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A MODIFIED DESIGN OF BED-TRAP FOR SAMPLING MALARIA VECTORS

by

N. A. Aslam
(formerly) Malaria Unit, Ministry of Health
Kaduna, Northern Nigeria[1]

The Mass Malaria Control Campaign has been running in Western Sokoto since 1954 and as a consequence the vector population has gone down appreciably. More efficient techniques are, therefore, essential to assess the biting density of the vectors in such an area in order to assess the entomological impact in relation to the aim of malaria eradication in this area, in the presence of an efficient vector like Anopheles gambiae.

The investigation described below was intended to measure indoor and outdoor biting by the anophelines, and to compare the efficiency of two types of bed-traps.

Methods

Tungan Buzu, a swamp village on the border of the DDT-sprayed area, was selected because it had a comparatively high vector population. Two unoccupied, unsprayed guest-huts were selected as bedrooms for the experiment. One was towards the swamp (Site No. I) and the other away from it (Site No. II).

The "old type" of bed-trap used in this experiment is that briefly described by Service (1963). The bait sleeps on a mattress at ground level, under a single mosquito-net which is rolled and pinned on one side so as to form an entry-slit 35-40 cm long and up to 8 cm wide. As the slit is at the same level as the bait,

[1] Present address Natural History Museum, South Kensington, London, United Kingdom.

this trap differs materially from the type figured in World Health Organization (1963), where the sleeper lies on a raised bed while the entrance (and escape-route) of the trap is at a lower level, consisting of a gap 15-30 cm wide between the edges of the net and the ground. The writer has not had an opportunity to compare the efficiency of the latter type of trap with the modified design described below.

The modified type, used by the author, is a single mosquito-net of the same size as the old one, but a slit, two feet (60 cm) long and one inch (2.4 cm) wide, is cut on both sides of the net at the middle one foot nine inches (53 cm) below the top of the net. The slit is supported by a rectangular wire frame of the same size and is tied across at six inch (15 cm) intervals, to prevent the gap increasing when the net is pulled. A string is tied on either side of the slit inside the net. The occupant, after tucking the net under his bed (on a rectangular six inch (15 cm) high stretcher), ties the opposite strings together, thereby pulling the slits inwards and giving a lead to the attracted mosquitos to enter (see Fig. 1).

The traps were numbered 1 and 2 (modified type) and 3 and 4 (standard type). The men were designated as A, B, C and D, each being allotted one trap for the whole series, and the capture-stations were marked as No. I and No. II as already mentioned. Bias was minimized by daily intercharge of the men, along with their traps, giving the following arrangement:-

Day	Site No. I		Site No. II	
	In	Out	In	Out
First	1A	2B	3C	4D
Second	2B	1A	4D	3C
Third	3C	4D	1A	2B
Fourth	4D	3C	2B	1A

The rotation was completed in four days and was repeated three times. The nets were erected at 19.00 hours and the collection done at 6.00 hours next morning. The outdoor results were rejected when disturbed by rain, along with the corresponding indoor ones.

It was not practicable in this experiment to eliminate the effects of differences in personal attractiveness of the four baits, by arranging for interchange of the traps among them. The results below are subject to reserve on account of this factor.

Results

In Table 1 are shown the actual catches of four prevalent Anopheles species on 12 nights of trapping with each type of bed-trap. Each figure in the body of the table represents the catch in one trap (either at Site I or Site II), and the totals at the foot are divided by 12 to give the average catch per trap-night. Taking the four species together it will be seen that the over-all catch in the modified bed-traps was 312 specimens indoors and 416 outdoors, whereas the old bed-traps caught 135 indoors and 280 outdoors. This strongly indicates that the modified bed-trap was more efficient in both situations than the old design.

The total catches of the four species are also shown on the histogram (Fig. 2) by type of bed-trap and situation of capture (indoors or outdoors). Some of the differences between the four total catches relating to each species are of doubtful statistical significance owing to the rather wide variance in mosquito activity from night to night. Nevertheless, as is clear from a study of Fig. 2 the new type of bed-trap caught substantially larger numbers than the old type in the cases of A. gambiae (indoors and outdoors), A. wellcomei (indoors and outdoors), and A. pharoensis (indoors). The catches of A. nili were too small to signify.

It will be noted (Table 1) that the indoor catches of A. gambiae (the most prevalent species) were larger in the modified trap on all 12 nights, and the outdoor catches were larger in that trap on 9/12 nights.

The reason for the lower efficiency of the old type of bed-trap is thought to be that it has the entrance at the same level as the sleeping bait; consequently there is a good chance of an escape of some mosquitos after biting. That chance is

much reduced in the modified trap. This interpretation is borne out by the fact that the differences in numbers caught by the two types of trap were on the whole greater indoors than outdoors: in the outdoors situation the blood-fed mosquitos may tend to fly upwards in response to the light from the sky, which would reduce the probability of their leaving the trap through a slit at the same level as the bait.

The results further show that the average attractiveness of man to the mosquitos was similar indoors and outdoors for A. gambiae, A. pharoensis and A. nili. A. wellcomei was the only species of the four in which a strong exophagic tendency was revealed in this experiment. However, the relative catches indoors and outdoors under these artifical conditions should not be taken to reflect the indoor and outdoor components of natural contact between the mosquitos and man, having regard to the sleeping habits of the people (Dodge, 1965; Garrett-Jones, 1964).

The free entry into the traps indoors by the prevalent species of Anopheles is in contrast to the results of Service (1963) and other observers in West Africa.[1] This may have been due partly to the fact that both doors of the guest-huts were left open during the trapping. There was no person in the huts other than the bait, and fires were not permitted. Normal living huts are usually occupied by more than one person sleeping, and have a fire burning during the night. The door is frequently kept closed. However, the observations were of too short duration to allow further investigation of these influences.

A. coustani, A. squamosus, A. rufipes and A. flavicosta were caught in numbers too small to interpret.

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[1] Other workers have used a variety of bed-net traps with varying success in sampling Anopheles out-of-doors. Some very careful comparative work in Upper Volta (Hamon, J. (1964) Bull. Soc. Path. exot., 57, 576) showed that direct capture on collector-baits out-of-doors collected substantially larger samples of most species than did bed-traps, even when the traps were cleared of mosquitos every hour. The chief exceptions were A. gambiae, equal samples of which were collected by each method, and A. pharoensis which was sampled more readily in the trap. The trap used in this work measured about 3 x 2 metres and had vertical entry-slits at the angles of one end of the net. (Editor's remark)

In conclusion it can be said with some confidence that the new type of bed-trap was more efficient than the old one under the conditions of the test. It has the additional advantage that the adjustment of the width of the entry-slits is not left to the judgement of the operator.

Summary

A modified bed-trap is described, and its efficiency as compared with the old type is assessed in Tungan Buzu, a DDT-sprayed village in Western Sokoto, North Nigeria.

A. gambiae was found to be attracted in equal numbers to human baits in a sprayed village, whether stationed outdoors or in an unsprayed hut.

Biting by A. pharoensis, A. wellcomei and A. nili is also discussed. The modified trap was found to be more efficient than the old one, especially for indoor use.

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TABLE 1. INDOOR AND OUTDOOR CATCHES OF ANOPHELINES IN OLD AND MODIFIED TYPES OF BED-TRAP

Replicate	Date of collection	Numbers caught indoors								Numbers caught outdoors							
		New trap				Old trap				New trap				Old trap			
		gam	ph	ni	wel	gam	ph	ni	wel	gam	ph	ni	wel	gam	ph	ni	wel
1	20.9.63	9	5	2	1	4				6	4	3	8	3		2	2
	23.9.63	13	1			3	3			5	12	1		17	25	1	10
	24.9.63	8			4	5			2	5	5	1	2	5	6		1
	25.9.63	7	14			4	2			34	1		5	5	6	2	10
2	26.9.63	12	6	1	3	4	6			7	9	1		3	8	2	2
	28.9.63	8	5	3	2	4	7			22	9	2	5	6		2	
	3.10.63	5	1			2	1	2	2	2	2	3		7	14	4	36
	4.10.63	50	9	1	28	2	2	1	2	7				6	2		2
3	5.10.63	11	5		11	7	8		8	25	8		26	7	8	1	21
	6.10.63	18	6		5	8	7		3	10	5		11	5	5	4	5
	7.10.63	11	10	4	4	9	3		3	14	13	1	68	6	5	1	11
	8.10.63	13	6	3	7	7	2	3	9	18	12	7	37	5	1	1	5
	Total	165	68	14	65	59	41	6	29	155	80	19	162	75	80	20	105
	Average per trap/ night	13.8	5.7	1.2	5.4	4.9	3.4	0.5	2.4	12.9	6.7	1.6	13.5	6.3	6.7	1.7	8.8

Note: Outdoor observations at times when they were disturbed by rain have been excluded, along with respective indoor ones.

Abbreviations: gam = Anopheles gambiae ph = A. pharoensis
ni = A. nili wel = A. wellcomei

FIG. 1 MODIFIED TYPE OF BED-NET TRAP, IN CROSS-SECTION
(DIMENSIONS APPROXIMATE)

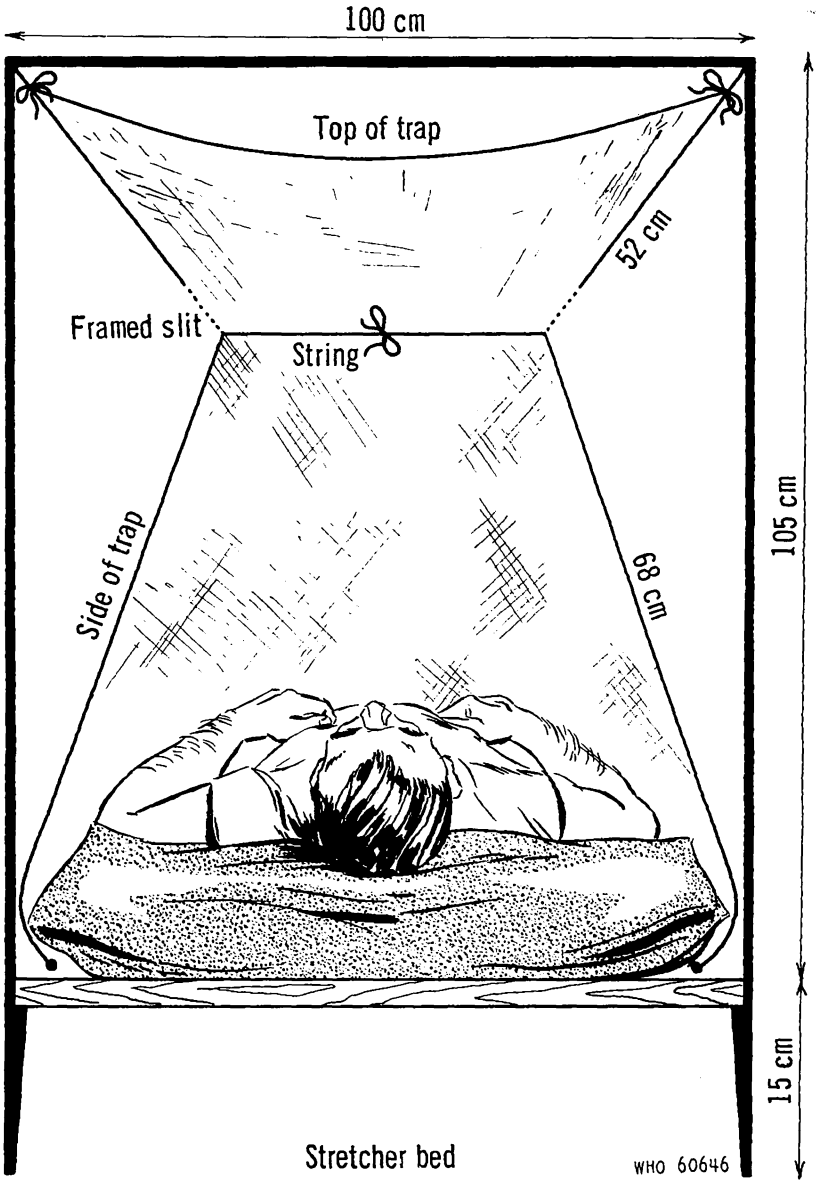
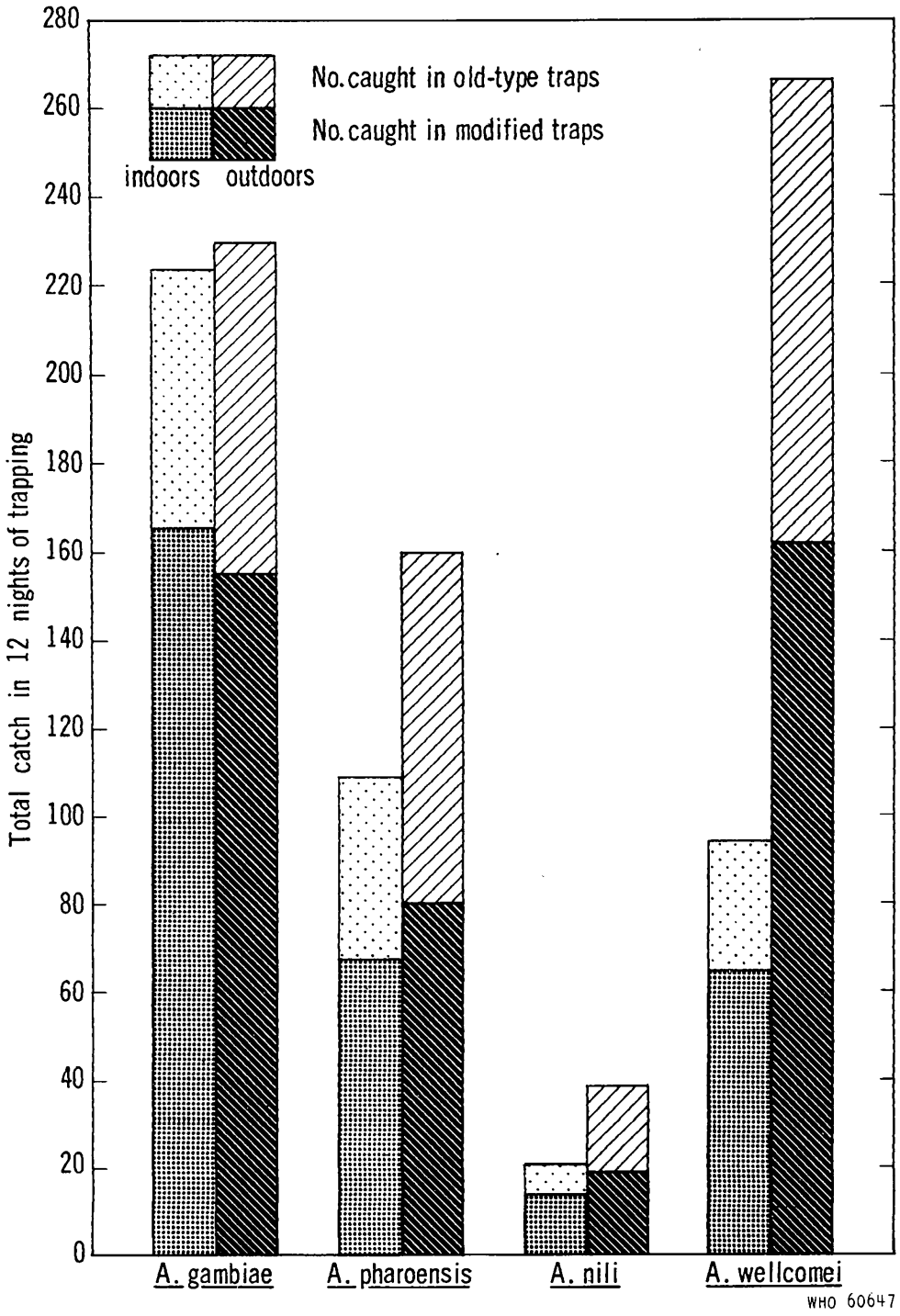


FIG. 2 ANOPHELES CAPTURES IN SIMULTANEOUS INDOOR AND OUTDOOR TRAPPING WITH FOUR BED-NET TRAPS (TUNGAM BUZU, IX-X/1963)



RESUME

L'auteur décrit un piège-lit modifié et il en compare l'efficacité avec le modèle plus ancien. Les essais ont eu lieu dans deux secteurs non traités d'un village par ailleurs traité au DDT et situé dans une région marécageuse limitrophe de la zone d'opérations de la campagne antipaludique de masse du Sokoto occidental (Nigéria septentrional).

Le piège se compose d'une seule moustiquaire dans laquelle une fente de 60 cm de long et de 2,4 cm de large est pratiquée au milieu des deux faces latérales, à 53 cm du sommet. La fente est cousue tous les 15 cm à un cadre en fil de fer qui l'empêche de bâiller quand on tire la moustiquaire.

Ce piège modifié s'est révélé plus efficace que l'ancien, en particulier à l'intérieur des habitations. Cette supériorité paraît tenir au fait que les moustiques s'en échappent moins facilement que du piège-lit antérieur dont l'entrée était placée au même niveau que le dormeur servant d'appât.

Au cours de ces essais, on a constaté qu'en moyenne les moustiques étaient aussi attirés par l'homme à l'intérieur qu'à l'extérieur des maisons dans le cas de Anopheles gambiae, A. pharoensis et A. nili. A. wellcomi, en revanche, a manifesté une forte tendance exophage.

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