

Natural hosts of *Glossina morsitans submorsitans* Newstead and *Glossina palpalis gambiensis* Vanderplank in the Republic of Mali

Samuel N. OKIWELU ⁽¹⁾

Saddu MAIGA ⁽²⁾

Summary

During tsetse ground surveys in an area of approximately 50,000 km² in Central Mali (1977-80) to map an accurate *Glossina* distribution prior to the initiation of a tsetse control programme, blood meals of *Glossina morsitans submorsitans* and *Glossina palpalis gambiensis* were collected and identified. The results are the first records of the natural hosts of *Glossina* in Mali. During the dry season, both species exhibited differences in host preferences between areas of similar fauna. *G. m. submorsitans* collected from the forest reserves west of 8°15'W showed a strong preference for suids, while those from east of 8°15'W, in the Monts Mandingues reserve, preferred bovids.

Collections of *G. p. gambiensis* were restricted to areas east of 8°15'W; there was a marked preference for reptiles in the forest reserve Faya, bovids accounted for the highest number of feeds in the reserve Monts Mandingues, while reptiles dominated the feeds of flies from the scattered forest galleries outside the reserves. Numbers of meals collected for each species during the rainy season were extremely low; seasonal comparisons were therefore not undertaken. The importance of these results in the understanding of the epizootiology of animal trypanosomiasis in the area is discussed.

Key words : Natural hosts — *Glossina morsitans* — *Glossina palpalis* — Mali.

Résumé

LES HÔTES NATURELS DE *Glossina morsitans submorsitans* N. ET DE *Glossina palpalis gambiensis* V. EN RÉPUB.

Au cours d'une étude sur le terrain des glossines d'une zone d'environ 50 000 km² au centre du Mali afin de cartographier avec précision leur répartition avant le lancement d'un programme de lutte, les repas sanguins de *Glossina morsitans submorsitans* et de *G. palpalis gambiensis* ont été recueillis et identifiés. Les résultats obtenus sont les premiers concernant les hôtes naturels des glossines du Mali.

Durant la saison sèche, les deux espèces montrent des différences dans le choix des hôtes bien que les régions aient une faune identique. Dans les réserves forestières situées à l'ouest du 8°15'W, *G. m. submorsitans* montre

Les récoltes de *G. p. gambiensis* ont été limitées aux régions situées à l'est du 8°15'W; on a trouvé une préférence marquée pour les reptiles dans la réserve forestière de Faya, alors que dans la réserve des Monts Mandingues les bovins fournissaient la majeure partie des repas sanguins. En dehors des réserves, dans les galeries forestières disséminées, les reptiles sont les proies les plus nombreuses.

(1) School of Biological Sciences, University of Port Harcourt, P.M.B. 5323, Port Harcourt, Rivers State, Nigeria.

(2) New Lands Activity, Mali Livestock II, Project, O. M. BE. VI, B.P. 1382, Bamako, Mali.

Durant la saison des pluies, les repas sanguins de chaque espèce furent récoltés en très petit nombre de sorte que les auteurs n'ont pas entrepris de comparaisons saisonnières. L'importance de ces résultats pour la compréhension de l'épidémiologie de la trypanosomiase animale dans cette région du Mali est ensuite discutés.

Mots-clés : Hôtes naturels — *Glossina morsitans* — *Glossina palpalis* — Mali

1. INTRODUCTION

This study was undertaken under the New Lands Activity of the Mali Livestock II project, whose objective is the improvement of livestock in Mali. One of the goals is to control *Glossina* in the savannah areas south of the Sahel and move trypanosome — susceptible Zebu cattle from the overstocked Sahel to these areas. Prior to the initiation of the project, there was a dearth of information on the ecology of *Glossina* in Mali. A number of ecological studies on *Glossina* were therefore initiated. A knowledge of the preferred hosts of *Glossina* is important for the understanding of the epidemiology and epizootiology of trypano-

somias. It was therefore necessary to determine the natural hosts of the dominant species

palis gambiensis, during tsetse ground surveys and simultaneously with studies on other aspects of *Glossina* ecology.

2. DESCRIPTION OF STUDY AREA

Collections of gorged flies were made from 3 zones, designated 1, 2 and 3, covering areas of approximately 19,000, 21,000 and 7,000 km² respectively (fig. 1). The zones lie between 10°20' W

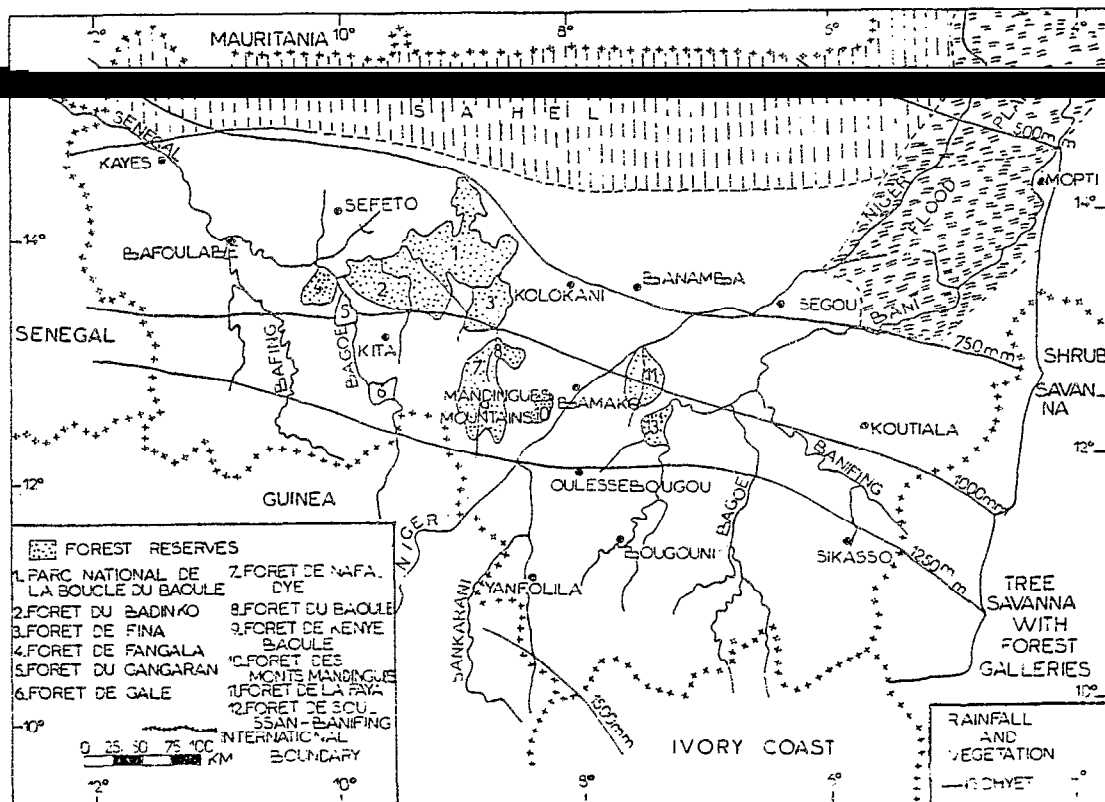


FIG. 1.

and 5°48'W, 14°07'N and 12°08'N. They extend from the Southern Sudan to the Northern Guinea Savanna and lie between isohyets 750 mm and

3 MATERIALS AND METHODS

Consequently, these zones have relatively low human population densities. In contrast, zone 1 has the highest human population density, and it has only two small forest reserves. There are three overlapping seasons : hot and rainy (June-October), warm and dry (November-January), hot and dry (February-May). Detailed accounts of vegetation and climate of the zones have been given elsewhere (Okiwelu *et al.*, in press).

The larger mammals known to occur in the

During preliminary tsetse ground surveys in the 1977-78 dry season, blood meals of *G. m. submorsitans* were collected from zones 2 and 3 and those of *G. p. gambiensis* from zone 1 (forest reserve Faya) (fig. 1). Subsequent blood meal collections were restricted to zone 1. During the 1978-79 dry season, blood meal smears of *G. m. submorsitans* were collected from the reserve *Monts Mandingues*, but in the 1979-80 dry seasons, smears of both *G. m. submorsitans* and *G. n. gambiensis* were

waterbuck, elephant, genet, oribi, jackal, hippopotamus, kob, hartebeest and korrigum. Reptiles (crocodiles, snakes, lizards) and birds are abundant.

dry season from forest galleries (Sai, Souba, Balan, Kanika, Sanankoroni Farania, Kodyala, Toulabougou) in scattered locations outside the forest reserves (fig. 2).

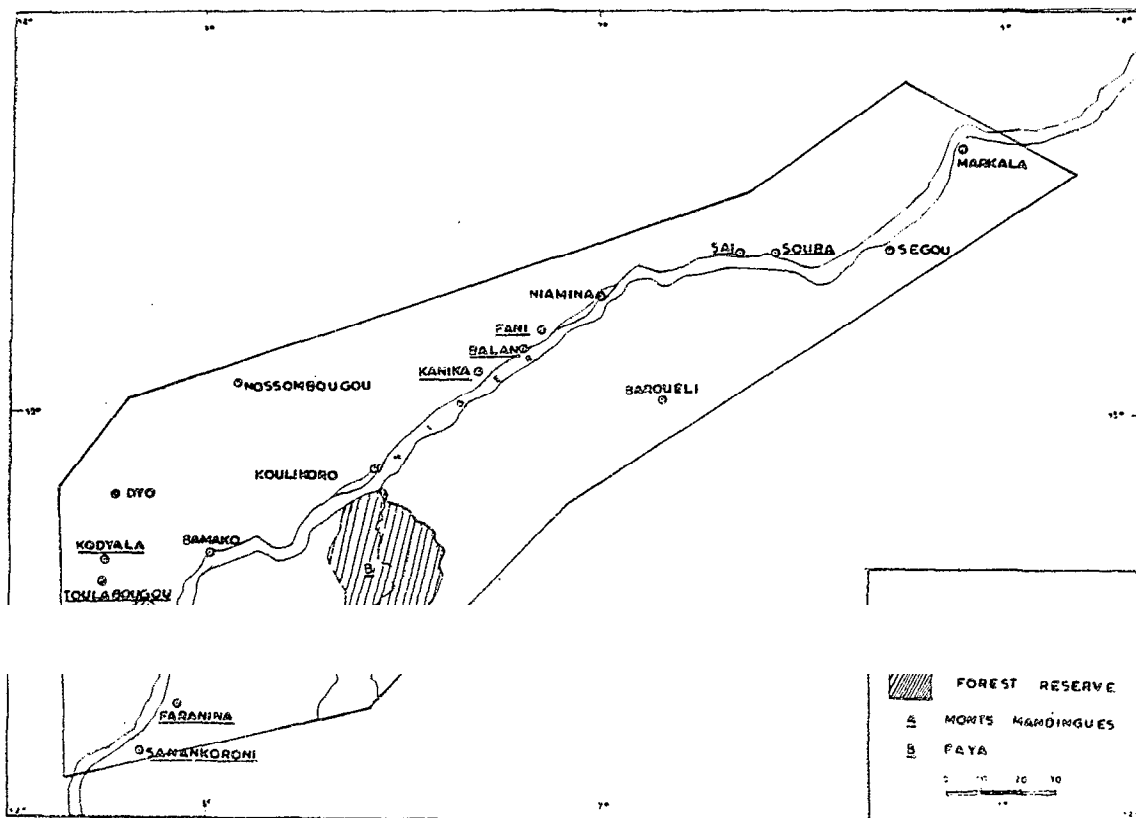


FIG. 2.

TABLE I

Blood meals of *Glossina morsitans submorsitans* from zones 1, 2 & 3.

ZONES	AREAS	SEASONS	HOSTS											
			PRIMATES		SUIDS		BOVIDS					OTHERS MAMMALS	REPTILES	BIRDS
			MAN	UNIDEN- TIFIED	WART- HOG	UNIDEN- TIFIED	BUF- FALO	BUSH BUCK	ROAN ANTELOPE	DUI- KER	UNIDEN- TIFIED	UNIDEN- TIFIED		
2 and 3	Mostly Forest Reserves	Dry Nov. 1977- May, 1978	1	1	15	2	0	0	0	0	0	1	0	0
TOTALS FOR EACH GROUP			2 (10 %) *		17 (85 %)		0					1 (5 %)	0	0
1	Forest Reserve Mnts Mandingues	Dry Nov. 1978- May, 1979	0	1	6	4	0	0	0	0	33	1	0	0
TOTALS FOR EACH GROUP			1 (2.22 %)		10 (22.22 %)		33 (73.32 %)					1 (2.22 %)	0	0
1	Forest Reserve Mnts Mandingues	Dry Nov. 1979- May, 1980	7	2	7	4	2	2	1	5	11	0	0	1
TOTALS FOR EACH GROUP			9 (21.42 %)		11 (26.19 %)		21 (50 %)					0	0	1 (2.22 %)
1	Forest Reserve Mnts Mandingues	Rainy Jun- Oct. 1979	0	0	5	0	0	1	0	0	0	0	0	2
TOTALS FOR EACH GROUP			0		5 (62.5 %)		1 (12.5 %)					0	0	2 (25 %)

(10 %) * Percentage of total blood meals for each area and season

TABLE II
Blood meals of *Glossina palpalis gambiensis* from zone 1

AREAS	SEASONS	HOSTS											
		PRIMATES		SUIDS		BOVIDS					OTHER MAMMALS	REPTILES	BIRDS
		MAN	UNIDENTIFIED	WART-HOG	UNIDENTIFIED	BUF-FALO	BUSH BUCK	ROAN-ANTELOPE	DUI-KER	UNIDENTIFIED	UNIDENTIFIED		
Forest Reserve Faya	Dry Nov. 1977 May 1978	0	0	1	1	0	0	0	0	0	0	33	0
TOTALS FOR EACH GROUP		0		2 (5.71 %) *		0					0	33 (94.29 %)	0
Forest Reserve Monts Mandingues	Dry Nov. 1979 May 1980	3	2	2	0	1	3	0	1	3	0	5	
TOTALS FOR EACH GROUP		5 (25 %)		2 (10 %)		8 (40 %)					0	5 (25 %)	0
Forest Reserve Monts Mandingues	Rainy Jun-Oct. 1979	0	0	1	0	0	0	0	0	0	0	2	0
TOTALS FOR EACH GROUP		0		1 (33.33 %)		0					0	2 (66.67 %)	0
Outside Forest Reserve	Dry Nov. 1979- May, 1980	1	3	1	0	0	0	0	0	1	0	7	3
TOTALS FOR EACH GROUP		4 (25 %)		1 (6.25 %)		1 (6.25 %)					0	7 (43.75 %)	3 (18.75 %)

(5.71 %) * Percentage of total blood meals for each area and season

Gorged flies were collected by both hand nets and the Challier-Laveissière traps. These were grouped according to species, and smears were made on filter paper. Blood meals were identified by immunological tests on serum proteins at Imperial College Field Station, Ascot, Berks, United Kingdom.

4. RESULTS

G. m. submorsitans

During the 1977-78 dry season in zones 2 and (85 %) and the remaining feeds were from primates (10 %) and other mammals (5 %); no feeds were obtained from bovids (table I). The pattern in the Monts Mandingues forest reserve (zone 1) was different; in the 1978-79 dry season, a marked preference for bovids (73.33 %) was exhibited and the rest of the feeds came from suids (22.23 %), primates (2.22 %) and other mammals (2.22 %) (table I). Although the percentage feeding on bovids during the 1979-80 dry season was lower, this group still accounted for the highest number of feeds: bovids (50 %), suids (26.19 %), primates (21.42 %) and birds (2.38 %) (table I). The 1979 rainy season data were from only 8 gorged flies: 6 of the meals were from suids, 2 from bovids (Table I).

G. p. gambiensis

In the 1977-78 dry season, most of the feeds of this species from the forest reserve Faya (zone 1) were obtained from reptiles (94.29 %) and the rest were from suids (5.71 %) (table II). Bovid were accounted for the highest number of feeds (40 %) in the forest reserve Monts Mandingues in the 1977-80 dry season, and the rest were distributed as follows: reptiles (25 %), primates (25 %) and suids (10 %) (table II). However in the forest galleries outside the two main reserves in zone 1, the distribution of feeds during the 1979-80 dry season was, reptiles (43.75 %), primates (25 %), birds (18.75 %), suids (6.25 %) and bovids (6.25 %) (table II). The 1979 rainy season data in the reserve Monts Mandingues were from only 3 gorged flies; 2 of these had fed on reptiles and one on gorged flies (table II).

5. DISCUSSION AND CONCLUSION

The marked preference for suids by *G. m. submorsitans* from zones 2 and 3 were similar to those obtained by Jordan *et al.* (1962) for the same species in Nigeria. Weitz (1963, 1964) had shown that this species fed equally on suids and bovids. The contrasting preference for bovids by this species in the Monts Mandingues forest reserve (zone 1), indicates that in Mali, *Glossina* host preferences may vary from one area to another despite similarity in fauna. The preference for bovids is unusual for this spe-

Weitz's (1963, 1964) group of mainly bovid feeders. It has been demonstrated that *Glossina* feeding mainly on bovid generally have higher trypanosome infection rates than those preferring suids (Jordan, 1965; Moloo, 1973; Okiwelu, 1977). These observations have been complemented by those on trypanosome infection rates in game animals from various tsetse-infested countries, which showed that bovids were generally more important than suids as reservoirs of trypanosomes: Zambia (Kinghorn and Yorke, 1912; Keymer, 1969), Malawi (Bruce *et al.*, 1914), Tanzania (Buchanan, 1928; Ascheroff, 1958). The dominance of bovids in the feeds of *G. m. submorsitans* in the reserve Monts Mandingues may partly explain the relatively high incidence of trypanosomiasis in both the trypanosome-tolerant Ndama and the trypanosome-susceptible Zebu cattle in and around the reserve during the 1979-80 dry season disease surveys (Awan and Bouare, 1980). The host preference pattern for *G. m. submorsitans* in the 1979 rainy season conforms to the classical concept of this species as being mainly suid feeders. Since, the number of rainy season collections was very low, comparison of host preferences between seasons was not undertaken.

The results obtained in the dry seasons in the reserve Faya and the forest galleries located outside the reserves in zone 1, conform to the classical concept of *G. palpalis* as being mainly reptile feeders, but obtaining meals from other available sources. Similar results were obtained by Challier (1973) in Upper Volta, Jordan *et al.* (1962) in Nigeria and Foster (1963, 1964) in Liberia. The low number of bovid feeds may partly account for the low incidence of trypanosomiasis in cattle in these areas of zone 1 infested mainly by *G. p. gam-*

biensis (Awan and Bouare, 1980). There was also reduced vegetational cover in these areas as a result of human activities; this reduction might have caused a decrease in large mammals, and a corresponding reduction in levels of trypanosome infection rates in *Glossina* and subsequently in cattle. A correlation between scarcity or abundance of game animals and levels of trypanosome infection rates in *Glossina* has been established (Lloyd and Johnson, 1924; Vanderplank, 1947). The dry season feeding pattern for *G. p. gambiensis* in the reserve Monts Mandingues was a marked contrast to that in other sections of the zone; bovids accounted for the highest number of feeds. The increased number of bovid feeds during the dry season in the reserve Monts Mandingues was probably a result of increased contact between the two *Glossina* species and bovids at the few watering holes available for both hosts and vectors during this period of the year. It is likely that in the reserve Monts Mandingues, *G. p. gambiensis* contributes significantly to the maintenance of animal trypanosomiasis. The number of blood meals of this species collected during the rainy season from the reserve Monts Mandingues were

very few and consequently seasonal comparisons were not undertaken.

The widespread but low levels of cattle trypanosomiasis found in areas with only *G. p. gambiensis* infestation, indicates that this species may be significant in the maintenance and transmission of animal trypanosomiasis in Mali. As MacLennan (1969) noted, the significance of *G. palpalis* in the epizootiology of animal trypanosomiasis in West Africa is probably greatly underestimated.

ACKNOWLEDGEMENTS

These studies were jointly financed by the Government of the Republic of Mali and the United States Agency for International Development, to whom we are grateful. We are indebted to Dr. A. Telly, Head, New Lands Activity,

support provided at various times by Dr. F. Traore, Dr. O. Guindo and Mr. F. Cisse of the Mali Livestock II Project Management, Messrs. T. Teele and W. Crosson of the International Consulting Company, Chemonics, which provided technical assistance, is appreciated. These studies would not have been possible without the assistance of Drs. P. F. L. Boreham and R. Killick-Kendrick in analysing the blood meals. Finally, we wish to thank Messrs C. Diarra, M. Diarra, Y. Sanogo, E. Coulibaly, O. Toure, O. Karantoa and T. Koloma for the field collections.

Manuscrit reçu au Service des Éditions de l'O.R.S.T.O.M. le 17 avril 1981

REFERENCES

ASHCROFT (M. T.), 1958. — An attempt to isolate *T. rhodesiense* from wild animals. *Trans. R. Soc. trop. Med. Hyg.*, 52 : 276-282.
 AWAN (M. A. Q.) & BOUARE (S.), 1980. — Répartition et importance de la trypanosomiase animale dans la zone
 velles (Juillet 1979-Avril 1980). O.M.V.E.VI.Bamako.
 BRUCE (D.), HAMMERTON (A. E.), BATEMAN (H. R.), MACKIE (F. P.) & LADY BRUCE, 1914. — The trypanosomes found in the blood of wild animals living in the sleeping sickness areas, Nyasaland. *Report of the Sleeping Sickness Commission of the Royal Society*, n° 15 : 16.
 BUCHANAN (J. C. R.), 1929. — A note on the trypanosome infection of wild game. *Kenya East Afr. Med. J.* : 4.
 CHALLIER (A.), 1973. — Écologie de *Glossina palpalis gambiensis* Vanderplank, 1947 (Diptera, Muscidae) en savane d'Afrique occidentale. *Mém. O.R.S.T.O.M.*, n° 64, 274 pp.
 FOSTER (R.), 1963. — Contributions to the epidemiology of human sleeping sickness in Liberia. Bionomics of the vector *G. palpalis* R.-D. in a savannah habitat focus of the disease. *Trans. R. Soc. trop. Med. Hyg.*, 57 : 465-475.
 FOSTER (R.), 1964. — Contributions to the epidemiology of human sleeping sickness in Liberia : Bionomics of

the vector *Glossina palpalis* (R.-D.) in a forest habitat. *Bull. ent. Res.*, 54 : 727-744.
 JORDAN (A. M.), 1965. — The hosts of *Glossina* as a main factor affecting trypanosome infection rates of tsetse flies in Nigeria. *Trans. R. Soc. trop. Med. Hyg.*, 59 : 423-431.
 JORDAN (A. M.), LEE-JONES (F.) & WEITZ (B.), 1962. — The natural hosts of tsetse flies in Northern Nigeria. *Ann. trop. Med. Parasit.*, 56 : 430-442.
 KEYMER (I. F.), 1969. — A survey of trypanosome infection. *Ann. trop. Med. Parasit.*, 63 : 195-200.
 KINGHORN (A.) & YORKE (W.), 1912. — On the transmission of human trypanosomes by *Glossina morsitans* Westw; and on the occurrence of human trypanosomes in game. *Ann. trop. Med. Parasit.*, 6 : 1-23.
 LLOYD (L.) & JOHNSON (W. B.), 1924. — The trypanosome infections of tsetse flies in Northern Nigeria and a new method of estimation. *Bull. ent. Res.*, 14 : 265-283.
 MACLENNAN (K. J. R.), 1969. — The epizootiology of animal trypanosomiasis in West Africa. The African Trypanosomiasis. Ed. Mulligan. H. W. Allen and Unwin, London, 950 pp.
 MOLOO (S. K.), 1973. — Relationship between hosts and trypanosome infection rates of *Glossina swynnertoni* Aust in the Serengeti National Park, Tanzania. *Ann. trop. Med. Parasit.*, 67 : 205-211.
 OKIWELE (S. N.), 1977. — Host preference and trypanosome infection rates of *Glossina morsitans morsitans* West-

- wood in the Republic of Zambia. *Ann. trop. Med. Parasit.*, 71 : 101-107.
- OKIWELU (S. N.), VAN WETTERE (P.), MAIGA (S.), BOUARE (S.) & CRANS (W.), (in press). — Contribution to
- tion in the incidence of trypanosomiasis in game. *Ann. trop. Med. Parasit.*, 41 : 365-374.
- WEITZ (B.), 1963. — The feeding habits of *Glossina*. *Bull. Wild. Hlth. Org.*, 28 : 711-729.

VAN DER PLANK (P. L.), 1971. — Seasonal and annual varia-