catches of the distribution survey. Zones I – V are indicated as part of a strategy to eradicate the two tsetse species from N.E. KwaZulu-Natal. Positions of temporary target barriers are indicated. The remaining boundaries of zones are natural barriers of fly-free areas	197

LIST OF ACRONYMS AND ABBREVIATIONS

3DT	3-Dimensional trap
Ag-ELISA	Antigen – Enzyme Linked Immuno-Sorbent Assay
ANOVA	Analysis of variance
AOP	Acetone, octenol and phenols mixture
ARC-ISCW	Agricultural Research Council-Institute for Soil, Climate and Water
ARC-ITSC	Agricultural Research Council-Institute for Tropical and Subtropical Crops
ARC-OVI	Agricultural Research Council-Onderstepoort Veterinary Institute
AVHRR	Advanced Very High Resolution Radiometer
BCT	Buffy Coat Technique
CCD	Cold Cloud Duration
CSIR	Centre/Council for Scientific and Industrial Research
DAVID	Disease and Vector Integrated Database
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GPS	Global Positioning System
IAEA	International Atomic Energy Agency
IGR	Insect Growth Regulator
IPAR	Intercepted Photosynthetically Active Radiation
KZN	KwaZulu-Natal
KZNNCS	KwaZulu-Natal Nature Conservation Services
LIT	Lethal Insect Technique
LP	Legpanel
MP	Monopanel
NDVI	Normalized Difference Vegetation Index
NOAA	National Oceanic and Atmospheric Administration
NRI	Natural Resources Institute
PAAT	Programme Against African Trypanosomiasis
PATTEC	Pan African Tsetse and Trypanosomiasis Eradication Campaign
RT	Rectangular sticky screen
RTTCP	Regional Tsetse and Trypanosomiasis Control Programme
SAFCOL	South African Forestry Company Limited
SANDF	South African National Defense Force

SAT	Sequential Aerosol Technique
SC	Synthetic Cow
SIT	Sterile Insect Technique
XLP	Cross-shaped legpanel
XT	Cross-shaped target (sticky trap)