

ORIGINAL ARTICLES

The Status of the Tsetse Fly as the Vector of Human Trypanosomiasis in Malawi

G Davison

Introduction

The tsetse fly is the vector of several species of trypanosomes which infect livestock in Malawi and of the one sub-species, *Trypanosoma brucei rhodesiense*, which causes sleeping sickness in man. The current status of the flies and the problem they cause has recently been re-examined as part of an on-going Programme.

The Regional Tsetse and Trypanosomiasis Control Programme (RTTCP) aims to control the diseases which the tsetse flies convey to man and his livestock in the middle and lower Zambesi drainage system by eliminating the vector so solving the problem permanently. This will involve reclaiming an infested area of some 322 000 square km lying within the neighbouring states of Zimbabwe, Zambia, Mozambique and Malawi. As many as four species of tsetse occur in the area, but in most localities only one or two species are found, namely *Glossina morsitans morsitans* and *G. pallidipes*.

Recent research and technology developed and applied mainly in Zimbabwe has shown that total eradication of tsetse flies over large areas is now more readily attainable than ever before, and by methods that do not endanger the environment. This progress encouraged the European Development Fund to investigate the feasibility, possible costs, likely benefits and possible negative consequences of eradicating the flies in the "common fly-belt". The RTTCP was therefore established in conjunction with the four Governments concerned in 1985, the "Initial Phase" being primarily "Investigative".

In Malawi, the Project began in 1986 with a period of equipment procurement preceding the start of field work. Since there had not been continuous thorough monitoring of the fly or the

disease in the preceding ten years, the main objective of the first phase in Malawi was to conduct a nation-wide distribution survey of the current problem.

The National Survey

This was conducted by three teams, each consisting of two sub-units. Each team sampled a different facet of the problem as follows:-

- (i) Bovine Trypanosomiasis Team (BTT), sampled the incidence of the disease nagana in cattle only.
- (ii) Human Trypanosomiasis Team (HTT), sampled humans to reveal cases of Sleeping Sickness.
- (iii) Tsetse Survey Team (TST), examined the distribution and composition of the tsetse population.

Methods

The two trypanosomiasis sampling teams were restricted to microscopic examination of wet and dry-stained blood smears. With centrifuges available most of the time, the buffy coat and PCVs were also examined in some cases.

The Tsetse Survey Team used F3 traps baited with acetone, octenol and phenols set up at sites in suitable habitat selected by reference to aerial photographs. Five traps were placed at each site and left there for three days. A pattern of sites was sampled in and around each focus so as to enable the extent of the infestation to be mapped.

The tsetse and nagana surveys were completed by staff of the Department of Animal Health and Industry by September 1989 but the human problem, as sampled by staff of the Ministry of Health supported by RTTCP funds, has still to be fully investigated.

Results

TSETSE: The survey confirmed the continued presence of *G. morsitans* in all the foci listed below and shown in the Figure. Similarly, the previously recorded presence of *G. brevipalpis* in pockets on the lake shore was again reported. However, the capture of *G. pallidipes* in three of the large foci

The Regional Tsetse and Trypanosomiasis
Control Programme
G. Davison

Correspondence to:
G. Davison
Technical Advisor to the RTTCP in Malawi
29, Trinity Road, P.O. Amby
Harare
Zimbabwe

confirmed the presence of this species in Malawi for the first time. A secondary low density population of this species alone was found in a locality where no flies had been recorded before.

All the foci listed are associated with wildlife or large forest reserves where some game animals still exist. Outside of such areas, little suitable habitat for the shade loving flies exists below the 1200 m contour, the upper limit of the fly's range. Some significant recessions in tsetse distribution since the last major study was conducted (Mitchell and Steele, 1950-1954) were noted, presumably due to intensive settlement by the much increased human population.

PRIMARY FOCI:

- | | |
|---------------------------------|----------------|
| (i) Vwaza Marsh Game Reserve | <i>G.m/G.p</i> |
| (ii) Kasungu National Park | <i>G.m</i> |
| (iii) Nkhosakota Game Reserve | <i>G.m/G.b</i> |
| (iv) Phirilongwe Forest Reserve | <i>G.m</i> |
| (v) Namizimu Forest Reserve | <i>G.m</i> |
| (vi) Liwonde National Park | <i>G.m</i> |
| (vii) Lengwe National Park | <i>G.m/G.p</i> |
| (viii) Mwabvi Game Reserve | <i>G.m/G.p</i> |

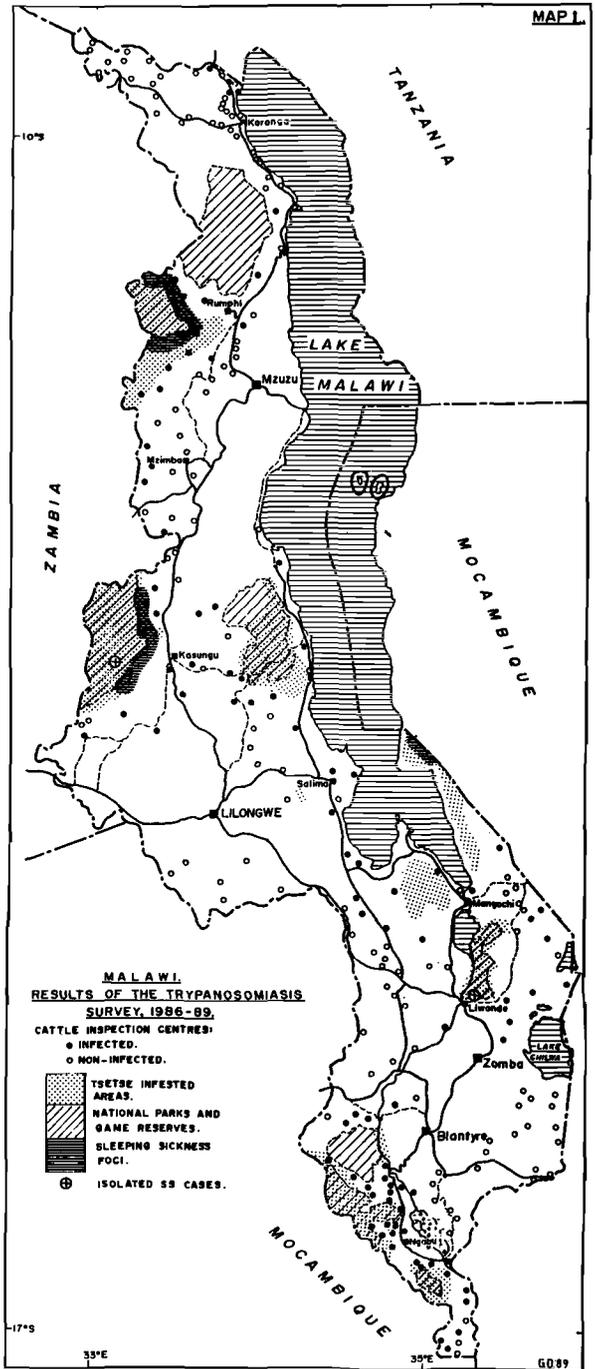
SECONDARY FOCI:

- | | |
|--------------------------|------------|
| (ix) Tuma Forest Reserve | <i>G.m</i> |
| (x) Majete Game Reserve | <i>G.p</i> |

TRYPANOSOMIASIS: Whilst the names given to the foci listed above are derived from the core area of the infestation, the flies actually disperse out from these centres into the adjacent settled areas, and so create the problem. The distance to which this dispersion takes place is dependant on the density of the settlement encountered and the season, conditions being most favourable in the cool, wet months from January to June.

This dispersion results in the contact between man and fly which gives rise to the transmission of infections. Man is not a favoured food host of tsetse flies, but in the absence of natural hosts, they will feed on humans out of necessity. Around each of the foci listed, a zone of infection was recorded amongst cattle up to thirty kilometres beyond where the last fly could be caught.

In the case of human infections, 85 cases were recorded during the period. Thirty eight of them were found by the survey unit's random sampling amongst villagers living close to tsetse areas, and 47 presented themselves to District Hospitals and Clinics. The number of cases found by the latter means increased sharply in each area after the survey team had held meetings with the people and local health workers, to inform them of the likely presence of the disease and describe the primary symptoms.



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The cases recorded from November 1986 - September 1989 were distributed as follows:-

Vwaza	31
Kasungu	33
Namizimu (Makanjila)	10
Liwonde	1
Nkhotakota	1
Others	9 *

* These cases amongst expatriates were not treated in Malawi Health Service facilities so do not appear in the official records. Five of them can be attributed to the Kasungu focus and four to Vwaza.

Eighteen deaths were reported during the survey period. (The figures given above are those reported to the Project meetings by the Sleeping Sickness Survey Team and other sources and do not constitute the official record for the entire country.)

Significantly, no cases were found amongst Malawians resident in the Lower Shire Valley where a long history of the disease is known. All the other active foci recorded were known previously, with the possible exception of that at Makanjila which may or may not have contributed to the long record of the disease in the Mangochi Hospital records.

The Sleeping Sickness Team had only just begun to sample the Nkhotakota area when the survey period ended in September 1989, but some random sampling had taken place and an awareness of the disease created amongst the people and medical staff in rural clinics. Subsequently, a tremendous upsurge in cases has been recorded at the District Hospital, the total for the period October 1989 - July 1990 being 155 cases.

This development, which is a product of several factors and not solely due to the new awareness created by the survey effort, has greatly exceeded the availability of drugs and the capacity of the hospital to diagnose and treat all the patients. Some 31 deaths have been recorded, but many more are known to have occurred in the villages amongst those who hold the common belief that the disease is a product of witchcraft and therefore incurable by modern medicine.

The areas yet to be sampled by the survey team are all near Mangochi, where people live in the presence of tsetse flies coming out of the Namizimu, Mangochi and Phirilongwe Forest Reserves, and the northern extension of the Liwonde National Park. The single case recorded in Liwonde was an adult female who lived just east of Liwonde town but collected fire wood in the Park nearby. Some sampling of people living along the eastern boundary of this focus has taken place, but not to the north in the Malombe Tribal Authority and Chisope areas where flies are also abundant.

Discussion

The survey results, and the response to the training given, confirmed that the previously known problems in the Kasungu and Vwaza areas were more serious than the available records suggested. A major problem may also exist in the Makanjila area, which to date has only been sampled very briefly (8 villages) because of an adverse security situation. The presence of a large number of refugees there further complicates the issue.

The events at Nkhotakota, which were not part of the survey effort, are however far more critical. The number of cases confirmed to date is serious, but the matter is greatly compounded when one considers the limited facilities available at the laboratory there and the workload imposed on the lone technician that runs it. The belief that the disease is incurable is still widespread despite some efforts to overcome it. These efforts have been seriously undermined by the shortage of drugs and bed-space which has on occasions necessitated known infected patients to be discharged from the hospital without being treated or completely cured. (Relapses are a common feature of the disease even amongst patients treated under ideal conditions). Their subsequent deaths will have reinforced the belief that inhibits some people from coming to a Health Centre at all. A further high risk group of people who do not volunteer their condition are those who indulge in illegal activities in the Game Reserve.

The medical problem at Nkhotakota involves overcoming the shortages of drugs, hospital bed space, professional and technical staff/time, as well as the deeply imbedded beliefs of the local people. The RTTCP has supplied an emergency stock of drugs to the Health Service but this support is due to fall away. A vector control operation is scheduled to begin in 1991 with the objective of eradicating the isolated population of tsetse in the Nkhotakota Game Reserve. (It is predominantly *G. morsitans* but with many pockets of *G. brevipalpis*). This is a long and costly operation that at best may take 5-6 years to complete. However, as the placement of the killing devices (insecticide impregnated, odour baited screens - called "targets") is planned to begin along the eastern boundary, it may break the man-fly contact there early on, say in two years time. The technique is already in use in the Kasungu National Park where reductions in fly population as high as 90% were achieved in nine months, despite an unsolved problem of a very high rate of theft of targets.

A particularly important consequence of the termination of the RTTCP support for the Health Service in 1991 will be the lack of support for the Human Trypanosomiasis Team. Although by then

they should have completed the sampling of the few remaining "suspect areas" detailed above, their experience and mobility would have been of great value in the Nkhotakota area. The conditioning/training of villagers, the diagnosis of asymptomatic carriers, the transportation of immobile chronic cases and the follow-up of discharged patients are all functions which require staff and mobility far greater than are presently available, or possible in the absence of donor support. The value of a mobile unit was recently demonstrated by the visit of one survey unit to the area in May 1990. In only five days the unit found 19 cases, 17 of them asymptomatic or latent infections. (None were hospitalised and this group do not appear in the "total to date".) Patients discovered in this condition may be easier to treat successfully (possibly as outpatients) than the late stage cases which present themselves in poor condition. If the pool of infection is to be cleaned up to coincide with the vector control

operation, and so solve the problem permanently, active random sampling of the population will be necessary.

The good prospects of achieving a permanent solution to a human and animal health problem in a relatively short time makes the Nkhotakota situation unique. At the same time a very little used wildlife area will be made safe and developed for tourism, as a result of road making which is a necessary requirement for anti-tsetse operations.

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Houseflies and Shigella

The role of houseflies in the spread of shigella and other diarrhoeal diseases has long been believed but evidence has been largely circumstantial. An intervention study done at two self contained military camps in Israel provides more concrete evidence that this is so. In both camps refuse was covered and there was routine spraying with permethrin insecticide (using 5 litre devices). Recruits were provided with non-fly proof trench latrines but encouraged to wash hands. The intervention used was to place about 60 fly traps placed around latrines, field kitchen and mess tents, and to use high capacity permethrin insecticide spraying machines (100 litres). The fly traps follow a similar principle to the ventilated pit latrine (VIP): the flies are initially attracted by a bait (fermenting yeast) placed underneath the trap; after feeding the flies are attracted to sunlight coming through an opening covered with mesh at the top of the trap; the flies then fly upwards into the trap where they eventually die of exhaustion. The bait is replenished twice a week and the traps emptied every 3 - 4 weeks. These intensive fly control measures were introduced into one camp for a period of 11 weeks and after a short break (and the arrival of new recruits at both camps) the traps were transferred to the other camp for 11 weeks. The following year (1989) the same procedure was followed but the order of the intervention was reversed. Fly density was reduced 64% during periods of intensive fly control; clinic visits for diarrhoea reduced 42% and episodes of shigella reduced by 85%. Antibodies to shigella were measured in the recruits and were 76% lower in those staying in fly control camps. Antibodies to enterotoxigenic *E. Coli* were also lower by 57%.

(The concept of these fly traps is similar to tsetse fly odour-baited, insecticide-impregnated "targets" and insecticide-impregnated bed nets used in the control of malaria. Editor)

Cohen D, Green M, Block C, et al. Reduction of transmission of shigellosis by control of houseflies (*Musca domestica*). *Lancet* 1991;337:993-997.