Efficacy of three trap types for trapping *Glossina palpalis*, *G. tachinoides*, and *G. mortisans* in the Mole Game Reserve in Ghana

D. DANKWA, E. O. K. ODDOYE & K. B. MZAMO
Animal Research Institute, Council for Scientific and Industrial Research, P. O. Box AH 20, Achimota, Ghana

ABSTRACT

A study was undertaken to determine the most effective of three trap types [biconical, monoconical, and NGU siamese (NG2B)] for catching three *Glossina* species (*G. palpalis*, *G. tachinoides*, and *G. mortisans*). The three species were trapped in the Mole Game Reserve where they occur. Results showed that in the absence of odour attractants, the biconical trap was the most efficient trap. Out of a total of 4619 tsetse flies caught during the trapping period, 2073 (44.9 %) were caught in the biconical trap. The monoconical trap caught 1362 tsetse flies (29.5 %) whilst the NG2B trap caught 1184 tsetse flies (25.6 %). There was no significant difference ($P > 0.05$) in the number of tsetse flies caught by the various traps. There were, however, locational differences, with the number of flies caught in the riverine area being significantly higher ($P < 0.05$) than the number caught in the pond area, but not significantly different ($P > 0.05$) from the number caught in the woodland. There was also a very significant difference ($P < 0.001$) in the species of tsetse flies caught by the traps. Significantly ($P < 0.001$) more *G. tachinoides* were caught as compared to *G. mortisans*. Virtually no *G. palpalis* were caught. The number of female flies caught (3621) was significantly higher ($P < 0.001$) than the number of male flies caught (995).

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RÉSUMÉ

DANKWA, D., ODDOYE, E. O. K. & MZAMO, K. B.: *Efficacité de trois modèles de piège pour attraper* Glossina palpalis, G. tachinoides et G. mortisans *dans la Reserve Naturelle de Mole au Ghana.* Une étude était entreprise pour déterminer le plus efficace de trois modèles de piège [biconique, monoconique et NGU siamese (NG 2B)] pour attraper trois espèces de *Glossina (G. palpalis, G. tachinoides* et *G. mortisans).* La prise au piège était faite dans la Reserve Naturelle de Mole où tous les trois espèces se trouvent. Les résultats montraient qu'en absence des odeurs attirantes le piège biconique était le piège le plus efficace. Sur une totalité de 4619 des mouches tsé-tsé attrapées pendant la période de prise au piège, 2073 (44.9 %) étaient attrapées dans le piège biconique. Le monoconique attrapa 1362 des mouches tsé-tsé (29.5 %) alors que le piège de NG2B attrapa 1184 des mouches tsé-tsé (25.6 %). Il n'y avait pas de différence considérable ($P > 0.05$) dans le nombre des mouches tsé-tsé attrapées par les différents pièges. Il y avait, cependant des différences d'emplacement avec le nombre des mouches attrapées dans la zone fluviale étant considérablement élevé ($P < 0.05$) que le nombre attrapé dans la zone de mare mais pas considérablement différent ($P > 0.05$) du nombre attrapé dans la zone boisée. Il y avait aussi des différences bien considérables ($P < 0.001$) parmi les espèces des mouches tsé-tsé attrapées par les pièges. Considérablement ($P > 0.001$) plus de *G. tachinoides* étaient attrapées en comparaison de *G. mortisans*. Pratiquement aucune *G. palpalis* n'était attrapée. Le nombre des mouches femelles attrapées (3621) était considérablement plus élevé ($P < 0.001$) que le nombre des mouches mâles attrapes (995).

Introduction

Tsetse fly (*Glossina* sp.) is the vector of protozoan blood parasites known as trypanosomes. These parasites are the causal agents of trypanosomiasis ("sleeping sickness" in man and "nagana" in domestic animals). Trypanosomes are transmitted by *Glossina* sp. from one vertebrate host to another, often undergoing cycles of development

within the fly.

Man and his domestic animals are susceptible to the pathogenic effects of trypanosomes, resulting in low productivity of the animal and finally death.

Glossina spp. inhabit over one million square kilometres of Africa (Jordan, 1986), very large portions of which are without cattle because of the tsetse flies and their trypanosomes (FAO, 1979). There is an urgent need for the control of *Glossina* spp. (vectors of trypanosomiasis in livestock) as a pre-requisite to improved livestock and socio-economic development in large areas of Africa (Laryea, 1990; personal communication).

Methods for the control of the vector of this disease include the following:

1. The use of modern traps for catching various species of tsetse fly. The catching potential of these traps may be increased by baiting them with attractive odours like acetone, octenol, and cow urine. The killing potential of the traps may also be reinforced by impregnating them with insecticides, as was done in Korhogo in northern La Côte d' Ivoire where insecticide-impregnated traps were used to reduce tsetse fly populations by 90-99 per cent (Kupper, 1988).
2. Insecticidal treatment of animals contributes significantly to reducing tsetse fly populations wherever they are used (Laveissiere *et al.*, 1985).
3. The sterile insect technique (SIT), which is species-specific, can be a useful component of an integrated system, where the elimination of the fly is the objective (Takken *et al.*, 1986).

Tsetse fly trapping as a method of control of trypanosomiasis has generated a lot of interest in recent times. Efforts to reduce cost and increase the efficiency of traps have resulted in the proliferation of trap types, some of which may be better suited for some species of tsetse fly than for others. Because of the wide variety of traps available, there is the need to determine which trap is most suitable for each species.

In this work, the efficacy of three trap types – the biconical trap developed in the early 1970s (Challier & Laveissière, 1973), the monoconical trap (Lancien, 1981), and the more recent NG2B (Brightwell *et al.*, 1987) – were tested for their efficacy in trapping the West African riverine species of *G. palpalis* and *G. tachinoides* as well as the savanna species, *G. mortisans*, in the Mole Game Reserve.

Materials and methods

The Mole Game Reserve was chosen because it harbours all three species of *Glossina* mentioned. The vegetation in the game reserve is mainly wooded grassland interspersed with relics of tropical rain forest and is ideal for *G. mortisans*. Gallery forest along the banks of the streams and rivers that run through the reserve provide a home for *G. palpalis* and *G. tachinoides* which prefer more humid areas. The most common game animals include elephants, waterbucks, antelopes, baboons, warthogs, and monkeys. Some of these are intermediate hosts of the flies.

Three replicates were run of a 3 × 3 Latin square design, by using nine trap sites over 3 days as described by FAO (1992). Days represented the columns, sites represented the rows, and the trap types were treatments. Replicates (locations) used were as follows:

1. The vegetation surrounding the main dam of the game reserve.
2. The gallery forest along the Amamole stream.
3. Open grassland in between thickets.

Three designs of trap (biconical, monoconical, and NG2B), all made from identical material (Fig. 1), were compared. No odour baits, insecticides or other attractants were used to enhance performance of the traps. There were three trap sites per location. Sites were about 100 m apart. The traps were rotated among the various sites so that by the end of the 3rd day each trap had been in each site for a 24-h period. The total number of flies caught was recorded on a daily basis for each trap and site. The experiment was

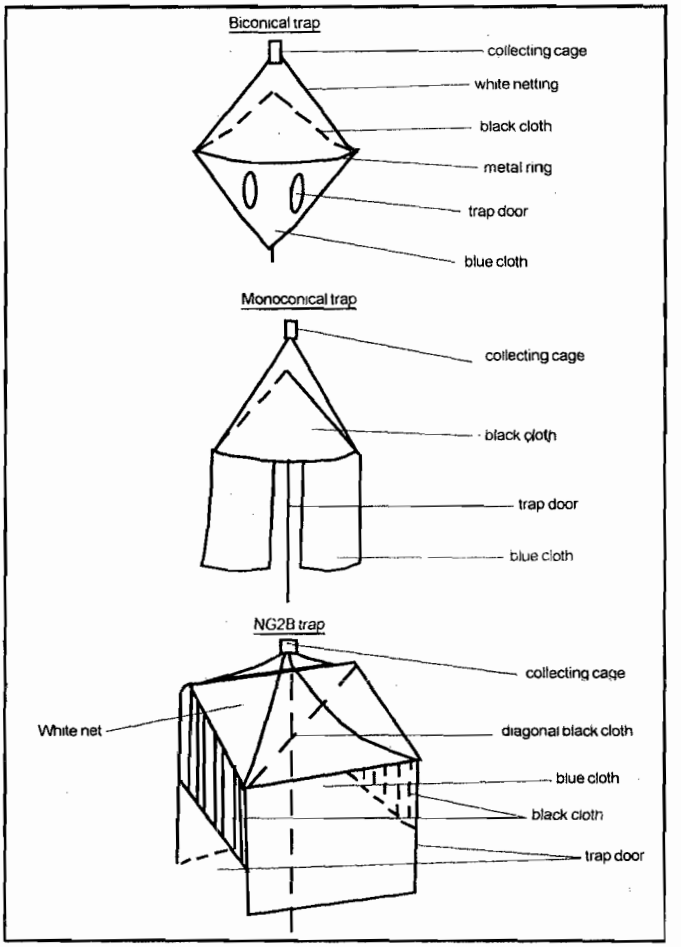

Fig.1. Three trap types.

repeated after the 3rd day so that there was a total of six trapping days. The total fly count for the 2 days (Days 1 and 4, Days 2 and 5, Days 3 and 6) was used in the analysis. Tsetse fly counts were transformed [Log_{10} (count + 1)] before analysis of variance was carried out by using the statistical package of the Statistical Analysis Systems Institute (SAS, 1987). Pairwise comparison of least square means was done to determine which treatment means were significantly different from each other. Least square means were then de-transformed [(antilog x) - 1] and used in preparing a table of means. The experimental model was, therefore, as follows:

$$Y_{ijkl} = \mu + L_i + T_j + D_k + S_l/L_i + e_{ijkl}$$

where Y_{ijkl} = Log-transformed tsetse fly count;
μ = overall mean;
L_j = effect of *i*th location (replicate);
T_j = effect of *j*th trap type;
D_k = effect of *k*th day;
S_l/L_j = effect of ith site nested within location; and
e_{ijkl} = a random error associated with each observation.

The total number of flies caught at each location was separated into the number of flies of each species caught by each trap type and the sex of the fly. These were also log transformed and means were compared by using the student t-test.

Results and discussion

A total of 4619 tsetse flies (Table 1) was caught during the trapping period. Of these, 44.9 per cent were caught by the biconical trap, 25.6 per cent by the siamese NG2B trap, and 29.5 per cent by the monoconical trap (Table 1). The number of flies caught per trap type did not differ significantly ($P > 0.05$) (Table 2). Although there was no significant difference among trap types for number of flies caught, the biconical trap seemed more efficient than the other two. The number of flies caught in the riverine location (Table 2) was significantly higher ($P < 0.05$) than the number caught in the pond area, but not significantly different ($P > 0.05$) from the number caught in the woodland. There was no significant difference ($P > 0.05$) in the ability of the various trap types to trap the various fly species. There was, however a very significant difference ($P < 0.001$) in the

TABLE 1

Total Number of Tsetse Flies Caught by Each Trap during the Trapping Period

Trap type	*Species of fly*	*No. of males*	*No. of females*	*Total no. of flies*
Biconical	*G. mortisans*	33	133	166
	G. tachinoides	402	1504	1906
	G. palpalis	0	1	1
	Subtotal	435	1638	2073
NG2B	*G. mortisans*	33	135	168
	G. tachinoides	215	801	1016
	G. palpalis	0	0	0
	Subtotal	248	936	1184
Monoconical	*G. mortisans*	22	134	156
	G. tachinoides	290	913	1203
	G. palpalis	0	0	0
	Subtotal	312	1047	1362
Grand total		995	3621	4619

TABLE 2

Least Square Means of Total Tsetse Fly Counts as Affected by Trap Type and Location

Parameter	*LSMEAN*	*D-LSMEAN*[1]
Trap type		
Biconical	2.20a	157
Monoconical	2.07a	115
NG2B	2.03a	106
Location		
Pond	1.91a	80
Riverine	2.32b	210
Woodland	2.02ab	106
[2]SED	0.383	

1 - De-transformed Lsmean ((antilog ×) - 1)
2 - Standard error of the difference between two means. Lsmeans within a parameter with common postscripts are not significantly different.

number of the various species caught by all the trap types. Virtually no G. *palpalis* were caught (Table 1). All traps caught significantly more *G. tachinoides* than *G. mortisans*. A similar trend was noticed when types of species caught were compared in the various locations. In all locations, significantly ($P<0.05$) higher numbers of *G. tachinoides* were recorded as compared to *G. mortisans*. This trend could either reflect the actual field populations of each species or a measure of the attractiveness of the traps to the species concerned. All traps caught more female than male flies (Table 1). The total number of flies caught comprised 78.4 per cent females and 21.6 per cent males. This difference was very highly significant ($P<0.001$). Similar observations were recorded by Amsler, Filledier & Millogo (1994). There is evidence (Dankwa, unpublished) that as flies emerge from their pupae, the ratio of males to females is about equal. Female flies, however, tend to live longer than male flies, resulting in a field population with more females than males (FAO, 1979). This may explain why more females were caught in this study.

Conclusion

The study has established that in the Mole Game Reserve, more female flies were trapped than male flies, and that *G. tachinoides* was the dominant species. Traps proved equally good in their ability to trap flies, even though the biconical seems to be more efficient. More flies were trapped in the riverine area, and efforts at eradicating the fly should concentrate on riverine areas.

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