Community participation in the control of tsetse flies. Large scale trials using the pyramid trap in the Congo

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Abstract

An experiment of *Glossina palpalis* control was carried out by rural communities in 55 villages of the Niari river sleeping sickness focus (Bouenza region, Republic of the Congo). It was based on the use of a new trap, not requiring insecticide impregnation, in which the captured *Glossina* are preserved. The results show that this simple, cheap trap is an effective method of control, resulting in a considerable decrease in the tsetse population and is easily operated by the villagers. Screening surveys, using the indirect immunofluorescent test, conducted regularly in this focus, showed a decrease in the prevalence rate after the elimination of the flies. Long-term community participation is limited and must be improved by a better understanding of socio-cultural aspects and in certain cases must be associated with the work of a specialized team.

Introduction

Sleeping sickness vector control has been marked by several stages in the Congo. The first trials of ground spraying with insecticides were failures (Adam et al., 1969; Adam and Le Pont, 1971). Later, the use of biconical traps (Challier et al., 1977) showed encouraging results (Lancien et al., 1981). However, inspite of efforts to further simplify this trap (Lancien, 1981; Gouteux and Noireau, 1986) the difficulty with this method was the periodic impregnation of the traps or screens with residual insecticide. In the climatic condition of the Congo the effect of the insecticide barely exceeded one or two months (Gouteux et al., 1986a). The development in 1986 of a simple trap, more attractive for the Congolese tsetse species than the biconical trap, with a capture system for automatically catching and killing the flies without insecticide impregnation (Gouteux et al., loc. cit., Gouteux and Lancien, 1986) was a decisive step. This trapping system is currently used by the Congolese National Programme for Trypanosomiasis Control (Service de l'Epidémiologie et des Grandes Endémies, S.E.G.E.) as the only vector control mesure (Duteurtre and Gouteux, 1986). The research conducted in the Congo is in line with recommendations of WHO which gives priority to trapping (Anonymous, 1983; WHO, 1986) and also encourages experiments by the communities and at primary health care level (WHO, 1983). After having demonstrated the efficacy of the insecticide-free trap (Gouteux et al., 1986b) it was important to assess the feasibility of local communities taking over the monitoring for the traps. The use of this capture system was made easier with no insecticide to manipulate. A priori, this method is simple, cheap, safe and could be generalized to epizootiological situations such as tsetse control for protection of ranch or pastoral zones. Trials were thus undertaken to test this method of control on a large scale at community level. Results of these trials are given in this paper.

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Materials and methods

Trapping

The blue-black pyramid trap (Gouteux and Lancien, 1986) is used as a permanent catching system. Since its first description, some improvements have been made (Gouteux, unpublished). The shape of the trap is now formed by two wooden rods (instead of four), which prevents it from being folded up by the wind. The "stomach" of the catching system consists of a plastic bag containing diesel oil (very cheap and not volatile) used to kill and preserve the insects. The trap is hung up in the trees by the capture bag. Hanging has the advantage of being easy to set up and provides better resistance to storms that mounting on post. Another advantage of the system is the visual control of the efficacy of each trap since the captured flies are preserved. From a pratical point of view, this system enables the control effort to be assessed directly. From a psychological point of vue, the villagers are motivated by the accumulation of the tsetse flies in the capture bag. According to the number of flies caught, the traps can be moved in order to obtain maximum efficacy. Previous trials have shown that there are in fact "strategic capture points" where the greatest number of flies are caught (Gouteux et al., 1986a). The determination of these points using this system is an important factor for the rapidity and success of the control.

The traps were provided to the villagers free of charge by the National Control Programme (S.E.G.E.). Kits for mending traps and counting flies (Gouteux et al., 1987) and an explanatory booklet and posters (available on request to authors) were provided with the traps.

Modalities of participation

The number of traps distributed was estimated according to the area to be covered. This number was modified during the trial according to the results obtained and following the number of broken traps handed in to the control team for replacement.

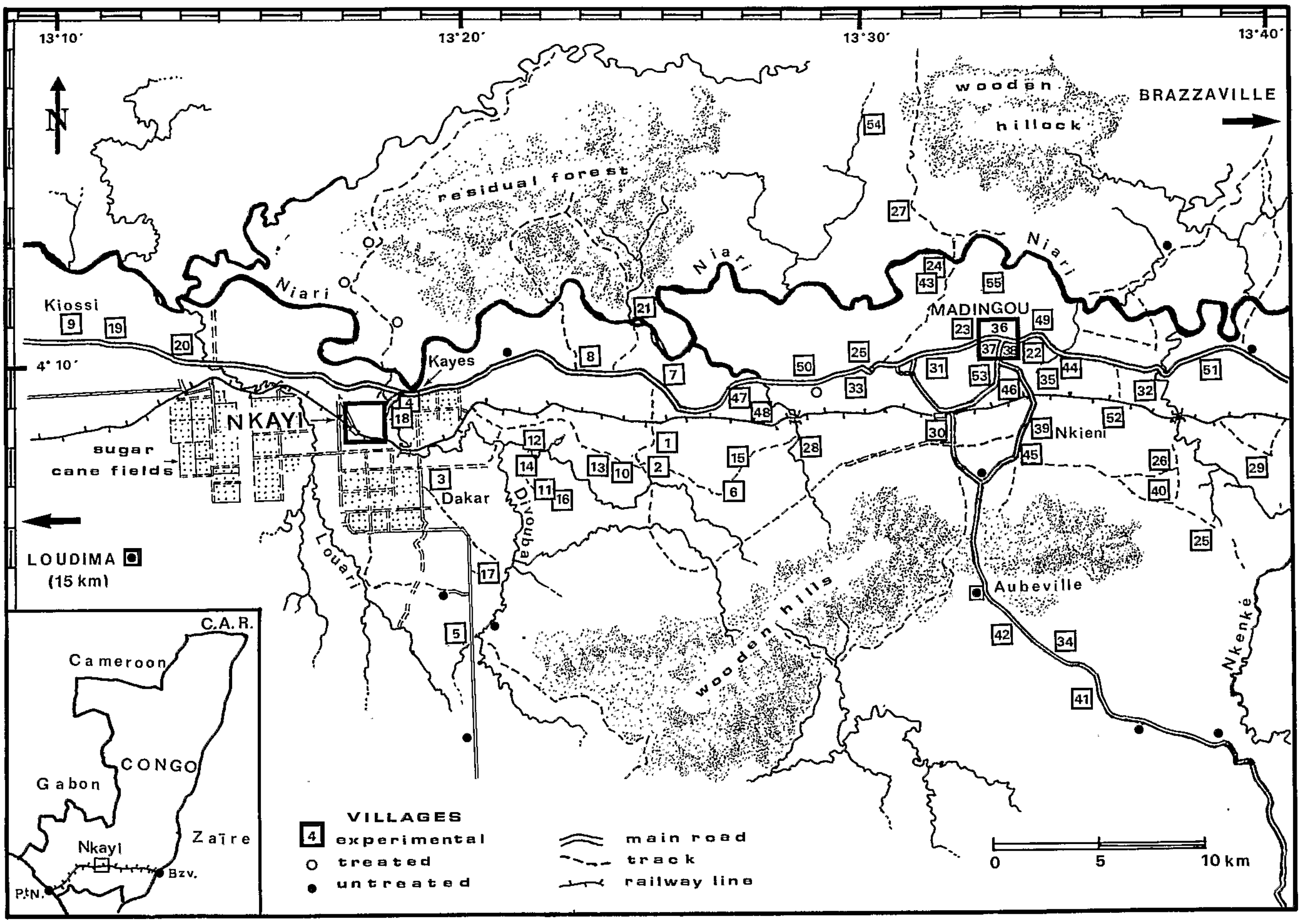

Fig. 1 Map of villages studied (numbered from 1 to 55). The shaded areas indicate altitude and not vegetation

The local trap operator, designated by the villagers to be responsible for trapping, was given the control equipment at meeting of the Village Committee and Health Committee (when the latter had been set up). Explanations were given in French and in the local language, and were illustrated by the poster and booklet. A record card was also given to keep account of the number of captured flies. The team then demonstrated the various operations.

The first control trials involved 30 villages and were initiated by the ORSTOM team from May to December 1985 (Gouteux et al., 1986b). After this date the villagers themselves carried out the control entirely in 25 other villages and continued the work in the 30 initial villages. The ORSTOM supervision of the operations consisted of the team visiting all the villages every two or three months. The final assessment of these trials was done in May 1987.

Entomological evaluation

The number of tsetse flies captured was recorded at short intervals at the beginning of the control (at least once a week during the first month) then once a month. These data were processed by computer in Brazzaville and are available on request (Gouteux and Sinda, 1987). The records enabled the apparent densities per trap per day (ADT) to be calculated. The rate of decrease of the tsetse fly population after a given period was calculated from the ADT at that time expressed as the percentage of the average ADT at the beginning of trapping. From Decembre 1985 all the records were carried out by the villagers except in village number 4 (Kayes) where the trials was conducted entirely by our team and used as a reference village (Gouteux and Noireau, 1986). Two other villages, Aubeville and Loudima (Fig. 1) were used to asses the seasonal trend of two control populations of *Glossina palpalis*, by series of short trapping sequences (four to five days). Since significant fluctuations were not observed (ADT varied between 8 and 6 *Glossina* per trap per day) corrections in the observed decrease were not needed in the treated villages.

Medical surveys of the population

The impact on transmission has not been studied specifically but has been assessed by the trend in the rate of positive serology by indirect immunofluorescent antibody test (IFAT) during several successive screening surveys conducted both by SEGE and ORSTOM. IFAT is used as the reference test in the Congo since the sensitivity and specificity are respectively 95 % and 100 % (Noireau et al., 1988). All the tests were read at the ORSTOM laboratory in Brazzaville, according to the same protocol established by Frezil et al. (1974). These routine surveys covered an average of 67 % of the population in the villages and accounted for the detection of over 90 % of the cases. The passive detection of a few cases usually initiated the first screening survey. Cases of seronegative subjects who became seropositive at later survey were noted. All the surveys conducted between 1983 and 1987 are taken into account here.

Study zone (Fig. 1)

Situation

The experimental villages are located in the Bouenza region and are part of the "Niari river" focus (Frezil ét al., 1980) situated along the Brazzaville – Pointe Noire road and railway line. This

Table 1 Results obtained at the end of control trials in the villages of Kayes area

No.	Villages a	Number of traps	Initial ADT b	Reduction rate c	Number of Tsetse counted d
1	Bodissa I	10	7,8	97,8%*(*)	2829
2	Bodissa II	17	12,2	99,2%*	4960
3	Dakar	36	16,3	99,3%*	6695
4	Kayes	9	20.3	99,9%***	483
5	Kibonga-Louamba	3	2,8	100,0%*	91
6	Kilounga	6	3,7	100,0%*(*)	426
7	Kimpalanga	29	7,9	96,7%*(*)	3295
8	Kimpambou	21	13,0	98.7%*(*)	3210
9	Kiossi	48	20,3	100,0%**	14506
10	Kindamba-Bitiba	8	3,4	97,9%*(*)	470
11	Kindamba-Mboukou	3	11,8	99,3%**	1498
12	Kindamba-Mouamba	17	10.8	100,0%**	1413
13	Kingouala-Bizamba	21	6,8	97,8%**	2751
14	Kingoye	2	2,2	90,0%**	341
15	Kinsoumbou	10	9,5	98,6%**	2872
16	Kimbaouka	6	22,0	97,6%*(*)	3057
17	Mpalou-Kayes	4	1,8	99,4%(*)	181
18	Mouananto	7	1,7	97,7%(*)	181
19	Moutela	12	0,9	95,6%*	81
20	Moutela-Louari	20 + 22e	2,1	11,7%*	5699
21	Mvouanzi	19	0.3	90.9%(*)	548
Total		330			55226

a) Except for village n° 20, the villagers began to collaborate after the beginning of the trials
b) Apparent Density per Trap (no. *Glossina*/trap/day)
c) Percentage of the initial ADT of *Glossina palpalis*
(*) after less than one year of control
* after one year
*(*) after one and half years
** after two years
*** after three years
d) This number gives an underestimate of the real number of flies eliminated
e) Number of traps added at the end of the trials in village n° 20

is the largest sleeping sickness focus in the Congo (approximately 60% of the detected cases) and is in a region of vital economic importance for the country. It is also the most densely populated rural area. Twenty-one villages or districts are located in the Kayes area (numbered 1 to 21), 34 in the Madingou area (n° 22 to 55). Among these, two urban situation must be mentioned: Mouananto district of Nkayi and Madingou, comprising respectively 35,000 and 12,000 inhabitants, will be the subject of a separate study.

Population

The population of the villages and districts included in this study was 22,521 inhabitants according to the official census of 1984. Given the average growth rate in the Congo of 3.5% (but between 1985 and 1986 this rate was 8.4% in the Kayes area) the population was estimated at about 25,000 inhabitants in 1987. Since 1983, 564 cases of sleeping sickness have been detected in this zone, giving an average prevalence rate of 3% with a local variation of 0–15%. The low prevalence rate generally observed is characteristic of a very old trypanosomiasis focus (Frezil, 1983). Sleeping sickness is endemic in certain villages of this former "caravan trail focus" since the beginning of the century (Martin et al., 1909). Of the 55 villages, six have still not been screened and seven presented negative results.

Vector

Glossina palpalis palpalis (Robineau – Desvoidy, 1830) is the only species present nowadays. The scarcety of game in the *Hyparrhenia* savannah compels this species to live essentially in peridomestic habitats. The abundance of the fly populations is thus directly related to the number of pigs raised by the villagers (Gouteux et al., 1986b). There is also a reservoir of "wild" *Glossina* located mainly on the river Niari (Fig. 1) and is in sporadic contact with man (Gouteux, unpublished data).

Results

Entomological results

The results by village are given in the Tables 1 and 2. The number of traps indicated in Tables corresponds to the maximum number in action in each village. A total of 240,514 tsetse were harvested. This is an underestimate of the real number of flies destroyed (flies not counted because badly preserved, traps no harvested). An ADT of zero was achieved in 9 villages. The high decrease in the apparent density per trap was concomitant with a spectacular decrease in tsetse bites, observed both by the villagers and the ORSTOM team. This result was greatly appreciated by the villagers.

The graphs in Fig. 2 illustrate the various types of decreases observed. The villages n° 55 and 50 show a slow decrease, observed in several villages, and results obtained with an optimum yield per trap are given in villages n° 25 and 16. This figure also reveals difficulties in villages n° 49 and 42, which may be related to insufficient number of traps for n° 49 (and also n° 20, see Table 1), or to an incorrect trapping site for n° 42. In addition, in many cases of bad results, maintenance was unsatisfactory: traps torn or overgrown by the vegetation, capture bags full or burst. An ethological resistance of the fly to

Table 2 Results obtained at the end of control trials in the villages of Madingou area

N'	Villages a	Number of traps	Initial ADT b	Reduction rate c	Number of Tsetse counted d
22	Biyoki	37	29,5	98.6%*	12981
23	Dakar	30	51,1	95,4%*	22114
14	Douala-Iba	11	1,2	91,2%(*)	792
25	Kibounda*	31	19,4	96,9%*	5201
26	Kihoungou*	21	3,1	100,0%*	396
27	Kikimou	15	9,2	98,4%(*)	
28	Kimbaouka*	31	3,4	100,0%*	1550
29	Kimpambou-Kayes	50	17,4	97,2%(*)	22992
30	Kingembo*	15	16,5	88,5%(*)	2863
31	Kindiadi	30	4,2	88m5%(*)	2863
32	Kingoma	30	4,3	79,9%(*)	1803
33	Kinsende	24	5,7	99,1%*	937
34	Kinsimba	30	–	–	?
35	Kintamba*	27	2,3	100,0%**	242
36	Madingou 1	60	1,3	54,4%(*)	
37	Madingou 2	50	1,4	87,8%(*)	
38	Madingou 3	50	3,4	97.0%(*)	2050
39	Nkieni*	3	0,5	100,0%**	25
40	Mbehelo*	19	3,4	98,5%*	504
41	Mbinda	25	7,5	84,2%(*)	7314
42	Mboma	10	3,0	96,3%*	3286
43	Mbouki	40	22,6	84,2%(*)	16985
44	Micola	20	10,5	93,2%*	1942
45	Moussenengue*	49	13,4	92,6%**	10333
46	Moukokotadi	66	–	–(*)	298
47	Mpalou II	5	17,1	94,1%*	7204
48	Mpalou I	20	19,6	72,2%(*)	6840
49	Nganda	20	10,3	89,9%(*)	3697
50	Ngoma-Bitodi	15	2,1	98,7%(*)	2141
51	Nkoyi	6	9,4	–(*)	527
52	Nsanga*	25	18,6	83,4%**	13241
53	Nsatoumeya	25	2,0	100,0%(*)	193
54	Nseke-Pembe	35	48,4	–(*)	1162
55	Nsoukou-Madingou*	8	10,3	93,6%(*)	2997
Total		933			185288

a) The villages in which the participation began after the beginning of the control trials are indicated with an asterisk
b) Apparent Density per Trap (no. *Glossina*/trap/day)
Percentage of the initial ADT of *Glossina palpalis*
(*) after less than one year of control
* after one year
*(*) after one and half years
** *after two years*
d) This number gives an underestimate of the real number of flies eliminated

Table 3 Average percentage decrease in *G. palpalis* populations according the control modalities:

	Number of villages	Average rate of Decrease	(standard deviation)
a	21	86,9%	(20,3)
b	30	97,0%	(4,1)
c	29	97,5%	(3,4)

a) Total supervision by rural communities from the beginning of trials
b) communities supervision after the beginning of control
c) Results obtained by the ORSTOM control team without participation of the villagers

trapping could be involved but this was not apparent during these trials. Table 3 compares the results obtained by the control team and by the villagers. The differences reflect the above-mentioned difficulties which are inherent to village participation. However the differences are insignificant enough to demonstrate that this technique of vector control can be undertaken with success by communities. In fact, the villagers recognized the tsetse flies perfectly well. In most cases they trapped in the correct place, and knew when to move the traps. When the flies had been eliminated from the village, the traps were often placed elsewhere, for example on cultivated land situated near the Niari river, in the reservoir of "wild" *G. palpalis.*

The problem of fly reinvasion and repopulation after the communities give up trapping will be examined in another study. It is interesting, however, to observe that there was a very slow increase in the populations of *G. palpalis.* Indeed, in all cases, after four months without trapping, the density was far from that observed initially.

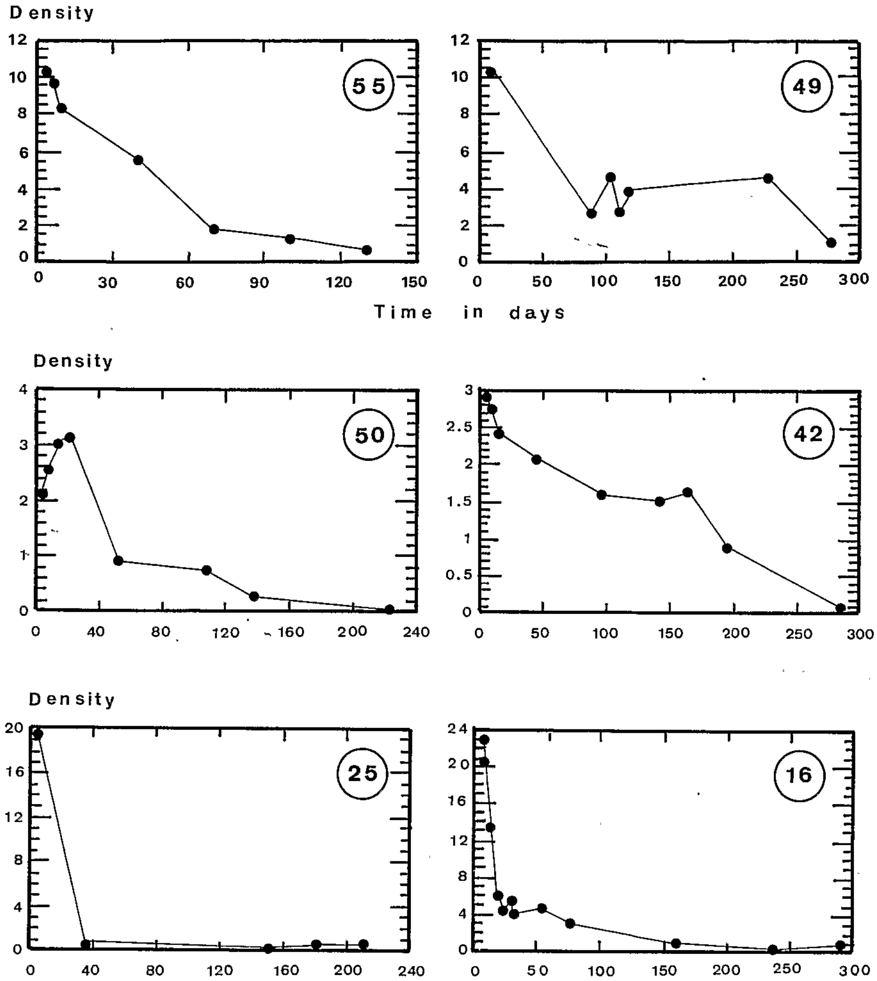

Fig. 2 Example of the main modes of trend in apparent density (mean no./trap/day) of *Glossina palpalis* during trapping. The circled number corresponds to the number of the village (see Tables 1 and 2).

Table 4 Trend in the positive seroprevalence rates at surveys conducted in 1983, 1984 and 1985, before vector control and in 1986–January 1987, after vector control

Date of survey	Number of subjects tested	positive	Prevalence %	(a)
1983	2436	58	2,38	(± 0,61)
1984	1028	41	3,99	(± 1,20)
1985	8219	221	2,69	(± 0,35)
1986–1987	7246	30	0,41	(± 0,15)

a: 95 % confidence interval

Serological surveys

The results of the routine screening surveys show a significant decrease in the prevalence in the trapping zone whereas the prevalence was stable in previous years (Table 4). Moreover, in a zone without tsetse control in the same focus (Loudima area, Table 5), simultaneously conducted surveys did not demonstrate a significant decrease. In the treated zone, only four cases of seroconversion were noted among 30 patients (13 %) whereas in the Loudima area there were four out of nine (44 %).

Population involvement

The participation of the population, estimated by the number of trap recordings by the local collectors and the duration of participation, was variable. The greater the num-

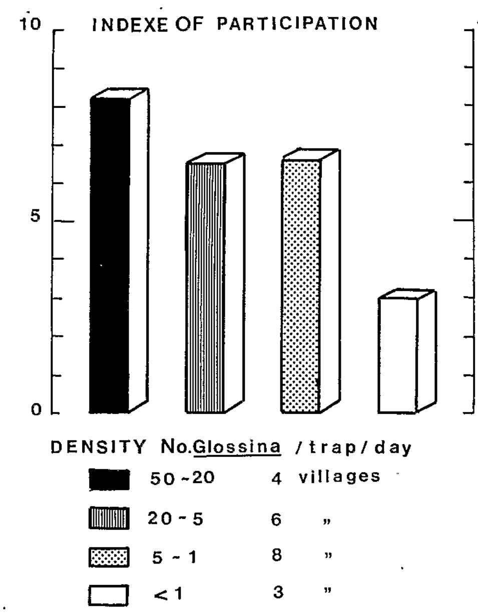

Fig. 3 Comparison of the average number of collections carried out by the villagers (taken as index of participation in trapping) according to the apparent density of *Glossina palpalis* at the beginning of trapping

Table 5 Trend in the positive seroprevalence rates at two surveys conducted in 1985 and 1987 in the area of Loudima, a zone used as a control

District	Dates of survey	Number of tested	Subject positive	Prevalence %	(a)
Loudima Pont	1985	652	5	0,77	(± 0,67)
	1987	475	3	0,63	(± 0,71)
Loudima Poste	1985	554	4	0,71	(± 0,71)
	1987	315	2	0,49	(± 0.88)
Louvila	1985	406	2	0,49	(± 0,68)
	1987	238	1	0,42	(± 0,82)
Moukondo	1985	745	12	1,61	(± 0,90)
	1987	519	2	0,39	(± 0,53)
Passipe	1985	148	4	2,70	(± 2,62)
	1987	96	1	1,04	(± 2,03)
Total	1985	2505	27	1,08	(± 0,40)
	1987	1643	9	0,55	(± 0,36)

a: 95 % confidence interval

ber of bites (related to the size of the tsetse population) the more active the participation (Fig. 3). The participation decreased markedly with the scarcity of the flies. The relationship between the tsetse challenge and the participation poses a problem for any long term action. On the other hand, there is no relationship between the prevalence of the disease in the villages and the participation.

In ten villages, the entire deployment of traps was regularly surveyed and flies counted monthly for nine months to two years. In ten other villages no traps were harvested. The average number of tsetse collections was 6.3 over an average period of 216 days. At the end of the study, participation of the villagers had ceased in 41 villages, but in certain villages the trial continued without interruption. This showed that well-maintained traps could last over two years.

The success of the participation depends on several complex factors. The preliminary approach revealed the importance of the social aspects. Acculturation and the loss of traditional values, the presence of young unemployed people are unfavorable factors. Near large towns and in urban districts the participation was a failure. In the Mouananto district of Nkayi (n° 18) traps were even destroyed or stolen.

Cost

A kit costs less than 1000 CFA francs (3$ US) and a trap about 9 $ US. A total of 1263 traps (an average of 23 per village) were placed. About 200 spare traps per year were available. The trapping material for this control campaign involving 25,000 inhabitants thus costs about 17,400 $ US over three years.

Discussion

Without a specific longitudinal study it is difficult to assess the true impact of trapping on the level of sleeping sickness transmission. However, the compilation of data from the routine serological surveys indicates a decrease in the average prevalence rate after tsetse control. In support of this, most of the detected cases come from the zone of Kayes where the tsetse had been only partially eliminated because the villagers had not continued the control in Mouananto (n° 18) and Dakar (n° 3). Furthermore, a serological and parasitological study of sentinel domestic animals showed that animal trypanosomiasis transmission had been interrupted in both villages followed up for this purpose (n° 4 and 9) where tsetse were drastically reduced as shown by the ADT of nearly zero (Gouteux et al., 1988).

These results which must be confirmed by further trials, indicate that the transmission is mainly peridomestic in the "Niari river" focus, as shown in studies by Frezil et al. (1980). Although there are some exceptions, "wild" *G. palpalis*, rarely in contact with men, play a minor role in this focus (Gouteux, unpublished data).

This method of control requires some improvements. The maintenance of the traps is the key to success. An abandoned trap gradually loses its efficacy with time, the net tears, the capture bag full of insects becomes less effective, it becomes gradually overgrown with vegetation and finally disappears in the bush. The activities of clearing the vegetation, maintenance, repairs, can be easily undertaken by the communities but in practice various difficulties arise including requests for financial compensation, hidden fears etc. or simply the lack of perseverance. One solution could be a mixed strategy based on village participation in favorable cases, i.e. small monoclan or monoethnic villages with little acculturation (G. Boungou, personal communication, 1987) and the setting up of a national or local control team to follow-up the trapping in urban zones and large villages where ethnic groups are mixed and certain altruistic traditions have been lost (a disadvantage of modern life). The destruction of the traps by youths might be due to our refusal of their request for payment or because for some villagers the tsetse trapping is considered as involving witchcraft. In general, community action could be improved by a better understanding of psycho-sociological mechanisms and more research in this way should be useful. Good results will only be achieved if medical team workers, faced with other cultures and other ways of thinking, provide incentives to get the trap accepted and, more important, adopted by villagers (Leygues and Gouteux, 1988).

The health committees constitute the basic health infrastructure which was set up in the Congo by decree on 21st March 1985. Their involvement in this project, however, has often been disappointing. In order to be more effective the health Committee should be implanted in the villages to a greater extent and should represent the true wishes of the community. The support of motivated and active social groups (teachers, religious representatives, sects and mystical associations) should also be envisaged, especially in urban areas.

Conclusions

Trapping had great popular success in the whole of the Bouenza region, even reaching certain villages of the Pool region around Brazzaville. Villagers everywhere requested tsetse control traps and the local political authorities emphasized these requests. However, it was financially impossible for ORSTOM and the National Control Programme to extend the control zone. This situation is thus an incentive to generalize this method.

The original perception of the participants was too often totally ignored by the health authorities. The current recrudescence of trypanosomiasis is the result of the impossiblity of using the drastic (but effective) methods of the colonial days. Now, we dispose of an alternative method for vectorial control, but to obtain the maximum results, it is necessary to study more thoroughly the sociocultural implication of tsetse trapping.

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References

Adam, J. P., A. Challier, F. Le Pont: Etude de la transmission de la maladie du sommeil dans le foyer résurgent de Loudima. Organisation d'une campagne de lutte contre les glossines. rap. multigr. ORSTOM Brazzaville (1969) 1–22

Adam, J. P., F. Le Pont: Contrôle entomologique des résultats des campagnes antiglossines à Loudima. Rap. multigr. ORSTOM Brazzaville (1971) 1–12

Anonymous: Lutte contre la maladie du sommeil due à *Trypanosoma brucei gambiense.* Consultation PNUD / Banque Mondiale / OMS. Bull. Wld. Hlth. Org. 61 (1983) 35–40

Challier, A., M. Eyraud, A. Lafaye, C. Laveissière: Amélioration du rendement du piège biconique pour glossine (Diptera, Glossinidae) par l'emploi d'un cône inférieur bleu. Cah. ORSTOM sér. Ent. Méd. Parasit. 15 (1977) 283–286

Duteurtre, J. P., J. P. Gouteux: Les stratégies de lutte antisommeilleuse en République Populaire du Congo. Recherches et Perspectives. Med. trop. 46 (1986) 375–380

Frezil, J. L.: La trypanosomiase humaine en République Populaire du Congo. Trav. Doc. ORSTOM N° 155, Paris (1983) pp. 45–50

Frezil, J. L., J. Carrié, F. Rio: Application et valeur de la technique d'immunofluorescence indirecte au dépistage et à *Trypanosoma gambiense.* Cah. ORSTOM sér. Ent. Méd. Parasit. 12 (1974) 111–126

Frezil, J. L., J. P. Eouzan, J. C. Alary, J. R. Malonga, P. Y. Ginoux: Epidémiologie de la trypanosomiase humaine en République Populaire du Congo. II Le foyer du Niari. Cah. ORSTOM sér. Ent. Méd. Parasit. 18 (1980) 229–246

Gouteux, J. P., P. Bansimba, N. Bissadidi, F. Noireau: La prise en charge de la lutte contre les tsétsé par les communautés rurales: premiers essais dans cinq villages congolais. Ann. Soc. Belge. Méd. trop. 67 (1987) 37–39

Gouteux, J. P., J. Lancien: Le piège pyramidal à tsétsé (Diptera: Glossinidae) pour la capture et la lutte. Essais comparatif et description de nouveaux systèmes de capture. Trop. Med. Parasit. 37 (1986) 61–66

Gouteux, J. P., J. Lancien, F. Noireau, D. Sinda: Lutte antivectorielle par piégeage et impact sur la transmission de la maladie du sommeil dans une zone à forte densité de *Glossina fuscipes quanzensis* (rivière Léfini, République Populaire du Congo). Trop. Med. Parasit. 37 (1986a) 101–104

Gouteux, J. P., F. Noireau: Un nouvel écran-piège pour la lutte antitsétsé. Ent. exp. applic. 41 (1986) 291–297

Gouteux, J. P., F. Noireau, D. Sinda, J. L. Frezil: Essais du piège pyramidal contre *Glossina palpalis palpalis* (Rob.-Des.) dans le foyer du Niari (Région de la Bouenza, République Populaire du Congo). Cah. ORSTOM sér. Ent. Méd. Parasit. 23 (1986b) 181–190

Gouteux, J. P., D. Sinda: Recherches opérationelles sur la lutte par piégeage contre les glossines vectrices de trypanosomiase humaine en République Populaire du Congo. Bilan des essais de lutte dans 55 villages. Rap. multigr. ORSTOM Brazzaville (1987) 1–33

Gouteux, J. P., D. Sinda: L'utilisation d'animaux sentinelles dans l'évaluation de la lutte contre les vecteurs de la maladie du sommeil. Premiers résultats dans un foyer congolais. Acta trop. 45 (1988) 331–338

Lancien, J.: Description du piège monoconique utilisé pour l'élimination des glossines en République Populaire du Congo. Cah. ORSTOM sér. Ent. Méd. Parasit 19 (1981) 235–238

Lancien, J., J. P. Eouzan, J. L. Frezil: Elimination des glossines par piégeage dans deux foyers de trypanosomiase en République Populaire du Congo. Cah. ORSTOM sér. Ent. Méd. Parasit. 19 (1981) 239–246

Leygues, M., J. P. Gouteux: La lutte communautaire contre une endémie tropicale: Croyances surnaturelles et piéges à tsétsé au Congo. Soc. Sci. Med. 28 (1989) 1255–1267

Martin, G., E. Roubaud, G. Leboeuf: Rapport de la mission d'étude de la Maladie du Sommeil au Congo français 1906–1908. Paris, Masson & Cie (1909) 50–97

Molyneux, D. H.: Selective primary Health Care: Strategies for control of disease in the developing world. VIII: African trypanosomiasis. Rev. infec. Dis. 5 (1983) 945–956

Noireau, F., J. L. Lemesre, M. Y. Nzoukoudi, M. T. Louembet, J. P. Gouteux, J. L. Frezil: Serodiagnosis of sleeping sickness in the Republic of the Congo: Comparison of indirect immunofluorescent antibody test and card agglutination test. Trans. R. Soc. Trop. Med. Hyg. 82 (1988) 237–240

World Health Organization: La trypanosomiase africaine: épidémiologie et lutte. Report of a WHO Expert Committee. Wld. Hlth. Org. Techn. Report Ser. n° 739, Geneva (1986)

World Health Organization: Lutte antivectorielle intégrée: Septième rapport du Comité OMS d'experts de la biologie des vecteurs et de la lutte antivectorielle. Report of a WHO expert Committee. Wld. Hlth. Org. Techn. Report ser. n° 688, Geneva (1983)

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