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TSETSE AND HUMAN TRYPANOSOMIASIS CHALLENGE IN SOUTH EASTERN UGANDA

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Abstract—Pyramidal traps (8000) have been set up against *Glossina fuscipes fuscipes* to control *Trypanosoma rhodesiense* in Busoga. In order to understand the pattern of tsetse/human contact, the collection of data on the density, spatial distribution and mobility of flies has been related to the dynamics of human trypanosomiasis in Busoga. As for *T. gambiense*, few reasonable correlations between global fly densities and incidence of the disease have been found. However, field observation with a recording time of seasonal variations of movements of people and animals associated with particular habitats, remains the key to understanding the transmission of the disease.

Key Words: Pyramidal traps, *Glossina fuscipes fuscipes, Trypanosoma rhodesiense,* dynamics of transmission

Résumé—Pièges pyramidaux (8000) ont été mis en place contre *Glossina fuscipes fuscipes* afin de lutter contre la maladie du sommeil à *Trypanosoma rhodésiense* dans le Busoga. Dans le but de comprendre les modalités du contact homme/mouche, la récolte des données sur la densité, la distribution spatiale et la mobilité des mouches, ont été mis en relation avec la dynamique de la transmission de la trypanosomiase humaine dans le Busoga. Comme pour *T. gambiense,* peu de corrélations entre la densité globale de mouche et l'incidence de la maladie ont été trouvées. Cependant, des observations de terrain avec un enregistrement daté des mouvements saisonniers des hommes et des animaux dans des habitats favorables aux mouches demeure la clé de la compréhension de la transmission de la maladie.

Mots Cléfs: Pièges pyramidaux, *Glossina fuscipes fuscipes, Trypanosoma rhodesiense,* dynamique de la transmission

INTRODUCTION

The knowledge of the dynamics of a tsetse fly population submitted to the pressure of a system which attracts then destroys the flies conditions the success of a trapping control campaign.

In order to break off the transmission of *Trypanosoma rhodesiense* sleeping sickness in southeast Uganda, a trapping control programme had been carried out against the vector, *Glossina fuscipes fuscipes*.Pyramidal traps (8000) (Lancien-Gouteux, 1985) have already been installed, a quarter of the high risk area has been treated (Fig. 1) and striking epidemiological results have been obtained with 90% of the reduction of the number of cases in the treated area.

However, this interruption can only result in a true elimination of the disease, if the complex relationships between vector/trapping system, parasite and hosts have been clarified.

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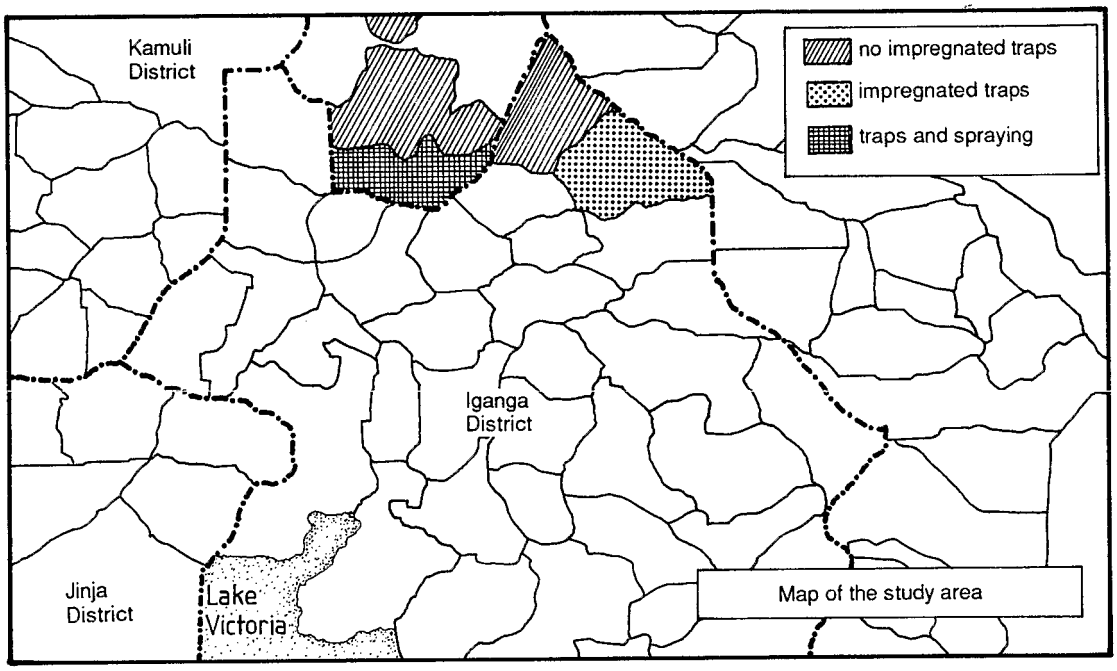

Fig. 1. A map of the study area.

RESULTS

Entomological results

The pyramidal trap (Lancien-Gouteux, 1985) used for the control (Fig. 2), has got a permanent system of catching flies, giving a constant evaluation of the results such as apparent density before, and all along the treatment.

The pyramidal trap. In the five subcounties treated, the reduction of the apparent density varies between 96.5% and 97.5% after 6 months, and increases to 99% after 9 months.

However, after 9 months, the colours of the traps have faded and have lost their attractivity and have to be replaced. When the new traps are installed, there is more reduction again, associated with the improvement of catches (Fig. 3).

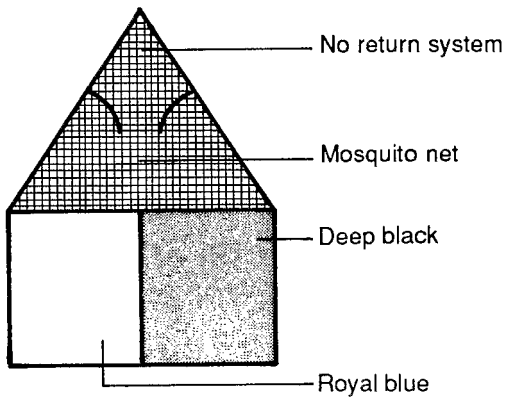

Fig. 2. The pyramidal trap (Lancien-Gouteux, 1985).

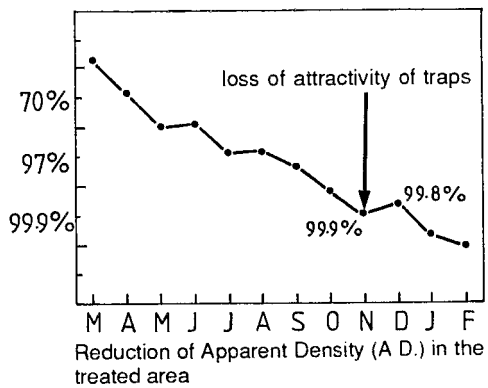

Fig. 3. Reduction of apparent density in the treated area after 10 months of trapping.

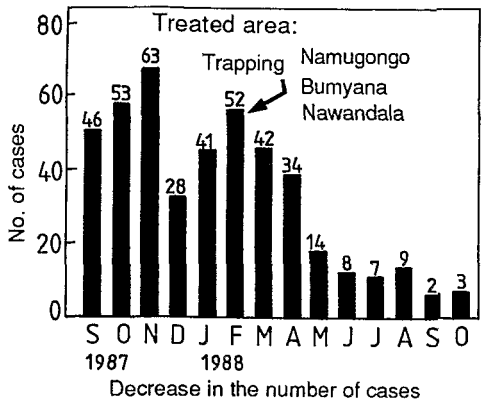

Fig. 4. The epidemiological results of the villages treated by trapping.

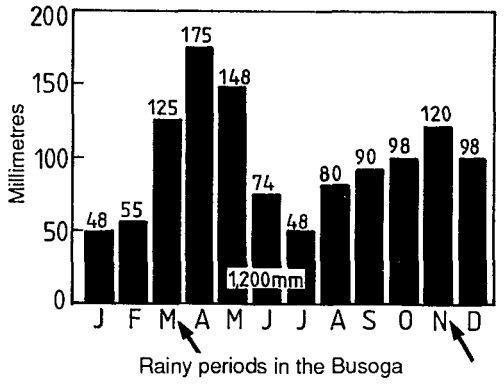

Fig. 6. Rainy periods in the Busoga.

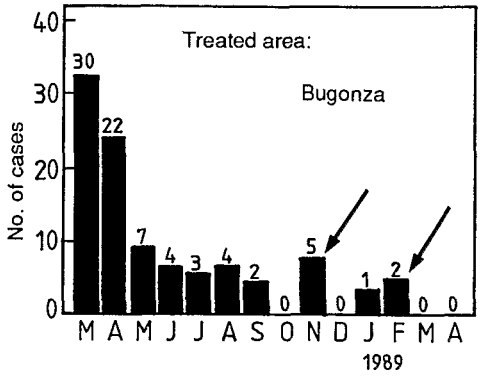

Fig. 5. Outbreak of the disease after a loss of efficiency of trapping.

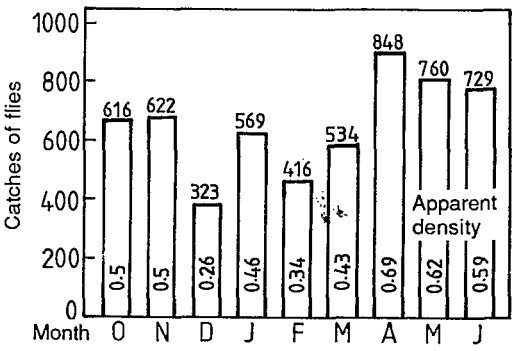

Fig. 7. Monthly variation of the density of flies in Wakatanga.

Medical results

An active screening of the villagers enabled us to diagnose and treat the patients. This active screening gave us the monthly incidence of the disease. In villages treated by trapping, the epidemiological results (Fig. 4) show us a reduction of 90% of the number of cases after 5 months.

However, the pressure of antivectoral control has to be constant and to be maintained up to 99% of reduction of the apparent density. The loss of efficiency of the traps gives rise to an abrupt outburst of transmission of the disease (Fig. 5).

This raises the question whether this revival is linked to the worn out traps, seasonal variations of density, behaviour of the flies or temporary changes of human or animal behaviour.

SEASONAL VARIATIONS OF *GLOSSINA FUSCIPES FUSCIPES* POPULATION

The climate

With a temperature remarkably constant (around 22°C), the climate of Busoga is influenced by Lake Victoria. It has short dry seasons and is often cloudy with two rainfall seasons (Fig. 6).

Influence of the weather on the fly density

Sampling traps have been set up in an experimental area located in central Busoga called Wakatanga, allowing us to follow the variations of the fly density (Fig. 7). An increase in the catches is observed in Wakatanga during the rainy season.

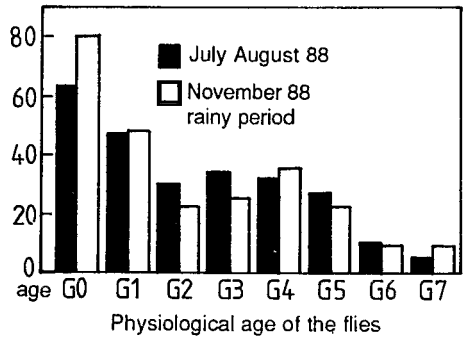

Fig. 8. Variations of physiological age of flies according to the season.

Influence of the climate on the average age of the flies caught

The flies caught in Wakatanga from June to November 1988, have been dissected in order to be able to define the physiological age of the females, 61% belongs to the young groups "nulliparous" and "parous" and 39% to the oldest groups (Fig. 8).

During the rainy season of November 1988, this population has not been observed to age.

SPATIAL DISTRIBUTION OF THE VECTOR

The fly populations are gathered together in "agglomerats" in the vegetation, creating favourable microclimates for their survival. The wet and swampy areas surrounded by forests and sprinkled with *Acacia camplycantha* and *Pheonix reclinata*, with bushes of *Lantana camara*, compose one of the habitats. Around the plantations, in the dry areas, the stretches of forests remain the permanent resting places for tsetse.

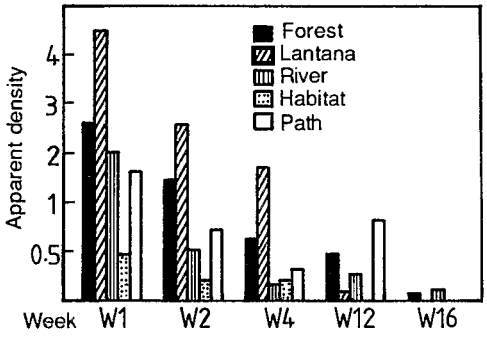

Fig. 9. Effects of traps in different types of geographical environment.

Although some few flies remain temporarily around the habitations, typical peridomestic populations have not been clearly identified.

The time required to get to control the vector, with the control traps, varies according to the vegetal environment (Fig. 9). Around the habitations, the preliminary catches are very low and the point 0 is reached very rapidly. Near the forest surrounded with bushes, initial catches are high and the slow decrease in the population is low. In the savanna, near the bushes of *Lantana*, initial catches are high, but the decrease in the population is rapid. Around the cattle enclosures catches are relatively high.

MOBILITY OF FLY POPULATIONS

The sedentary behaviour of the fly populations is very pronounced; this is why, despite a low density of traps (less than 8 per km^2), and a low decrease of the fly population in the permanent resting sites, the traps located more than 500 m out of the forest cover, catch no flies after 1 week.

In our experimental area, in the small locality of Kabere, a reduction of 98.5% of the apparent density has been achieved by trapping for 6 months (2 flies per trap per day to a density of 0.03). However, in the untreated neighbouring localities, such as Lugobango located at less than 1000 m, the density of the fly population has remained very high (apparent density = 3.46 per trap per day). Despite this proximity of the flies no reinvasion has been registered in Kabere which during the 6 months had a continuous monitoring of the population by trapping.

DYNAMICS OF THE TRANSMISSION

Before the beginning of the vector control programme, the medical results of 1986 and 1987 show us an increase in the disease transmission during the rainy season (Fig. 10). This peak of transmission during the rainy season remains, even after the control of flies. The intensity of transmission is not always correlated with the density of the vector population (Fig. 11). In this way, the Kiyunga parish (Bumanya subcounty), despite a very low apparent density (0.25), had in the last 6 months 11 patients with sleeping sickness (Table 1).

The local outbreak of microfocus of transmission of the disease seems to be difficult to relate only to the global density of flies.

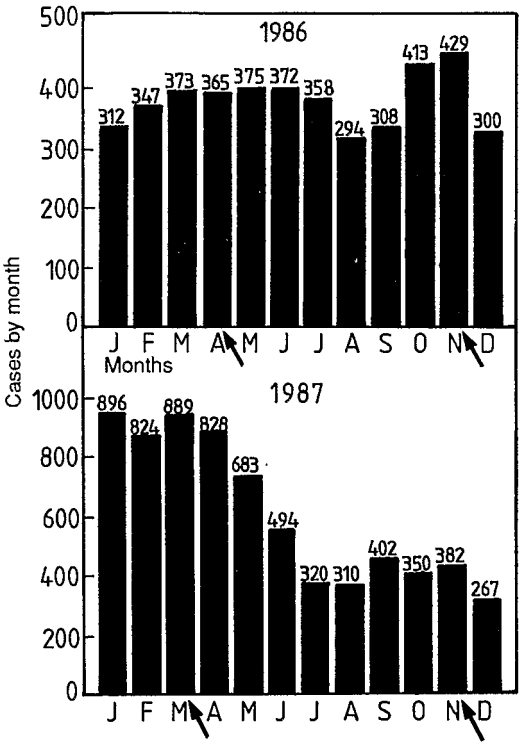

Fig. 10. Incidence of new cases related to the rainy periods.

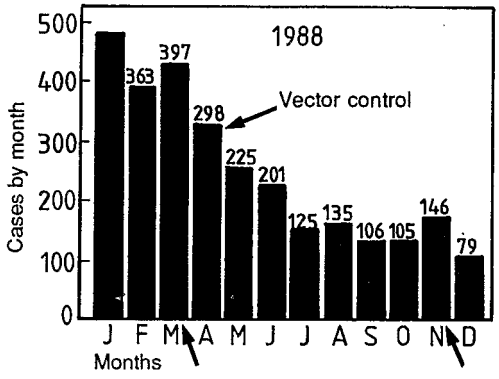

Fig. 11. Increase of transmission during the rainy season.

SEASONAL MOBILITY OF HUMAN POPULATION

Agricultural activities and essential food crops play a very important role in the mobility of villagers. The beginning of the rainy season, is particularly the time when all the members of the family have to dig (mainly at the forest savanna border) in order to get the land ready for sowing before the heavy rains.

Table 1. Number of cases related to the apparent density

Subcounty	Parish	No. of cases	Apparent density	No. of traps
Magada	Izirangobi	0	0.1	80
	Nabinyonyi	7	0.8	80
	Mazuba	1	1.3	120
	Kiwanyi	2	1.2	200
	Magada	3	0.5	200
	Kagulu	0	0.5	40
Namungongo	Kaliro	4	2.2	80
	Kasokwe	8	3.4	140
	Namukoge	0	1.5	100
	Nabikoli	1	0.3	180
	Bugonza	3	1. 2	50
	Butege	1	0.6	140
	Buayuya	3	0.9	80
Bumanya	Bumanya	10	2.2	100
	Kyani	0	1.2	80
	Kiyunga	11	0.2	80
	Kasuleta	4	2.5	50
Ivukula	Nabitula	1	1.3	20
	Lwatama	0	0.9	100
	Ivukula	6	2.2	100
	Kisowozi	1	1.7	60
	Iwungiro	0	0.7	80

A study of the incidence of new cases during the last 6 months (Fig. 12) shows us that at the beginning of the rains (November) an increase in the proportion of human male infections is probably related to this mobility.

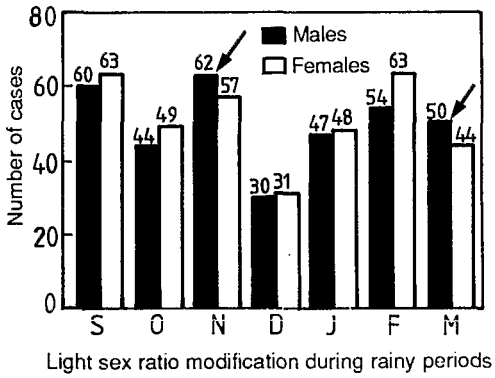

Fig. 12. Human patients sex ratio modification during rainy periods.

The outbreak of sleeping sickness is related to the abandonment of cotton growing and invasion of *Lantana camara* bushes. The change in the schedule of activities (cotton was sown in June and collected in January), can also be presumed.

MOBILITY OF CATTLE

In Busoga, while crops are the main activity an average of 6000 head of cattle in each subcounty, is enough to play a major role in the dynamics of the disease by:

(1) feeding the flies.
(2) moving the flies from one place to the other, and
(3) being a reservoir of the disease.

The cattle are grazed under the supervision of a keeper and secured during the night around the habitations.

DISCUSSION

Some observations on the average age of the flies in Busoga, made by Harley (1964) attest to the ageing of flies during the rainy season. However, the sampling method (attraction with an ox), was not identifying an increase in density of fly populations. The increase in fly catches in the traps during this time, reflects that this method of sampling is more able to show the activity of flies.

However, attractivity of traps is always strongly related to the climatic conditions (cloudy weather and high relative humidity), and the density can be strongly underestimated. The entomological evaluation of the results of the trapping programme are used as a guideline for an improvement of the technique. The medical evaluation of the incidence of the disease remains the most reliable method of evaluating the efficiency of the work.

However, a correct veterinary evaluation with "sentinelle" animals in close contact with the remaining flies seems to be the only way to prevent this abrupt outburst of transmission of the human disease.

CONCLUSION

The outbreak of patchy points of transmission even with successful trapping control programme, is intimately linked to the inopportune convergence during the rainy season of two factors:

(1) increasing of density of flies associated with increase in the vectoral capacity, and
(2) presence at this time of human population at the border of the forest in the favourable habitats of the tsetse.

During the time of sowing, domestic animals are taken away and the flies have to feed on the human population. However, the role of humans as a potential reservoir for the disease of the domestic animals remains unknown.

The set up at the beginning of June 1989 in the district of Kamuli in Busoga, of a wide programme of integrated control including:

(1) block treatment with berenil of all the domestic animals,
(2) trapping, and
(3) active screening of the villagers, will give the answer to some of the lacking parameters.

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