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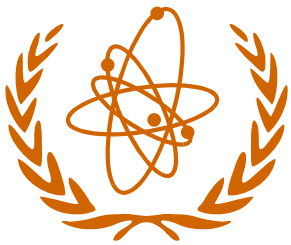

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SECTION B – ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

[See also **19**: nos. 9285, 9289.]

9263 **Chance, M.L. and Molyneux, D.H., 1995.** The human trypanosomiases (sleeping sickness and Chagas' disease). *Current Opinion in Infectious Diseases*, **8** (5): 328-335.

Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

The latest developments in the epidemiology, diagnosis, treatment, pathology, vector-parasite relationships and vector control studies are reviewed for African human trypanosomiasis.

9264 **Food and Agriculture Organization of the United Nations, 1996**. *Report of the Meeting of the Panels of Experts on Ecological, Technical and Development Aspects of the Programme for the Control of African Animal Trypanosomiasis and Related Development, Rome, 20-23 November 1995*. Rome; FAO. 22 pp.

FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy.

This meeting, whose purpose was to improve the sustainability of tsetse and trypanosomiasis control and ensure its integration with agricultural development programmes, brought together FAO experts and invited speakers representing all aspects of control, research and related development in order to further refine programme structure and identify priority areas for action. The meeting's deliberations are summarised under the following headings: (i) Review of progress and coordination; (ii) Objectives, structure and functions of programme modules; (iii) Policy definition for trypanosomiasis control; (iv) Problem identification and strategic planning; and (v) Programme implementation: structures and functions. The primary output of the meeting was the definition of the structures, in outline logical framework format (appended as annexes to the report), necessary to promote collaboration and active participation at all levels from the farmer to the international community. Some general recommendations arising from the discussions, and relating to trypanosomiasis control and FAO's role, are also given.

9265 **Hendrickx, G. and Napala, A., 1995**. Un projet innovateur de lutte contre la trypanosomiase animale au Togo. [An innovative project for the control of trypanosomiasis in Togo.] *World Animal Review*, no. 83: 68-70.

Projet de Lutte contre la Trypanosomiase, GCP/TOG/013/BEL, B.P. 114, Sokodé, Togo.

A novel approach adopted by the trypanosomiasis control project GCP/TOG/013/BEL involves systematic, grid-based sampling to correlate all the georeferenced data relevant to understanding the disease and its impact and to planning intervention. Data collected through field surveys were related to satellite imagery, provided by FAO ARTEMIS, as well as to other existing data sources on land-use patterns and demography for prediction exercises and analysis using a geographical information system. The information obtained advocated practical control in the form of decentralised programmes involving livestock keepers and private veterinarians. This approach may serve as a model for trypanosomiasis control in onchocerciasis-freed areas of West Africa as well as elsewhere in tsetse-infested sub-Saharan Africa.

9266 **Hursey, B.S. and Slingenbergh, J., 1995**. The tsetse fly and its effects on

agriculture in sub-Saharan Africa. *World Animal Review*, no. 84/85: 67-73. Animal Health Service, Animal Production and Health Division, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy.
The FAO Programme for the Control of African Animal Trypanosomiasis and Related Development, inaugurated in 1974, and initially based on the concept of tsetse eradication from large tracts of sub-Saharan Africa, has been significantly revised in the light of the development of new, more refined and environmentally acceptable control techniques and an increasing awareness of the need to relate disease management to demography, population dynamics, natural resource potential and agricultural systems. In order to carry out the analysis required for strategic planning, FAO has initiated the development of a geographic information system (GIS) on tsetse and agriculture. Data made available by the Environmental Research Group, Oxford, on the anthropogenic and environmental correlates of livestock distribution in the West African semi-arid and subhumid zones have been further analysed by FAO. A computer simulation model and GIS have been used to produce maps of present (1995) and predicted (2010) human and cattle population densities and arable land use in the moist subhumid zone of Nigeria, as well as areas of greatest predicted agricultural expansion where tsetse control is likely to be most needed to allow successful integration of ruminant livestock. An FAO field project in Togo has also shown that in areas with a trypanosomiasis prevalence of more than 30% it becomes virtually impossible to establish and maintain a mixed-farming system. An analysis made to identify priority areas for intervention indicates that, in the medium term, more sustainable socio-economic benefits are to be gained by focusing on the wetter mixed-farming areas of the subhumid zone, especially where human populations are at their greatest. A major consideration when implementing vector control in such situations is the readiness of the rural societies to play an active role in sustaining the tsetse campaign long enough to achieve autonomous disease control through the gradual and progressive transformation of the landscape.
9267 **Itty, P., Rowlands, G.J., Traub, D., Hecker, P., Coulibaly, L. and d'Ieteren, G., 1994**. Etude économique de la production bovine villageoise dans une région du nord de la Côte d'Ivoire infestée par les glossines. [Economic study of village cattle production in a tsetse-infested area in northern Côte d'Ivoire.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **47** (3): 333-343. Itty: Institut d'Economie Rurale, Ecole Polytechnique Fédérale de Zurich, 8092 Zurich, Switzerland.
This study examined the production of predominantly trypanotolerant village cattle herds under trypanosomiasis risk in Boundiali area, northern Côte d'Ivoire. The aim was to estimate returns and identify the major economic constraints. Biological data collected between January 1986 and December 1989 and economic and financial data collected in 1988 were used in a bio-economic herd simulation model to obtain 10 year projections of herd structure, meat and milk production and returns. The results indicated very high economic returns to the country's economy. The recent devaluation of the F CFA should in addition increase the competitiveness of the livestock sector. These results are encouraging in view of the government's efforts to enhance livestock production. The financial returns to the producers are, however, modest, particularly because of high herding costs as the Peul herdsmen receive a large share of the milk

produced. Increased productivity and financial returns appear difficult to achieve under this management system.

9268 **Jemal, A., Justic, D. and Hugh-Jones, M.E., 1995**. The estimated long-term impact of tsetse control on the size of the population of cattle in the Didessa Valley, western Ethiopia. *Veterinary Research Communi-cations*, **19** (6): 479-485.

Jemal: Department of Epidemiology and Community Health, Louisiana State University, Baton Rouge, LA 70803, USA.

The long-term impact of tsetse control on cattle population size in the Didessa Valley, western Ethiopia, was analysed using an age-structured population model. A prior analytical assessment revealed that the risk of cattle dying in the tsetse-unprotected villages ranged from 4 to 9 times higher than in the tsetse-protected village. Model results show that during a period of 10 years the cattle population in the tsetse-protected village of Meti is likely to increase from 167 to 583 animals, while that in the adjacent tsetse-unprotected village of Gale remains almost constant. Model simulations also predict that improving the survival rate of calves in the tsetse-unprotected villages of Taikiltu and Temoloko (which presently have calf mortality rates of up to 35%) would bring a substantial increase in their cattle population.

9269 **Rogers, D.J. and Randolph, S.E., 1988**. Tsetse flies in Africa: bane or boon? *Conservation Biology*, **2** (1): 57-65.

Department of Zoology, South Parks Road, Oxford OX1 3PS, UK.

This paper examines the changing perception of the role of tsetse flies in the development of tropical Africa. Trypanosomiasis transmitted by these vectors historically prevented the establishment of mixed (i.e. arable and livestock) farming and thus the occurrence of an agricultural revolution within the potentially more productive humid zones of the continent. Initially the colonial powers saw the tsetse as the bane of African development, and much of colonial policy was aimed at eradicating the vectors directly or at eliminating the diseases they transmit. The observation of inefficient farming techniques in the fly-infested areas, coupled with overstocking of cattle in the fly-free areas, generally led to naive development plans which often exacerbated the very problems they aimed to solve. The presence of the tsetse fly, however, prevented these mistakes from being more widespread and thus now provides a window of opportunity for sensible development which acknowledges the uniqueness of African soils and ecosystems. Ecologists can play a vital role in this process, although the absence of relevant hard data still retards progress.

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

[See also **19**: nos. 9278, 9287, 9299, 9300.]

9270 **Ahmed, A.B., Onyiah, J.A. and Suleiman, S.N., 1995**. Reproductive disorders in a laboratory colony of *Glossina palpalis palpalis* Robineau-Desvoidy (Diptera: Glossinidae). *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (3): 259-263.

Ahmed: Entomology and Parasitology Division, NITR, P.M.B. 2077, Kaduna, Kaduna State, Nigeria.

Reproductive disorders were used as a framework in assessing the loss in fecundity of a colony of *G. p. palpalis*. One thousand five hundred females at

various stages of the pregnancy cycle were selected at random from the main colony and divided into 10 groups of 150 individuals each according to age, which ranged between 5 and 90 days. All the groups were observed for the next 30 days and then dissected. Abortions were the commonest form of disorder and the major source of loss of fecundity, closely followed by the pupariation of third instar larvae *in utero*. The incidence of ovular blockage, insemination failure and degeneration of embryo/egg follicles was low. No instance of atrophy of the ovary was seen. Aborted eggs and larvae were recorded from all the age groups studied, indicating that abortions occur at any stage of the female pregnancy cycle. With a total reproductive disorder of 3.0%, losses in fecundity through reproductive abnormalities in the tsetse colony studied are minimal.

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY
[See also **19**: nos. 9299, 9300, 9307.]

9271 **Aksoy, S., 1995**. *Wigglesworthia* gen. nov. and *Wigglesworthia glossinidia* sp. nov., taxa consisting of the mycetocyte-associated, primary endosymbionts of tsetse flies. *International Journal of Systematic Bacteriology*, **45** (4): 848-851.
Department of Internal Medicine, Yale University School of Medicine, New Haven, CT 06510, USA.
The primary endosymbionts (P-endosymbionts) of tsetse flies are harboured inside specialised cells (mycetocytes) in the anterior region of the gut, and these specialised cells form a white, U-shaped organelle called the mycetome. The P-endosymbionts of five tsetse fly species (*Glossina tachinoides*, *G. palpalis palpalis*, *G. austeni*, *G. brevipalpis* and *G. morsitans morsitans*) have been characterised morphologically, and their 16S ribosomal DNA sequences have been determined for phylogenetic analysis. These organisms were found to belong to a distinct lineage related to the family Enterobacteriaceae in the gamma subdivision of Proteobacteria, which includes the secondary endosymbionts of various insects and *Escherichia coli*. These bacteria are also related to the P-endosymbionts of aphids, *Buchnera aphidicola*. Signature sequences in the 16S ribosomal DNA and genomic organisational differences which distinguish the tsetse fly P-endosymbionts from members of the Enterobacteriaceae and from the genus *Buchnera* are described. It is proposed that the P-endosymbionts of tsetse flies should be classified in a new genus, *Wigglesworthia*, and a new species, *Wigglesworthia glossinidia*. The P-endosymbiont found in the mycetocytes of *G. m. morsitans* is designated the type strain of this species.

9272 **Gooding, R.H. and Rolseth, B.M., 1995**. Genetics of *Glossina palpalis palpalis*: designation of linkage groups and the mapping of eight biochemical and visible marker genes. *Genome*, **38** (5): 833-837.
Department of Biological Sciences, University of Alberta, Edmonton, Alberta T6G 2E9, Canada.
The loci for three enzymes (hexokinase, phosphoglucomutase, and testicular esterase) and two eye-colour mutants (brick and tan) are mapped on the X chromosome of *G. p. palpalis*. The loci occur in the order *brick Hex (tan/Pgm) Est-t*, with a recombination frequency of approximately 78% between the outer two loci. The locus for octanol dehydrogenase is located in linkage group II and

the loci for malate dehydrogenase and phosphoglucose isomerase are separated by a recombination frequency of about 42.5% in linkage group III. Intra-chromosomal recombination occurs at a much lower frequency in males than in females. The distribution of five biochemical marker genes in the linkage groups of *G. p. palpalis* is markedly different from that found in other higher flies.

9273 **Hargrove, J.W., 1995**. Towards a general rule for estimating the stage of pregnancy in field-caught tsetse flies. *Physiological Entomology*, **20** (3): 213-223.

ODA/IPMI Tsetse Research Project, Box CY52, Causeway, Zimbabwe.

Ovarian dissections were performed on the tsetse flies *Glossina morsitans morsitans* and *G. pallidipes* of known ages, maintained in the laboratory or on an island in Lake Kariba, Zimbabwe. The lengths (l_2 and l_u) of the second largest oocyte and of the larva *in utero* were found to increase approximately exponentially during pregnancy. The length (l_1) of the largest oocyte increased exponentially for about the first 80% of pregnancy. Linear relationships between the log values of l_1, l_2 and l_u in field-caught flies, of unknown chronological age, are consistent with the idea that growth patterns are similar in laboratory, island and open field situations. The egg phase takes up *c*. 45% of pregnancy in both species, regardless of season and the absolute duration of pregnancy. The changes in the log values of l_1, l_2 and l_u, over the ranges within which they change linearly, can be used to assign flies to their stage of pregnancy. When applied to field data the rule showed that *G. pallidipes* caught in odour-baited traps, and on a mobile electric net, exhibited major activity peaks shortly before and after parturition. Flies from the trap (but not the net) showed a smaller peak of activity near the middle of pregnancy. The egg and the three larval phases *in utero* take up *c*. 45%, 25%, 20% and 10% of pregnancy respectively.

9274 **Loke, H. and Randolph, S.E., 1995**. Reciprocal regulation of fat content and flight activity in male tsetse flies (*Glossina palpalis*). *Physiological Entomology*, **20** (3): 243-247.

Randolph: Department of Zoology, South Parks Road, Oxford OX1 3PS, UK.

To disentangle cause and effect in previously observed relationships between fat content and flight activity in male *G. palpalis*, three groups of flies were fed at different intervals to raise their fat content to different levels before their flight activity was recorded. The greater the mean daily blood intake, the higher the fat content and the greater the subsequent spontaneous flight activity, thereby using up almost all of the fat reserves before the next blood meal. It

is proposed that although male flies would benefit from maximum food intake to permit maximum flight associated with mate-seeking, they do not in fact feed as often as possible either in the field or in the laboratory. This is explicable if energy acquisition is constrained by an additional mortality risk associated with feeding.

9275 **Tritsch, D., Mawlawi, H. and Biellmann, J.-F., 1994**. Mechanism-based inhibition of proline dehydrogenase by proline analogues. *Biochimica et Biophysica Acta*, **1202** (1): 77-81.

Biellmann: Laboratoire de Chimie Organique Biologique, URA CNRS 31, Faculté de Chimie, Université Louis Pasteur, 1 rue Blaise Pascal, 67008 Strasbourg Cedex, France.

The inactivation of proline dehydrogenase by several L-Pro analogues was investigated with the aim of blocking the essential metabolic pathway of tsetse flies allowing the degradation of L-Pro to L-Glu. *In vitro* studies on rat liver mitochondria showed that only 4-methylene-L-proline was able to inactivate proline dehydrogenase. The inactivation kinetics agreed with a mechanism-based inhibition. The other tested analogues *E*- and *Z*-4-fluoromethylene-L-proline, and *cis*- and *trans*-5-ethynyl-D,L-proline were neither substrate nor inactivator of the enzyme. *In vivo* 4-methylene-L-proline showed no toxicity against *Drosophila* flies, but was lethal for *Glossina pallidipes*, suggesting that this compound might be useful in tsetse control.

9276 **Vreysen, M.J.B. and Vloedt, A.M.V. van der, 1995**. Analysis of the mating scar pattern of *Glossina palpalis palpalis* (Rob.-Desv.) and *Glossina fuscipes fuscipes* Newstead (Diptera: Glossinidae). *Annales de la Société belge de Médecine tropicale*, **75** (3): 239-243.

Vreysen: IAEA Project URT/5/016, P.O. Box 2593, Zanzibar, Tanzania.

An analysis was made of the mating scar pattern of female *G. p. palpalis* and *G. f. fuscipes*. Measurements on fifty permanent preparations of the mating scars of females reared in the laboratory revealed significant differences in the length, width and in the distance between the centres of the mating scars of the two species. Plotting the distance between the centres of the two mating scars against the ratio width/length resulted in a 93% separation of the two species. It is proposed that this technique could be used during field surveys to expose possible cross-breeding in nature or as a tool in the entomological evaluation of a tsetse eradication campaign where one species is released in

the habitat of the other.

9277 **Weyda, F., Soldán, T. and Matha, V., 1995**. Rickettsia-like organisms in the tsetse fly *Glossina palpalis palpalis*. *Cytobios*, **81** (327): 223-228.
Institute of Entomology, Slovak Academy of Sciences, Branisovská 31, 370 05 Ceské Budejovice, Slovakia.
Rickettsia-like organisms (RLO) from the midgut and salivary glands of *G. p. palpalis* are described. They differ from endosymbionts living in mycetomes by size and structure. In contrast to previously published results, RLO without any association with virus particles were discovered. RLO were also present in non-hypertrophied salivary glands of tsetse flies.

9278 **Zdárek, J. and Denlinger, D.L., 1995**. Changes in temperature, not photoperiod, control the pattern of adult eclosion in the tsetse, *Glossina morsitans*. *Physiological Entomology*, **20** (4): 362-366.
Denlinger: Department of Entomology, Ohio State University, 1735 Neil Avenue, Columbus, OH 43210, USA.
The timing of adult eclosion in tsetse, an event that normally occurs in mid-afternoon, is regulated by the daily cycle of temperature elevation. If a temperature cycle is maintained, the rhythm of eclosion persists under continuous light or continuous darkness. Artificially shifting the temperature peak to the scotophase results in a concomitant shift in the eclosion pattern. Daily temperature variations as small as 0.4□C are sufficient to establish the rhythm. Eclosion activity tracks the temperature peak, even if the pulses are of short duration (4 h) or with irregular frequencies of 12 or 36 h. The temperature-induced rhythm offers a simple mechanism for separating females and males. Individuals that pupariate on the same day eclose as adults over a 4-5 day period at 25□C, and in such collections, females are the first to eclose. This distinction makes it possible to collect samples of predominantly one sex, a feature that may facilitate the collecting of males for use in the sterile-male technique.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **19**: nos. 9274, 9276.]

9279 **Amsler, S. and Filledier, J., 1994**. Comparaison de différents systèmes de collecte avec deux types de pièges pour la capture des glossines et des Tabanidés. [Comparison of different systems for collecting tsetse

and horse flies with two types of trap.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux,* **47** (4): 387-396.
CIRDES, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.
The efficiency of biconical (Challier-Laveissière) and monoconical (Mérot) traps with a cage or a bottle as the collecting system for *Glossina tachinoides, G. morsitans submorsitans* and the Tabanidae was evaluated in 1992 and 1994 at the Comoé site, Burkina Faso, by CIRDES. The bottle increased the catches of *G. tachinoides* only when used with the monoconical trap, but the numbers collected were always smaller than with the biconical trap/cage system. The biconical trap with a bottle gave results which varied according to the year concerned, but these results were never more than equal to those with the cage. The differences were more significant in the catches of males. The biconical trap associated with a cage was the most efficient system for catching *G. m. submorsitans*. The bottle reduced the catches with both types of trap. The use of the bottle increased (and sometimes doubled) the catches of horse flies with both types of trap.

9280 **Amsler, S., Filledier, J. and Millogo, R., 1994**. Attractifs olfactifs pour la capture de *Glossina tachinoides* et *Glossina morsitans submorsitans* (Diptera: Glossinidae) au Burkina Faso. Effet de la position du sachet diffuseur dans le piège biconique Challier-Laveissière. [Olfactory attractants for the capture of *G. tachinoides* and *G. m. submorsitans* in Burkina Faso. Effect of position of dispenser sachets in Challier-Laveissière biconical traps.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **47** (3): 301-311.
CIRDES, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.
Two experiments were carried out in the dry season in Burkina Faso, in the experimental area of Comoé (Sudano-Guinean zone), to evaluate the effect of the position of odour sachets in biconical traps on catches of *G. tachinoides* and *G. m. submorsitans*. The trial compared internal and external positions of sachets containing either metacresol alone or a 3:1 mixture of metacresol and octenol. The position of the dispenser did not seem to be a fundamental factor determining trap efficiency. The results varied with season, species and sex of *Glossina*. The influence of distance was not investigated.

9281 **Brady, J., Griffiths, N. and Paynter, Q., 1995**. Wind speed effects on odour source location by tsetse flies (*Glossina*). *Physiological Entomology*, **20** (4): 293-302.
Brady: Imperial College, Silwood Park, Ascot, Berks SL5

7PY, UK.
Tsetse flies (mainly *Glossina pallidipes*) were captured by various means at sources of artificial host odour in Zimbabwe and Kenya. Their rates of arrival and flight directions were compared with simultaneous data on the wind's speed and direction, on time-scales ranging from 1 s to 30 min. It was predicted that because increasing wind speed up to 1 m/s straightens out the airflow (Brady *et al*., 1989) it will straighten out odour plumes, make them easier to navigate, and should therefore increase the rate of arrival of flies at an odour source. In the event, the relationship proved to be more complex, with both positive and negative correlations of arrival rate on wind speed. It seems there is a bimodal relationship: odour source finding is positively related to increasing wind speed in weak winds up to ~0.5 m/s (presumably as the odour plume straightens out), but is negatively related to increasing wind speed in strong winds above ~1.0 m/s (presumably due to increasing turbulence breaking up the odour plume).

9282 **Gidudu, A.M., Cuisance, D., Reifenberg, J.M. and Frézil, J.L., 1995**. Amélioration de la technique de salivation des glossines pour la détection des métatrypanosomes infectants: étude de quelques facteurs biologiques et non biologiques sur le comportement de sondage des glossines. [Improvement of tsetse fly salivation technique for the detection of infective metatrypanosomes: study of the impact of certain biological and non-biological factors on probing behaviour of tsetse flies.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 153-160.
Gidudu: Department of Entomology, Ministry of Agriculture, Animal Industry and Fisheries, P.O. Box 201, Entebbe, Uganda.
The probing and salivation behaviour on a warm slide of three tsetse fly species or subspecies (*Glossina morsitans morsitans*, *G. palpalis gambiensis*, *G. tachinoides*) was examined with respect to various parameters (species, sex, age, starvation period, trypanosome infection, quality of support). Each fly was given the opportunity to probe the warm slide (38□C) for 5 min (by probing is meant an attempt to touch the glass slide by the proboscis in a biting position). *G. m. morsitans* was by far the most efficient at probing (70.5%) when compared with *G. tachinoides* (50.5%) and *G. p. gambiensis* (45.8%). Overall, males (61.3%) were more active than females (52%), and those of the *morsitans* group were more active than those

of the *palpalis* group. Teneral flies probed more easily than non-teneral flies, with an increased advantage in *G. m. morsitans*. The starvation period increased the probing behaviour but, at 48 h, *G. m. morsitans* probed as much as *G. p. gambiensis* and *G. tachinoides* at 72 h. The males of *G. m. morsitans* and *G. p. gambiensis* were more precocious than females, but the inverse was observed in *G. tachinoides*. Infection by *Trypanosoma congolense* (EATRO 325 strain) did not affect the probing behaviour of males of all three species but seemed to lower that of females in the *palpalis* group. Addition of a drop of PSG or blood improved the probing behaviour of infected *G. m. morsitans* females (the only ones tested). The results are discussed in relation to biological data and knowledge of the receptor systems of tsetse flies.

9283 **Griffiths, N. and Brady, J., 1995**. Wind structure in relation to odour plumes in tsetse fly habitats. *Physiological Entomology*, **20** (4): 286-292.

Brady: Imperial College, Silwood Park, Ascot, Berks SL5 7PY, UK.

Key characteristics of airflow were measured in the African bush in a study of host odour plume structure. Wind speed, speed variance, direction, and directional variance were measured by conventional cup anemometers plus wind-vanes and by a solid state ultrasonic anemometer, on time scales from seconds to minutes. The two technologies gave opposite relationships between wind speed and turbulence measured as rate of angular direction change in the wind (□/s). A positive correlation between turbulence and wind speed was observed with mechanical anemometers and wind-vanes, evidently caused by their inherent hysteresis (stalling in weak wind, overswinging after gusts). The same correlation was *negative* with the solid-state anemometer which, being hysteresis free, should have measured the true directional turbulence more accurately. Such fine-scale turbulence at a fixed point in space (on a scale of about ~15 cm diam.) decreased with wind speed up to ~1.5 m/s , as does large-scale (~1 m diam.) turbulence of air moving *through* space (Brady *et al*., 1989). This decrease occurred both within vegetation and out in the open, but the slope and intercepts of the relationship depended on vegetation and topography. Variables for describing wind speed and turbulence are considered in the context of odour plume structure.

9284 **Griffiths, N., Paynter, Q. and Brady, J., 1995**. Rates of progress up odour plumes by tsetse flies: a mark-release video study of the timing of odour source

location by *Glossina pallidipes*. *Physiological Entomology*, **20** (2): 100-108.
Brady: Imperial College, Silwood Park, Ascot, Berks SL5 7PY, UK.
The arrival of individually marked *G. pallidipes* at a host odour source after their video-timed release from 30-75 m downwind was measured in the field in Zimbabwe. In the absence of odour, the proportion recaptured was < 2% (= ~ random expectation); when synthetic ox odour was released, the probability of recapture at the source increased with proximity of release, from 6% at 75 m to 21% at 30 m (about twice this number arrived within ~2 m of the source). There were two distinct distributions of recaptures: a `fast' cohort which found the source within 40 s, and a `slow' cohort which took from 1 to > 20 min, with ~50% of the flies in each cohort. The fastest flies probably reached the source in a single, mainly straight flight from take-off, at an overall average (straight line) displacement speed of 2.8-4.5 m/s (i.e. close to the preferred flight speed of ~5 m/s). The flies apparently maintained their ground speed largely independent of the wind speed they headed into. The `slow' cohort had a constant probability of arrival at the source, presumably after losing and re-contacting the plume, and after having stopped at least once on the way. There were no marked correlations with wind parameters, although the probability of recapture increased slightly with the directness of the wind from the source, and the probability of `slow' flight increased slightly with wind speed. It is inferred that a repeated sequence of anemotactic `aim-then-shoot' orientation at take-off plus optomotor-steered in-flight correction of direction is used as a form of biased random walk to bring the flies close to the odour source, rather than the use of moth-type anemotactic zigzagging.

9285 **Hadis, M., Endeshaw, T., Kebede, A., Asfaw, T. and Tilahun, T., 1995**. Decline of *Glossina morsitans ugadensis* in Gambella, Ethiopia. *East African Medical Journal*, **72** (6): 365-369.
Hadis: National Research Institute of Health, P.O. Box 1242, Addis Ababa, Ethiopia.
Gambella is the only area where sleeping sickness is endemic in Ethiopia. Four species of *Glossina* had been reported from Gambella out of the five species found in the country in surveys made before 1985. These are *G. m. ugadensis*, *G. pallidipes*, *G. fuscipes* and *G. tachinoides*. A tsetse fly survey was carried out in parts of Gambella owing

to the fact that the area is undergoing ecological changes due to massive deforestation (because of resettlement and development programmes), poaching, and introduction of domestic animals into tsetse-infested parts of Gambella after 1985. Tsetse populations were sampled for one year, March 1993 to April 1994, using biconical traps and hand catches. The survey found all *Glossina* species which were previously reported except *G. m. ugadensis*. It seems that a combination of factors, such as lack of host animals and increase in human population, have caused this decline. This study has consolidated the fact that tsetse flies of the *morsitans* group, especially *G. morsitans*, are easily affected by human interference while the *palpalis* group is resistant to this factor. This suggests that villagisation and rural development could be practised where *G. morsitans* is the only species in a certain area to alleviate pressure on already impoverished land in parts of Africa.

9286 **Hargrove, J.W., Holloway, M.T.P., Vale, G.A., Gough, A.J.E. and Hall, D.R., 1995**. Catches of tsetse (*Glossina* spp.) (Diptera: Glossinidae) from traps and targets baited with large doses of natural and synthetic host odour. *Bulletin of Entomological Research*, **85** (2): 215-227.

Hargrove: Tsetse Control Branch, Department of Veterinary Services, Box CY52, Causeway, Harare, Zimbabwe.

In Zimbabwe, catches of *Glossina morsitans morsitans* and *G. pallidipes*, at an odour source produced by up to 60 tonnes of cattle, fell by 90% from April to October 1987. With the time effect removed, the catches were: positively correlated with daily maximum temperature; up to twice as high with a trap as with an electrified target; and unaffected by the presence of an incomplete ring of electrified netting (11.5 m diameter) around the catching site. Catches increased as a power of bait mass in accord with the theory of odour dispersal. The power was *c*. 0.32-0.44 for *G. pallidipes*, *c*. 0.15 for post-teneral *G. m. morsitans*, 0.67 for Stomoxyinae and 0.48 for non-biting muscids. Earlier results from dose-response studies accord with the new model. Tsetse catches were 1.7-4.5 times higher with 20 tonnes of cattle as bait than with a synthetic simulate of this dose, consisting of carbon dioxide, acetone, butanone, octenol and phenolic residues. Important olfactory components thus remain to be identified. Trap efficiency for *G. m. morsitans* rose from 10-20% to 40% with increasing bait mass between 0 and 5 tonnes; thereafter

bait mass had no effect. Increased efficiencies were also seen in Stomoxyinae (5 to 60%) and in post-teneral *G. pallidipes* (45 to 70-80%). Increases in catch for bait mass greater than 5 tonnes were due to increased attraction rather than increased efficiency. Targets were 60-66% efficient for *G. pallidipes*, regardless of dose; for *G. m. morsitans* the efficiency was *c*. 54% when unbaited and 24-35% when 60 tonnes of cattle were used as bait. The probability that *G. pallidipes* landed on the cloth part of the target, rather than colliding with the flanking nets, increased as the square of the bait mass for both sexes: from 0.11 to 0.22 for males and from 0.06 to 0.15 for females. There was no effect of bait mass on landing probability for *G. m. morsitans* and no difference between the sexes: *c*. 11% of the catch landed on the cloth portion of the target. Efficiency and landing behaviour were independent of climate and season.

9287 **Jarry, M., Khaladi, M. and Gouteux, J.-P., 1996**. A matrix model for studying tsetse fly populations. *Entomologia experimentalis et applicata*, **78** (1): 51-60.

Jarry: Département de Mathématiques Appliquées, URA-CNRS 1204, IPRA-UPPA, Avenue de l'Université, F-64000 Pau, France.

Some characteristics of tsetse fly population dynamics were investigated using a matrix model. To take into account the peculiarities of the tsetse fly life cycle, the classic Leslie model was modified. Our model integrated the physiological age group of *Glossina* females, the pupal and adult survival rate and the pupal life span. The limit of the growth rate was studied and the results were satisfactory when compared with data of tsetse fly mass rearing. The effect of adult and pupal survival rates on the growth rate was examined and confirmed the importance of adult survival. The sensitivity analysis showed that the growth rate was particularly sensitive to change in the survival rate of young nulliparous females. This matrix model, directly accessible to the experimenter, enhanced our understanding of tsetse population dynamics.

9288 **Späth, J., 1995**. Olfactory attractants for West African tsetse flies, *Glossina* spp. (Diptera: Glossinidae). *Tropical Medicine and Parasit-ology*, **46** (4): 253-257.

Glogauer Weg 12, D-84130 Dingolfing, Germany.

The effect of various natural host odours on *Glossina longipalpis*, *G. medicorum* and *G. tachinoides* was analysed from

catches in odour-baited biconical traps. Substances tested were ox urine, and the eight components of its phenolic fraction, as well as acetone and 1-octen-3-ol, both of which are present in ox breath. Ox urine increased the catch of *G. tachinoides* significantly by 1.2 times. Its phenolic fraction gave increases of up to 1.6 for *G. longipalpis* and 1.4 for *G. tachinoides* (significant in both cases). Adding acetone and/or 1-octen-3-ol to the phenolic fraction increased attraction of *G. longipalpis* and *G. tachinoides* significantly by up to 1.8 and 1.3 times, respectively. Octenol on its own increased the catch of all three species significantly by up to 2.2 times. Acetone alone, in combination with octenol or with the phenolic fraction, reduced the catch of *G. medicorum* significantly to a level of 0.2. 3-Methylphenol and 4-methylphenol are those components of the phenolic fraction which showed the highest attractiveness on tsetse flies in the experiments. Several mixtures of both methylphenols and/or 1-octen-3-ol were tested as attractants for all three tsetse species.

9289 **Takougang, I., Ekobo, A.S., Eyenga, V.E. and Enyong, P., 1994**. Etude de la faune vectorielle sur le site du futur barrage de Memv'ele (Cameroun). [Study of disease vectors at the site of the proposed hydroelectric dam at Memv'ele (Cameroon).] *Bulletin de la Société de Pathologie exotique*, **87** (4): 261-266.

Takougang: Ecole Normale Supérieure, B.P. 47, Yaoundé, Cameroon.

The present study was designed to assess the health risk of the future hydroelectric dam at Memve'ele with reference to vector-borne diseases. An entomological survey in the project area, using biconical traps for 3 days at points of man-fly contact, caught 22 tsetse flies (20 *Glossina palpalis* and 2 *G. tabaniformis*), giving a mean apparent density of 1.2. No trypanosomes were found on dissection. The possible risks of the development are discussed in view of the likely influx of infected persons.

9290 **Torr, S.J., Hall, D.R. and Smith, J.L., 1995**. Responses of tsetse flies (Diptera: Glossinidae) to natural and synthetic ox odours. *Bulletin of Entomological Research*, **85** (1): 157-166.

Torr: NRI, Central Avenue, Chatham Maritime, Chatham Kent ME4 4TB, UK.

In Zimbabwe, studies were made of the levels of known tsetse attractants present in natural ox odour. Typically an ox (400 kg) produced phenol (0.1 mg/h), 3-

methylphenol (0.09 mg/h), 4-methylphenol (0.7 mg/h), 3-ethylphenol (0.01 mg/h), 4-ethylphenol (0.02 mg/h), 3- and 4-n-propylphenol (0.02 mg/h), 1-octen-3-ol (0.01 mg/h), carbon dioxide (140 litres/h), acetone (5 mg/h) and butanone (0.3 mg/h). Of these, only phenol, 4- and 3-methylphenol and carbon dioxide were always detected in ox odour. Studies were made of the numbers of *Glossina pallidipes* and *G. morsitans morsitans* attracted to natural ox odour and synthetic odour, the latter consisting of blends of identified attractants dispensed at the doses naturally present in ox odour. Natural ox odour caught twice ($P < 0.05$) as many *G. pallidipes* and 1.5 times ($P < 0.05$) as many *G. m. morsitans* as the synthetic blend, suggesting the presence of an unidentified attractant in ox odour. Passing ox odour through filters indicated that all attractants can be trapped on a combination of charcoal and sodalime filters but the unidentified attractant(s) may pass through a sodalime filter, and break through a charcoal filter used for more than 6 h. Increasing the dose of ketones in the synthetic odour from 2 to 100 mg/h doubled the catches at the source. Increases in ketone levels in hosts, induced by starvation or possibly trypanosomiasis, may increase attraction of tsetse to such animals.

3. tsetse control (including environmental side-effects)

[See also **19**: nos. 9275, 9276, 9280, 9324.]

9291 **Bauer, B., Amsler-Delafosse, S., Clausen, P.-H., Kabore, I. and Petrich-Bauer, J., 1995**. Successful application of deltamethrin pour on to cattle in a campaign against tsetse flies (*Glossina* spp.) in the pastoral zone of Samorogouan, Burkina Faso. *Tropical Medicine and Parasitology*, **46** (3): 183-189.

Bauer: CIRDES, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.

One thousand five hundred to two thousand head of cattle were treated with deltamethrin 1% Spot On in an area of high tsetse densities, notably of *Glossina morsitans submorsitans*. After four treatments at monthly intervals, the time between two treatments was increased to 2 months. Eleven months after the commencement of the campaign the fly population had decreased from initially 54.2 flies/trap/day to densities varying between 0.06 and 2.0 flies/trap/day, mostly *G. palpalis gambiensis*. Blood-meal analysis showed that this species was surviving in limited areas, mainly feeding on monitor lizards; consequently it is unlikely that this

species can be eradicated solely by the use of cattle treated with a pyrethroid. The resistance of *Trypanosoma congolense* to all commercially available trypanocides necessitated the epidemiological monitoring of calves which were born after the start of the campaign in order to reassess the real challenge. The risk of new infections was low, basically due to contacts between the cattle and tsetse outside the ranching area. A weight increase from 122.3 kg to 213.6 kg of calves aged 6-12 months was recorded from October 1993 to October 1994. An average daily weight gain of more than 400 g was observed from the end of April 1994 to the beginning of August 1994.

9292 **Berg, H., 1995**. Modelling of DDT dynamics in Lake Kariba, a tropical man-made lake, and its implications for the control of tsetse flies. *Annales Zoologici Fennici*, **32** (3): 331-353.

Department of Systems Ecology, Stockholm University, S-10691 Stockholm, Sweden.

DDT has been extensively used in western Zimbabwe for the control of tsetse flies and malaria mosquitoes, and in agriculture. The input between 1967 and 1990 in the Lake Kariba area was used to do a retrospective analysis of the distribution and dynamics of the insecticide in the environment. The results are compared with trends in available data and it is suggested that the turnover of DDT in the tropics is faster than in temperate areas. It is also suggested that the residence time of DDT in Lake Kariba is comparatively short due to the lake's characteristics of being man-made and tropical. These characteristics may also influence the accumulation of DDT in the aquatic biota. Potential environmental effects from ground spraying with DDT are compared with other technically and economically feasible methods to control tsetse flies in the area, such as targets treated with deltamethrin and aerial spraying with endosulfan.

9293 **Douthwaite, R.J., 1995**. Occurrence and consequences of DDT residues in woodland birds following tsetse fly spraying operations in NW Zimbabwe. *Journal of Applied Ecology*, **32** (4): 727-738.

c/o IUCN, P.O. Box 10950, Kampala, Uganda.

Concentrations of DDT and its metabolites were compared over space, time, feeding strategy and diet in the striped kingfisher *Halcyon chelicuti*, red-billed wood-hoopoe *Phoeniculus purpureus* and five songbird species: white-headed black chat *Thamnolaea arnoti*, black tit *Parus niger*,

chinspot flycatcher *Batis molitor*, white helmet shrike *Prionops plumatus* and white-browed sparrow-weaver *Plocepasser mahali*. The white-browed sparrow-weaver fed mainly on seeds but the remaining species were insectivorous. The kingfisher, chat and helmet shrike fed heavily on secondary consumers. DDT residue concentrations 1-3 months after treatment reflected feeding site more than diet. Geometric means varied between species by up to 15 times. Highest concentrations were found in the wood-hoopoe and chat, which sometimes foraged on sprayed tree trunks, while lowest concentrations were found in the flycatcher and helmet shrike, which foraged mainly in tree and shrub canopy. Depending on species, geometric mean concentrations of DDT equivalents fell from 90-1300 μg/g lipid weight at 1-3 months post treatment to 16-87 μg/g lipid weight at 14-17 months. The proportion of DDE in ΣDDT increased from 23-77% to 69-98% over the same period. Interspecific variation at 14-17 months still reflected feeding site rather than trophic accumulation. Populations of the wood-hoopoe and chat declined over 2-3 years in sprayed areas by about 90%, but no differences attributable to spraying were detected in the other species.

9294 **Kaaya, G.P. and Munyinyi, D.M., 1995**. Biocontrol potential of the entomogenous fungi *Beauveria bassiana* and *Metarhizium anisopliae* for tsetse flies (*Glossina* spp.) at developmental sites. *Journal of Invertebrate Pathology*, **66** (3): 237-241.

ICIPE, P.O. Box 30772, Nairobi, Kenya.

Spores of two entomogenous fungi *B. bassiana* and *M. anisopliae*, were mixed with sterile sand at two different concentrations (1.0 and 0.5 g/l) and larvae of tsetse flies *Glossina morsitans morsitans* allowed to pupate in it, simulating field larviposition sites. One gram weight of *B. bassiana*-sand mixture was estimated to contain 1.4 ∃ 10^6 spores/g and that of *M. anisopliae*-sand mixture 2.3 ∃ 10^6 spores/g. Adult tsetse emerging from pupae in sand-spore mixtures suffered heavy mortalities 2-10 days post-emergence. The highest mortality recorded at 1.0 g/l was 97% for *B. bassiana* and 80% for *M. anisopliae*. Lower spore concentrations produced lower mortalities. Possibilities of biocontrol of tsetse in the field using mycopesticides at breeding sites are discussed.

9295 **Langley, P.A., 1995**. Evaluation of the chitin synthesis inhibitor triflumuron for controlling the tsetse *Glossina morsitans morsitans* (Diptera: Glossinidae). *Bulletin of Entomological Research*, **85** (4): 495-500.

Insect Investigations Ltd, School of Pure and Applied Biology, University of Wales, Cardiff CF1 3TL, UK. Topical doses of triflumuron in acetone as low as 0.05 μg per fly induced a significant reduction in the production of viable offspring by adult *G. m. morsitans*, the effect being greatest in the two reproductive cycles following treatment. A dose of 0.5 μg terminated successful reproduction for the life of the fly. A single dose was as effective as the same dose split into five separate treatments. Exposure of females by tarsal contact during passage through a cotton cloth cone treated with 3% suspension concentrate of triflumuron was sufficient to terminate successful reproduction for at least four reproductive cycles following treatment. Males exposed to treated surfaces for 5 min could transfer effective amounts of triflumuron to females during mating for at least 2 days after treatment. Target materials, treated with 1% triflumuron in acetone and exposed to field conditions in Zimbabwe for 6 months (April to September), retained their ability to induce a peak abortion rate of 60-70% (40-45% overall) among females exposed by brief tarsal contact in the laboratory.

9296 **Leak, S.G.A., Woudyalew Mulatu, Rowlands, G.J. and d'Ieteren, G.D.M., 1995**. A trial of cypermethrin `pour-on' insecticide to control *Glossina pallidipes*, *G. fuscipes fuscipes* and *G. morsitans submorsitans* (Diptera: Glossinidae) in south-west Ethiopia. *Bulletin of Entomological Research*, **85** (2): 241-251.

Leak: ILRI, P.O. Box 30709, Nairobi, Kenya.

Tsetse populations and trypanosome prevalence in cattle were monitored from 1986 to 1993 in the Ghibe Valley, south-west Ethiopia. From January 1991 to December 1993 between 2000 and 4000 cattle were treated at monthly intervals with cypermethrin. An approximate dosage of 1 ml per 10 kg bodyweight was used to control *Glossina* spp. Treatments were given as `pour-on' applications along the backlines of animals, using automatic drench-gun applicators. This resulted in a decline of 93% in the apparent density of *G. pallidipes*. A reduction of 83% in the apparent density of *G. morsitans submorsitans* was also observed. This reduction was associated with a reduction in trypanosome prevalence in cattle of over 74% in 1993, despite a high level of resistance to all available trypanocidal drugs. The numbers of *Stomoxys* spp. and Tabanidae were also significantly reduced ($P < 0.01$).

9297 **Nagel, P., 1995**. *Environmental monitoring handbook for tsetse control*

operations. Edited by the Scientific Environmental Monitoring Group. Weikersheim, Germany; Margraf Verlag. 323 pp. (ISBN 3-8236-1249-2.)
Nagel: Institut für Biogeographie, Zentrum für Umweltforschung, Universität des Saarlandes, Saarbrücken, Germany.
This handbook derives from the activities of the Scientific Environmental Monitoring Group (SEMG), a group of experts from European Member States, which was set up as a condition of EC support for the RTTCP, and is intended as an authoritative source of information for personnel commissioned to conduct environmental monitoring, including middle-level and senior tsetse control officers. The handbook contains chapters on: Tsetse control – basic information with regard to its influence on the African environment (African trypanosomoses and their vectors, present tsetse control measures); Environmental monitoring – principles applied to tsetse control (basic principles and ecological data, general design of monitoring programmes); Effects and environmental fate of insecticides used for tsetse control (general effects, susceptibility of target species, general toxicological and ecotoxicological information); Techniques and equipment for environmental monitoring; Results of environmental monitoring studies within the framework of tsetse control operations (side effects of residual applications, non-residual aerosol applications, accidental high contamination, stationary targets and livestock baits, and conclusions); Planning and implementation of environmental monitoring (selection of appropriate techniques, implementation and schedule); Guidelines for environmental monitoring (preventive measures to avoid or minimise environmental damage, remedial measures to deal with environmental damage, safety of pesticide handling, setting up an eco-technical team, training in environmental monitoring). There are also detailed bibliographies, annexes relating to contracts, reports and protocols, a glossary of technical terms, an index of plants and animals, and a subject index.

9298 **Swallow, B.M., Woudyalew Mulatu and Leak, S.G.A., 1995.** Potential demand for a mixed public-private animal health input: evaluation of a pour-on insecticide for controlling tsetse-transmitted trypanosomiasis in Ethiopia. *Preventive Veterinary Medicine*, **24** (4): 265-275.
Swallow: ILRI, P.O. Box 30709, Nairobi, Kenya.
The new pour-on insecticides that can be used to

control tsetse-transmitted trypanosomiasis confer benefits to the owners of the cattle given treatments and to other people keeping cattle in areas affected by the control. A study was conducted in southwest Ethiopia to assess farmers' perceptions of the public and private benefits of the pour-on, and to identify the household-level factors affecting its demand. Ninety-seven percent of the 166 survey respondents had received pour-on treatments when they were free and 67% paid for treatments the month before the survey. Farmers noted public and private benefits from using the pour-on, the most important of which were less trypanosomiasis, fewer problems with biting flies (including tsetse), and fewer problems with ticks. The probit model estimated to quantify the effects of different variables indicates that proportions of cows and oxen, distance to the treatment centre, and seasonal factors were significant determinants of demand.

9299 **Vreysen, M.J.B. and Vloedt, A.M.V. van der, 1995**. Radiation steriliz-ation of *Glossina tachinoides* Westw. pupae. I. The effect of dose fractionation and nitrogen during irradiation in the mid-pupal phase. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (1): 45-51.

Vreysen: IAEA Project URT/5/016, c/o Ministry of Agriculture, Department of Livestock Development, P.O. Box 159, Zanzibar, Tanzania.

A study was carried out to analyse the effect of nitrogen during radiation and dose fractionation on *G. tachinoides* pupae during the mid-pupal phase (days 15-20 following larviposition (PL)). The radiation protective effect of nitrogen during treatments of 10-80 Gy of 15-20-day-old pupae was demonstrated by an increased total eclosion rate (for 15-day-old pupae), higher residual male fertility levels and longer life spans. The proportion of reproductive abnormalities observed in their female mates increased with increased radiation dose, when treated at younger pupal stages and following treatment in air. After treatment of 15-day-old pupae with 10 Gy in nitrogen, female fertility was 0.068 pupae per mature female day as compared to 0.035 pupae/m.f.d. in air. No such increase was observed when treated as 20-day-old pupae. A dose of 60-80 Gy in nitrogen administered to 20-day-old female pupae was required to obtain 95% sterility. Splitting the radiation dose in nitrogen atmosphere into two fractions 1, 2 or 5 days apart (first dose of 10 Gy given on day 15 PL) did not influence the total

eclosion rate, mating response or insemination capacity of the male flies. Sterility of males treated in fractions separated by 1 and 2 days was similar to the level in those given a continuous dose on day 15 PL but the level of induced lethal mutations decreased with fractions separated by 5 days. Survival of the males treated in fractionated doses was similar as compared with males treated with one continuous dose on day 20 PL but better when compared with males treated with one continuous dose on day 15 PL. Female fecundity was reduced by splitting the radiation dose in fractions 1 and 2 days apart. Complete sterility was induced in female pupae when fractions were separated by 5 days, irrespective of the radiation dose used in this study. Irradiation of *G. tachinoides* pupae in the mid-pupal phase in nitrogen with doses split into two fractions separated by 1 or 2 days (total dose of 40 Gy) or 5 days (total dose of 60-80 Gy) resulted in high quality (average longevity > 20 days), sterile (residual fertility < 5%) male flies.

9300 **Vreysen, M.J.B. and Vloedt, A.M.V. van der, 1995**. Radiation sterilization of *Glossina tachinoides* Westw. pupae. II. The combined effects of chilling and gamma irradiation. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (1): 53-61.

Vreysen: IAEA Project URT/5/016, c/o Ministry of Agriculture, Department of Livestock Development, P.O. Box 159, Zanzibar, Tanzania.

Female and male *G. tachinoides* were exposed as 5-day-old pupae to 15□C for 9 to 21 days. Female pupal development was delayed at 10.4 and 18.4 days and male pupal development at 9.9 and 18.4 days for pupae incubated for 9 and 21 days respectively. Pupal eclosion was only affected by chilling periods exceeding 15 days. Mating response, insemination capacity and fertility of males exposed as pupae to a 9-day chilling period were not affected, but their survival was significantly reduced from 52.1 □ 26.2 days to 35.3 □ 18.8 days. Survival of adult females was reduced when exposed as pupae to chilling periods exceeding 12 days. After 9 days at 15□C, however, females produced 11% less offspring than untreated females. Pupae, incubated for 9 days at 15□C when 5 or 10 days old, were irradiated with 10 and 20 Gy in air or nitrogen 1 h, 7 h, 1, 3 and 5 days after the incubation treatment. In general, the eclosion rate, male fertility and average male survival were increased when the radiation treatment was given in nitrogen and

when chilling and irradiation treatments occurred later in pupal life. Only males chilled for 9 days as 5-day-old pupae and irradiated with 10 Gy in air on day 20 PL (post larviposition) had a residual fertility below 5% and lived on average longer than 20 days. Survival of all experimental female flies was reduced as compared with the control. Their receptivity to mating, however, remained normal in most cases. Complete sterility was induced in females incubated at 15□C for 9 days as 5-day-old pupae and irradiated with 10 Gy in air on day 15-20 PL and in females incubated at 15□C for 9 days as 10-day-old pupae and treated with 10 Gy in air on days 20 or 21 of pupal life.

4. epidemiology: vector-host and vector-parasite interactions

[See also **19**: nos. 9281-9284, 9288, 9290, 9333, 9336, 9338, 9339, 9361.]

9301 **Baylis, M. and Mbwabi, A.L., 1995**. Effect of host packed cell volume on the bloodmeal size of male tsetse flies, *Glossina pallidipes*. *Medical and Veterinary Entomology*, **9** (4): 399-402.

Baylis: Institute for Animal Health, Ash Road, Pirbright, Surrey GU24 0NF, UK.

Haematin contents of engorged, male tsetse flies, *G. pallidipes*, were compared with the packed cell volumes of oxen on which they had fed. Haematin contents increased with PCV up to PCV of *c*. 30%. Haematin contents appeared to level off or decline with further increase in PCV. These results support a model of blood-feeding in tsetse flies in which the rate of blood consumption decreases as PCV increases, because of increase in blood viscosity, and tsetse are unable to compensate for the decrease in consumption rate by feeding for a longer time. After allowing for the effects of PCV, bloodmeal sizes of tsetse increased with ox body temperature.

9302 **D'Amico, F., Poussinga, J.M., Le Masson, C., Le Masson, A. and Cuisance, D., 1995**. Pratiques pastorales Mbororo et trypanosomoses bovines dans une zone de savanes humides de Centrafrique. [Mbororo pastoral practices and bovine trypanosomosis in an area of wet savanna of the Central African Republic.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 203-212.

D'Amico: CIRAD-EMVT, c/o Centre ORSTOM de Montpellier, Département Santé, 911 avenue Agropolis, B.P. 5045, 34032 Montpellier Cedex 1, France.

A study was undertaken on the organisation of the pastoral area of the Mbororo cattle breeders in the Central African Republic and the spatial movements of their Zebu cattle inside this area. Besides the breeders' encampment, the pastoral space is divided into three main areas: the cattle resting area, their watering place, and the pasture which is criss-crossed by numerous paths. Use of the pastoral area was found to be based on a spatial and temporal segregation of the movements of the Zebu cattle. In the wet savannas of the Central African Republic, where *Glossina fuscipes fuscipes* is the main vector of bovine trypanosomosis, the authors show that a thorough examination of the pastoral strategies provides further elements in the understanding of the epidemiology of nagana. Thus, the differential management of calves and adult cattle is probably an important epidemiological factor.

9303 **Gidudu, A.M., Cuisance, D., Reifenberg, J.M. and Frézil, J.L., 1995.** Contribution à l'étude de l'émission de *Trypanosoma congolense* par *Glossina morsitans morsitans* (Diptera, Glossinidae) au laboratoire. [Contribution to the study of the ejection of *T. congolense* by *G. m. morsitans* in the laboratory.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (3): 264-270.

Gidudu: Department of Entomology, Ministry of Agriculture, Animal Industry and Fisheries, P.O. Box 201, Entebbe, Uganda.

The process of trypanosome ejection was studied in *G. m. morsitans* experimentally infected with *T. congolense* EATRO 325 (savanna type). The technique used was that of salivation on warm slides (38□C) for 5 min. The effect of various media (PSG, blood, PSG + ATP) was evaluated. Whatever the sex of the flies, the percentages of infections revealed by this technique did not differ significantly using either PSG or blood. Detection of parasites by microscopic examination of saliva showed that 75-100% of the males eject trypanosomes during successive probes, whereas 30-100% of the females were found to be positive using the same procedure. The number of trypanosomes ejected per fly varied greatly in the course of time, with an average of 48.4 (of which 32.5 were infective metatrypanosomes) among the males and 19.3 (of which 12.2 were infective metatrypanosomes) among the females, with an increasing proportion of stumpy forms. Addition of ATP did not affect the proportion of flies found positive, but seemed to favour the ejection of trypanosomes, notably infective forms. These results are discussed with

respect to vector-parasite relationships and the vectorial capacity of *G. m. morsitans* with a parasite belonging to the subgenus *Nannomonas*.

9304 **Kazadi, J.M., Jochems, M., Kabore, H., Mbeng, C., Hees, J. van and Kageruka, P., 1995**. Standardisation et évaluation de la technique de salivation manuelle pour le dépistage des infections par trypanosomes chez la glossine (Diptera: Glossinidae). [Standardisation and evaluation of the manual salivation technique for the detection of trypanosome infections in the tsetse fly.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 171-175.

Department of Animal Health, Prince Leopold Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp 1, Belgium.

Two methods of salivation of tsetse flies, namely manual salivation and the method of Bruce *et al*., were simultaneously evaluated in 1702 uninfected male *Glossina palpalis palpalis* (Zaire), *G. p. gambiensis* (Bobo-Dioulasso), *G. p. gambiensis* (Maisons-Alfort) and *G. morsitans morsitans* (Mall) fasted for 24, 48 and 72 h. The risk of salivation was 0.66 by the manual method and 0.01 by the method of Bruce *et al*. The manual salivation method was standardised in 79 male *G. m. morsitans* (Mall) infected with *Trypanosoma congolense* IL 1180. By this method, 70.88% of flies carrying mature and/or immature infections were identified. A clear difference was observed in the proportion of tsetse flies which salivated after 72 h and those which salivated after 48 and 24 h of fasting.

9305 **Masiga, D.K., McNamara, J.J., Laveissière, C., Truc, P. and Gibson, W.C., 1996**. A high prevalence of mixed trypanosome infections in tsetse flies in Sinfra, Côte d'Ivoire, detected by DNA amplification. *Parasitology*, **112** (1): 75-80.

Masiga: KETRI, P.O. Box 362, Kikuyu, Kenya.

The prevalence of various species and subgroups of trypanosomes in the Sinfra area of Côte d'Ivoire was determined using the polymerase chain reaction (PCR). Using this technique to amplify specific satellite DNA targets, it was possible to identify developmental-stage trypanosomes in the midguts and the proboscides of tsetse without expansion of parasite populations. The predominant tsetse species in the area was *Glossina palpalis*, while *G. pallicera* and *G. nigrofusca* were also present. Microscopical examination of 811 non-teneral flies revealed an infection rate of 14% in midguts and/or proboscides. Three sub-groups of *Trypanosoma congolense* (savanna, forest and Kilifi), *T. simiae*, *T. godfreyi*, West

African *T. vivax* and *T. brucei* ssp. were identified using PCR. *T. congolense* forest was the most abundant of the *Nannomonas* trypanosomes. Approximately 40% of all infections were mixed, and there was a significantly higher prevalence of apparently mature *T. brucei* ssp. trypanosomes than has previously been reported. The present study demonstrates that PCR facilitates the easy identification of mature trypanosome infections in tsetse, providing a reliable estimation of trypanosomiasis challenge.

9306 **Milligan, P.J.M., Maudlin, I. and Welburn, S.C., 1995**. *Trypanozoon*: infectivity to humans is linked to reduced transmissibility in tsetse. II. Genetic mechanisms. *Experimental Parasitology*, **81** (3): 409-415.

Milligan: Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

Trypanozoon infections are less likely to mature in female tsetse than in males. Analysis of maturation data from 37 *Trypanozoon* isolates in *Glossina morsitans morsitans* showed that, while the proportion of mature infections (salivary gland infections as a proportion of established midgut infections) varied from isolate to isolate, the proportion of mature infections in female flies was consistently smaller than the proportion in male flies. The log of the probability of maturation in females is, on average, twice the log of the probability in males (estimate of the ratio of the logged proportions is 2.09, 95% confidence interval (CI) 1.8 to 2.5). Human serum-resistant isolates were less likely to mature than human serum-sensitive isolates (ratio of logged proportions maturing was 1.5, 95% CI 1.3 to 1.8, in both male and female tsetse). Data for four other trypanosome stocks show that the probability of maturation decreases as the maturation time (the delay between the infected bloodmeal and maturation) increases. The decrease is approximately exponential with twice the half-life in male flies compared to that in female flies (estimate of the ratio of the exponential parameters is 1.97, 95% CI 0.7 to 3.3). A model is proposed to explain these observations which assumes that product(s) from an X-linked gene(s) kills or otherwise prevents migrating parasites from establishing a mature infection. Longer maturation times are associated with a heavy penalty in terms of transmissibility as measured by the vectorial capacity.

9307 **Moloo, S.K. and Gooding, R.H., 1995**. A comparison of *Glossina morsitans centralis* originating from Tanzania and Zambia, with respect to vectorial competence for

pathogenic *Trypanosoma* species, genetic variation and inter-colony fertility. *Medical and Veterinary Entomology*, **9** (4): 365-371.
Moloo: ILRI, P.O. Box 30709, Nairobi, Kenya.
Two laboratory strains of *G. m. centralis* originating from different fly-belts (one from Singida, in Tanzania, and the other from Mumbwa, in Zambia) were compared with respect to vectorial competence for pathogenic *Trypanosoma* species, genetic variation and inter-colony fertility. The vectorial competence of *G. m. centralis* of Tanzanian origin for *T. vivax* and *T. congolense* is similar to, whereas for *T. brucei brucei* it is lower than, the colony of Zambian origin. Nevertheless, these two laboratory strains of *G. m. centralis* showed levels of susceptibility to the three pathogenic *Trypanosoma* species which were much greater than previously observed in laboratory colonies of other *Glossina* species. Electrophoresis of fifteen enzymes revealed that the two colonies differ significantly in allele frequencies at only three loci (*Odh*, *Est-1* and *Est-2*) that are relatively close together on one of the autosomes. Hybridisation experiments revealed that *G. m. centralis* from the two fly-belts are consubspecific.

9308 **Solano, P. and Amsler-Delafosse, S., 1995**. *Trypanosoma congolense* chez différentes espèces de taons (Diptera: Tabanidae) au Burkina Faso. [*T. congolense* in various species of horse flies in Burkina Faso.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 145-146.
CIRDES, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.
Four out of six Azawak Zebu bulls raised in northern Burkina Faso were found to be infected with trypanosomes, including *T. congolense*, 6 months after they had been transferred, uninfected, to the CIRDES experimental farm at Banankélédaga (20 km from Bobo-Dioulasso). Entomological surveys are carried out regularly in the area around this farm and, in one year, only 10 tsetse flies were captured, none of which showed infection in the midgut. However, a large number of tabanids were captured in the tsetse traps and dissection of some of them showed the presence of trypanosomes in their midgut. DNA amplification with the polymerase chain reaction (PCR) technique showed that the trypanosomes found in two tabanids (*Tabanus taeniola* and *Atylotus agrestis*) belonged to the savanna type of *T. congolense*.

9309 **Solano, P., Argiro, L., Reifenberg, J.M., Yao, Y. and Duvallet, G., 1995**. Field application of the polymerase chain

reaction (PCR) to the detection and characterization of trypanosomes in *Glossina longipalpis* (Diptera: Glossinide) in Côte d'Ivoire. *Molecular Ecology*, **4** (6): 781-785. Duvallet: CIRAD-EMVT, B.P. 5035, 34032 Montpellier Cedex 1, France.
The PCR technique was used for the identification of natural trypanosome infections in *G. longipalpis* in Côte d'Ivoire. A total number of 139 flies were examined microscopically for the presence of trypanosomes. Out of them 50 were detected positive and were subsequently prepared for the PCR using primers specific for *Trypanosoma (Nannomonas) congolense* of savanna, riverine-forest, Kilifi and Tsavo types, *T. (N.) simiae*, *T. (Duttonella) vivax* and *Trypanozoon*. Almost 90% of the infections detected by the PCR were attributed to *Nannomonas*, especially *T. congolense* savanna and riverine-forest types, with many infections in which both of these two types were present. *T. simiae* and *T. vivax* were also detected in some flies. The sequence specificity of the PCR products was confirmed by hybridisation with parasite-type specific DNA probes. Differences between parasitological and PCR results are discussed.

9310 **Welburn, S.C., Maudlin, I. and Milligan, P.J.M., 1995**. *Trypanozoon*: infectivity to humans is linked to reduced transmissibility in tsetse. I. Comparison of human serum-resistant and human serum-sensitive field isolates. *Experimental Parasitology*, **81** (3): 404-408. Welburn: Tsetse Research Group, University of Bristol, Langford, Bristol BS18 7DU, UK.
The transmissibility of recent isolates of human serum-sensitive (HSS) and human serum-resistant (HSR) *Trypanozoon* was compared by transmission of 37 stocks through an inbred line of *Glossina morsitans morsitans*. As in previous studies maturation was found to be dependent on fly sex, with males producing significantly greater proportions of salivary gland infections than females. HSS stocks were, however, 1.8 times more likely to mature to mammalian infective form than HSR stocks in male tsetse and 2.7 times more likely to mature than HSR stocks in female tsetse. Infectivity to man has apparently evolved at the expense of transmissibility in tsetse. The likelihood of sexual processes occurring in *Trypanosoma brucei rhodesiense* in wild flies is discussed.

5. human trypanosomiasis
(a) SURVEILLANCE
[See also **19**: no. 9317.]

9311 **Paquet, C., Castilla, J., Mbulamberi, D., Beaulieu, M.F., Gastellu Etchegorry, M. and Moren, A., 1995**. La trypanosomiase à *Trypanosoma brucei gambiense* dans le foyer du nord-ouest de l'Ouganda. Bilan de 5 années de lutte (1987-1991). [Control of trypanosomiasis due to *T. b. gambiense* in north-west Uganda: report of a 5 year campaign, 1987-1991.] *Bulletin de la Société de Pathologie exotique*, **88** (1): 38-41. Paquet: Epicentre, 8 rue Saint-Sabin, Paris, France.
In Uganda, a case-finding and treatment programme has been implemented by Médecins Sans Frontières and the Ministry of Health in the north of West-Nile province, Uganda. Records of patients treated in the hospital of Moyo from January 1987 to June 1991 were analysed. A total of 4822 cases of trypanosomiasis due to *T. b. gambiense* were recorded, a cumulative incidence rate for this period of 5.6%. Passive and active case-finding strategies were used, both based on the card agglutination test (CATT) as a screening tool, followed by parasitological examinations. The mobile teams identified 1906 of the 4822 cases (39.5%). The case fatality rate was 2.6%. This study confirmed the association between social and political disruptions, large movements of population and extension of trypanosomiasis in this region of Africa. Active case-finding seems to quickly reduce disease prevalence in hyper-endemic areas. An integrated programme is then necessary to control sleeping sickness transmission.

(b) PATHOLOGY AND IMMUNOLOGY

9312 **Khonde, N., Pépin, J., Niyonsenga, T., Milord, F. and Wals, P. de, 1995**. Epidemiological evidence for immunity following *Trypanosoma brucei gambiense* sleeping sickness. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **89** (6): 607-611. Pépin: Infectious Diseases Section, Centre Hospitalier Universitaire, 3001 12ème Avenue Nord, Sherbrooke, Québec J1H 5N4, Canada.
In order to investigate whether protective immunity appears after *T. b. gambiense* sleeping sickness, we undertook a retrospective cohort study of three remote villages in central Zaire (total population 1431), in which 38% of all adults had a past history of human African trypanosomiasis. Among adults previously diagnosed with trypanosomiasis and treated, the risk of a second episode of trypanosomiasis during the 10 year period of observation was only 15% (with a 24 months refractory period) and 30% (without a refractory period) of the risk of a first episode in adults never previously diagnosed. We could not demonstrate a

similar difference among children, to some extent because only a few of them were diagnosed for a first time with trypanosomiasis. Our findings suggest that very significant immunity appears after Gambian sleeping sickness, and that developing a vaccine against this subspecies of trypanosomes is biologically plausible.

9313 **Meda, H.A., Doua, F., Laveissière, C., Miezan, T.W., Gaens, E., Brattegaard, K., Muynck, A. de and Cock, K.M. de, 1995**. Human immunodeficiency virus infection and human African trypanosomiasis: a case-control study in Côte d'Ivoire. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **89** (6): 639-643.

Meda: Department of Epidemiology, Prince Léopold Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.

To assess the association between human immunodeficiency virus (HIV) infection and human African trypanosomiasis (HAT) in Côte d'Ivoire, a cross-sectional case-control study was conducted on 301 HAT patients recruited in the main foci of the country. For each HAT patient, 3 controls, matched for sex, age and residence, were selected. Data relating to socio-demographic factors and potential risk factors for *Trypanosoma brucei gambiense* and HIV infections were obtained, and serum samples were collected for HIV-1 and HIV-2 tests. A positive test consisted of enzyme immunoassay reactive to HIV-1, HIV-2 or both and confirmed by a synthetic peptide test or Western blot. Data were analysed using conditional logistic regression with EGRET software. No statistically significant difference was found between the prevalence of HIV infection in HAT patients and controls (4.3% and 3.5% respectively; crude odds ratio (OR) 1.28, 95% confidence interval (CI) 0.65-2.50). In multivariate analysis, allowance for 5 covariates did not change the association between the two infections (adjusted OR 1.27, 95% CI 0.64-2.52). Although this study had limited statistical power, no significant association was found between HIV infection and *T. b. gambiense* infection in rural Côte d'Ivoire. Studies are needed to determine whether HIV infection influences the clinical course of HAT, a question not addressed in the present study.

9314 **Okomo-Assoumou, M.C., Daulouède, S., Lemesre, J.-L., N'zila-Mouanda, A. and Vincendeau, P., 1995**. Correlation of high serum levels of tumor necrosis factor-α with disease severity in human African trypanosomiasis. *American*

Journal of Tropical Medicine and Hygiene, **53** (5): 539-543.
Vincendeau: Laboratoire de Parasitologie, Université de Bordeaux II, 146 rue Leo Saignat, F-33076 Bordeaux, France.
The levels of TNF-α in sera from *Trypanosoma brucei gambiense*-infected patients from the endemic region of Boko Songho (Bouenza focus in Congo) were measured. An increase was observed in sera from patients (geometric mean = 53.75 pg/ml, *n* = 69) compared with control subjects from the same endemic area (6.72 pg/ml, *n* =31). The patients were classified as being in the early (blood lymphatic) stage and late (meningo-encephalitic) stage of disease according to the presence of parasites and cells in the CSF. An increase in TNF-α was noted in late stage patients (68.42 pg/ml, *n* = 28) compared with early stage patients (43.68 pg/ml, *n* = 41). Those patients with fever, asthenia and oedema and those with neurologic signs had higher levels of TNF-α (89.36 pg/ml, *n* = 26) than others (38.07 pg/ml, *n* = 43). No differences in TNF-α levels were seen when trypanosomes were detected in one location (blood, lymph nodes or CSF) or two or three locations. These data show that the levels of TNF-α in serum of *T. b. gambiense*-infected patients were correlated with disease severity (presence of signs of inflammation or presence of major neurologic signs) and indicate that TNF-α could be involved in some aspects of human African trypanosomiasis physiopathology.

9315 **Pentreath, V.W., Alafiatayo, R.A., Crawley, B., Doua, F. and Oppenheim, B.A., 1996**. Endotoxins in the blood and cerebrospinal fluid of patients with African sleeping sickness. *Parasitology*, **112** (1): 67-73.
Pentreath: Department of Biological Sciences, University of Salford, Salford M5 4WT, UK.
Endotoxin levels were measured in the blood and CSF of control individuals and two groups of patients with African sleeping sickness. Endotoxin levels were markedly elevated in the patients' blood (infected groups mean endotoxin values 40.2 pg/ml and 53.8 pg/ml, compared to control 11.6 pg/ml, $P < 0.0001$ for both increases) and CSF (infected groups mean endotoxin values 45.8 pg/ml and 50.1 pg/ml compared to control 6.3 pg/ml, $P < 0.0001$ for both increases). The levels were reduced 6 weeks following different drug treatments in the two groups (blood levels to mean 33.8 pg/ml and 28.5 pg/ml; CSF levels to 37.4 pg/ml and 27.0 pg/ml). The blood endotoxin values correlated with the CSF values before treatment ($r = 0.74$ and 0.57 for the

two groups; $P < 0.0001$ for both) and after treatment ($r = 0.57$ and 0.56 for the two groups; $P < 0.0001$ for both). It is concluded that raised endotoxin equilibrates in the blood and CSF compartments, and may contribute significantly to the pathology of sleeping sickness.

9316 **Smith, A.B. and Hajduk, S.L., 1995**. Identification of haptoglobin as a natural inhibitor of trypanocidal activity in human serum. *Proceedings of the National Academy of Sciences of the United States of America*, **92** (22): 10262-10266. Hajduk: Department of Biochemistry and Molecular Genetics, Schools of Medicine and Dentistry, University of Alabama, Birmingham, AL 35294, USA.

Trypanosoma brucei brucei can only infect animals. Man is protected from this subspecies by a toxic subtype of high density lipoproteins (HDLs) called the trypanosome lytic factor (TLF). The toxic molecule in TLF is believed to be the haptoglobin-related protein that when bound to haemoglobin kills the trypanosome via oxidative damage initiated by its peroxidase activity. The amount of lytic activity in serum varies widely between different individuals with up to a 60-fold difference in activity. In addition, an increase in the total amount of lytic activity occurs during the purification of TLF, suggesting that an inhibitor of TLF (I_{TLF}) exists in human serum. We now show that the individual variation in trypanosome lytic activity in serum correlates to variations in the amount of I_{TLF}. Immunoblots of I_{TLF} probed with antiserum against haptoglobin recognise a 120 kDa protein, indicating that haptoglobin is present in partially purified I_{TLF}. Haptoglobin involvement is further shown in that it inhibits TLF in a manner similar to I_{TLF}. Using an anti-haptoglobin column to remove haptoglobin from I_{TLF}, we show that the loss of haptoglobin coincides with the loss of inhibitor activity. Addition of purified haptoglobin restores inhibitor activity. This indicates that haptoglobin is the molecule responsible for inhibition and therefore causing the individual variation in serum lytic activity.

(c) TREATMENT

[See also **19**: no. 9351.]

9317 **Peceny, J., Cuzin-Ferrand, L., Marchou, B. and Auvergnat, J.C., 1995**. Méningo-encéphalite à *Trypanosoma b. gambiense* traitée par l'éflornithine. [Late-stage *T. b. gambiense* trypanosomiasis treated by eflornithine.] *Médecine et Maladies infectieuses*, **25** (3 bis): 542-544.

Peceny: Service des Maladies Infectieuses et Tropicales, CHU Purpan, F-31059 Toulouse Cedex, France.
Late-stage African trypanosomiasis was diagnosed in two female patients aged 28 and 30 years living in France, 1 and 2 years after leaving Congo and Zaire, respectively. One patient had been suffering from vomiting, weight loss and sleeping problems; the other from a depressive state which deteriorated into a stupor. Both were successfully treated with eflornithine (100 mg/kg, 4 times a day i.v. for 14 days) which was well tolerated, and both continued free of infection after follow-up of 3 years and 1 year respectively. The mode of action, dose regimen, side effects and problems of use of eflornithine in Africa are discussed.

6. animal trypanosomiasis

(a) SURVEY AND DISTRIBUTION

9318 **Delafosse, A., Bengaly, Z. and Duvallet, G., 1995**. Absence d'interaction des infections à *Trypanosoma theileri* avec le diagnostic des trypanosomoses animales par détection des antigènes circulants. [Absence of interaction by *T. theileri* with the diagnosis of animal trypanosomoses using antigen-detection enzyme immunoassays.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (1): 18-20.
CIRDES, Unité Epidémiologie et Biotechnologie Appliquée, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.
This work presents data gathered at CIRDES during epidemiological monitoring. The prevalence levels of *Trypanosoma vivax*, *T. congolense* and *T. brucei* obtained using antigen-detection ELISA were compared in non-infected animals and in animals infected with *T. theileri*. The aim was to investigate whether there were any serological cross-reactions between *T. theileri* and the pathogenic trypanosomes. The results show that there was no interaction by *T. theileri* with the diagnosis of the pathogenic trypanosomes using antigen-detection ELISA.

9319 **Ndao, M., Pandey, V.S., Zinsstag, J., Pfister, K. and Meirvenne, N. van, 1995**. Evaluation of sodium dodecyl sulfate (SDS) as a haemolytic agent for the detection of microfilariae and trypanosomes in the blood of cattle. *Annales de la Société belge de Médecine tropicale*, **75** (2): 145-148.
Pandey: Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp 1, Belgium.
The objective of the present study was to compare the buffy coat and the haemolytic detergent techniques for the simultaneous detection of trypanosomes and microfilariae in naturally infected cattle in The

Gambia. A total of 488 blood samples collected from 166 village N'Dama cattle during a 6 month period were examined by the buffy coat technique and by two methods using the powerful haemolytic agent, sodium dodecyl sulphate (SDS): SDS direct using a drop of blood and a drop of SDS on a microscope slide, and SDS-centrifugation where larger quantities of blood and SDS were mixed, centrifuged and the sediment examined. Of the 488 blood samples examined, 6 (1.2%) were positive for trypanosomes by SDS-centrifugation and 4 (0.8%) by SDS direct and the buffy coat technique (all *Trypanosoma vivax* except one *T. congolense*). SDS-centrifugation was also the most sensitive test for detecting microfilariae (23.8% positive compared to 14.3% with the other two methods).

9320 **Omeke, B.C.O., 1994**. Pig trypanosomosis: prevalence and significance in the endemic Middle Belt zone of Southern Nigeria. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **47** (4): 381-386.

Department of Veterinary Physiological Sciences, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan S7N 0W0, Canada.

Abattoir and field/market surveys of 1954 crossbred pigs aged 6-30 months for trypanosomosis in the Middle Belt zone of Southern Nigeria revealed a 26.8% infection rate. Of those infected, 66.5%, 23.9% and 8.2% were due to mixed, single *Trypanosoma brucei* and single *T. congolense* infections, respectively. Although 1.5% of the infections were unidentified, there was no evidence of *T. simiae*. The infection rate was significantly higher ($P < 0.05$) among the abattoir pigs (37.8%) than among the farm pigs (21.8%) in both sexes. Peak infection was noted among pigs aged 11-15 months and during the end of the rainy season and the beginning of the dry season (September to December). Complementary mice inoculation tests revealed 83 subpatent and prepatent cases and are recommended as a confirmatory diagnostic technique. The disease poses problems for pig productivity and the cooperation of scientists is essential.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **19**: no. 9268.]

9321 **Akinbamijo, O.O. and Reynolds, L., 1994**. Trypanosomiasis induced reproductive wastage in West African Dwarf sheep. *In*: Lebbie, S.H.B., Rey, B. and Irungu, E.K. (eds), *Small ruminant research and development in Africa* (Proceedings of the Second Biennial Conference of the African Small

Ruminant Research Network, AICC, Arusha, Tanzania, 7-11 December 1992), pp. 95-102.
Akinbamijo: Department of Animal Production Systems, Agri-cultural University, 6700 AH Wageningen, Netherlands.
This study reports the results of investigations on the effects of *Trypanosoma vivax* infection in pregnant and lactating West African Dwarf ewes on digestible organic matter intake (DOMI), live weight changes, milk yield pattern, lamb birth weight and growth rate. During pregnancy and lactation. DOMI was lower ($P < 0.05$) in infected ewes. Rate of weight gain did not differ between infected and control animals before 14 weeks post-breeding (8 weeks p.i.). Infected ewes had low maternal weights and poor body condition at parturition, which were associated with low ($P < 0.01$) lamb birth weights and survival. Abortion rate was 15% in the infected ewes with a lamb mortality rate of up to 85%. Lambs born to infected dams had lower weaning weights compared with lambs from control ewes. In lactating dams, neither milk yield nor composition was affected by infection during the first half of lactation. However, during late lactation infected ewes produced less ($P < 0.05$) milk and lost more weight compared to uninfected lactating ewes. Growth rates of lambs nursed by control and infected dams did not differ in the pre-weaning period.

9322 **Buza, J.J., Logan-Henfrey, L., Andrianarivo, A.G. and Williams, D.J.L., 1995**. Rise in erythropoietin concentrations in experimental *Trypanosoma congolense* infection of calves. *Journal of Comparative Pathology*, **113** (4): 343-356.
Logan-Henfrey: ILRI, P.O. Box 30709, Nairobi, Kenya.
A bioassay was used to measure erythropoietin (EPO) concentrations in calves with haemorrhagic anaemia due to blood loss and in calves with anaemia due to *T. congolense* infection. The bioactivity of EPO was measured in the assay by its stimulatory effect on ^{125}I-deoxyuridine incorporation in spleen cells from phenylhydrazine-treated mice. EPO concentrations in blood-volume-depleted calves were elevated 6 h after blood loss, maximal (1225 mU/ml) at 33 h and below detection limits at 72 h. Reticulocytes (0.05 □ 0.1%) appeared in blood by 72 h, peaked at 120 h and disappeared from the circulation by 7 days after bleeding. The PCV started increasing at 120 h and reached near pre-bleeding values by 14 days. In *T. congolense*-infected calves, parasites were first detected in the peripheral blood 12 days post-infection.

Parasitaemia peaked (5 ∃ 10^5 trypanosomes/ml of blood) at 15-18 days p.i. and, thereafter, several waves of parasitaemia were observed, but the peaks gradually diminished. Undiluted plasma from *T. congolense*-infected calves suppressed ^{125}I-deoxyuridine incorporation into spleen cells from 13 days p.i. onwards. The suppressive effect of plasma was partly negated by five-fold dilution, which made possible the detection of increased EPO concentrations during the acute and chronic stages of the anaemia. The highest EPO peaks, reaching 2300 mU/ml in one calf, were detected during the chronic stage of the infection. At 15-39 days p.i., there was a transient bone-marrow erythropoietic response characterised by an increase in mean corpuscular volume and a decrease in mean corpuscular haemoglobin concentration but with few reticulocytes (0.4%). However, from 76 days p.i. onwards, this response waned despite low PCV and elevated EPO concentrations. These results suggest that there is an ineffective erythroid response in the face of elevated EPO concentrations during bovine trypanosomiasis. The negative effect of plasma and serum from trypanosome-infected calves on the *in vitro* bioactivity of EPO suggests the presence of inhibitory factors.

9323 **Katunguka-Rwakishaya, E., Parkins, J.J., Fishwick, G., Murray, M. and Holmes, P.H., 1995**. The influence of energy intake on the pathophysiology of *Trypanosoma congolense* infection in Scottish Blackface sheep. *Veterinary Parasitology*, **59** (3-4): 207-218.

Holmes: University of Glasgow Veterinary School, Bearsden Road, Bearsden, Glasgow G61 1QH, UK.

The intensity of parasitaemia, degree of anaemia, live body weight gains and blood biochemical changes were measured in two groups of Scottish Blackface sheep infected experimentally with *T. congolense* and allowed either a high (9.9 MJ metabolisable energy (ME) per day) or a low (6.1 MJ ME per day) energy intake. It was observed that infected animals on the low energy intake had a longer mean prepatent period, but following patency they developed more severe anaemia and greater growth retardation than those on the high energy intake. Both infected groups exhibited significant reductions in serum total lipids, phospholipids, plasma cholesterol and albumin. However, these changes were more severe in the animals on the low energy intake than in those on the high energy intake. It was concluded that adequate energy nutrition enhances the ability of infected animals to

withstand the adverse effects of infection, by promoting body weight gains and moderating the severity of the pathophysiological changes associated with ovine trypanosomosis.

9324 **Le Gall, F., Blanc, F., Gouteux, J.P., Mainguet, M., Cuisance, D., Lemesre, J.L., Nitcheman, S., Cavaleyra, M., D'Amico, F., Pounékrozou, E. and N'Dokoué, F., 1995**. La lutte par piégeage contre *Glossina fuscipes fuscipes* pour la protection de l'élevage en République centrafricaine. IV. Impact entomologique, parasitologique et zootechnique. [Control of *G. f. fuscipes* by trapping to protect livestock in the Central African Republic. IV. Entomological, parasitological and zootechnical impact.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 161-169.

Le Gall: World Bank, AGRTN, 1818 H Street, N.W. Washington, DC 20433, USA.

As part of an integrated control campaign against bovine trypanosomiasis in the Central African Republic, 19 Mbororo Zebu herds were monitored to evaluate the impact of a trapping campaign against *G. f. fuscipes* restricted to watering places. Over a 5 month period, July to December 1990, tsetse apparent density fell by 85%. Trypanosome prevalence fell from 18% to 10.5% and haematocrit values improved. The impact on productivity was more difficult to assess over a short period, with no significant differences in the parameters measured (mortality, fecundity, quantity of milk), but fewer trypanocidal treatments were required.

9325 **Lutje, V., Mertens, B., Boulangé, A., Williams, D.J.L. and Authié, E., 1995**. *Trypanosoma congolense*: proliferative responses and inter-leukin production in lymph node cells of infected cattle. *Experimental Parasitology*, **81** (2): 154-164.

Lutje: ILRI, P.O. Box 30709, Nairobi, Kenya.

T-cell-mediated immune responses to defined antigens of *T. congolense* were measured in cattle undergoing primary infection. The antigens used were the variable surface glycoprotein and two invariant antigens, a 33 kDa cysteine protease (congopain) and a recombinant form of a 69 kDa heat-shock protein. Proliferative responses were highest during the second week p.i. and were detected in cells obtained from the lymph node draining the site of infection but not in peripheral blood mononuclear cells. Production of IL-2 and IFN-γ was measured in supernatants from antigen-stimulated lymph node cell cultures. Expression of IL-2, IL-4 and IFN-γ mRNA was detected in antigen-stimulated lymph node cells by reverse transcription-polymerase chain amplification.

9326 **Mutayoba, B.M., Eckersall, P.D., Jeffcoate, I.A., Cestnik, V., Holmes, P.H. and Reid, S.W.J., 1995**. Alterations in plasma luteinising hormone and testosterone concentrations and responses to injection of gonadotrophin-releasing hormone in sheep infected with *Trypanosoma congolense*. *Animal Reproduction Science*, **40** (3): 203-214.
Mutayoba: Department of Veterinary Physiology, Biochemistry, Pharmacology and Toxicology, Faculty of Veterinary Medicine, Sokoine University of Agriculture, P.O. Box 3017, Morogoro, Tanzania.
The influence of experimental *T. congolense* infection on plasma luteinising hormone (LH) and testosterone and the pituitary-testicular responsiveness to gonadotrophin-releasing hormone (GnRH) during the acute (day 22) and chronic (day 62) phases of infection were examined in nine uninfected control and ten infected rams. Blood samples were collected twice a week starting 4 weeks prior to infection and three times a week during the infection period which lasted 79 days, and at 20 min intervals for 1 h before and 3 h after injection of GnRH (20 mg i.v.). Plasma testosterone levels started declining after the onset of parasit-aemia within the first week of infection and mean testosterone concentrations in infected rams were significantly lower ($P < 0.01$) than in control rams. No sig-nificant difference in circulating LH concentration was observed between control and infected rams after infection, although the mean plasma LH concentration after week 8 in the latter appeared to be lower. LH response to GnRH on day 22 was higher ($P < 0.05$) in infected rams and on day 62 was similar in the control and infected rams. Testosterone responses after GnRH on both occasions were not significantly different although pre-injection means were lower in the infected rams. The evidence from this study suggests that the pituitary responsiveness to GnRH was not impaired by a *T. congolense* infection in rams and the pituitary and testicular endocrine functions are affected differently in trypanosomosis.

9327 **Mutayoba, B.M., Eckersall, P.D., Jeffcoate, I.A., Harvey, M.J.A., Cestnik, V. and Holmes, P.H., 1996**. Effects of castration on luteinizing hormone secretion and response to gonadotrophin-releasing hormone in sheep infected with *Trypanosoma congolense*. *European Journal of Endocrinology*, **134** (1): 115-122.
Jeffcoate: Department of Veterinary Physiology, University of Glasgow Veterinary School, Bearsden, Glasgow G61 1QH, UK.

The effects of trypanosomiasis on the endocrine function of the hypothalamo-pituitary-gonadal axis were investigated before and after castration of Scottish Blackface rams infected with *T. congolense* and uninfected controls. Blood samples were collected at 15-min intervals for 6 h before and at 10, 20, 40, 60, 80, 100 and 120 min after injection of synthetic gonadotrophin-releasing hormone (GnRH, 20 μg i.v.) 2 days before infection and 26 and 54 days after infection, with castration being performed 28 days after infection. Mean luteinising hormone (LH) pulse amplitude was higher (3.3 □ 0.2 *v*. 2.6 □ 0.3 ng/ml) and mean plasma testosterone concentration was lower (4.1 □ 0.6 *v*. 7.6 □ 1.2 nmol/l) in infected *v*. control rams 26 days after infection ($P < 0.05$). Mean plasma LH concentration and pulse amplitude increased in both groups after castration but both were significantly lower in infected compared to control rams (6.6 □ 1.5 and 13.0 □ 2.2 ng/ml, $P < 0.01$; 7.7 □ 0.9 and 11.6 □ 0.9 ng/ml, $P < 0.001$, respectively). However, LH responses to exogenous GnRH were similar in infected and control rams at each stage of the experiment, suggesting that the smaller increase in plasma LH after castration in infected rams was not caused by reduced responsiveness of the pituitary to GnRH but by alterations in GnRH secretion by the hypothalamus or its transport to the adenohypophysis. These results also demonstrate that impairment of testosterone secretion within 4 weeks of *T. congolense* infection in sheep may be due to testicular rather than pituitary effects.

9328 **Mwangi, D.M., Hopkins, J. and Luckins, A.G., 1995**. *Trypanosoma congolense* infection in sheep: ultrastructural changes in the skin prior to development of local skin reactions. *Veterinary Parasitology*, **60** (1-2): 45-52.

Mwangi: ILRI, P.O. Box 30709, Nairobi, Kenya.

Events occurring in the skin of sheep prior to development of *T. congolense*-induced local skin reactions (chancres) were studied using electron microscopy. Three days after infection, few trypanosomes were present in the dermal collagen. However, these parasites were more abundant 5 days p.i., and were also found in dermal lymphatics and in the connective tissue matrix between collagen bundles. Mast cells in the skin obtained 5 days p.i. showed evidence of degranulation. These events may play a role during the induction phase of trypanosomal chancres.

9329 **Omotainse, S.O. and Anosa, V.O., 1995**. Leucocyte and thrombocyte responses in dogs experimentally infected

with *Trypanosoma brucei*. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (3): 254-258.
Omotainse: Veterinary and Livestock Studies Division, NITR, P.M.B. 03, Vom, Plateau State, Nigeria.
Three dogs were subcutaneously infected with *T. brucei* strain ILRAD 1797. Artificial haemolytic anaemia was induced in two other dogs by phlebo-tomy, heat treatment and re-infusion of the blood, while two dogs were kept as controls. The infected animals developed pan-leucopenia and thrombocytopenia, while the dogs with artificial haemolytic anaemia developed leucocytosis and thrombocytosis. These findings suggest that there was a bone marrow depressing factor in the plasma of *T. brucei*-infected dogs especially as it affected leucocyte production.

(c) TRYPANOTOLERANCE

9330 **Igbokwe, I.O., Umar, I.A., Obagaiye, O.K., Saror, D.I. and Esievo, K.A.N., 1995**. Erythrocyte glutathione concentrations in Nigerian Zebu and Ndama cattle. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 177-179.
Igbokwe: Department of Veterinary Pathology, Faculty of Veterinary Medicine, P.M.B. 1069, Maiduguri, Nigeria.
A study of the erythrocyte glutathione (GSH) concentrations in 39 apparently healthy Nigerian Zebu and N'Dama cattle gave a range of 40.8-135.1 mg/100 ml RBC with a mean of 84.0 □ 25.4 mg/100 ml. The GSH concentrations and the PCV of the cattle were positively correlated ($r = 0.58$, $P < 0.05$). The N'Dama had significantly ($P < 0.05$) higher mean erythrocyte GSH and PCV levels than the Zebu. At comparable PCV levels, the erythrocyte GSH did not vary significantly ($P > 0.05$) between the breeds.

9331 **Mattioli, R.C., Faye, J.A., Bah, M. and Jabang, B., 1994**. Experimental *Trypanosoma congolense* infection on naturally occurring ticks in N'dama and Gobra zebu cattle. *Parassitologia*, **36** (3): 305-311.
ITC, P.M.B. 14, Banjul, Gambia.
The effects of experimental *T. congolense* infection in Gambian N'Dama and Gobra Zebu cattle on numbers of naturally occurring adult ticks attaching were studied. It was found that N'Damas, even when submitted to trypanosome infection, react consistently better than Gobra Zebus to tick attachment. These results emphasise the benefits of rearing disease-resistant cattle breeds, such as N'Dama, in areas where risks of trypanosomiasis and cowdriosis coexist.

(d) TREATMENT

[See also **19**: no. 9353.]

9332 **Eisler, M.C., Elliott, C.T. and Holmes, P.H., 1996**. A simple competitive enzyme immunoassay for the detection of the trypanocidal drug isometamidium. *Therapeutic Drug Monitoring*, **18** (1): 73-79.
Eisler: University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.
A new competitive enzyme immunoassay technique has been developed for the determination of concentrations of the trypanocidal drug isometamidium chloride (Samorin) in bovine serum. The method has been shown to be highly repeatable and reproducible, and it has several advantages over previous immunoassay techniques for the drug. There are fewer incubation steps overall; microtitre plates may be coated in batches and stored frozen for future use; and the competition incubation is overnight and is followed only by a brief colour development stage of 10 min. Coefficients of variation (CVs) of duplicate samples were ~5%, and mean response variances of untreated cattle (n = 57) were small (CV, 10%). Partitioning of variance showed 77% of this variability to be intrinsic to the samples, and the remaining 23% was due to the procedure. The limit of detection was approximately 0.5 ng/ml, which was considered to be satisfactory for the intended use of the method. The drug could be detected in serum of treated cattle for up to 10 weeks following treatment, and determinations showed a high level of reproducibility.

9333 **Kalu, A.U., 1995**. Sensitivity of animal-derived *Trypanozoon* stocks from sleeping sickness endemic foci of Nigeria to trypanocides and human plasma. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (2): 139-144.
Department of Veterinary Public Health and Preventive Medicine, University of Maiduguri, P.M.B. 1069, Maiduguri, Borno State, Nigeria.
Twelve *Trypanozoon* stocks isolated from semi-nomadic cattle and from pigs in known sleeping sickness foci of central and northern Nigeria were studied in terms of susceptibility to two trypanocides, diminazene aceturate (Berenil) and isometamidium chloride (Samorin), and to human plasma. In infected small ruminants (goats, sheep), three of the stocks were resistant to diminazene aceturate at doses of 7.0-14.0 mg/kg body weight, while isometamidium chloride at doses of 1.0 mg/kg b.w. or higher failed to effect parasitological cure of infections with two of the diminazene-resistant stocks. The two isometamidium-resistant stocks were also consistently resistant to

the trypanolytic action of human plasma. It is suggested that cattle are reservoirs of *Trypanosoma brucei* subspecies potentially infective to man and resistant to the therapeutic action of diminazene and isometamidium.

9334 **Musa, M.M., Abdoon, A.M.O., Nasir, B.T., Salim, Y.I., Abdel-Rahman, A.Y. and Shommein, A.M., 1994**. Efficacy of Cymelarsan in the treatment of natural chronic *Trypanosoma evansi* infection in camels in the Sudan. *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **47** (4): 397-400.

Musa: Tsetse and Trypanosomiasis Control Department, Central Veterinary Research Administration, P.O. Box 8067, Elamarat, Khartoum, Sudan.

The efficacy of Cymelarsan, administered by i.m. injection in the treatment of chronic cases of camel trypanosomosis due to *T. evansi*, was tested under controlled laboratory conditions. It was confirmed that Cymelarsan is a safe drug for use in dromedary camels when administered i.m. at dose rates of 0.25 or 0.50 mg/kg body weight. During the 90 days post-treatment no relapses occurred at either dose rate. Hence, the drug was found to be fully effective against the chronic form of the natural disease. A dose of 0.25 mg/kg body weight of Cymelarsan given i.m. is recommended.

7. experimental trypanosomiasis

(a) DIAGNOSTICS

9335 **Bishop, S., Rae, P.F., Phipps, L.P., Boid, R. and Luckins, A.G., 1995**. *Trypanosoma equiperdum*: detection of trypanosomal antibodies and antigen by enzyme-linked immunosorbent assay. [Rabbits, horses.] *British Veterinary Journal*, **151** (6): 715-720.

Bishop: CTVM, Easter Bush, Roslin, Midlothian EH25 9RG, UK.

9336 **Bosompem, K.M., Assoku, R.K.G. and Nantulya, V.M., 1995**. Hydrogen peroxide destaining: a new method for removing non-specific stains in nitrocellulose membrane-based dot-ELISA for the detection of trypanosomes in tsetse flies (*Glossina* spp.). *Journal of Immunological Methods*, **187** (1): 23-31.

Bosompem: Noguchi Memorial Institute for Medical Research, P.O. Box 25, Legon, Accra, Ghana.

9337 **Bosompem, K.M., Assoku, R.K.G. and Nantulya, V.M., 1995**. Production and characterization of a monoclonal

antibody specific for *Trypanosoma simiae*. *Annals of Tropical Medicine and Parasitology*, **89** (6): 611-620.

Bosompem: Noguchi Memorial Institute for Medical Research, P.O. Box 25, Legon, Accra, Ghana.

9338 **Bosompem, K.M., Assoku, R.K.G. and Nantulya, V.M., 1996**. Differentiation between culture-derived insect stages of *T. brucei*, *T. vivax*, *T. congolense* and *T. simiae* using a monoclonal antibody-based dot-ELISA. *Parasitology*, **112** (1): 59-66.

Bosompem: Noguchi Memorial Institute for Medical Research, P.O. Box 25, Legon, Accra, Ghana.

9339 **Bosompem, K.M., Moloo, S.K., Assoku, R.K.G. and Nantulya, V.M., 1996**. Detection and differentiation between trypanosome species in experimentally infected tsetse flies (*Glossina* spp.) using dot-ELISA. *Acta Tropica*, **60** (2): 81-96.

Bosompem: Noguchi Memorial Institute for Medical Research, P.O. Box 25, Legon, Accra, Ghana.

A modified nitrocellulose (NC) membrane-based dot-ELISA was used to detect and differentiate between *Trypanosoma brucei*, *T. congolense* and *T. simiae* procyclics in the midguts of experimentally infected tsetse flies. The modification of the assay consisted of (a) the lysis of *T. congolense* or *T. simiae* in NC membrane applied sample dots using Triton X-114, and (b) treatment of sample applied NC membrane strips with hydrogen peroxide to remove non-specific stains. Also, *T. brucei* was detected in the salivary glands, and *T. congolense* and *T. vivax* were detected in the mouthparts, in dot-ELISA without modification. In all the assays, *T. brucei* and *T. congolense* parasites were detected directly using MoAbs specific to each of them, whereas *T. simiae* parasites were detected by exclusion using a *T. congolense* specific and *Nannomonas* subgenus-specific MoAbs. The sensitivity of the assay for detecting midgut infections was 90.5%, 84.6% and 94.4% in detecting *T. brucei*, *T. congolense* and *T. simiae*, respectively. Sample dots stored at room temperature (19-26□C) under desiccated conditions did not show any loss in activity in 90 days. However, after 7 days of storage, a ring-pattern reaction appeared on some sample dots that were tested with *T. brucei* specific MoAb, irrespective of whether *T. brucei* antigens were present or not. These ring reactions, however, did not interfere with correct interpretation of the assay results. The specificity of the assay for detection of

T. brucei in the salivary glands was 100% and the sensitivity was 90%. Also, *T. vivax* and *T. congolense* organisms were each detected in the mouthparts of infected tsetse flies, with 100% specificity. The sensitivity was, however, lower: 43.8% for *T. vivax* and 55.6% for *T. congolense*.

9340 **Masake, R.A., ole-MoiYoi, O.K., Urakawa, T., Hirumi, H., Majiwa, P.A.O., Wells, C.W., Minja, S.H., Makau, J.M. and Nantulya, V.M., 1995**. Immunological characterization and expression in *Escherichia coli* and baculovirus systems of a *Trypanosoma vivax* antigen detected in the blood of infected animals. *Experimental Parasitology*, **81** (4): 536-545.
Masake: ILRI, P.O. Box 30709, Nairobi, Kenya.

9341 **Meirvenne, N. van, Magnus, E. and Büscher, P., 1995**. Evaluation of variant specific trypanolysis tests for serodiagnosis of human infections with *Trypanosoma brucei gambiense*. *Acta Tropica*, **60** (3): 189-199.
Meirvenne: Institute of Tropical Medicine, Laboratory of Serology, Nationalestraat 155, B-2000 Antwerp, Belgium.
Twelve *T. b. gambiense* clone populations of distinct variable antigen type (VAT) were combined in immune lysis tests with 340 sera of trypanosome-infected patients from eight different African countries and 267 non-trypanosomiasis control sera. The diagnostic specificity of the test was 100%. At a serum dilution of 1:4 the overall test sensitivity with single VATs varied from 39.1 to 98.2% and from 12.1 to 86.8% at 1:32. At a serum dilution of 1:32 some combination tests with two VATs still scored above 96%. The VAT recognition patterns were clearly correlated with the geographical origin of the sera, reflecting a diversity in variable antigen repertoires.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **19**: no. 9387.]

9342 **Dia, M.L., 1995**. Comparaison du pouvoir pathogène pour la souris d'un stock de *Trypanosoma evansi* de Mauritanie avec celui de stocks en provenance du Kenya, du Niger, du Tchad et de la Chine. [Comparison of the pathogenicity to mice of a stock of *T. evansi* from Mauritania with that of stocks from Kenya, Niger, Chad and China.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **48** (1): 21-25.
Centre National d'Elevage et de Recherches Vétérinaires, B.P. 167, Nouakchott, Mauritania.

9343 **Grassi-Zucconi, G., Semprevivo, M., Mocaer, E., Kristensson, K. and Bentivoglio, M., 1996**. Melatonin and its new agonist S-20098 restore synchronized sleep fragmented by experimental trypanosome infection in the rat. [*T. brucei*.] *Brain Research Bulletin*, **39** (2): 63-68.
Bentivoglio: Institute of Anatomy and Histology, University of Verona, Medical Faculty, Strada Le Grazie, 37134 Verona, Italy.

9344 **Ogunremi, O. and Tabel, H., 1995**. Genetics of resistance to *Trypano-soma congolense* in inbred mice: efficiency of apparent clearance of parasites correlates with long-term survival. *Journal of Parasitology*, **81** (6): 876-881.
Department of Veterinary Microbiology, University of Saskat-chewan, Saskatoon, Saskatchewan S7N 5B4, Canada.

9345 **Turner, C.M.R., Aslam, N. and Angus, S.D., 1996**. Inhibition of growth of *Trypanosoma brucei* parasites in chronic infections. [Mice, sheep.] *Parasitology Research*, **82** (1): 61-66.
Turner: Parasitology Laboratory, IBLS, Joseph Black Building, University of Glasgow, Glasgow G12 8QQ, UK.

9346 **Turner, C.M.R., Aslam, N. and Dye, C., 1995**. Replication, differenti-ation, growth and the virulence of *Trypanosoma brucei* infections. [Mice.] *Parasitology*, **111** (3): 289-300.
Turner: Parasitology Laboratory, IBLS, Joseph Black Building, University of Glasgow, Glasgow G12 8QQ, UK.

(c) CHEMOTHERAPEUTICS

[See also **19**: nos. 9362, 9371, 9390, 9395.]

9347 **Atouguia, J.M., Jennings, F.W. and Murray, M., 1995**. Successful treatment of experimental murine *Trypanosoma brucei* infection with topical melarsoprol gel. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **89** (5): 531-533.
Jennings: Department of Veterinary Parasitology, University of Glasgow, Bearsden Road, Glasgow G61 1QH, UK.

9348 **Bouteille, B., Marie-Daragon, A., Chauvière, G., Albuquerque, C. de, Enanga, B., Dardé, M.-L., Vallat, J.-M., Périé, J. and Dumas, M., 1995**. Effect of megazol on *Trypanosoma brucei brucei* acute and subacute infections in Swiss mice. *Acta Tropica*, **60** (2): 73-80.
Bouteille: Institut d'Epidémiologie Neurologique et de Neurologie Tropicale, Faculté de Médecine, 2 rue du Docteur Raymond Marcland, F-87025 Limoges Cedex, France.

9349 **Calenbergh, S. van, Verlinde, C.L.M.J., Soenens, J., Bruyn, A. de, Callens, M., Blaton, N.M., Peeters, O.M., Rozenski, J., Hol, W.G.J. and Herdewijn, P., 1995**. Synthesis and structure-activity relation-ships of analogs of 2∫-deoxy-2∫-(3-methoxybenzamido) adenosine, a selective inhibitor of trypanosomal glycosomal glyceraldehyde-3-phosphate dehydrogenase. [*T. brucei*.] *Journal of Medicinal Chemistry*, **38** (19): 3838-3849.

Herdewijn: Laboratory for Medicinal Chemistry, University of Ghent, Harelbekestraat 72, B-9000 Ghent, Belgium.

9350 **Callens, M. and Hannaert, V., 1995**. The rational design of trypanocidal drugs: selective inhibition of the glyceraldehyde-3-phosphate dehydro-genase in Trypanosomatidae. *Annals of Tropical Medicine and Parasitology*, **89** (Suppl. 1): 23-30.

International Institute of Cellular and Molecular Pathology, Research Unit for Tropical Diseases, Avenue Hippocrate 74, B-1200 Brussels, Belgium.

9351 **Iten, M., Matovu, E., Brun, R. and Kaminsky, R., 1995**. Innate lack of susceptibility of Ugandan *Trypanosoma brucei rhodesiense* to DL-α-difluoromethylornithine (DFMO). *Tropical Medicine and Parasit-ology*, **46** (3): 190-194.

Kaminsky: Swiss Tropical Institute, P.O. Box, CH-4002 Basel, Switzerland.

9352 **Jennings, F.W., 1995**. Suramin treatment of experimental *Trypanosoma brucei* infection of the central nervous system. [*Mice*.] *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **89** (6): 677.

Department of Veterinary Parasitology, University of Glasgow, Bearsden Road, Glasgow G61 1QH, UK.

9353 **Joshua, R.A., Obwolo, M.J., Bwangamoi, O. and Mandebvu, E., 1995**. Resistance to diminazene aceturate by *Trypanosoma congolense* from cattle in the Zambezi Valley of Zimbabwe. [Mice.] *Veterinary Parasitology*, **60** (1-2): 1-6.

Joshua: Department of Paraclinical Veterinary Studies, University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe.

9354 **Keku, T.O., Seed, J.R. and Tidwell, R.R., 1995**. The *in vitro* HL-60 cell-*Trypanosoma brucei rhodesiense* culture system: a rapid *in vitro* drug screen. *Tropical Medicine and Parasitology*, **46** (4): 258-262.

Keku: Division of Digestive Diseases and Nutrition, Department of Medicine, University of North Carolina, Chapel Hill, NC 27599-7080, USA.

9355 **Libby, P.R. and Porter, C.W., 1992**. Inhibition of enzymes of polyamine back-conversion by pentamidine and Berenil. [*T. brucei*.] *Biochemical Pharmacology*, **44** (4): 830-832.
Libby: Department of Neurosurgery, Buffalo General Hospital, Buffalo, NY 14203, USA.

9356 **Mutugi, M.W., Boid, R. and Luckins, A.G., 1995**. Differences in cloning and sub-cloning success rates in four stocks of *Trypanosoma evansi* and variation in suramin resistance of the clones. [Mice.] *Veterinary Parasitology*, **60** (3-4): 213-220.
Mutugi: 12 Shottery Road, Greystone Park, Harare, Zimbabwe.

9357 **Odika, I., Asuzu, I.U. and Anika, S.M., 1995**. The effects of hyperosmolar agents lithium chloride and sucrose on the brain concentration of diminazene aceturate in rats. *Acta Tropica*, **60** (2): 119-125.
Asuzu: Department of Veterinary Physiology and Pharmacology, University of Nigeria, Nsukka, Nigeria.

9358 **Wilkes, J.M., Peregrine, A.S. and Zilberstein, D., 1995**. The accumulation and compartmentalization of isometamidium chloride in *Trypanosoma congolense*, monitored by its intrinsic fluorescence. *Biochemical Journal*, **312** (1): 319-327.
Wilkes: ILRI, P.O. Box 30709, Nairobi, Kenya.

8. trypanosome research
(a) CULTIVATION OF TRYPANOSOMES
(b) TAXONOMY, CHARACTERISATION OF ISOLATES

9359 **Garside, L.H. and Gibson, W.C., 1995**. Molecular characterization of trypanosome species and subgroups within subgenus *Nannomonas*. [*T. congolense*, *T. simiae*, *T. godfreyi*.] *Parasitology*, **111** (3): 301-312.
Department of Pathology and Microbiology, University of Bristol, School of Veterinary Science, Langford, Bristol BS18 7DU, UK.

9360 **Garside, L.H. and Gibson, W.C., 1995**. Absence of the glutamic acid/alanine-rich protein (GARP) genes in the *Nannomonas* species *Trypanosoma simiae* and *T. godfreyi*. *Molecular and Biochemical Parasitology*, **74** (2): 211-215.
Garside: Department of Biological Sciences, University of Salford, Peel Building, Salford M5 4WT, UK.

(c) LIFE CYCLE, MORPHOLOGY, BIOCHEMICAL AND MOLECULAR STUDIES
[See also **19**: no. 9340.]

9361 **Abbeele, J. van den, Rolin, S., Claes, Y., Le Ray, D., Pays, E. and Coosemans, M., 1995**. *Trypanosoma brucei*: stimulation of adenylate cyclase by proventriculus and esophagus tissue of the tsetse fly, *Glossina morsitans morsitans*. *Experimental Parasitology*, **81** (4): 618-620.

Abbeele: Department of Parasitology, Prince Leopold Institute of Tropical Medicine, 155 Nationalestraat, B-2000 Antwerp, Belgium.

9362 **Agbe, A. and Yielding, K.L., 1995**. Kinetoplasts play an important role in the drug responses of *Trypanosoma brucei*. *Journal of Parasitology*, **81** (6): 968-973.

Department of Pharmacology and Toxicology, University of Texas Medical Branch, Galveston, TX 77555-1031, USA.

9363 **Bakalara, N., Seyfang, A., Baltz, T. and Davis, C., 1995**. *Trypanosoma brucei* and *Trypanosoma cruzi*: life cycle-regulated protein tyrosine phosphatase activity. *Experimental Parasitology*, **81** (3): 302-312.

Bakalara: Laboratoire d'Immunologie et Parasitologie Moléculaire, Université Bordeaux II, 146 rue Léo Saignat, F-33076 Bordeaux Cedex, France.

9364 **Bakalara, N., Seyfang, A., Davis, C. and Baltz, T., 1995**. Character-ization of a life-cycle-stage-regulated membrane protein tyrosine phosphatase in *Trypanosoma brucei*. *European Journal of Bio-chemistry*, **234** (3): 871-877.

Bakalara: Laboratoire d'Immunologie et Parasitologie Moléculaire, Université Bordeaux II, 146 rue Léo Saignat, F-33076 Bordeaux Cedex, France.

9365 **Bakker, B.M., Westerhoff, H.V. and Michels, P.A.M., 1995**. Regulation and control of compartmentalized glycolysis in bloodstream form *Trypanosoma brucei*. (Review.) *Journal of Bioenergetics and Biomembranes*, **27** (5): 513-525.

Bakker: E.C. Slater Institute, BioCentrum, University of Amsterdam, Amsterdam, Netherlands.

9366 **Barrett, M.P., Tetaud, E., Seyfang, A., Bringaud, F. and Baltz, T., 1995**. Functional expression and characterization of the *Trypanosoma brucei* procyclic glucose transporter, THT2. *Biochemical Journal*, **312** (3): 687-691.

Barrett: Department of Medical Parasitology, LSHTM, Keppel Street, London WC1E 7HT, UK.

9367 **Barrett, M.P., Zhang, Z.Q., Denise, H., Giroud, C. and Baltz, T., 1995**. A diamidine-resistant *Trypanosoma equiperdum* clone contains a P2 purine transporter with reduced substrate affinity. *Molecular and Biochemical Parasitology*, **73** (1-2): 223-229.

Barrett: Department of Medical Parasitology, LSHTM, Keppel Street, London WC1E 7HT, UK.

9368 **Brickman, M.J., Cook, J.M. and Balber, A.E., 1995**. Low temperature reversibly inhibits transport from tubular endosomes to a perinuclear, acidic compartment in African trypanosomes. [*T. b. rhodesiense*.] *Journal of Cell Science*, **108** (11): 3611-3621.

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