Trop. Anim. Hlth Prod. (1989) 21, 239–244

TRYPANOSOME INFECTION RATE OF *GLOSSINA MORSITANS SUBMORSITANS* IN BAHR EL ARAB, SOUTH DARFUR PROVINCE, SUDAN

M. M. Mohamed-Ahmed, A. I. Ahmed and A. Ishag

Veterinary Research Adminstration, PO Box 8067, Khartoum, Amarat, Sudan

SUMMARY

Trypanosome infection rate of Glossina morsitans submorsitans *in Bahr El Arab fly belt, Sudan was investigated in four areas using fly rounds with screen and bait animals together with traps during the dry season February to May 1985. The overall infection rate of tsetse flies captured in the four areas was 5·1%. The infection rate of* vivax *group trypanosomes comprised 64·7% of total infections,* congolense *group 31.2% and* brucei *group trypanosomes 3·9%: 27·3% of the* vivax *and 31·3% of the* congolense *were immature trypanosome infections. Mixed trypanosome infections were encountered in a few flies. Trypanosome infection rate of flies differed with the sampling technique employed. A linear positive correlation existed between the physiological age of males and their trypanosome infection rates.*

INTRODUCTION

Glossina morsitans submorsitans is the only species of tsetse fly known in the Bahr El Arab fly belt of South Darfur Province, Sudan (Ford and Katondo, 1977; Hall, Khier, Rahman and Noga, 1984). The distribution of this species in the area is essentially riparian following the main tributaries of the river Bahr El Arab (Yagi and Abdel Razig, 1971). Recent surveys in Bahr El Arab confirmed the known northern limit of tsetse in South Darfur (Hall *et al.*, 1984). However, Mohamed-Ahmed, Ismail and Ishag (1985) could not capture tsetse in the Radom area and suggested that the northern limit described by Hall *et al.* (1984) had shifted further south. They attributed this shift to the effect of drought.

Although there are adequate data on distribution of *G.m. submorsitans* in South Darfur Province information on trypanosome species and their relative infection rate of tsetse is still lacking (Osman and Musa, 1979; Hall *et al.*, 1984). Such information is needed for the assessment of the actual trypanosomiasis risk to the people and livestock and drug resistance studies. This paper describes for the first time in the Sudan the trypanosome infection rate in *G.m. submorsitans* in Bahr El Arab fly belt in relation to trypanosome species and the sex, age of the flies and the sampling methods used.

MATERIALS AND METHODS

The survey was conducted during the dry period February to May 1985 in Radom, Krogba, Kafiakingi and Hagar Nugara areas inside the Radom National Park of Bahr El Arab fly belt (8°:45″–10°N, 23°:30″–25°E). The ecology of Bahr El Arab including the National Park was described by Harrison (1955), Hall, Kheir, Rahman and Noga (1983) Hall *et al.* (1984).

Fly rounds and traps were employed for sampling of tsetse. Transect fly rounds were made using a black blanket screen, a roan horse (300 kg) and a red calf (70 kg). Traps were comprised of the biconical trap (Challier and Laveissiére, 1973), the Portable Canopy trap (Hall *et al.*, 1983), *F*2-square trap (Flint, 1985)

and a local modification of F2 and the biconical traps called Sennar traps. Transect flv rounds were followed as described by Hall *et al.* (1984) but instead of a square of 8000 m a triangle of 3000 m was chosen for the fly round path. Morning (06.00 to 10.00) and afternoon (14.00 to 18.30) transects were made on the same triangle to cover the morning and evening peaks of tsetse activity. Traps were erected 100 m apart. Three traps of each type were used in any one area except at Kafiakingi where one trap of each type was used. Trapped flies were collected at 08.00, 12.00 and 16.00 hours.

Flies captured by any one technique were counted, sexed and examined for tenerality. Data for different traps were pooled. Males were then aged by the wing-fray method (Jackson, 1946). Male and female flies were then dissected for trypanosome infections as described by Mohamed-Ahmed and Dairri (1987). In those instances where trypanosmes were not seen in the hypopharynx or salivary glands the infections were classified as immature. Each trypanosome-infected organ was macerated separately and stained with fresh Giemsa stain to identify trypanosome species (Buxton, 1955). Data on the various samples of tsetse from all four areas were pooled to give the overall trypanosome infection rate of *G.m. submorsitans* in Bahr El Arab.

RESULTS

Among 999 dissected male and female *G.m. submorsitans,* 51 (5·1%) were infected with trypanosomes: 33 (64·7%) of these infections were caused by the *vivax* group trypanosomes, 16 (31.2%) by the *congolense* group and two (3·9%) by the *brucei* group. Nine (27·3%) of the *vivax* and five (31·3%) of the *congolense* were immature trypanosome infections. Mixed trypanosome infections were encountered in two of the infected male flies (Table I).

Female *G.m. submorsitans* had a slightly higher overall trypanosome infection rate than males but the difference was not statistically significant (Chi-square = 0·7, $P > 0{\cdot}1$). On the other hand, trypanosome infection rates of flies captured by the four sampling techniques were in the ascending order of the screen, calf, horse and traps (Table II). The trapped sample had a significantly higher trypanosome infection rate than the screen (Chi-square = 5·9, $P < 0{\cdot}05$). Differences between the screen and calf, the calf and horse or the horse and traps were insignificant ($P > 0{\cdot}1$).

The mean age calculated from the mean wing-fray value (MWFV) and age

TABLE I

Trypanosome infections and trypanosome infection rate of male and female G.m. submorsitans *in Bahr El Arab fly belt*

Species of trypanosome	Male ($N = 715$)	Female ($N = 284$)
T. vivax	23	10
T. congolense	10	6
T. brucei	2	0
Mixed *T. vivax* and *T. congolense*	1	0
Mixed *T. congolense* and *T. brucei*	1	0
Trypanosome infection rate %	5·5	5·6

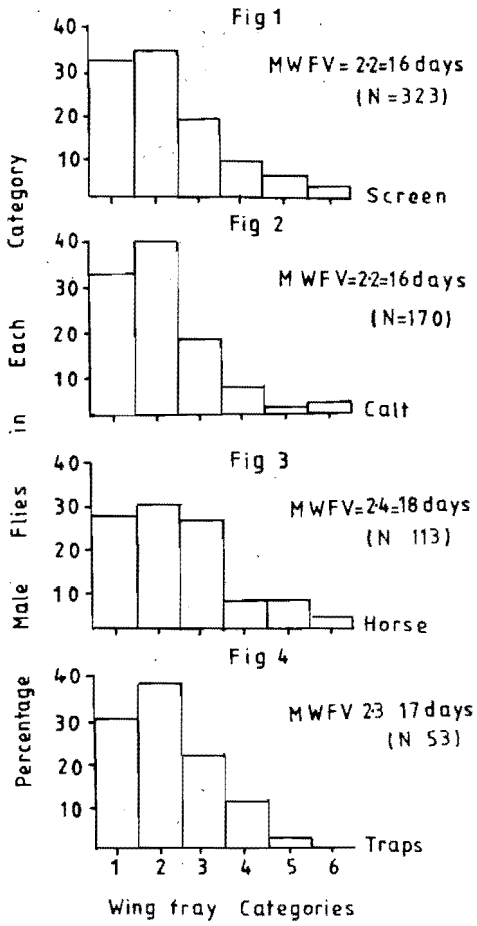
N = number of flies dissected.

TABLE II

Comparison of trypanosome infection rates of G.m. submorsitans *captured by different techniques in Bahr El Arab fly belt*

	Screen	Calf	Horse	Traps
Total no. of flies caught	464	239	180	116
Total no. of infections	19	11	9	12
Infection rate %	4·1[s]	4·6	5·0	10·3[s]

s = values followed by the letter (s) are significantly different at $P = <0{\cdot}05$.



FIGS. 1 to 4. The age-structure of male *G.m. submorsitans* as sampled by four different techniques in the Bahr El Arab fly belt. (MWFV = mean wing-fray value).

composition of each sample of male *G.m. submorsitans* are shown in Figs 1 to 4. The horse and trapped samples had higher mean ages than those from the screen or calf. As trypanosome infection rates of flies were higher in the horse and trapped samples, this suggested the increase of trypanosome infections with age of males. Thus on plotting the regression of trypanosome infection rates of males in each wing-fray category (Y) on their respective wing-fray category (X) a significant positive linear correlation was obtained (Fig. 5, $r = 0{\cdot}96$, $P < 0{\cdot}005$).

DISCUSSION

The present work shows that 5·1% of *G.m. submorsitans* in Radom National Park of Bahr El Arab harbours the three groups of the most pathogenic trypanosomes. This level of infection in flies is much lower than that reported by Osman and Musa (1979) and Hall *et al.* (1984) who reported 21·5%, 0 to 27% and 25% trypanosome infection rates of *G.m. submorsitans* from the same area. However, our result for infection rate in this species agrees with that obtained by Roberts and Gray (1972) in Nigeria but was much lower than that of Riordan (1977).

Relatively a greater proportion of immature *congolense* than immature *vivax* infections was obtained in the present work. Increased immature *congolense* group trypanosomes in *G.m. submorsitans* were also reported by Roberts and Gray (1972) and Riordan (1977) in Nigeria. High immature *congolense* group trypanosome proportions in tsetse probably result from their longer cycle of development in *Glossina* compared with the *vivax* group trypanosomes (Buxton, 1955).

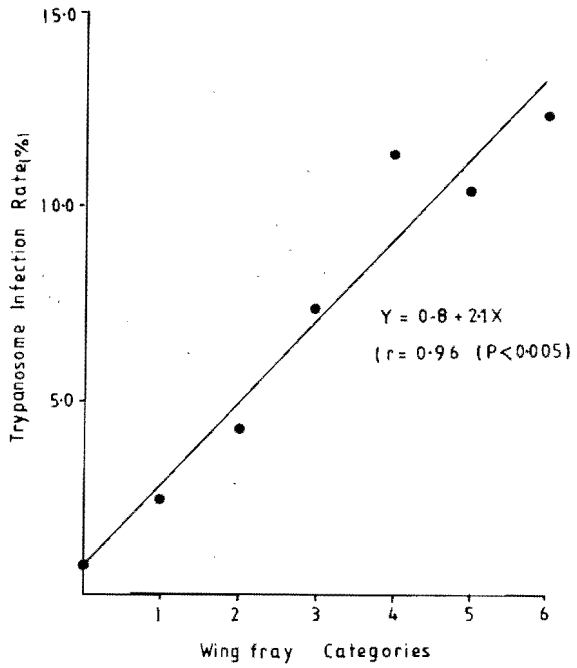


FIG. 5. The relationship between trypanosome infection rate and age of male *G.m. submorsitans* in the Bahr El Arab fly belt.

According to Jordan (1974) the trypanosome infection rate in a population of tsetse may vary with sex, age and the sampling method. In this work there was no significant difference in trypanosome infection rate between the sexes although Jordan (1974) had suggested a higher infection rate in females due to their better life expectancy. The significant variation in infection rates between the screen and the trapped samples of flies (Table II) agrees with Harley (1967a, b) who found that different samples of *G. pallidipes* from the same population included the highest proportion of infected flies when they had been caught by the traps. Harley (1967a, b) attributed this variation to differences in sex ratios and age compositions between the samples of *G. pallidipes*.

A significant positive linear correlation existed between percentage male *G.m. submorsitans* in each wing-fray category and their trypanosome infection rates (Fig. 5). This shows the increase of trypanosome infections with age of males which agrees with similar studies in other parts of Africa (Harley, 1967a, b; Geigy, Kauffmann and Diehl, 1968; Moloo, Stieger and Brun, 1973).

ACKNOWLEDGEMENTS

We are grateful to Mr G. Calderbank the head of Agricultural Section, Western Savannah Development Corporation, Nyala for the appreciation and partial sponsorship of this research. Thanks are also due to the Director of the Veterinary Research Adminstration, Soba, Sudan for permission to publish.

Accepted for publication July 1988

REFERENCES

BUXTON, P. A. (1955). The Natural History of Tsetse Flies, London School of Hygiene and Tropical Medicine—Memoir No. 10, London, H. K. Lewis & Co. Ltd, 816 pp. (Figure 148 p. 606).

CHALLIER, A. & LAVEISSIÉRE, C. (1973). Cahiers ORSTOM, Serie *Entomologie Medicale et Parasitologie*, **11**, 251–262.

FLINT, S. (1985). *Bulletin of Entomological Research*, **75**, 529–534.

FORD, J. & KATONDO, K. M. (1977). *Bulletin of Animal Health and Production in Africa*, **25**, 188–194.

GEIGY, R., KAUFFMANN, M. & DIEHL, P. (1968). *Acta Tropica*, **25**, 72–77.

HALL, M. J. R., KHIER, S. M., RAHMAN, A. H. & NOGA, S. A. (1983). *Tropical Animal Health and Production*, **15**, 191–206.

HALL, M. J. R., KHIER, S. M., RAHMAN, A. H. & NOGA, S. A. (1984). *Tropical Animal Health and Production*, **16**, 127–140.

HARLEY, J. M. B. (1967a). *Bulletin of Entomological Research*, **57**, 459–477.

HARLEY, J. M. B. (1967b). *Entomologia Experimentalis et Applicata*, **10**, 240–252.

HARRISON, M. N. (1955). Report on a Grazing Survey of the Sudan, Ministry of Agriculture, Khartoum.

JACKSON, C. H. N. (1946). *Bulletin of Entomological Research*, **37**, 391–399.

JORDAN, A. M. (1974). *Bulletin of Entomological Research*, **63**, 361–399.

MOHAMED-AHMED, M. M. & DAIRRI, M. F. (1987). *Tropical Animal Health and Production*, **19**, 11–20.

MOHAMED-AHMED, M. M., ISMAIL, A. & ISHAG, A. (1985). *Sudan Journal of Veterinary Research*, **7**, 19–25.

MOLOO, S. K., STIEGER, R. F. & BRUN, R. (1973). *Parasitology*, **66**, 259–267.

OSMAN, M. O. & MUSA, M. M. (1979). *Sudan Journal of Veterinary Research*, **1**, 43–45.

RIORDAN, K. (1977). *Annals of Tropical Medicine and Parasitology*, **71**, 11–20.

ROBERTS, C. J. & GRAY, A. R. (1972). *Annals of Tropical Medicine and Parasitology*, **66**, 41–53.

YAGI, A. I. & ABDEL RAZIG, M. T. (1971). Proceedings of the 13th International Committee for Trypanosomiasis, Lagos, OAU/STRS, Publication No. 105, pp 299–302.

TAUX D'INFESTATION PAR LES TRYPANOSOMES DE *GLOSSINA MORSITANS SUBMORSITANS* AU BAHR EL ARAB, PROVINCE DU DARFOUR AU SOUDAN

Résumé–Pendant la saison sèche de février à mai 1985 les taux d'infestation par les trypanosomes de Glossines du genre *G. morsitans submorsitans* ont été étudiés dans quatre zones en utilisant des écrans attractifs, des animaux-appâts et des pièges.

Le taux global d'infestation des mouches tsé-tsé capturées dans ces zones était de 5,1%. Le taux relatif aux trypanosomes du groupe *vivax* représentait 64,7% du nombre total des mouches infestées pour 31,2% pour les trypanosomes du groupe *congolense* et 3,9% pour ceux du groupe *brucei*. Les infestations par trypanosomes immatures représentaient 27,3% du total pour les *vivax* et 31,3% pour les *congolense*.

Des infestations mixtes ont été trouvées chez quelques mouches. Les taux d'infestation des mouches variaient en fonction de la technique d'échantillonnage utilisée. Une corrélation linéaire positive existait entre l'âge physiologique des mâles et leur taux d'infestation par les trypanosomes.

TASA DE INFECCION CON TRIPANOSOMA DE *GLOSSINA MORSITANS SUBMORSITANS* EN BAHR EL ARAB, PROVINCIA DARFUR SUR, SUDAN

Resumen–Se investigó la tasa de infección con tripanosoma de *G.m. submorsitans*, en Bahr El Arab, Sudan. La metodología consistió en atrapar moscas en cuatro áreas, utilizando mallas y animales vivos como carnada, y trampas. El estudio comenzó durante el período seco en febrero y continuó hasta mayo 1985. La tasa de infección encontrada en las moscas tsetse capturadas en las cuatro áreas fue de 5·1%. La tasa de infección del grupo de tripanosomas *vivax* fue 64·7%, del total de la infección; la tasa de infección del grupo *congolense* fue de 31·2% y del grupo brucei 3·9%. El 27·3% de infecciones con *vivax* y el 31·3% de *congolense*, fueron inmaduras. Se encontraron infecciones mixtas en algunas moscas. La tasa de infección de las moscas varió con la técnica de muestreo empleada. Se encontró una correlación linear positiva, entre la edad fisiológica de los machos y la tasa de infección de los mismos.