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Observations on the relative attractiveness to *Glossina pallidipes* of different animal baits, a tsetse trap, and a fly-round patrol

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Studies conducted in the Lambwe Valley, Kenya, have shown that in the absence of wild hosts, Glossina pallidipes *was more attracted to a calf than to a sheep, a goat, a man, or a tsetse trap, although the latter attracted more flies than the nonbovid baits. Other investigations have shown that a newly developed tsetse trap was much more efficient at catching* G. pallidipes *than a standard fly-round patrol technique. An added advantage of the trap was that the sex ratio of flies caught by it was more representative of that existing in the fly population. Fly-round patrols always caught many more male than female flies.*

In the mid-1960s Langridge (1972) developed a tsetse trap for collecting *Glossina pallidipes*, which is economically and medically the most important species of tsetse in Kenya. The trap, which is now commonly known as the "Langridge" trap, is basically a modification of the trap developed by R. H. T. P. Harris in the 1920s for collecting *G. pallidipes* in Zululand (see Buxton, 1955).

During a variety of entomological investigations conducted in the Lambwe Valley, Kenya, from 1968 to 1971, the Langridge trap was used extensively to sample *G. pallidipes* populations. This account is therefore largely concerned with appraisals of the merits of the trap in comparison with the standard fly-round patrol technique of sampling *G. pallidipes*. Some observations on the relative attractiveness of the trap, man, and domestic animals to *G. pallidipes* are also described since this is relevant to the epidemiology of the trypanosomiases in the study area.

MATERIALS AND METHODS

All investigations were conducted in the Lambwe Valley, South Nyanza District, Kenya, a description of which has been given by Allsopp & Baldry (1972). The results of studies on the hosts and trypanosome infection rates of *G. pallidipes* in this area have been described by England & Baldry (1972), while Allsopp et al. (1972) have discussed the relationships between *G. pallidipes* and the game animals resident in the area.

The studies reported here on the relative attractiveness to *G. pallidipes* of domestic animals, man, and the Langridge trap were conducted during February and March 1969 in three localities—the Obaluanda area, the new Ponge Dam at the eastern end of the Roo Valley, and near a small dam towards the western end of the Roo Valley.

In each of the three areas a natural clearing was found inside a *G. pallidipes* thicket habitat, which was large enough easily to accommodate 5 baits around the periphery. The baits used were a calf, a sheep, and a goat, all of which were caged, a Langridge tsetse trap, and a man. Each cage was newly constructed and a modified Langridge trap [3] was attached to the top. Each bait animal remained in its original cage throughout the investigation. Baits were arranged equidistantly around the clearing and their positions were rotated clockwise each day.

To minimize the chance of tsetse being carried into the clearings by operators or vehicles, no vehicles were allowed within 200 m of a clearing, and

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all persons approaching on foot were examined for following flies.

The working day consisted of 4 1-hour periods. At the start of each day's study, the bait animals were placed in their cage, the Langridge trap was erected, and the man acting as bait took up his position in company with an attendant whose job it was to catch, with a hand net, flies alighting on him.

At the end of each hour, the animals and the man acting as bait were allowed to rest for 15 min, the former being released from their cages. The cages of the Langridge trap and of the caged animals were removed and the tsetse flies counted, classified, and recorded. The flies were not released until the end of the working day, some flies being kept for dissection in order to determine the trypanosome infection rates.

Observations were made for 9 days at the Obaluanda and Ponge Dam sites and for 13 days at the other dam site.

For studies on the relative merits of Langridge tsetse traps and fly-round patrols, traps were made and used in the manner described by Langridge (1972). In using these traps three important points were always kept in mind—namely, that they must be carefully sited in a partly open and partly shaded position in order to realize their greatest catching potential; that their efficiency might decline if they were not repositioned at least 150 m from their previous position, at least once a month; and that their efficiency might fall with age, unless they were reconditioned monthly.

In practice it was found convenient to replace traps with reconditioned ones every month and to change their positions at the same time.

Traps were usually used for two 24-hour catching periods per week. During the intervening periods the traps were left open, i.e., with the cage removed, so that any flies that entered could easily escape.

Patrols involved a minimum of four men. Two men carried between them a black cloth screen suspended from a wooden pole; with the ends of the pole placed on the shoulders, the hands of the men were free to catch, by means of hand nets, flies alighting on either side of the screen. A third man determined the sex and condition of the flies that were caught and placed them in a cage for subsequent release on completion of the patrol. A fourth man recorded on a special data sheet the condition of each fly in relation to the position of the patrol team.

Patrols operated along defined paths (fly-rounds) of a convenient and known length, so that apparent densities (i.e., the number of nonteneral males per 10 000 m) could be calculated if desired. Fly-round patrols were conducted at the same time each morning, but in opposite directions on alternate days in order to compensate for any irregularities caused by flies following the catching party.

Studies on the comparative merits of traps and fly-round patrols, and on the decline in the efficiency of traps kept in one position for a long period, were made in the Otuok thicket area, while the effects of ageing on trap efficiency were studied in the Ruma thicket area. All investigations were made between 1968 and 1970.

RESULTS

The relative attractiveness to G. pallidipes of domestic animals, man, and the Langridge tsetse trap

During the first 23 days of the investigation the baits available to *G. pallidipes* were a calf, a sheep, a goat, a man, and a Langridge trap. The results (Table 1) clearly show that the calf was the most attractive bait, more than half the total catch of flies being obtained from this animal. During the last 8 days of the investigation the calf was removed from the experimental area, with the result that almost equal proportions of flies were attracted to the remaining baits (Table 1).

Table 1. Numbers of *G. pallidipes* collected from bait animals, a Langridge tsetse trap, and man, in the presence and absence of a bait calf

Bait	Numbers and percentages of flies attracted to different hosts and to a tsetse trap			
	With calf present [a]		Without calf [b]	
	No.	%	No.	%
calf	1 101	54.1	not applicable	not applicable
sheep	172	8.4	55	25.2
goat	132	6.4	47	21.5
man	260	12.7	63	28.9
trap	369	18.1	53	24.3
totals	2 034	99.7	218	99.9

[a] 23 4-h working days.
[b] 8 4-h working days.

When the calf was available, the proportions of *G. pallidipes* feeding on the three species of domestic animal were as follows: calf, 40.7%; sheep, 1.2%; goat, 0. When the calf was removed, 9.1% of the flies attracted to the sheep fed on it while none of the flies attracted to the goat attempted to feed.

Comparisons between fly-round patrols and Langridge trap catches

Between 15 December 1969 and 12 January 1970, the *G. pallidipes* population of part of the Otuok continuous thicket was concurrently sampled by fly-round patrols and by trapping. Five traps were positioned equidistantly along the fly-round (1 460 m), each trap being allowed to catch flies for two 24-hour periods per week. The twice-weekly fly-round patrol, conducted by a standard patrol team, took approximately 3 hours to complete on each occasion.

During the study period, the 5 traps were emptied 6 times and caught a total of 7 749 flies. This represents a mean catch of 1 291 flies for the 5 traps per round, and a mean individual trap catch of 258 flies. The proportion of females was 63.9%. At the same time, 7 screen patrols collected 837 flies, i.e., 119 flies per patrol. The proportion of females was 18.9%.

Under the conditions of the patrol route it is unlikely that the traps had an attractive influence on the fly population farther than 150 m on either side and it can therefore be assumed that the 5 traps were probably effective along the whole 1 460-m length of the round. On this basis, the efficiency of the traps at catching *G. pallidipes* was over 10 times that of the patrols.

At the end of November 1970, both sampling techniques were employed along a transect in another part of the Otuok thicket. A Langridge trap located at the thicket edge produced a mean trap catch of 902 *G. pallidipes* (3 trappings); 70.8% of these flies were female. The mean patrol catch along a 30-m sector traversing the thicket edge was 7.3 *G. pallidipes* (3 patrols) during the same period; 27.8% of these flies were female.

A second trap, located 150 m inside the thicket, produced a mean catch of 594 *G. pallidipes* (3 trappings); 71.1% of these flies were female. The mean patrol catch along a 90-m section of the round adjacent to the trap, was 14.3 flies, of which 23.3% were female (3 patrols).

A third trap was located 90 m farther inside the thicket. The mean trap catch was 895 *G. pallidipes* of which 72.3% were female. The mean patrol catch along 90 m of fly-round adjacent to the trap was 23 flies, of which 33.4% were female.

None of the three traps was positioned directly on the patrol round. They were concealed a few metres inside the thicket and thus not readily visible to flies moving along the round. Considering the density of the thicket, it also seems improbable that they could be seen through the thicket vegetation by flies as far away as 100 m. Therefore, if it is assumed that the traps were effective across a distance of only 90 m in any one direction, it can be concluded that in all cases the number of *G. pallidipes* caught by the traps was approximately 20 times that caught by the corresponding patrols.

The decline in the efficiency of traps kept in one position for a prolonged period

As stated earlier Langridge-type traps were believed to decline in efficiency if they remained in any one position for more than about a month. This was amply confirmed by data collected in the Otuok area between April and November 1970.

Five traps were located in isolated thicket clumps adjacent to the Otuok thicket in mid-April 1970. Although, the traps were replaced by new or reconditioned ones monthly, their positions were not changed until September 1970. The performance of these traps declined until they were repositioned, whereupon their performance increased remarkably (Table 2).

The decline in the efficiency of traps as a result of ageing

In the course of aerial spraying trials it seemed likely that the weathering of traps might be causing

Table 2. The effect of non-repositioning of Langridge tsetse traps on the catches of *G. pallidipes* in Otuok thicket, Lambwe Valley; April–November 1970

Month	Mean trap catch (*G. pallidipes*)	Remarks
April/May	66.5	traps replaced only
June	53.7	
July	41.4	
August	11.0	
September	24.8	traps replaced and repositioned
October	84.8	
November	81.2	

them to become less attractive to *G. pallidipes*. The situation was investigated during December 1968.

Altogether, 10 Langridge traps were placed in the Ruma thicket; 5 had been in constant use since late September 1968 and thus were over 2 months old, while 5 were new traps. During 6 trapping periods the mean catches of *G. pallidipes* were 0.24 flies for old traps and 5.64 flies for new traps. The new traps were thus catching 23.5 times more *G. pallidipes* than the old traps.

DISCUSSION

The results of observations made on the attractiveness of different types of animal bait and the Langridge type tsetse trap to *G. pallidipes* show that in the area studied a calf not only attracted the greatest number of flies but, of the animals available, it was the bait most frequently fed on. The proportion of flies attracted to the ox, sheep, and goat (54.1%, 8.4%, and 6.4%, respectively) seems to go a long way towards explaining the incidence of animal trypanosomiasis in these animals in the Lambwe Valley (17.0%, 5.0%, and 2.1%, respectively) as reported by Robson & Ashkar (1972). Although they do not agree with the limited data available from blood meal analysis on the feeding preferences of *G. pallidipes* in the area, as described by England & Baldry (1972), they agree fairly closely with the findings of Weitz (1963) for the species over a larger area of East Africa (1.6% feeds from ox, 0.1% from sheep/goat).

The proportion of *G. pallidipes* caught from the man acting as bait during the same experiment (12.7%) is misleading, and undoubtedly gives a false impression of the attractiveness of man to *G. pallidipes*. Of 923 blood meal squashes analysed by England & Baldry (1972) only 2 (less than 0.2%) were derived from man; this is compatible with Watson's (1972) findings that the annual incidence of sleeping sickness varied between 0.18% and 0.48%. There are three possible explanations to account for the apparently greater attractiveness of man observed during the experiment.

Firstly, although only one man was catching flies from the man acting as bait, both men (the bait and the catcher) were probably exerting an attractive influence on *G. pallidipes* in their vicinity. This could have increased the fly catch from the human bait by anything up to 100%.

Secondly, whereas those flies that visited the other baits and the trap were caught by passive methods, i.e., they had to find their own way into the trap and thus had some chance to escape, those which went to the man acting as bait had little chance of escaping since they were actively caught by the catcher as soon as they alighted. The proportion of flies that are attracted to a trapping device and then escape is not known, although personal experience leads the authors to believe that, on occasions, the proportion could be appreciable.

Thirdly, although *G. pallidipes* is selective in its choice of hosts under natural conditions, it is sufficiently adaptable to overcome its dislike for some animals and man, when its preferred hosts, i.e., bushbuck, bushpig, and buffalo, are not available. The data presented in Table 1 suggest that under such circumstances man may be relatively less disliked than either sheep or goat.

The results of comparative studies of trapping and fly-round patrol techniques clearly show that Langridge traps are much more efficient at sampling a *G. pallidipes* population than the other techniques, provided that they are reconditioned and repositioned at intervals of approximately 1 month. These observations confirm the findings of Tarimo et al. (1970) who, after making similar investigations, stated " It is concluded that the fly-round may give a false assessment of reduction of *G. pallidipes* following insecticide application. Consequently, the high reduction recorded by fly-rounds in an earlier experiment with pyrethrum (Irving et al., 1969) should be interpreted with caution ". Tarimo et al. (*op. cit.*) arrived at this conclusion after simultaneously using Langridge traps and fly-round patrols to assess the percentage reductions in a fly population after three aerial applications of a pyrethrum/DDT mixture. Percentage reductions according to patrols were 64, 36, and 29, and according to traps, 11, 7, and 0.

An additional advantage of Langridge traps, particularly when *G. pallidipes* populations are being sampled for ecological and epidemiological purposes, is that they catch more females than males (proportion of females during the present studies, 63.9–72.3%). Since female flies are believed to live longer than male flies, and therefore constitute the larger proportion of the fly population as a whole (see Jackson, 1937, 1940), the Langridge trap probably attracts and catches a representative cross-section of the fly population. Conversely, male flies predominate in fly-round patrol catches (proportion of females during the present studies, 18.9–33.4%).

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RÉSUMÉ

OBSERVATIONS SUR L'ATTRAIT RELATIF EXERCÉ SUR *GLOSSINA PALLIDIPES* PAR DIFFÉRENTS APPÂTS ANIMAUX ET UN PIÈGE À GLOSSINES; EFFICACITÉ COMPARÉE DU PIÈGE ET D'UNE ÉQUIPE DE CAPTURE

Des études ont été faites dans la vallée de la Lambwe sur les mérites respectifs de différents appâts animaux et d'un piège à glossines de type « Langridge » en tant que source d'attrait pour *Glossina pallidipes*.

Les glossines étaient beaucoup plus attirées par un bovin (54,1%) que par un mouton (8,4%), une chèvre (6,4%), un homme (12,7%) ou le piège (18,1%). En l'absence de bovin, les autres appâts, y compris l'homme, et le piège les ont attirées en nombres sensiblement équivalents (21,5 à 28,9%). Ces observations corroborent les données relatives à la prévalence de la trypanosomiase animale chez les espèces étudiées: 17,0% d'infections chez les bovins, 5,0% chez les moutons et 2,1% chez les chèvres. Le nombre de glossines capturées sur l'appât humain donne probablement une idée fausse de l'attrait réel exercé par l'homme sur l'insecte. Trois hypothèses sont formulées à cet égard.

On a aussi comparé l'efficacité du piège et des captures effectuées par une équipe d'environ quatre hommes pour l'échantillonnage des populations de *G. pallidipes*. Le piège a permis de capturer un nombre beaucoup plus élevé de mouches. En outre, le rapport des sexes parmi les spécimens obtenus par cette méthode (63,9 à 72,3% de femelles) était proche du rapport considéré comme normal au sein des populations naturelles, alors que parmi les insectes recueillis par les captureurs on ne comptait qu'une faible proportion (18,9 à 33,4%) de femelles.

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