The large-scale control of *Glossina palpalis* s.l., *G. fusca fusca*, *G. medicorum* and *G. longipalpis* in the southern guinean zone of the Ivory Coast by deltamethrin impregnated biconical traps

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Summary

Deltamethrin impregnated biconical traps (400 mg active ingredient per trap) positioned 300 m apart gave overall population reductions of 96.6, 66.7 and 34.6 % for the three tsetse species or species group along 82 km of gallery forest. G. palpalis *s.l. was more affected than the other species and breeding was interrupted for about two months. Initial decrease of mean population ages was followed by gradual recovery but less marked so for* G. palpalis s.l.

The irregular behaviour of the G. longipalpis *population can most likely be attributed to fly movements due to climatic changes or perhaps host migrations.* Fusca *group flies are less controlled too perhaps because of their different activity pattern.*

Bioassay and chemical analysis of Deltamethrin impregnated tissue bands indicate persistence of the insecticide for at least four months with a final fly mortality of still over 80 %.

The method described here has potential for disease control and may still be cheapened by further widening the trap spacing.

Key words : Tsetse flies — Impregnated traps — Animal trypanosomiasis — Control — Ivory Coast.

Résumé

LUTTE À GRANDE ÉCHELLE CONTRE *Glossina palpalis* S.L. *G. fusca fusca, G. medicorum* ET *G. longipalpis* À L'AIDE DE PIÈGES BICONIQUES IMPRÉGNÉS DE DELTAMÉTHRINE DANS LA ZONE SUD- GUINÉENNE DE LA CÔTE D'IVOIRE. *Des pièges biconiques imprégnés de deltaméthrine à la dose de 400 mg de matière active par piège, posés tous les 300 mètres dans une galerie forestière ont réduit les populations de* Glossina palpalis *s. l.,* G. *groupe* fusca *et* G. longipalpis, *respectivement de 96,6, 66,7 et 34,6 %.*

La longueur de la galerie traitée était de 82 km. L'effet du traitement a été plus marqué pour G. palpalis *s.l. que pour les autres espèces et la reproduction a été interrompue pendant deux mois environ. La baisse initiale d'âge moyen des populations a été suivie par un rééquilibrage progressif, cependant moins marqué pour* G. palpalis, *l'espèce la plus touchée.*

L'irrégularité du comportement de G. longipalpis *peut probablement être provoquée, soit par les changements climatiques, soit par les mouvements des hôtes nourriciers. Le groupe* fusca *a été moins affecté peut-être à cause de son activité crépusculaire.*

La dégradation de la deltaméthrine, évaluée par chromatographie en phase gazeuse, a révélé une persistance d'au moins quatre mois avec un taux de mortalité des glossines de 80 %.

La méthode décrite ici est efficace pour le contrôle des trypanosomoses animales. Cependant, pour des raisons économiques, il serait souhaitable de tester une augmentation des intervalles entre les pièges.

Mots-clés : Glossines — Pièges imprégnés — Trypanosomoses animales — Lutte — Côte d'Ivoire.

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Introduction

Renewed interest in insecticide impregnated traps for tsetse control (Laveissière, 1979b ; Laveissière et Couret, 1981 ; Gouteux *et al.*, 1981 ; Lancien *et al.*, 1981 ; Cuisance et Politzar, 1983 ; Küpper *et al.*, 1982) has been mainly with reference to human trypanosomiasis. Thus closely spaced traps have been employed to reduce tsetse populations at sites of disease transmission.

Control of animal trypanosomiasis will necessitate larger areas to be treated. The present trial covered 82 km of gallery forest with trap spacing of 300 m, in order to assess the potential of the method for animal trypanosomiasis control.

Description of the area

The gallery forest is along the river Kohouvra at the Marahoue Ranch (8°19′-N-6°29′ W) in the southern guinean zone of the Ivory Coast (fig. 1). It consisted mainly of the following tree and shrub species :

Carapa procera, Berlinia grandiflora, Cola laurifolia, Cola cordifolia, Phoenix reclinata, Raphia sudanica, Diospyros mespiliformis, Bombax costatum, Pterocarpus erinaceus, Landolphia heudelotii, Cassia spp., *Mimosa picra, Saba senegalensis* and *Syzygium guineense,* whereas *Uapaca togoensis, Parinari* spp., *Lophira lanceolata, Gardenia* sp., *Isoberlinia doka, Anogeissus leiocarpus, Ficus capensis, Afzelia africana, Parkia biglobosa, Terminalia* spp., *Pilios-*

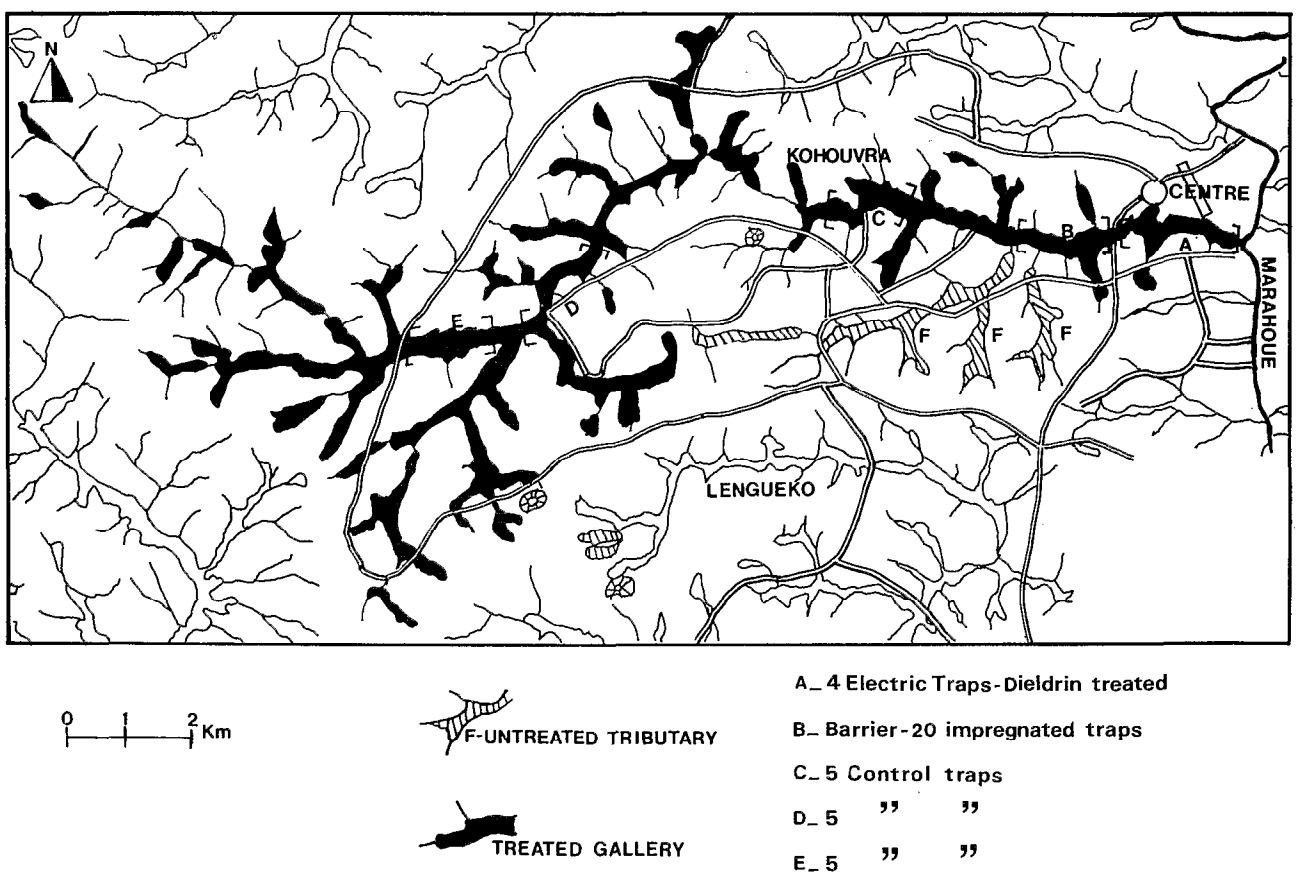

FIG. 1. — Map of Kohouvra River-Marahoue Ranch.

tigma thonningii, Daniellia oliveri and *Combretum* spp. dominate the surrounding savanna.

Tragelaphus scriptus, Cephalophus rufilatus, Kobus defassa, Kobus kob, Phacochoerus aethiopicus and some rare *Hylochoerus meinertzhageni* are the most often observed wildlife species together with the following monkeys : Colobidae, *Erythrocebus patas, Papio anubis* and *Cercopithecus aethiops*.

The climate between November and February is dominated by the harmattan with rather cold nights and dry-hot days. Occasional local rainfalls in mid-March are followed by widely spaced short rains in April signalling the onset of the rainy season from July to October. Thc annual rainfall mean is approximately 1 300 mm.

Human activities in the Kohouvra area are restricted to night-hunting, cattle trekking to a nearby dip and pastural activities along the gallery forest.

Material and methods

The gallery was treated with impregnated biconical traps between 5th January and 6th July 1982 (fig. 1).

250 traps (Laveissière, 1979a) were impregnated at 400 mg a.i. per trap, by soaking 50 of them in a metal tray (1 × 1 × 0,4 m) containing 1,67 l of deltamethrin (1,2 % e.c.) in 23,33 l of water. Each trap has a cloth surface of approximately 4 m^2 wich corresponds to 100 mg a.i. per m^2 tissue. All the traps were reimpregnated early March using the same technique and quantity of insecticide. The distance between the traps was 300 m. A 5 km chemical barrier was sprayed with 4 % dieldrin e.c. using Gloria 142 T knapsack sprayers and Stihl SG 17 mistblowers (A in fig. 1). Another 20 impregnated traps were placed at 100 m intervals to act as an additional barrier (B in fig. 1). Trap placement and barrier spraying required six days with an additional monthly effort to clear vegetation growth around the traps.

Apparent density (ADT = number of tsetse per trap and day) was recorded, beginning one month before the treatment using 15 traps, always in the same location on three 48 hrs — occasions (cages emptied daily) and every second week after the traps

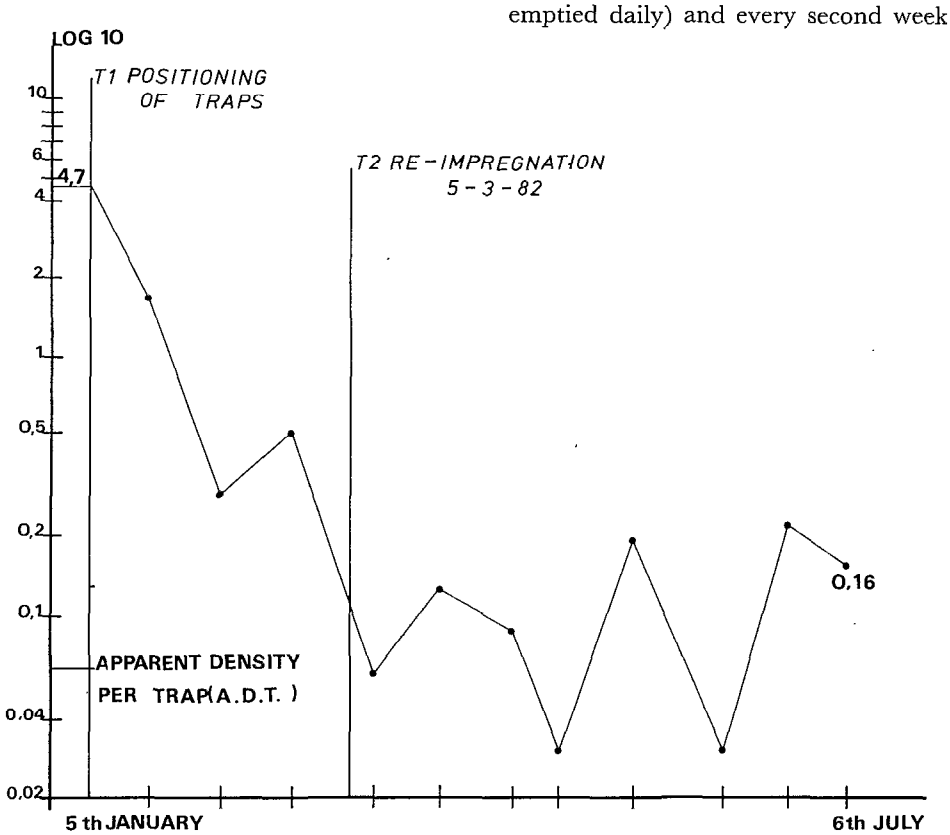

FIG. 2. — *G. palpalis* : Evolution of the fly density under the influence of impregnated traps (1982).

TABLE I

Numerical comparison of flies caught before (9.12-20.12.81) and after (5.1.-6.7.82) the treatment (15 traps per day)

	G.palpalis			Group fusca			G.longipalpis		
Before T	♂	♀	ADT	♂	♀	ADT	♂	♀	ADT
	31	22	3,5	10	6	1,1	3	3	0,15
	38	58	6,4	20	35	3,7	7	4	0,7
	39	55	6,3	10	21	2,1	10	5	0,1
	26	48	4,9	11	17	1,9	5	8	0,9
	28	43	4,7	3	15	1,2	4	8	0,8
	19	19	2,5	13	17	2,0	5	2	0,5
TOTAL	181	245	4,7	67	111	2,0	34	30	0,7
After T									
	7	16	1,52	7	13	1,32	3	5	0,53
	6	17	1,53	27	49	5,06	13	11	1,59
	2	2	0,26	9	12	1,40	0	2	0,13
	1	4	0,34	15	14	1,93	5	11	1,06
	5	3	0,53	8	10	1,20	6	3	0,60
	4	4	0,53	6	6	0,80	0	0	0,00
	0	0	0,00	2	11	0,86	1	0	0,06
	0	2	0,13	5	5	0,66	0	0	0,00
	1	0	0,06	11	26	2,46	0	2	0,13
	3	0	0,20	4	6	0,66	2	3	0,33
	2	0	0,13	2	8	0,66	2	3	0,33
	1	0	0,06	6	7	0,86	1	1	0,12
	0	1	0,06	2	10	0,80	1	4	0,33
	0	0	0,00	1	5	0,40	1	2	0,20
	1	2	0,20	1	5	0,40	6	7	0,90
	2	1	0,20	0	5	0,33	11	12	1,53
	0	0	0,00	3	7	0,66	0	1	0,06
	0	1	0,06	5	12	1,13	0	3	0,20
	1	0	0,06	3	4	0,46	1	5	0,40
	3	3	0,40	1	6	0,46	4	3	0,46
	2	0	0,13	5	8	0,86	4	5	0,59
	3	0	0,20	4	9	0,86	5	0	0,33
TOTAL	44	56		127	239		66	83	

were in position also over 48 hrs with cages emptied daily (table I). The mean ADT (for the 48 hrs-catch) was established and used to calculate regressions.

Table I gives a numerical comparison of the daily catches with 15 traps before and during the treatment.

The trap impact on the *G. longipalpis* population was monitored too but as no clear pattern emerged only figures are presented in table I and figure 4.

The ADT in the chemical barrier was recorded by four automatic traps (Ryan *et al.*, 1981a) modified to replace the electrical killing unit by a chemical one, with dead flies examined for species, sex and wing fray age (Jackson, 1946). Because of the lack of a dissecting microscope the physiological age technique could not be employed.

Population reduction of each species in the treated area was calculated using the mean ADT during December and the respective ADT of each control period and can be compared with the population evolution of the Kohouvra fly round and the Marahoue Ranch in 1981 (fig. 5).

Small pieces of impregnated tissue bands (100 mg a.i. per m^2 and corresponding to the trap-dosage) were analysed by gas chromatography and the mortality of *fusca* group flies studied 24 hours after 1 minute forced contact with the tissue, to investigate the persistence and toxicity of deltamethrin.

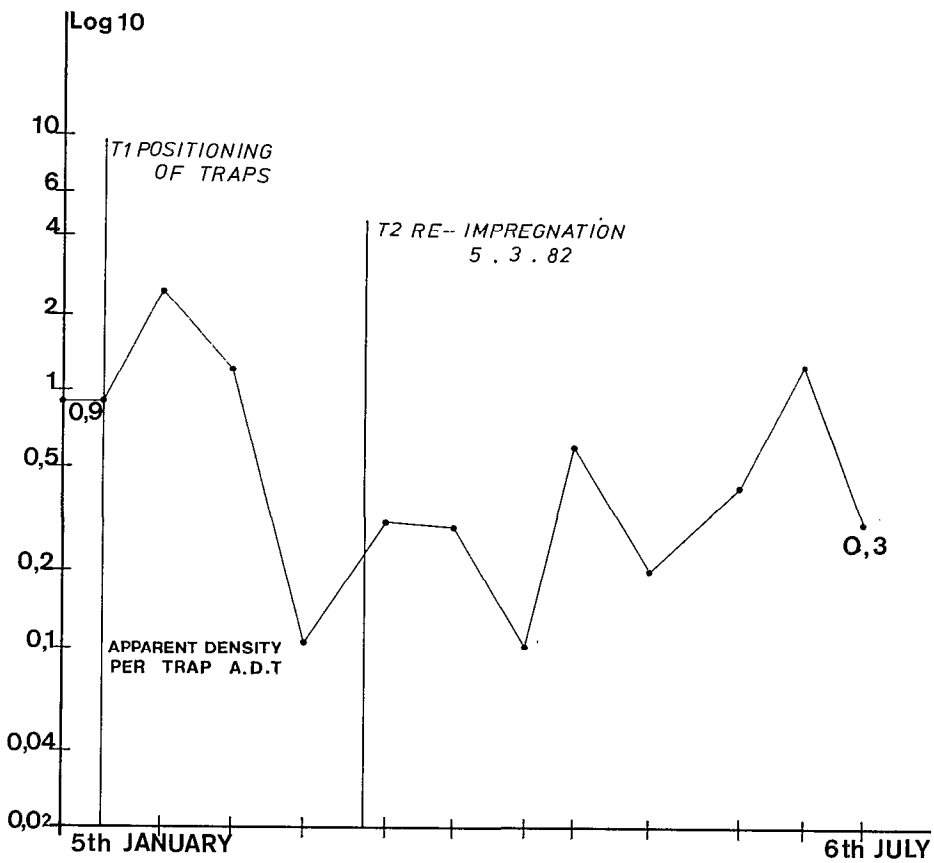

FIG. 3. — *G. fusca* group : Evolution of the fly density under the influence of impregnated traps (1982).

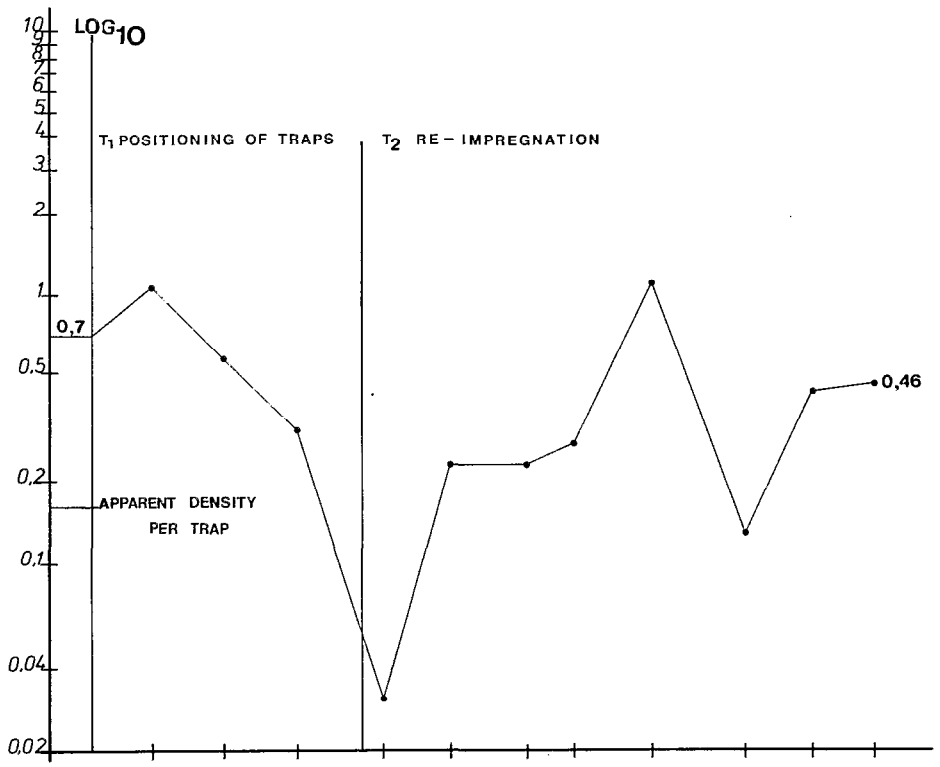

FIG. 4. — *G. longipalpis* : Evolution of the fly density under the influence of impregnated traps (1982).

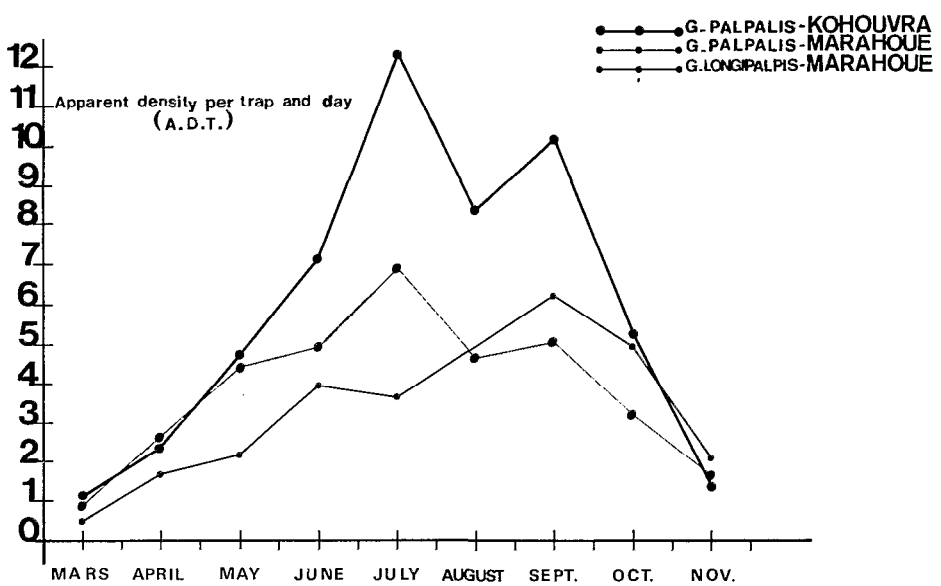

FIG. 5. — Evolution of the population of *G. palpalis* s.l. (1981).

Results

Figures 2, 3 and 4 show the overall reductions of *G. palpalis* s.l., *fusca* group flies and *G. longipalpis* by 96,6, 66,7 and 34,6 % respectively. *Fusca* group flies represent *G. fusca* and *G. medicorum* in the ratio of 1 : 9.

In all the cases the populations were severely affected during the first two months and recovered gradually until the end of the experiment.

Figure 6 shows the bioassay and chemical assay of deltamethrin degradation and supports other workers suggestions (Gouteux *et al.*, 1979 ; Barlow *et al.*, 1977) that 100 mg a.i./m² might still give 100 % mortality after six months (with assumed residue values of as little as 0,4 mg/m²), although in our own expriment the observed mortality was reduced to about 80 % in the course of four months.

Mean age, as shown by WF, of the populations was 1,0, 1,2 and 1,7 for the three species or species group in the chemical barrier and represented for *G. palpalis* only newly emerged flies. Within the treated area mean age were 1,9, 2,0 and 2,0 respectively for the whole observation period.

Out of 42 windfray examined *G. palpalis* from the trap treated area, 27 were in category 1, three in 2, five in 3, two in 4 and one in 5. All age categories higher than 1 were found in flies caught during the last three and a half months of experiment, indicating that reproduction must have practically ceased during the first two months. For *fusca* group flies and *G. longipalpis* no such clear pattern can be recognised, old and young flies being caught throughout the observation period.

The male proportion of all species is more affected by residual treatment than by impregnated traps. The sex ratios (♂/♀) are 0,51, 0,29 and 0,39 in area A (dieldrin treated) and 0,79, 0,53 and 0,80 in the trap treated area (D in fig. 1). Laveissière (1981) too has shown that impregnated traps affect the female population of *G. palpalis* more than the male population and older flies more than young ones. However trap bias means this conclusion must be treated with caution.

Discussion

The 300 m trap spacing used in this experiment is effective for *G. palpalis* s.l. with a linear fly distri-

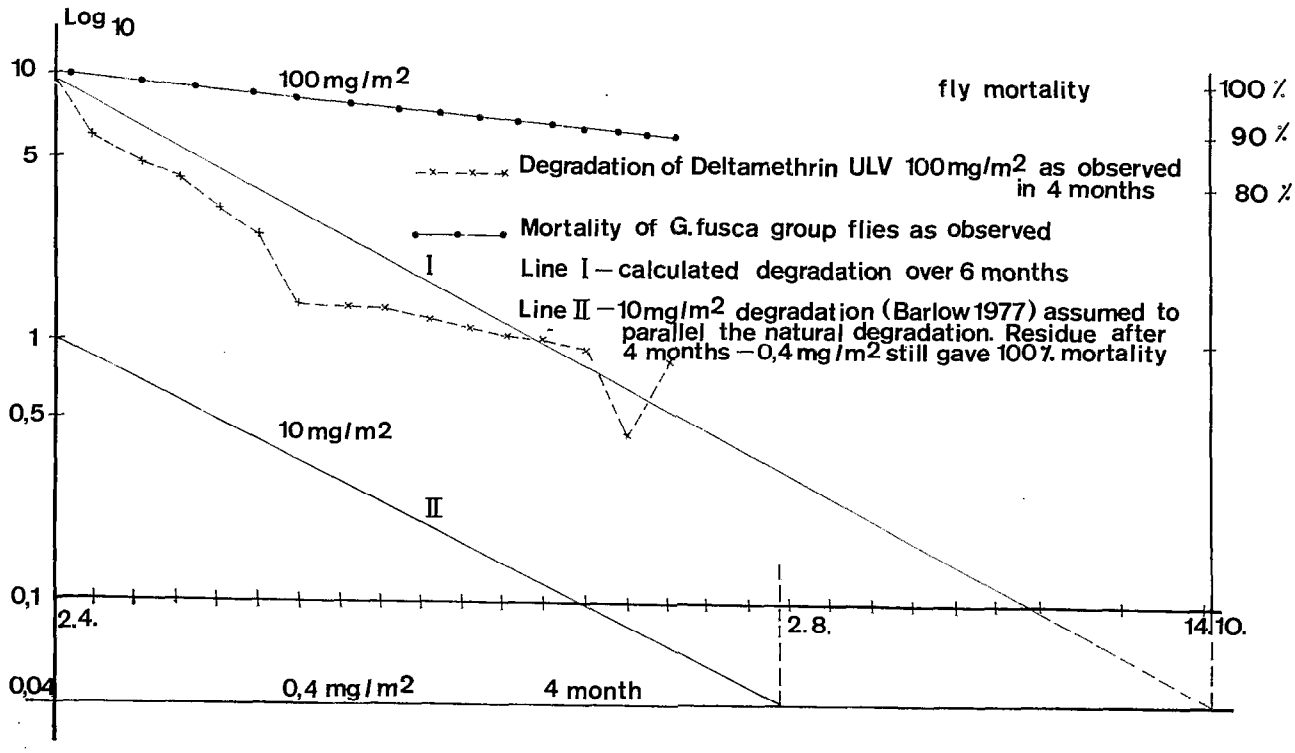

FIG. 6. — The persistence of deltamethrin.

bution. Although less so for the *fusca* group and *G. longipalpis* the impact on all species is marked and gave, at least for *G. palpalis*, a cessation of breeding for two months which is probably sufficient to break disease transmission by this fly (Ryan *et al.*, 1981b, 1982). The lesser reduction, numerically and age-wise, for the *fusca* group flies is probably due to its different activity pattern. The same applies to *G. longipalpis* which is essentially a savanna species, only seeking shelter in the gallery during very harsh climatic situations and therefore impossible to control by this method alone.

The most obvious explanation for the partial recovery of the population is invasion of the gallery forest from the peripheral forests and the untreated tributary (F in fig. 1). This invasion coincides with the onset of the hot dry season from April to June, which forces flies in less protected habitats to seek shelter in more favourable places. It is therefore likely, that flies will have moved to the gallery of the treated area, thus masking the true impact of the impregnated traps on the resident tsetse population.

These encouraging results may be compounded by further trials to study wider spacing of traps, treatment of fringing forest and savanna, the effects on disease transmission and thus the economic cost/benefit justification for such interventions.

It must not be forgotten that this type of control is only possible in the dry season. Initial studies (unpublished) show a potential population recovery of up to 30 % during the wet season.

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