

section b – abstracts

1. general (including land use)

9123 **Organization of African Unity/Scientific, Technical and Research Commission, 1995.** *Twenty-second Meeting of the International Scientific Council for Trypanosomiasis Research and Control, Kampala, Uganda, [25-29 October] 1993.* (Edited by K.R. Sones.) Nairobi; OAU/STRC. OAU/STRC Publication no. 117. 330 pp.

OAU/STRC, P.O. Box 30786, Nairobi, Kenya.

The texts and/or abstracts of papers presented at the twenty-second ISCTRC meeting are published under the following headings: Diagnosis; Human trypanosomiasis; Animal trypanosomiasis; *Glossina* biology; *Glossina* control. Abstracts of poster presentations are also included. An introductory section includes reports of relevant work carried out by international organisations (OAU/IBAR, FAO, WHO, ILRAD, ILCA, ICIPE, ITC, CRTA, IAEA) and recommendations for future action under the five main headings. Abstracts and/or bibliographic details of all presentations published in this report are included in this issue of *TTIQ*.

9124 **Reid, R.S., Kruska, R.L., Ellis, J.E., Wilson, C.J. and Perry, B.D., 1995.** Environmental impacts of trypanosomiasis control through land-use change: conceptual model, approach and preliminary results. *In*: OAU/STRC, 1995 (see 18: no. 9123), pp. 235-243.

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

This paper reports on the development of a conceptual model of the linkages between trypanosomiasis control and land use, and then discusses approaches to determine how land use change affects the environment. The conceptual model integrates epidemiological, ecological, economic and social information into the study of control-induced changes in land use at continental, regional, national and local scales. Geographical information systems (GIS) are used to generate hypotheses and to analyse broad-scale patterns, while field studies are used to establish causality and to ground-truth large-scale data sets. Preliminary analyses provide support for the hypothesis that trypanosomiasis is retarding the rate of agricultural growth in tsetse-infested compared with tsetse-free areas of Africa. However, large-scale correlations show that there is no simple inverse relationship between the presence of tsetse and the presence of agricultural land use and that tsetse appear to limit agricultural land use more strongly in southern than in West Africa. These results imply that decisions concerning where and when to control

trypanosomiasis can have strong implications for the success of efforts to enhance human welfare and to maintain environmental quality.

9125 **Robinson, T., 1995.** GIS as a management tool in tsetse and trypanosomiasis control. (Abstract only.) *In:* OAU/STRC, 1995 (see **18:** no. 9123), pp. 215-216.

IPMI Tsetse Project (ODA/NRI), c/o FCO (Lusaka), King Charles Street, London SW1A 2AH, UK.

It is important that the increasingly limited resources available for tsetse control are directed towards areas where it is appropriate, and where the communities that are most at risk from trypanosomiasis will be able to benefit from control operations. The important variables in decision making to prioritise areas for tsetse control come under the following headings:

tsetse distribution and abundance; cattle distribution and abundance; trypanosomiasis prevalence; human population pressure; land use considerations; economic considerations; inter-national and regional considerations and RTTCP national and regional strategic plans. Geographic information systems provide a means by which to integrate data from these different categories and to combine them in meaningful ways to prioritise areas for the control of tsetse.

The IPMI Tsetse Project is using the Eastern Province of Zambia, for which a lot of relevant data are available, as a study area with which to assess the usefulness of this approach. Preliminary results have identified areas where tsetse are likely to be present, cattle are abundant and a high level of crop use intensity is evident. We do not yet know what the prevalence of trypanosomiasis in cattle is, in these areas, but using GIS techniques we can identify areas that require thorough tsetse and trypanosomiasis surveys, in order to determine whether they really are priority areas for control operations.

9126 **Slingenbergh, J., 1995.** Monitoring tsetse and farmers. *In:* OAU/STRC, 1995 (see **18:** no. 9123), pp. 274-275.

FAO Animal Health Service, Viale delle Terme di Caracalla, 00100 Rome, Italy.

Indications are that African animal trypanosomiasis is indirectly responsible for restricting mixed farming in areas of best potential. FAO has established a Geographical Information System on tsetse and agriculture to define areas where trypanosomiasis control is most likely to translate into better farming and natural resource management. A prerequisite for the definition of agro-ecologically sound programmes is

the procurement of objective and accurate field data. Tsetse control may improve farming and land use or, in some defined areas, also pose a risk to enhanced land degradation, and a selective approach is therefore indicated.

9127 **Snow, W.F., Rawlings, P. and Norton, G.A., 1995.** A framework for the rapid field appraisal of tsetse and trypanosomiasis problems. (Poster; abstract only.)

In: OAU/STRC, 1995 (see **18**: no. 9123), p. 230.

Snow: ITC, P.M.B. 14, Banjul, Gambia.

A low-cost system for describing tsetse and trypanosomiasis problems will require the collection of information on a wide range of topics in order to identify high-risk situations and to formulate practical solutions to reduce the impact of the disease. A framework for the rapid field appraisal of tsetse and trypano-somiasis problems is proposed: (i) Indirect information from published reports at regional, national and provincial/district levels; (ii) Qualitative assessment using regional or country-specific questionnaires answered through direct observation by trained personnel and interviews with local informants; (iii) Quantitative assessment using rank scoring perceived by trained personnel and local informants, tsetse survey and prevalence in local livestock. The three input components should give complementary results and indicate whether more detailed surveys will be necessary.

9128 **Snow, W.F., Schoenefeld, A. and Pollock, J.N., 1995.** FAO/ITC training course for middle-level personnel on trypanosomiasis assess-ment and tsetse control, The Gambia, March 1993: field exercises, the assessment of tsetse and trypanosomiasis problems, and possible solutions. (Poster; abstract only.) *In:* OAU/STRC, 1995 (see **18**: no. 9123), p. 231.

Snow: ITC, P.M.B. 14, Banjul, Gambia.

This training course used two questionnaires, on farming systems and village economics and on livestock and tsetse, a rapid tsetse survey and assessment of the prevalence of trypanosomiasis in samples of village cattle to assess the intensity of trypanosomiasis problems facing livestock in a rural area of The Gambia. The three methods of assessing tsetse-trypanosomiasis problems gave complementary results and led to a similar conclusion: that trypanosomiasis was a major cause for concern. It is suggested that this framework represents a low-cost system which can provide sound information on which to base decisions on

the severity of tsetse-trypanosomiasis problems, the necessity for more detailed surveys and the practicability of control interventions.

2. tsetse biology

(a) REARING OF TSETSE FLIES

9129 **Davies-Cole, J.O.A. and Olubayo, R.O., 1995.** Blood meal size, inter-larval period and pupal weight of *Glossina morsitans centralis* fed on various host bloods. *In:* OAU/STRC, 1995 (see **18**: no. 9123), pp. 198-202. ICIPE, P.O. Box 30772, Nairobi, Kenya. Females of *G. m. centralis* were maintained on fresh defibrinated bloods of buffalo, waterbuck, eland, rabbit, goat or cow to study the quantity of blood meal taken, length of interlarval period and puparial weight for four gonotrophic cycles. The length of the interlarval period was independent of the cycle (cycles 2-4) but dependent on the host blood type. The interlarval period was negatively correlated with the mean blood meal taken per feeding opportunity. The puparial weight was dependent on the length of the interlarval period, the cycle and the host blood type as well as the mean blood meal size. The mean size of the blood meal taken per feeding opportunity was significantly different between the host blood types. It was dependent on the blood type, cycle and interlarval period.

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

9130 **Brunhes, J., Cuisance, D., Geoffroy, B., Hervy, J.P. and Lebbe, J., 1995.** Etude des glossines: un logiciel intelligent d'identification et d'enseignement. [Tsetse fly studies: a computer-aided identification program with teaching implications.] (Abstract only.) *In:* OAU/STRC, 1995 (see **18**: no. 9123), p. 217. Brunhes: ORSTOM, B.P. 5045, 34032 Montpellier, France. In the past, considerable experience in tsetse morphology was required to use identification keys. However, if a key item was particularly difficult to interpret or an anatomical character was missing on the specimen, the path was interrupted and the identification failed or was doubtful. Using XPER[®] software from J. Lebbe, the authors have collaborated to produce a program that allows a new approach to tsetse fly identification. This program gives the user total liberty to choose any character for identification. For example, it is possible to start the identification by reporting the country where the specimen was captured, e.g. Cameroon, in a coastal

forest, and then to take into account an anatomical character, e.g. on leg III, the last two tarsal joints which are black. During the successive selection the program itself leaves out the species whose distribution or morphology is inconsistent with the selected choice. This easy-to-use program guides the user and proposes, both on the screen and in the user guide, a completely renewed iconography. Moreover, it allows the previous selections to be checked, all closely related species to be compared and individual record sheets to be consulted, including a distribution map, a summary of discriminant morphological characters and records on biology, ecology, vector competence and control methods. This program will provide an efficient teaching aid and a valuable tool to every service or team involved in operations of prevention and control of tsetse flies. (See also **18**: no. 9133.)

9131 **Dale, C., Welburn, S.C. and Crampton, J.M., 1995.** Transgenic tsetse flies: a future vector control strategy? *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 212-214. Dale: Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK.

The control of insect-borne diseases by host genetic modification has become a focus of attention during the last decade. The basis of genetic modification involves the transformation of an insect's cells using a suitable transformation vector. Since susceptibility of tsetse flies to trypanosomes is known to be facilitated by rickettsia-like organisms (RLO) found in the fly midgut, we have been developing a transformation system for RLO with the aim of achieving transfer of genetically modified RLO to tsetse. By introducing genes which confer an advantage to both tsetse and RLO, but not the trypanosome, it may be possible to create stable, genetically engineered, refractory flies. Covalently closed circular (CCC) plasmid DNA was extracted from RLO from *Glossina palpalis palpalis*, *G. pallidipes* and *G. morsitans morsitans*, purified and subjected to electrophoresis and restriction digestion. The incQ plasmid pKT230 was used to transform RLO, and transformants were maintained in liquid medium under kanamycin selection. However, when antibiotic selection was removed, pKT230 was not maintained and the cells reverted to wild-type. Other possible transformation reactions are currently being investigated.

9132 **Geoffroy, B., Cuisance, D., D'Amico, F., Baldet, T., Deportes, I., Bialota, F., Bossy, J.P., Ravallec, M. and Otter, C.J. den, 1995.**

Contributions récentes à la connaissance des structures sensorielles des glossines. [Recent contributions to the knowledge of sensory structures of *Glossina*.] *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 206-211. Geoffroy: ORSTOM, Laboratoire d'Epidémiologie des Maladies à Vecteurs, B.P. 5045, 34032 Montpellier Cedex 1, France.

New data have been acquired on the number, morphology and topology of some sensory structures in seven species and sub-species of *Glossina* and one of *Stomoxys*. The total number of chemoreceptor sensilla on legs (femur, tibia, tarsus) is significantly different in males (*c.* 1000) and in females (*c.* 600) of *Glossina*; this sexual dimorphism confirms their role in the perception of sex hormones. This number is higher compared to other Diptera and changes from one species to another. If the subcosta of the wing bears campaniform sensilla, the costal vein bears, as well as tactile spines, bristles defined as chemoreceptors, present on the whole length of the wing of *Glossina*, but not *Stomoxys*. Their distribution is identical in the species studied and shows that these chemoreceptors are concentrated on the median part and especially on the dorsal side of the costa. Their number differs between species but not between the sexes. Overall, they are more numerous in species of the *morsitans* group than in those of the *palpalis* group. The morphology of the sensilla seen by scanning electron microscope confirms their chemoreceptor function. Sections observed under transmission electron microscope indicate that these bristles are multimodal (chemoreception and mechanoreception). They should have a more gustatory than olfactory function. An electrophysiological approach by recording the response of cells to contact with solutions of various products (NaCl, excreta of *Glossina*, pheromones, etc.) was undertaken in order to evaluate the possible role of the receptors in the life of *Glossina* with a view to improving control systems.

9133 **Geoffroy, B., Lebbe, J., Brunhes, J., Cuisance, D. and Hervy, J.P., 1995.** Système XPER^ε et identification assistée par ordinateur (IAO): un exemple en entomologie médicale avec les glossines. (XPER^ε system and computer-aided identification: an example in medical entomology with tsetse flies.) (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 232. Geoffroy: ORSTOM, Laboratoire d'Epidémiologie des Maladies à Vecteurs, B.P. 5045, 34032 Montpellier Cedex 1, France.

The XPER^ε program of J. Lebbe is the first computer-aided identification (CAI) specifically developed for use on IBM/PC compatible micro-computers. Today, it provides illustrated identification on screen, initiates automatic identification keys and analyses measurements through a graphic digitiser. CAI offers the advantage of multiple access. In a standard key, the way leading to identification of a specimen is imposed and unchangeable. Thus, when a datum is missing or difficult to establish, identification fails. The freedom offered by CAI to select the type of data and the order in which they may be specified is an irreplaceable advantage in such circumstances. Optimisation of data choices, available in CAI programs, greatly accelerates the identification process, allowing the user to choose directly the characteristics appearing the most remarkable. The Laboratory of Vector Taxonomy (ORSTOM Centre, Montpellier, France) is developing computerised databases in XPER^ε format for identification of insect vectors (mosquitoes, tsetse flies, etc.). A CAI program, such as the one dedicated to tsetse flies, offers instant help to the user in the form of text and illustrations on all types of data (technical sheet, distribution map, biology, vector competence, control methods) for each species. The XPER^ε CAI program is thus also an excellent training aid. (See also **18**: no. 9130.)

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **18**: nos. 9152, 9157.]

9134 **Green, C.H., 1995.** Are species differences in the responses of tsetse flies to colours innate? A laboratory study. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 193-197.

Tsetse Research Group, Department of Clinical Veterinary Science, Bristol University, Langford, Bristol BS18 7DU, UK.

Tsetse flies are more strongly attracted to bright royal blue, to black and to red targets than to those of any other colour. There are, however, differences in the colour preferences of different species in the field, especially in the relative responses to blue and black targets. These differences have been investigated in the laboratory, using video apparatus, to determine whether they are innate, or environmentally caused. Red targets were used in place

of black targets as tsetse cannot be seen easily against a black surface with video; red is thought to be close to black for tsetse. *Glossina morsitans morsitans*, *G. pallidipes*, *G. austeni* and *G. palpalis palpalis* have all been studied. All show strong target-orientated behaviour in the laboratory, but against a white or yellow background only *G. austeni* prefers blue to red targets, the others being equally attracted to the two colours. Against a grey background, however, all species show strong preference for red targets. Both innate and environmental factors appear to influence tsetse colour preferences. These results are relevant to the design of insecticidal targets which may be used under different conditions in the field.

9135 **Hendrickx, G., Rogers, D.J., Napala, A. and Slingenbergh, J.H.W., 1995.** Predicting the distribution of riverine tsetse and the prevalence of bovine trypanosomiasis in Togo using ground-based and satellite data. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 218-227.

Henrickx: Projet FAO GCP-TOG-013-BEL, c/o FAO Lomé, B.P. 4388, Lomé, Togo.

On-going field surveys in Togo, based on a one eighth of a degree grid sampling system, provide detailed data on the presence and abundance of tsetse flies and the prevalence of bovine trypanosomiasis throughout the country. Climatological (temperature, rainfall) and topological data, interpolated to the grid co-ordinates, agricultural activity data from maps, and satellite derived vegetation indices (NDVI) (from ARTEMIS, FAO, Rome) were added to the database for use as explanatory/predictor variables. This paper explores the relationships between the field data and predictor variables and highlights the potential of satellite data (NDVI) in predicting tsetse distribution and trypanosomiasis prevalence in Togo. Results are presented in the form of correlation matrices and maps, and proposals are made for improving the predictions. We suggest that this approach could be used to plan and implement trypanosomiasis control programmes.

9136 **Mihok, S., 1995.** Trapping techniques for *Stomoxys* spp. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 268.

Livestock Pests Research Programme, ICIPE, P.O. Box 30772, Nairobi, Kenya.

Trap designs and odour baits were tested during the rainy season of 1993 in Nairobi Park, Kenya, in an initial attempt to identify optimal techniques for catching blood-sucking flies other than *Glossina*.

Nairobi Park contained 11 different species and subspecies of *Stomoxys* as well as many other Stomoxyinae, with *S. nigra bilineata*, *S. inornata* and *S. taeniata* dominant. A Vavoua trap made from royal blue cloth proved to be the optimal sampling device when compared with tsetse traps such as the biconical, bipyramidal and NG2G, and when compared with Vavoua traps of other colours. Conventional tsetse odour baits such as acetone, and various animal urines (cow, buffalo, waterbuck, camel), failed to increase catches of *Stomoxys*. Lactic acid and animal dungs (hippopotamus, rhinoceros, elephant) were also not effective odour baits. However, *Stomoxys* responded positively to 1-octen-3-ol in some experiments.

9137 **Mukiria, P.K., Omuse, J.K., Mgtutu, S.P., Mbwabi, A.L., Omollo, J.O., Gamba, D., Kamau, S. and Ochwada, R.O., 1995.** Changes in tsetse distribution and species composition in three areas of Kenya. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see 18: no. 9123), p. 228.

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

As part of an on-going exercise to update the current tsetse distribution map in the country, three previously known tsetse infested areas were surveyed by a combination of odour-baited biconical, NGU and F3 traps. In one of the areas *Glossina pallidipes* was found to have completely replaced *G. longipennis*. In another area both *G. pallidipes* and *G. longipennis* had disappeared, and in the third the *G. longipennis* belt had shrunk considerably. The new tsetse distribution maps for the three areas have been drawn and possible reasons for the changes postulated.

9138 **Napala, A., Hendrickx, G., Vermeilen, A. and Gnagna, K., 1995.**

Répartition et abondance des glossines et de la trypanosomiase bovine au Togo. [Distribution and abundance of *Glossina* and bovine trypano-somiasis in Togo.] (Poster; abstract only.) *In*: OAU/STRC, 1995 (see 18: no. 9123), pp. 74-75.

Projet FAO GCP-TOG-013-BEL, c/o FAO Lomé, B.P. 4388, Lomé, Togo.

A detailed survey of the distribution of tsetse flies and bovine trypanosomiasis was undertaken in Togo. An area of 2750 km² covering the Danyi and Akpasso plateaux is free of tsetse. *Glossina tachinoides* is the most widespread species, occurring throughout Togo except south of 6°20'N. *G. palpalis palpalis* is also widespread but is not found north of 10°00'N except along the river Oti. *G. p. gambiensis* has declined considerably, with only sporadic captures along the

river Oti. *G. morsitans submorsitans* is found only in the two large game reserves, Fazao (central Togo) and Kéran (northern Togo); however, movement northwards from the latter along the river Oti has been recorded. *G. longipalpis* is found only in protected fauna and flora areas in the southern more humid areas: the Fazao game reserve, the Kpessi forest area, along the Mono and Ogou rivers (Abdoulaye Forest) and in the Tchila Montana Forest. Of *fusca* group flies, only *G. medicorum* occurs, within islands of denser vegetation in the *G. longipalpis* area. North of the Atakora mountain range, bovine trypanosomiasis has a prevalence of 13% compared to the national average of 9.8%. The river Oti valley and the Kéran game reserve are particularly badly affected (17% positive). In the southern part of the country the situation is less serious with a mean of 8% positive.

9139 **Oloo, F.P., Otieno, L.H., Olet, P.A. and Mohammed Ahmed, M.M.,**

1995. Effectiveness of tsetse traps for *Glossina fuscipes fuscipes* in western Kenya. (Abstract only.) *In:*

OAU/STRC, 1995 (see **18:** no. 9123), p. 267.

Oloo: Veterinary Department, P.O. Kabete, Kenya.

Six different trap designs, biconical, pyramidal, monoconical, Vavoua, NGU2B and NGU2G, were compared for their effectiveness in catching *G.f. fuscipes* in open and dense habitats associated with low and high fly densities along the shore of Lake Victoria. There was no significant difference between the traps tested. However, the pyramidal trap had the highest catch, followed by the biconical, Vavoua and monoconical. The pyramidal trap was also the most cost-effective, followed by the Vavoua. Apparently the response of *G.f. fuscipes* to each trap was not dependent on the fly density as the traps performed similarly in habitats with open and dense vegetation cover. The males and females did not respond differently. The pyramidal trap is therefore an appropriate tool for survey and control of *G.f. fuscipes* in the Lake Victoria Basin. The Vavoua could be used as an alternative.

9140 **Vale, G.A., 1995.** Priorities in studies of the ecology and behaviour of tsetse. *In:* OAU/STRC, 1995 (see **18:** no. 9123), pp. 189-192.

RTTCP, P.O. Box A560, Avondale, Harare, Zimbabwe.

In the 1960s, field glossinologists were concerned largely with ecology, but from the 1970s the attention turned almost exclusively to the behaviour of flies near stationary host-like baits. The present obsession should be relieved, partly by giving more attention to

the relationship between tsetse and vegetation, and partly by encouraging a more speculative approach to research.

9141 **Yao, Y., Green, C.H. and Spath, J., 1995.** Etude de la distribution saisonnière et du cycle d'activités de *Glossina longipalpis* Wiedemann, 1830 (Diptera: Glossinidae) en zone préforestière de la Côte d'Ivoire. [A study of the seasonal distribution and activity cycle of *G. longipalpis* in the pre-forest zone of Côte d'Ivoire.] *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 203-205.

Yao: Service de Lutte contre la Trypanosomiase Animale et les Vecteurs, 01 B.P. 3301 Bouaké 01, Côte d'Ivoire. The abundance of *G. longipalpis* in different vegetation types was studied throughout the year. Seasonal changes in the diurnal activity cycle were also followed. The results show that *G. longipalpis* is the dominant species in the border between forest and savanna, and in areas left fallow after forest clearing and subsequently colonised by *Eupatorium odoratum*; there is, however, an expansion into the savanna in the wet season. Most of the diurnal activity takes place in the afternoon, with a relatively shallow peak during the wet season and a much sharper peak in the dry season. A reduction of activity is evident in the middle of the day, during the hottest period. Better understanding of the seasonal distribution of this species will help to identify the best trapping sites and also the places of contact between livestock and tsetse. Knowledge of the diurnal activity cycle will help with the selection of the best time for sampling the species.

3. tsetse control (including environmental side-effects)

[See also **18**: nos. 9124-9127, 9131, 9136, 9139, 9176, 9190.]

9142 **Bauer, B., Amsler, S., Kabore, I. and Petrich-Bauer, J., 1995.**

Application of synthetic pyrethroids to cattle. Laboratory trials and tsetse control operations with specific consideration of extension to rural communities. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 276-279.

CRTA, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso. So far, more than 20 different formulations of various pyrethroids, most of them already commercially available, have been tested against tsetse flies in large-scale bio-assays at CRTA using *Glossina palpalis* and a treated Zebu tethered in a fly chamber. Exposure of

the treated Zebu to periodic sunlight and rinsing with water simulate potentially negative climatic effects on persistence. High mortalities and abortion in pregnant female flies are recorded in the first weeks after treatment but the knockdown effect and its persistence is more important. Results to date show deltamethrin 1% (Spot-on) to be the most efficient product with persistence exceeding 90 days. Alphacypermethrin 1% and lambda-cyhalothrin pour-on formulations also gave good results for 60 days. Five years of field experience have shown that the use of pyrethroids applied to cattle for simultaneous tsetse and tick control is very effective and is a more readily acceptable method of tsetse control than traps and screens from the economic point of view of the livestock owners. Ideally pour-ons or sprays could be used as a starter, facilitating the introduction of other means of control during an on-going tsetse campaign.

9143 **Douati, A., Mehlitz, D. and Menninger, R., 1995.** Lutte contre les glossines (Glossinidae, Diptera) en régions de savane de Côte d'Ivoire: réduction des populations de tsétsé et des infections trypanosomiennes. [*Glossina* control in savanna regions of Côte d'Ivoire: reduction of tsetse population and trypanosomiasis infection.] (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 305.

Douati: Service de Lutte contre la Trypanosomiase Animale, B.P. 45, Korhogo, Côte d'Ivoire.

The tsetse control programme of Côte d'Ivoire covers 60,000 km² of guinean and sudanean savanna. The control is focused on transhumance areas and agropastoral farms and utilises monoconical traps (Vavoua). The main species of tsetse are *Glossina palpalis* and *G. tachinoides*. The control strategy depends on the type of animal husbandry practised and the type of vegetation. Trypanosomiasis monitoring is based on haematological and serological techniques. The results show a decrease of the tsetse population of about 95%. The trypanosomiasis infection rates decreased from 40% to 5%. Thus, the trypanosomiasis problem is under control in the region.

9144 **Grundler, G. and Kientz, A., 1995.** Possibilities of the participation in tsetse control of the beneficiaries in Côte d'Ivoire. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 280-281.

Grundler: Eversbuschstrasse 15, 80999 Munchen, Germany.

In order to guarantee the long-term success of tsetse control measures in Côte d'Ivoire, the possibilities and problems of securing the participation of the beneficiary populations were investigated. A wide range of animal husbandry systems is found and each group has different aims for breeding cattle and attaches a different importance to its livestock and its productivity. In addition to the motivation, mental reservations and financial capacity of the different target groups, the prospects for livestock development in different areas need to be considered in order to identify areas where total or significant participation is possible and areas with little potential. Passive participation (abstinence from any action which disturbs tsetse control) is very important and may require education. Active participation can consist of financial contributions or active field work. Different models of community participation, adapted to the different target groups, are outlined.

9145 **Hendrickx, G. and Napala, A., 1995.** Résultats préliminaires des effets de différentes méthodes de lutte contre la trypanosomiase animale africaine: commentaires concernant leur coût, bénéfice et faisabilité au Togo. [Preliminary report on the effect of different control methods of African animal trypanosomiasis: comments on their cost, effectiveness and feasibility in Togo.] (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 310-311. Projet FAO GCP-TOG-013-BEL, c/o FAO Lomé, B.P. 4388, Lomé, Togo.

In order to define a procedure for controlling animal trypanosomiasis in the Togolese context, and which would be effective even when totally dependent on the beneficiaries for finance and implementation, a Belgian funded FAO project has initiated several pilot schemes in Togo: a large-scale operation along a forest gallery (118 km) using blue and black targets (1 m²) soaked in alpha-cypermethrin (600 mg); two small-scale operations using the same method but limited to watering places or small forest areas; testing of the additional effect on tsetse control of treating affected animals on a regular basis with a curative drug (Berenil); a large-scale operation (300 km²) using pour-on insecticide application (Spot-on) in the savanna region; and two smaller-scale trials using the same method in more humid regions along more or less important gallery forests. Based on results obtained so far, the use of Spot-on, with or without supplementary health measures,

is proposed as the most appropriate method in the given situation. In spite of its cost-effectiveness, it is anticipated that the high cost might be a major handicap to large-scale use by farmers. Several possibilities are being considered for reducing implementation expenses.

9146 **Kakaire, D., Katabazi, B., Nowak, F., Laqua, H., Hartmann, G., Tietjen, U., Lancien, J., Mbulamberi, D.B. and Mehlitz, D., 1995.**

Monitoring the success of control measures against sleeping sickness in Mukono District, south-east Uganda. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 272-273.

Kakaire: Animal Health Research Centre, P.O. Box 24, Entebbe, Uganda.

A longitudinal study on the transmission dynamics of human and animal trypanosomiasis was carried out in the Lake Victoria shore area of Mukono District, south-east Uganda. Baseline data on the seasonal fluctuation of the apparent density of *Glossina fuscipes fuscipes*, its host preferences and its infection rates with *Trypanosoma* spp. were recorded monthly and the trypanosome infection rate in domestic animals was determined every three months. Control comprised vector reduction using deltamethrin-impregnated monopyramidal traps and the chemotherapeutic treatment of *Trypanozoon*-infected domestic animals. Collected isolates of trypanosomes of the subgenus *Trypanozoon* were examined for their potential human infectivity. One year after the onset of control measures the tsetse apparent density was 0.16, showing a decrease of 97.9% compared to pre-intervention data. The *Trypanozoon* prevalence rate in the cattle and pig population monitored decreased from 34.9% to 9.1% and from 47.8% to 8.2%, respectively. The proportion of potential human-infective *T. brucei* populations dropped significantly. No new cases of sleeping sickness were recorded after the onset of control measures.

9147 **Kamara, D., Echessah, P., Swallow, B. and Curry, J., 1995.**

Assessment of the socio-economic factors affecting implementation of community-based tsetse control in Busia, Kenya. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 293-301.

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

The use of baited traps and targets to control the tsetse fly has the potential for successful and sustainable trypanosomiasis control by local communities. However, with community-based programmes, community organisational capacity, incentives needed to

initiate and sustain programmes, and intra-community distribution programmes become important issues. A multi-disciplinary study in a sleeping sickness focus in Busia District, Kenya, is investigating this and other issues, using participatory, focus group and formal survey methods. Findings to date indicate the existence of a complex set of linkages between animal trypanosomiasis and human health, subsistence and nutrition, resulting in multiple social and biological impacts on local populations. Various factors including ownership and use of livestock, beliefs and attitudes concerning trypanosomiasis, and the length and degree of exposure to the disease and control programmes appear to be important determinants of the willingness of both the communities and individuals to participate in control activities.

9148 **Leak, S.G.A., Woudyalew Mulatu, Rowlands, G.J. and d'Ieteren, G.D.M., 1995.**

The control of *Glossina pallidipes*, *G. fuscipes fuscipes* and *G. morsitans submorsitans* in southwest Ethiopia using cypermethrin 'pour-on' insecticide. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 257-263.

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 October 1993 between 2000 and 4000 cattle were treated at monthly intervals with a synthetic pyrethroid insecticide, cypermethrin high-*cis*. A dosage of 1 ml per 10 kg body weight was used to control tsetse flies. Treatments were given as a 'pour-on' application along the backlines of animals, using automatic drench-gun applicators. This resulted in a decline of 93% in the apparent density of *G. pallidipes* and of 83% in the apparent density of *G. m. submorsitans* by 1993. This reduction was associated with a reduction in trypanosome prevalence in cattle of 74%, despite a high level of resistance to all available trypanocidal drugs. The numbers of *Stomoxys* spp. and Tabanidae were also significantly reduced ($P < 0.01$).

9149 **Makumi, J.N., Green, C.H., Opiyo, E.A. and Stevenson, P., 1995.**

Suppression of a population of *Glossina longipennis* using targets impregnated with deltamethrin in an oil formulation. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 251-255.

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

Odour-baited targets, impregnated with 0.05% deltamethrin in a mixture of acetone and Cereclor oil, and deployed over a 65 km² area for one year, increased

the mortality of *G. longipennis* and suppressed but did not eradicate the population. Deposits of deltamethrin on the cloth and netting were bioassayed by brief contact of teneral flies to the cloth and netting. The targets were lethal to both *G. longipennis* and *G. morsitans morsitans* 8 months after impregnation.

9150 Mango, C.K.A., Langley, P.A., Okedi, T., Guya, S., Otieno, D. and Omuse, J.K., 1995. Efficacy data of S-31183-pyriproxyfen on *Glossina pallidipes* Austen population suppression in Kiboko, Machakos District. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 307.

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

A study to determine efficacy of S-31183-pyriproxyfen in combination with odour-baited biconical traps on suppression of *G. pallidipes* populations was carried out at Kiboko, Machakos District. Population suppression was assessed by monthly 24 h sampling, mean wing fray ratio of both males and females, ovarian ageing of females, pteridine fluorescent ratio in heads and wings, and catches on electrified mobile screens. Flies were dissected for infection rates and a group of thirty cattle each from experimental and control areas were examined for the type and rate of infection. The mean monthly 24 h samples showed a reduction in fly density per day per trap in the experimental area. The mean ovarian age of females, mean wing fray ratio and pteridine fluorescent ratio in heads and wings indicated an old fly population in the experimental area, implying little recruitment of young flies. It would appear that older flies were migrating into the experimental area. The use of an electrified mobile screen showed a younger population in the control area compared to that in the experimental area. The mean infection rates in flies in both experimental and control areas were comparable. However, the mean infection rate in cattle grazed in control areas was higher than that observed in the experimental area.

9151 Mangwiro, T.N.C. and Wilson, A., 1995. The control of tsetse and trypanosomiasis by application of insecticides to cattle: an evaluation of deltamethrin pour-ons. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 264-266.

Mangwiro: Tsetse and Trypanosomiasis Control Services, P.O. Box 8283, Causeway, Harare, Zimbabwe.

The use of insecticide-treated cattle as live targets is now accepted as a relatively simple, cost-effective

method of tsetse control. Dipping is the least expensive method of applying deltamethrin to cattle. Where no dipping facilities exist, a pour-on formulation (1% deltamethrin in an oil base) can be used but this is 2-3 times more expensive. Two experiments were carried out in Zimbabwe to evaluate 1% deltamethrin pour-ons based on less costly oils. Candidate formulations were applied at a rate of 1 ml per 10 kg body weight to trained oxen. Female *Glossina pallidipes* which alighted and fed on these oxen at selected sites in the bush were caught and their knockdown and mortality recorded. Mortality for alighting tsetse was reasonable for all formulations used in both experiments. In terms of knockdown, which is more important than mortality in field use, Spot-on (coconut oil base) performed best. Of the candidate formulations, the effectiveness of the cotton seed and sunflower oil formulations declined rapidly to 30% after 30 days, the coconut/paraffinic oil formulation produced nearly 100% knockdown for 50 days and then averaged 60% for up to 100 days, and the coconut/vegetable/paraffinic oil formulation produced 100% knockdown for 70 days and then averaged 60% for up to 100 days, making it similar to Spot-on in effectiveness.

9152 **Nevill, E.M., Kappmeier, K. and Venter, G.J., 1995.**

Entomological studies towards the control of tsetse flies in Zululand. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 302-304.

Onderstepoort Veterinary Institute, Private Bag X05, Onderstepoort 0110, South Africa.

Prior to 1945, nagana was a serious problem in Zululand, with *Glossina pallidipes* being the main vector. An aerial spraying campaign carried out between 1946 and 1950 using DDT and BHC resulted in the eradication of this fly species. However, cases began to appear again in Zululand in 1980, and in 1990 around 10,000 cattle died of nagana. *G. brevipalpis* and *G. austeni* were shown to be the vectors of the disease. Several reasons were suggested for the renewed outbreak: increased human and cattle populations leading to increased grazing in tsetse habitats, e.g. riverine and coastal bush and near to the game reserve; siting of plunge dips near to rivers; using an acaricide that did not affect tsetse; and large numbers of cattle present at the dips at the same time. The use of synthetic pyrethroid dips was introduced to control tsetse, but limited to a period of two years to minimise the risk of resistant ticks

emerging. After the two years were over, at some dips one in five cattle was treated with a pour-on formulation of the synthetic pyrethroid. Since relatively little work has been done on the two tsetse species implicated in the current outbreak, a research programme has been initiated to investigate effective traps and odours for these species. An extensive survey is also planned to map the precise extent of the tsetse distribution. The desirability of a regional approach to tsetse control is emphasised and in this context the possibility of South Africa being included in the Regional Tsetse and Trypanosomiasis Control Programme is raised.

9153 **Okello-Onen, J., Heinonen, R., Ssekitto, C.M.B., Mwayi, W.T., Kakaire, D. and Kabarema, M., 1995.** Control of tsetse flies in Uganda by dipping cattle in deltamethrin. (Abstract only.) *In*: OAU/STRC, 1995 (see 18: no. 9123), p. 256. Okello-Onen: Animal Health Research Centre, P.O. Box 24, Entebbe, Uganda.

The effect of treating cattle in deltamethrin to control tsetse flies and ticks was investigated on two ranches 8 km apart in a central district of Uganda where a high risk of trypanosomosis prevails. This area has a moderate challenge of *Glossina pallidipes*. The cattle had a very low tick challenge due to regular treatment with dioxathion. On one ranch a dip was charged with deltamethrin to treat cattle regularly for 3 months. The other ranch was used as a control, but the animals continued to be treated regularly with dioxathion using hand spray pumps. In the ranch with deltamethrin treatment a reduction of 96.9% in the tsetse population was recorded after two treatments at 2 week intervals. Total (100%) control of tsetse was achieved from the fourth treatment up to the end of the trial period. The ranch with dioxathion treatment experienced an overall tsetse reduction of 19.15%. However, the mean apparent tsetse density of 4.83 flies/trap/day recorded at the control ranch was significantly different from the mean at the ranch with deltamethrin treatment of 0.81 flies/trap/day ($P < 0.001$). It was difficult to assess the effect of this product on ticks but there are indications that deltamethrin is capable of reducing tick populations and the incidence of tick-borne diseases.

9154 **Shereni, W. and Pope, A.J.R., 1995.** Effects of residual deposits of deltamethrin applied by the ground spraying technique against tsetse fly (Diptera: Glossinidae) populations in north-western Zimbabwe. (Poster;

abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 308.

Shereni: Tsetse and Trypanosomiasis Control Branch, P.O. Box 8283, Causeway, Harare, Zimbabwe.

Residual deposits of deltamethrin were applied with knapsack sprayers at the rate of 0.05% (2.6 g a.i./ha) to resting sites of *Glossina morsitans morsitans* and *G. pallidipes* in a 600 km² area of savanna woodland. Both species were eliminated within 4 months of treatment. In comparison, a 96% reduction in Epsilon trap catches had been achieved by the end of the rainy season in the adjacent (control) area treated in a similar manner but with 4% aqueous suspension of DDT. Tsetse flies persisted in this area until the following year's spraying season, 12 months later. The more rapid decline in fly catches with deltamethrin was attributed to knockdown and predation of flies that had collected a sub-lethal dose of insecticide. Deposit levels of deltamethrin had dropped to 20% of initial dosage 3 months after treatment. At this deposit level, the insecticide was sufficient to cause a 19.6% mortality and a 50% knockdown of female *G. pallidipes* in bioassays conducted under laboratory conditions. Exposure of the deltamethrin-treated area to fire did not significantly reduce effectiveness of the pesticide.

9155 **Swallow, B.M. and Woudyalew Mulatu, 1995.** Evaluating the willingness of Ghibe Valley (Ethiopia) residents to contribute time and money to a tsetse control programme using targets. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 282-292.

Swallow: ILRI, P.O. Box 46847, Nairobi, Kenya.

A tsetse control experiment with 500 deltamethrin-impregnated targets was initiated in the Ghibe Valley, south-west Ethiopia, in April 1990. The theft of a large number of targets following the socio-political disturbances of May 1991 spoiled major reductions in tsetse density and trypanosome prevalence. It was proposed that a greater level of farmer and community participation would contribute to the effectiveness of the control. A survey of 180 household heads was conducted to ascertain residents' willingness to take more active roles in the experiment. Respondents were asked what ought to be done to reduce the problems of theft. The respondents generally indicated a willingness to participate more actively in guarding the targets and in detecting and punishing thieves. Respondents were asked the maximum amounts of money and/or labour that they would be willing to contribute

to a redesigned experiment. Willingness to contribute money was found to be related to the gender of the household head, the number of cattle held by the household and whether the household was involved in the ongoing health and productivity study. Willingness to contribute labour was related to employment status, participation in other community groups and information available to the respondent about the programme.

9156 Swallow, B.M., Woudyalew Mulatu and Leak, S.G.A., 1995.

Evaluation of pour-on by Ethiopian farmers. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 309.

Swallow: ILRI, P.O. Box 46847, Nairobi, Kenya.

Since April 1990 a tsetse control experiment with the synthetic pyrethroid Ectopor has been conducted in the Gullele-Tolley area of the Ghibe Valley, south-west Ethiopia. Monthly applications of the pour-on were given to about 2000 cattle between April 1991 and July 1992 and about 3000 cattle between July and November 1992. Since December 1992 the treatments have been made available to all farmers in the area on a cost recovery basis. Formerly the treatments were free to selected farmers. A survey of 200 household heads who keep cattle in the control area was conducted to assess the impact of the price increase on farmers' demand for the treatments. Respondents to the household survey were asked about the advantages of the pour-on.

Farmers noted a variety of advantages such as less trypanosomiasis (gendi), fewer problems with ticks, animals grazing well and quietly, cows quieter when milking, fewer problems with ox peckers bothering the animals, and the animals' wounds healing faster.

9157 Warnes, M.L., Torr, S.J. and Hargrove, J.W., 1995. Current research into the use and deployment of odour baited targets in Zimbabwe. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 269-271.

IPMI Tsetse Project, c/o Tsetse Control Branch, Department of Veterinary Services, P.O. Box CY 52, Causeway, Harare, Zimbabwe.

Trypanosomiasis is controlled in Zimbabwe mainly by killing the vector using odour-baited insecticide-impregnated targets and insecticide-treated cattle. Economic and environmental considerations show these to be the most appropriate methods available. Zimbabwe is on the edge of tsetse distribution, consequently eradication of the fly to the country's borders is a realistic aim, but the problem of preventing reinvasion from neighbouring countries remains. Research is

continuing into improving the efficiency of odour-baited targets on three fronts. Firstly, experiments indicate the existence of unidentified attractive odours from oxen that can at least double the efficacy of the odour bait, and efforts to isolate and identify these odours continue. Secondly, investigations on the movement of tsetse are leading to more effective target deployment patterns, particularly with regard to target barriers. Finally, research is taking place into possible improvements in the logistics of control operations and more effective methods of extension amongst local people to reduce theft and damage to targets.

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

[See also **18**: nos. 9131, 9152, 9167, 9168, 9177, 9179.]
9158 **Kaddu, J.B., 1995.** The ultrastructure of *Trypanosoma* in the peritrophic membrane of *Glossina*. (Abstract only.)
In: OAU/STRC, 1995 (see **18**: no. 9123), p. 70.

Department of Zoology, Faculty of Science, Makerere University, P.O. Box 7062, Kampala, Uganda.
Few studies have been made on the infection of *Trypanosoma* in *Glossina* at ultrastructure level, and none in the proventriculus. This study was undertaken to find out the effect of *T. congolense* on the peritrophic membrane (PM) of *G. pallidipes* and the significance of the trypanosome-PM interaction in the migration of *T. congolense* in *Glossina*. Over 3000 Ugandan *G. pallidipes* emerging from wild puparia incubated at 26 ± 2°C and humidity of 70-90% were infected through feeding on albino rats infected with *T. congolense* Lugala/EATRO/1381. The flies were examined microscopically 30 min to 40 days p.i. using previously described techniques. Using light microscopy, live motile trypanosomes within pieces of the PM were observed. Electron microscopy showed clearly defined abnormalities in the PM. The parts of the PM where trypanosomes were embedded were swollen, and had cavities which were more electron-translucent than the amorphous layer of the PM. The infected PM also had pseudopodia-like processes. It was hypothesised that the entombed trypanosomes extricate themselves from the intraperitrophic cavities through ruptures in the electron-dense layer of the PM while the PM advances posteriorly in the gut.

9159 **Masiga, D., Bromidge, T. and Gibson, W., 1995.** A polymerase chain reaction (PCR) methodology for the identification

of African trypanosomes. (Abstract only.) *In:* OAU/STRC, 1995 (see **18**: no. 9123), p. 68.
 Masiga: KETRI, P.O. Box 362, Kikuyu, Kenya.
 The accurate identification of different trypanosome species, subspecies and strains is a fundamental problem in studies of the epidemiology of trypanosomiasis in Africa. Yet species with different pathogenicities are difficult to distinguish by morphology of bloodstream forms or developmental stages in the tsetse fly vector. Until recently, identification of the latter relied on location in the fly, which is only accurate to subgenus level. The method also fails to detect mixed infections, for example of *Nannomonas* and *Duttonella*, or to identify immature infections where trypanosomes are found in the midgut. We have used a methodology based on the polymerase chain reaction (PCR), a technique for amplifying DNA *in vitro*, in the identification of small numbers of trypanosomes. This assay is specific and sensitive and allows the accurate identification of trypanosomes at different stages of development.

9160 **Maudlin, I., Welburn, S.C., Okuna, N. and Milligan, P.J.M., 1995.** Differential transmission of human infective and non-infective trypanosome stocks from Uganda. *In:* OAU/STRC, 1995 (see **18**: no. 9123), pp. 100-102.
 Maudlin: Tsetse Research Group, Langford House, Langford, Bristol BS18 7DU, UK.
 Trypanosomes isolated from man, tsetse and domestic livestock in Tororo district, Uganda, at the height of the recent sleeping sickness epidemic (1988-90) were characterised by three methods: (i) restriction fragment length polymorphisms (RFLP), (ii) isoenzyme electrophoresis and (iii) *in vitro* human serum sensitivity tests. Isolates were also used to infect male and female *Glossina morsitans morsitans* which were dissected 28 days p.i. and the transmission index calculated (TI = salivary gland/midgut infection %). A total of 37 trypanosome stocks were transmitted through tsetse of which 22 were classified as human serum sensitive (HSS) and 15 were human serum resistant (HSR). RFLP and isoenzyme analysis confirmed the division of these isolates into two discrete groups. As previously observed, male tsetse were consistently found to mature significantly more midgut infections than females infected with the same trypanosome stock. Furthermore both male and female *G. m. morsitans* matured significantly more *Trypanosoma b. brucei* midgut infections than *T. brucei rhodesiense* (χ^2 comparing the two groups = 27.4, $P <$

0.001). The difference in maturation response of trypanosomes may reflect differences in the number of lectin binding sites on the parasite surface. Man-infective trypanosomes are clearly less efficiently transmitted through tsetse than their non-man-infective counterparts which may affect the progression of *T. b. rhodesiense* sleeping sickness epidemics.

9161 **McNamara, J., Laveissière, C. and Masiga, D., 1995.** New insights into the different trypanosomes infecting wild tsetse. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 69.

McNamara: MRC Trypanosomiasis Research Group, University of Bristol, Langford, Bristol BS18 7DU, UK. The species specificity of DNA hybridising probes has improved trypanosome identification in tsetse. PCR methods are more sensitive (see **18**: no. 9159) and identify low numbers of trypanosomes. In a comparative evaluation in Côte d'Ivoire with midgut cultures from wild tsetse (mostly *Glossina palpalis palpalis*, but some *G. pallicera pallicera* and *G. nigrofusca*), hybridising probes indicated that *Trypanosoma brucei* was rare. The only *Nannomonas* species was *T. congolense*, and included the riverine-forest (RF) and savanna (S) types. Also, the Kenya coast, or Kilifi, type was found for the first time in West Africa. In contrast, PCR showed that *T. brucei* and multiple infections occurred very frequently. The *T. brucei* was often mixed with two types (RF, S) of *T. congolense*, while numerous other infections consisted of these two types of *T. congolense*.

9162 **Okia, M., Mbulamberi, D.B. and Muynck, A. de, 1995.** Risk factors assessment for sleeping sickness acquisition in S.E. Uganda: a case-control study. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 91-95.

Okia: National Sleeping Sickness Control Programme, P.O. Box 1241, Jinja, Uganda.

The major risk factors associated with acquisition of *Trypanosoma brucei rhodesiense* sleeping sickness in the Busoga focus, south-east Uganda, were investigated using a case-control study. One hundred and twenty-two cases and 244 controls were used in the study. For each case, two age-, sex-, and residence-matched nearest neighbour and village controls were selected. Patients and controls answered the same questionnaire which had been developed and field tested before the study started. The following factors were found significantly associated: cases spent more time outside their village of residence than controls, and more cases than controls collected firewood in the forest.

Generally, cases had fewer domestic animals grazing near the places of man-fly contact, especially near the homesteads, the water-collecting and bathing points, and near farms and gardens than controls. Cases had lesser demand for preventive care than controls, but more antecedents of sleeping sickness in the family. Generally cases had a less well developed information network than controls, and belonged economically to a less powerful group. Based on these results we may conclude that the risk of developing *T. b. rhodesiense* sleeping sickness depends upon a multitude of economic and cultural factors and human behaviour, which determine man-fly contact. These factors should be taken into account in the planning and monitoring of sleeping sickness control programmes.

9163 **Olubayo, R.O., 1995.** Vectorial capacity of *G. m. centralis* and *G. m. morsitans* for different types of trypanosomes in different mammalian hosts. (Poster; abstract only.)
In: OAU/STRC, 1995 (see **18**: no. 9123), p. 229.

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

A study was carried out to determine which factors within mammalian hosts inhibit or promote parasite development in the fly. *Glossina morsitans* were experimentally infected with either *Trypanosoma congolense* or *T. brucei* and maintained on different mammalian blood. The pattern of infection in *G. m. centralis* and *G. m. morsitans* membrane-fed on goat, eland and buffalo blood mixed with *T. congolense* or *T. brucei* was studied from day 1 to day 10. After the initial blood meal all flies had trypanosome infection, with most flies harbouring infections of 10^4 to 10^5 parasites on day 3. However, after a second blood meal, on day 3, flies cleared many infections, with *G. m. morsitans* clearing more infection than *G. m. centralis*. Infective feeds of goat blood consistently increased final infection rates by limiting the number of infections lost between days 3 and 6. This effect was reproduced by feeding flies on erythrocytes, but not serum. These results suggest that compounds from some mammalian erythrocytes act in a similar manner to midgut lectins, and hence have a protective effect on trypanosome establishment in the fly.

5. human trypanosomiasis

(a) SURVEILLANCE

[See also **18**: no. 9180.]

9164 **Büscher, P., Depla, E., Magnus, E. and Meirvenne, N. van, 1995.** A serodiagnostic ELISA using variable antigens of *Trypanosoma brucei gambiense*. In: OAU/STRC, 1995 (see **18**: no. 9123), pp. 46-52.

Büscher: Laboratory of Serology, Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium. An antibody detection ELISA for diagnosis of *T. b. gambiense* infection in man is presented. The antigens consist of semi-purified variable surface glycoprotein of two different antigen types (VATs) of *T. b. gambiense*. Both antigens were tested separately and as a mixture. A first evaluation of this ELISA on 351 human *T. b. gambiense* infection sera and 635 non-trypanosomiasis sera revealed high sensitivity and specificity. The necessity of using a combination of VATs is demonstrated by the relationship between the geographical origin of the serum samples and the sensitivity of the single antigen tests.

9165 **Laveissière, C., Meda, H.A., Denoman, J., Doua, F. and Miezán, T., 1995.** Dépistage de la trypanosomiase humaine et soins de santé primaires en Côte d'Ivoire. [Case detection of sleeping sickness cases and primary health care in Côte d'Ivoire.] In: OAU/STRC, 1995 (see **18**: no. 9123), pp. 82-90.

Laveissière: IPR/OCCGE, B.P. 1500, Bouaké, Côte d'Ivoire.

The recrudescence of human sleeping sickness and the disorganisation of the health system make it necessary to find new, efficient and cheaper ways for the detection of cases to stop the spread of the disease. In a forest area of Côte d'Ivoire, case detection is now the responsibility of community health agents of 12 primary health care centres (29 villages). All these agents are young literate villagers. Each agent, after receiving adequate training, carries out a census of the population and blood sample collection on filter-paper. Dried blood samples are tested in the district laboratory and results are sent back to the agent who has to ensure that the seropositive persons go to the local laboratory for parasitological testing. As they are members of their community, the agents constitute a sustainable surveillance network for monitoring and control of the disease, so that the health team may operate promptly and effectively as soon as an outbreak occurs in any area. The cost of this strategy is three times cheaper than the traditional mobile team system.

9166 **Kansiime, F.K., Akol, M., Okitai, D. and Odiit, M., 1995.** Immuno-fluorescent antibody test (IFAT) as a routine

diagnostic test in the control of *T. b. rhodesiense* sleeping sickness in south eastern Uganda. (Poster; abstract only.) In: OAU/STRC, 1995 (see **18**: no. 9123), p. 73. UTRO, P.O. Box 96, Tororo, Uganda.

The immunofluorescent antibody test (IFAT) was incorporated into the sleeping sickness control programme for surveillance. A total of 1875 suspects were screened by the examination of thick blood smears, as routinely done by the sleeping sickness orderlies (SSO), and by IFAT. Fourteen and 288 were positive by microscopy and by IFAT, respectively. The IFAT positives were re-examined by the haematocrit centrifugation technique (HCT) and by mouse inoculation (MI). Of these, 12 and nine were parasitologically positive by HCT and MI, respectively. The cerebrospinal fluid of the IFAT positives was also analysed by parasitological methods and eight cases were identified. In this case, the SSO would have diagnosed only 14 cases and missed 29. As the incidence of sleeping sickness in south-eastern Uganda is much reduced, surveillance using parasitological methods alone is clearly inadequate. IFAT should be used throughout the epidemic area to enhance case detection.

9167 **Khonde, N., Niyonsenga, T., Loko, L. and Pépin, J., 1995.** Analyse de l'agrégation familiale de trypanosomiase à *T. b. gambiense* dans une communauté à très forte incidence dans le centre du Zaïre. [Analysis of familial clustering of *T. b. gambiense* trypanosomiasis in a very high incidence community of central Zaïre.] (Abstract only.) In: OAU/ STRC, 1995 (see **18**: no. 9123), pp. 79-80.

Khonde: Service des Maladies Infectieuses, Centre Hospitalier Universitaire, 3001 12^{ème} Avenue Nord, Sherbrooke, Qc, J1H 5N4, Canada.

A comprehensive survey was carried out in Duakombe and two nearby hamlets located in central Zaïre, a community with a very high incidence of *Trypanosoma brucei gambiense* trypanosomiasis since 1982. A detailed questionnaire was administered to all inhabitants which reviewed, amongst other things, their own past history of trypanosomiasis and the history of past trypanosomiasis among their relatives (mother, father, children, brothers, sisters, half-brothers, half-sisters). The accuracy of this information was verified against the records of Nioki hospital (30 km away) and those of the local trypanosomiasis control mobile team. Among the 1403 inhabitants of this

community, 298 had been treated for the disease in the past. Among children for whom both parents were present during the survey, the risk of having had trypanosomiasis before was related to a past history of the disease in the mother, but not to its past history in the father. The most likely explanation for these findings is behavioural rather than genetic, as young children spend a large proportion of their time closer to their mothers and thus may be exposed to the same infective tsetse flies.

9168 **Khonde, N., Niyonsenga, T., Loko, L. and Pépin, J., 1995.** Y a-t-il immunité après la maladie du sommeil à *T. b. gambiense*? Une étude épidémiologique dans une communauté à très forte incidence. [Is there immunity after *T. b. gambiense* sleeping sickness? An epidemiological study in a very high incidence community.] (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 81.

Khonde: Service des Maladies Infectieuses, Centre Hospitalier Universitaire, 3001 12ème Avenue Nord, Sherbrooke, Qc, J1H 5N4, Canada.

As part of a comprehensive survey carried out in Duakombe and two nearby hamlets in central Zaire (see **18**: no. 9167), the risk of being diagnosed with trypanosomiasis and the risk of relapse/reinfection is being examined throughout a 10-year period starting on 1 January 1982 and ending on 1 January 1992. The risk of developing a first episode of trypanosomiasis will be estimated as the number of first episodes per 100 person-years of observation among individuals without a prior diagnosis of the disease. We will estimate the risk of relapse/reinfection as the number of episodes necessitating a second treatment per 100 person-years of observation among individuals previously treated. The comparison of these two estimates will allow us to calculate the minimal degree of immunity conferred by a first episode of trypanosomiasis.

9169 **Olaho-Mukani, W., Nyang'ao, J.M.N., Tengekyon, K.M. and Omuse, J.K., 1995.** Evaluation of the card indirect agglutination test for trypanosomiasis using stored sera from *Trypanosoma brucei rhodesiense* infected patients. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 43-45.

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

A card indirect agglutination test for trypanosomiasis (CIATT⁶) was evaluated using stored human sera comprising samples from 123 *T. b. rhodesiense*, 13 malaria and four leishmaniasis patients, and 10 apparently healthy subjects. Sera from *T. b. rhodesiense* patients had been stored at -20°C for periods ranging from 2 to 15

years. Of the 123 trypanosome positive sera, 120 (97%) were positive on CIATT. All sera from malaria or leishmaniasis patients and apparently healthy subjects were negative on CIATT. CIATT is a promising card test with high potential for field application. The test is easy to perform, requires minimum input for equipment, and results are obtainable within 5 min.

9170 **Truc, P. and Formenty, P., 1995.** A kit for *in vitro* isolation of African trypanosomes from man and other animals, and its potential value for the diagnosis of gambian trypanosomiasis. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 42.
 Truc: IPR/OCCGE, B.P. 1500, Bouaké 01, Côte d'Ivoire.
 A new simple test kit for isolating African trypanosomes *in vitro* (KIVI) was tested with blood samples from man and other animals in Congo and Côte d'Ivoire. A high rate of success was achieved, with positive cultures being found 5-36 days after inoculation. The method was also of value in diagnosis. Parasitaemia was initially detected by thick film, the haematocrit method, the mini-anion exchange column, and/or the quantitative buffy coat method using blood or swollen lymph glands. In Congo, none of the 22 domestic animals was parasitaemic and none gave positive cultures. Of 35 human subjects, 10 of whom were trypanosome (T) negative and five CATT negative, 27 gave positive KIVI cultures (seven were T- and two CATT-). In Côte d'Ivoire, of 27 subjects of whom three were T- and one CATT-, 26 were KIVI+ (three of them were T- and one CATT-). Of 43 domestic animals, of which 31 were T-, 25 were KIVI+ (17 of them were T-). Of 97 wild animals, of which 81 were T-, 76 were KIVI+. Isoenzyme electrophoresis showed that all the human stocks belonged to 'gambiense group 1'. All the domestic animal stocks belonged to classical *Trypanosoma brucei brucei*. Work is in progress to identify the wild animal stocks by isoenzyme and PCR.

(b) PATHOLOGY AND IMMUNOLOGY

(c) TREATMENT

9171 **Boa, Y.F., Mouanga, A., Assi, A.B., Ettien, F., Diagana, M., Kouassi, B. and Giordano, C., 1995.** Trypanosomiase humaine africaine à *T. b. gambiense*: 7 jours de traitement au DFMO pourraient suffire! [*Gambiense* African trypanosomiasis: a 7-day course of DFMO could be enough!] *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 104-106.

Boa: Département de Neurologie, Faculté de Médecine, Université d'Abidjan, 11 B.P. 311 Abidjan, Côte d'Ivoire.

In order to reduce the cost of treatment by DFMO (eflornithine) in *gambiense* trypanosomiasis, a new protocol was developed. This consisted of a dose of 400 mg/kg/day given for 7 days. The daily dose was divided into four and each given in a 220 ml isotonic saline i.v. drip every 6 h. Three female patients, aged 4, 10 and 20 years, in the meningo-encephalic stage of the disease, were treated according to this protocol and made spectacular recoveries. The two followed remained healthy at the latest checkup (at 600 days and 270 days). This protocol needs to be tested on a larger scale. If successful, it could halve the treatment cost.

9172 **Khonde, N., Loko, L., Mpia, B. and Pépin, J., 1995.** Etude ouverte d'un traitement écourté de 7 jours d'eflornithine chez 32 patients avec une trypanosomiase à *T. b. gambiense* ayant rechuté après le traitement initial. [Open trial of a 7-day course of eflornithine among 32 patients with relapsing *T. b. gambiense* trypanosomiasis.] (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 103.

Khonde: Service des Maladies Infectieuses, Centre Hospitalier Universitaire, 3001 12ème Avenue Nord, Sherbrooke, Qc, J1H 5N4, Canada.

Thirty-two patients with *Trypanosoma brucei gambiense* trypanosomiasis adequately treated in the past and who were found to have relapsed (trypanosomes in the CSF and/or a significant increase in the CSF WBC count) were treated with a 7-day course of i.v. eflornithine at 100 mg/kg every 6 h, between May 1992 and February 1993. Their initial treatment had been melarsoprol (20 patients), oral eflornithine (7), nifurtimox (2), pentamidine-suramin (1), pentamidine alone (1) or diminazene (1). When the diagnosis of relapse was made, 17 of them had trypanosomes in the CSF; for the whole group, CSF WBC count ranged between 21 and 403/mm³ (mean: 119/mm³). One patient died shortly after treatment. After the short course of eflornithine, lumbar punctures were to be performed at 1, 3, 6, 12, 18 and 24 months. So far, 10 patients have been followed for at least 6 months, 11 for 3-6 months and 6 for 1-3 months, and none of them has yet been found to have relapsed. A 7-day course of eflornithine at 100 mg/kg given i.v. every 6 h may thus

be an efficient treatment of relapsing *T. b. gambiense* trypanosomiasis.

9173 **Kuzoe, F., 1995.** Current status of eflornithine for the treatment of sleeping sickness. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 119-120.

TDR, WHO, 1211 Geneva 27, Switzerland.

Eflornithine was developed as a treatment for human African trypanosomiasis by Marion Merrell Dow Pharmaceuticals (MMD), USA, and UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR). It is very effective against *gambiense* sleeping sickness, but is not effective alone against the *rhodesiense* form of the disease. It appears to be effective against late stage *rhodesiense* sleeping sickness in combination with suramin. Eflornithine is well tolerated but is expensive. A trial is currently under way to compare 14 day versus 7 day duration of treatment in an attempt to reduce costs. MMD is not interested in producing the drug, and WHO is hoping to find a third party to manufacture it. Registration of eflornithine in endemic countries has been disappointingly slow, with only Uganda and Equatorial Guinea having completed registration so far. Endemic countries need to be sensitised to the problems concerning future availability of the drug, and should actively seek funds to purchase the drug when it is produced.

9174 **Rombo, L., Bronner, U., Doua, F., Miézan, T.W., Ericsson, Ö. and Gustafsson, L., 1995.** Parasitocidal concentrations of pentamidine for *T. b. gambiense*. What do you need and what do you get? (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 121.

Rombo: Unit of Tropical Pharmacology, Department of Infectious Diseases and Clinical Pharmacology, Huddinge University Hospital, Karolinska Institute, Stockholm, Sweden.

The pharmacokinetic information for pentamidine is incomplete and the presently used dosage regimens are based on clinical experience. We therefore decided to study the kinetics of the drug in patients with trypanosomiasis caused by *Trypanosoma brucei gambiense*. In addition, there is still scarce information on the minimum dose and time required to eliminate *T. b. gambiense* which necessitated studies *in vitro*. The principal findings were as follows. Pentamidine can be detected in plasma for a considerable period of time which reflects its pronounced tissue affinity. The drug has a long terminal elimination half life and is

accumulated during repeated dosing. Prolonged exposure to pentamidine *in vitro* was essential in order to establish the true effect of the drug. Already after a single dose of 2.3 mg base/kg, the median plasma concentration of the pentamidine isethionate is above inhibitory *in vitro* concentrations for a week. Thus, a reduction of the number of treatments might well be possible.

6. animal trypanosomiasis

(a) SURVEY AND DISTRIBUTION

[See also **18**: nos. 9135, 9138, 9170, 9193, 9202.]

9175 **Anosa, V.O., Antia, R.E., Ohore, O.G., Agbede, R.I.S., Ajayi, S.A., Anika, S.M., Lawani, F., Ogunsusi, R. and Okoro, H.O., 1995.**

Prevalence of trypanosomiasis in ruminants in southwestern Nigeria as determined by parasitological and antigen ELISA methods. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 148-151.

EEC Trypanosomiasis Project, Department of Veterinary Pathology, University of Ibadan, Ibadan, Nigeria.

A two-year four-season study of the prevalence of trypanosomiasis in ruminants was conducted in southwestern Nigeria using parasitological and antigen-ELISA methods. The herds selected were either government-owned, or belonged to the traditional herdsmen settled in these areas. Prevalence was significantly greater in the rainy season than in the dry season in the cattle, sheep and goats. *Trypanosoma vivax* was the most common species encountered, followed by *T. congolense* and then *T. brucei*. Mixed infections were rarely detected by the parasitological methods but were quite common with the antigen-ELISA technique. Antigen-ELISA detected far more 'infections' than the parasitological techniques used, the overall ratio of antigen-positive to parasitologically positive being 7.5:1 in cattle, 6.0:1 in sheep and 12.5:1 in goats. A pilot study conducted to validate the antigen-ELISA test in Nigerian sheep infected with *T. vivax* showed that trypanosome antigens were not detectable before infection, rose markedly as soon as parasitaemia became detectable and disappeared within 2 weeks of treatment with diminazene aceturate.

9176 **Coulibaly, L., Rowlands, G.J., Authié, E., Hecker, P.A., d'Ieteren, G.D.M., Krebs, H., Leak, S.G.A. and Rarieya, J.M., 1995.** Effect of tsetse control with insecticide-impregnated traps on trypanosome prevalence and productivity of cattle and sheep in northern Côte d'Ivoire. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 244-250.

Coulibaly: SODEPRA/GTZ/CIPEA, B.P. 143, Boundiali, Côte d'Ivoire.

Nineteen herds of cattle (N'Dama, Baoulé and Zebu crosses) and 20 flocks of Djallonké and Djallonké \times Sahel sheep in the region of Boundiali, northern Côte d'Ivoire, were monitored monthly for body weight, PCV and the presence of trypanosomes in blood over various periods from January 1984 to December 1992. A tsetse control campaign using alpha-cypermethrin-impregnated traps was introduced in January 1988. Tsetse control reduced tsetse relative density by over 95%. This resulted in a corresponding reduction in prevalence of *Trypanosoma congolense* of over 90% in both sheep and cattle over the period 1988 to 1992. Average reductions in prevalence of *T. vivax* were lower, on average 65% in adults and 83% in young animals. *T. vivax* was the predominant species affecting calves, and the reduction in prevalence of this species due to tsetse control was significantly associated with increases in growth rate. 9177 **Duvallet, G., Bengaly, Z., Reifenberg, J.M. and Argiro, L., 1995.**

Des nouveaux outils pour le diagnostic et l'épidémiologie de la trypano-somose animale africaine: résultats préliminaires au CRTA/CIRDES. [New tools for diagnosis and epidemiology of African animal trypanosomiasis: preliminary results at CRTA/CIRDES.] *In*: OAU/ STRC, 1995 (see 18: no. 9123), pp. 59-67. CRTA/CIRDES, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.

The new biotechnologies being used at CRTA/CIRDES for the diagnosis of African animal trypanosomiasis (monoclonal antibodies, DNA probes and PCR) allow a higher sensitivity and specificity. The antigen detection ELISA test was seven times more sensitive than the phase contrast buffy coat technique tested on 1633 cattle, in tsetse infested areas around Bobo-Dioulasso (Burkina Faso). Moreover, the antigen detection test highlighted the importance of mixed infections in the field: 62% of infections were mixed infections, whereas the parasitological technique detected only 2% mixed infections. Several stocks and clones of *Trypanosoma congolense* from Bobo-Dioulasso area were characterised by radioactive DNA probes. Eight stocks were positive with a savanna type probe and one with a forest type. The PCR technique is even more sensitive and will be used for the characterisation of the parasites in tsetse flies. However, DNA probes and PCR techniques, since they are expensive and difficult to implement, should be restricted to epidemiological

studies and are not envisaged for large-scale application.

9178 **Gauthier, J., Salembéré, S., Bengaly, Z., Saulnier, D. and Duvallet, G., 1995.** Prévalence des principales hémoprotozooses animales au Burkina Faso. [Prevalence of major animal haemoprotozooses in Burkina Faso.] (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 71. CRTA/CIRDES, 01 B.P. 454, Bobo-Dioulasso 01, Burkina Faso.

Following several epidemiological surveys in different provinces of Burkina Faso, a distribution map of the major animal haemoprotozooses has been established. The following diseases were studied: trypanosomosis, babesiosis and anaplasmosis. Prevalences were obtained with the following serological tests: ELISA antigen or antibody detection test for trypanosomosis, ELISA antibody detection for babesiosis and ELISA or Dot-ELISA antibody detection for anaplasmosis.

9179 **Majiwa, P.A.O., 1995.** DNA probe- and PCR-based methods for the detection of trypanosomes. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 53-58.

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

Highly repetitive, tandem or interspersed DNA sequences unique to different species, type or sub-type of the African trypanosomes have been cloned as recombinant plasmids for use in specific and sensitive identification of the trypanosomes. Protocols have been adapted for use with these DNA probes in the detection of trypanosomes in the blood or buffy-coat samples from mammalian hosts and the saliva of live tsetse flies. The detection of parasite DNA relies upon hybridisation with parasite type-specific DNA probe labelled with digoxigenin, followed by revealing the hybridised probe using anti-digoxigenin antibodies conjugated to alkaline phosphatase and the addition of enzyme substrates resulting in either visible colour or emission of light detectable by autoradiography.

Combined with the polymerase chain reaction (PCR), the method detects trypanosomes in buffy-coat samples from antigenaemic but aparasitaemic cattle, and in the saliva of live infected tsetse flies. The majority of these recombinant DNA probes are presently available from various sources.

9180 **Nantulya, V.M., 1995.** The development of latex agglutination antigen tests for diagnosis of African trypanosomiasis. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 37.

Brentec Diagnostics, P.O. Box 42477, Nairobi, Kenya.

Diagnosis of African trypanosomiasis relies on the demonstration of the parasites in blood. However, chronic and subclinical infections, which constitute over 80% of the infections in the field, are difficult to diagnose using the standard trypanosome detection methods because the parasitaemia is often below the detection limit of these methods. To circumvent this diagnostic problem, tests have been developed for the detection of invariant species or sub-genus specific circulating antigens in blood as a means of diagnosis of *Trypanosoma vivax*, *T. congolense*, *T. brucei*, *T. evansi* and the human pathogens, *T. b. gambiense* and *T. b. rhodesiense*. The tests consist of latex particles which are sensitised with the specific antibodies. The presence of specific antigens in the specimens leads to the agglutination of the sensitised latex particles. The results are read within 5 min and virtually no equipment is required, as the tests can be carried out using heparinised whole blood, or plasma or serum. The results from a preliminary evaluation have shown these tests to have a high degree of sensitivity and specificity. The tests are currently undergoing field evaluation in several countries.

9181 **Nyang'ao, J.M.N., Olaho-Mukani, W., Ross, C. and Omuse, J.K., 1995.** An update of the current status of trypanosomiasis in camels in Kenya. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 72. Nyang'ao: KETRI, P.O. Box 362, Kikuyu, Kenya. The prevalence of camel trypanosomiasis in Kenya was studied in selected herds comprising 1000 camels in total. A detailed clinical examination was carried out including assessment of the body condition and haematocrit level. The presence of trypanosome infection was determined using the micro-haematocrit centrifugation technique (MHCT), mouse subinoculation (MI) and antigen and antibody enzyme-linked immunosorbent assays (ELISA). In herds where trypanosome challenge was high, low haematocrit levels, emaciation and general weakness were common. Deaths and abortions were reported in such herds. The prevalence of infection in sampled herds ranged from 1% to 60% by MHCT and MI, while antigen ELISA detected 5% to 90% infection rates. High antibody titres were demonstrated in most herds. From the observations made in the present study, it would appear that camel trypanosomiasis may be more prevalent than previously thought.

9182 **Olaho-Mukani, W. and Nyang'ao, J.M.N., 1995.** Evaluation of Suratex[®] for the field diagnosis of *Trypanosoma evansi* infections in camels in Kenya. *In: OAU/STRC, 1995 (see 18: no. 9123), pp. 38-41.*

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

Suratex, a card latex agglutination trypanosomal antigen test for the diagnosis of patent and sub-patent *T. evansi* infection, was evaluated for the diagnosis of surra in camels. Six herds, comprising 326 camels, were sampled and tested. In three camel herds from different localities ($n = 150$), 19 (12.7%) camels were positive on the microhaematocrit centrifugation technique (MHCT) and 46 (30.7%) by mouse inoculation (MI), while Suratex detected 107 (71.3%). Suratex detected 18 of the 19 MHCT positive camels (94.4%) and 41 of the 46 MI positive camels (89%). In another group of three camel herds from the same ranch, but under different drug regimes ($n = 176$), Suratex detected a 38.6% infection rate. In bulls on prophylaxis, 22 out of 65 (33.8%) were Suratex positive. The prophylaxis in this group of camels had been administered 8 months prior to the examination. In heifers and weaners, which were treated only on evidence of infection, infection rates detected by Suratex were 64.7% and 21%, respectively. The MHCT and MI did not detect any infection in these animals. These results demonstrate that Suratex is a promising test for the field diagnosis of surra. Results are obtained within 5 min and hardly any equipment is required.

(b) PATHOLOGY AND IMMUNOLOGY

[See also 18: nos. 9176, 9195.]

9183 **Antia, R.E., Ohore, O.G., Ogunsanmi, A.O., Michael, J., Awolaja, O.A., Ajuwape, A.T.P., Adeneye, J.O. and Oyejide, A., 1995.**

Clinicopathological changes associated with trypanosome antigenaemia in Nigerian cattle. (Abstract only.) *In: OAU/STRC, 1995 (see 18: no. 9123), p. 136.*

EEC Trypanosomiasis Project, Department of Veterinary Pathology, University of Ibadan, Nigeria.

Haematological, biochemical and immunological changes produced by trypanosome infection in aparasitaemic but antigenaemic cattle were studied under conditions of natural exposure in 310 cattle comprising several breeds with varying degrees of trypanosusceptibility. Employing the Ag-ELISA, approximately 75% of the cattle were non-antigenaemic (NAC) while the remaining 25% were antigenaemic (AC). Compared to NAC, AC showed

significant ($P < 0.05$) decreases in the erythrocytic indices (PCV, total RBC and haemoglobin). Significant increases in erythrocyte sedimentation rate and osmotic fragility as well as in total plasma protein and gamma globulin levels were associated with antigenaemic status. Plasma fibrinogen and albumin concentrations were, however, unaffected. Neutrophil numbers were significantly lower in AC while platelet counts were higher. The levels of several clinically important blood enzymes and other plasma constituents were not affected by antigenaemia. However, AC had significantly lower plasma cholesterol but higher triglyceride levels ($P < 0.05$) than NAC. Relative trypanotolerance of the various cattle breeds was not correlated with PCV, antigenaemic status, IgG antitrypanosome antibody levels, blood zinc, nor gastrointestinal parasitism, but there was some association with serum lysozyme and plasma potassium levels.

9184 **Bealby, K.A., Chisanga, H.K., Silutongwe, J., Connor, R.J. and Rowlands, G.J., 1995.**

A study of the effects of trypanosome infection on the fertility of female goats in Luangwa Valley, eastern Zambia. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 171.

Bealby: Department of Veterinary and Tsetse Control Services, Box 510016, Chipata, Zambia.

Seventy 1- to 4-year-old female indigenous goats were matched and randomised into two groups to measure the effects of naturally acquired trypanosome infections on oestrus and conception. All goats were treated twice with diminazene aceturate (Berenil) at 7 mg/kg body weight at 2 week intervals. Two and 6 weeks later 28 goats received 0.5 mg/kg of isometamidium chloride (Samorin). Forty-two goats were not treated during this period. A male goat was then introduced to both groups for 3 weeks. Following removal of the male goat all 70 female goats were treated with Berenil and subsequently protected with Samorin until kidding. Goats were sampled weekly. During the 6 weeks before and the 3 weeks when the male was with the females, 15 of the 42 unprotected goats were detected parasitaemic on at least one occasion. No parasitaemias were detected among the 28 protected goats. Twenty-three of the 28 (82%) protected goats kidded successfully compared to 23 of the 42 (55%) unprotected goats ($P < 0.05$).

9185 **Joshua, R.A., Neils, J.A. and Tella, M.A., 1995.** Virulence of *Trypano-soma congolense* in goats and sheep of different

haemoglobin types. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 129.

Department of Veterinary Medicine, University of Ibadan, Nigeria.

The course of infection by a recently isolated stock of *T. congolense* was compared in West African Dwarf (WAD) and Red Sokoto (RS) breeds of goats and in two breeds of sheep. All the RS goats had a short incubation period and died within 11 days of challenge. The WAD had a relatively long incubation period and only one death by the 13th day; the remaining WAD goats maintained microscopically latent infection for the observation period of 2 months. The mean drop in values of PCV, haemoglobin concentration and RBC was more marked in the RS goats than in the WAD. A comparison of the haemoglobin types in the two breeds of goats, using the immunoelectrophoresis method, showed that most of the WAD had haemoglobin type A while the majority of RS goats had haemoglobin type AS. The highly susceptible WAD goat had the AS haemoglobin type. Studies carried out in Yankasa and WAD breeds of sheep showed that WAD sheep carrying type A haemoglobin are likewise more resistant than the Yankasa breed that possesses the type AS haemoglobin. These haemoglobin types might be important markers in the natural resistance of these hosts to trypanosomiasis.

9186 **Katunguka-Rwakishaya, E., Holmes, P.H. and Murray, M., 1995.**

The pathophysiology of ovine trypanosomiasis caused by *Trypanosoma congolense*: ferrokinetic and erythrocyte survival studies. *In*: OAU/ STRC, 1995 (see **18**: no. 9123), pp. 137-140.

Katunguka-Rwakishaya: P.O. Box 7062, Kampala, Uganda. Experimental infection of Scottish Blackface sheep with *T. congolense* resulted in a fluctuating parasitaemia, pyrexia, macrocytic normochromic anaemia and leucocytosis. The decline in mean PCV followed the first trypanolytic crisis and there was a significant correlation between PCV and parasitaemia. Studies with ⁵¹Cr labelled red blood cells (rbc), [¹²⁵I] albumin and [⁵⁹Fe] transferrin 11 weeks p.i. revealed that infected sheep had significantly lower mean red cell volumes, but higher plasma and blood volumes than control sheep. The infected sheep also had enhanced erythropoietic activity as judged by significantly higher plasma iron turnover rates, faster disappearance of radiolabelled iron and high ⁵¹Cr-rbc, and the calculated rbc life-spans were lower in infected than in control sheep. It was concluded that the anaemia observed was due to

accelerated extravascular destruction of rbc and haemodilution. There was no evidence of dyserythropoiesis.

9187 **Katunguka-Rwakishaya, E., Holmes, P.H., Parkins, J.J., Fishwick, G. and Murray, M., 1995.** The influence of energy intake on the pathophysiology of experimental *Trypanosoma congolense* infection in sheep. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 168.

Katunguka-Rwakishaya: P.O. Box 7062, Kampala, Uganda. 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 MJME/day) or low (6.1 MJME/day) energy intake. It was observed that infected animals on the low energy intake had a longer prepatent period, but following patency they tended to develop higher levels of parasitaemia, more severe anaemia and greater growth retardation than those on a higher energy intake. Both infected groups exhibited significant reduction in serum total lipids, phospholipids, plasma cholesterol and albumin. However, these changes were more severe in the animals allowed a low energy intake than in those allowed a higher energy intake. It was concluded that adequate energy nutrition enhances the ability of infected animals to withstand the adverse effects of infection, by promoting better weight gains and moderating the severity of the patho-physiological changes associated with ovine trypanosomiasis.

9188 **Katunguka-Rwakishaya, E., Holmes, P.H., Parkins, J.J., Fishwick, G. and Murray, M., 1995.** The pathophysiology of ovine trypano-somiasis: influence of dietary protein on body weight, anaemia and lipid metabolism. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 169.

Katunguka-Rwakishaya: P.O. Box 7062, Kampala, Uganda. 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 *Trypanosoma congolense* and given either a high or low protein diet. Both groups of infected sheep developed similar degrees of anaemia, but the erythropoietic activity, as judged by the changes in mean corpuscular volumes and the appearance of normoblasts in circulation, was greater in animals on a higher protein diet. The infected animals on a high protein diet gained weight at the same rate as their uninfected controls, while those on a low protein

diet gained significantly less weight than their uninfected controls between 0 and 70 days p.i. Following treatment with the trypanocidal drug, isometamidium chloride, both infected groups recovered from the anaemia; however, the rate of recovery was faster in animals on a higher protein diet than those on a low protein diet. It was concluded that high protein intake ameliorates the adverse effects of infection, as assessed by the severity of anaemia and weight changes, and also enhances the rate of recovery following chemotherapy.

9189 **Okech, G., Watson, E.D., Luckins, A.G. and Makawiti, D.W., 1995.**

Experimental infection of Boran cattle in early pregnancy with *Trypanosoma vivax*. (Poster; abstract only.) In: OAU/STRC, 1995 (see 18: no. 9123), p. 173. Okech: KETRI, P.O. Box 362, Kikuyu, Kenya.

The effect of *T. vivax* on maintenance of pregnancy was determined in susceptible Galana and trypanotolerant Orma Boran heifers cyclically infected during the third trimester of pregnancy. Two out of three infected Galana heifers aborted, while none of the three Orma heifers aborted. Four control animals, two of each Boran type, produced live calves at term. Prior to abortion, there was a significant decrease in plasma progesterone concentration in one of the animals, suggesting that luteolysis had occurred. Maintenance of pregnancy appeared to have depended on the tolerance and the ability of individual animals to control the effects of trypanosome infection.

9190 **Rowlands, G.J., Coulibaly, L., Hecker, P.A., d'Ieteren, G.D.M. and Rarieya, J.M., 1995.** Assessing impacts of tsetse control in northern Côte d'Ivoire on animal productivity. (Poster; abstract only.) In: OAU/STRC, 1995 (see 18: no. 9123), p. 306.

Rowlands: ILRI, P.O. Box 46847, Nairobi, Kenya. Herd-to-herd variations in the primary biological impact of an intervention can sometimes be utilised to investigate secondary impacts. This approach has been used in the analysis of the effects of tsetse control on calf live weight gain. Nineteen herds of cattle were monitored in the region of Boundiali in northern Côte d'Ivoire from January 1987 to December 1989. From January 1988 to December 1989 insecticide-impregnated biconical traps were used to control tsetse flies in the area. Annual tsetse density was reduced by over 95% and average monthly trypanosome prevalence in cattle by over 80%. Increases in growth rate were plotted against decreases in trypanosome prevalence

from 1987 to 1988 and 1989 for each of the 19 herds and regression analysis undertaken with *Trypanosoma congolense* and *T. vivax* as independent variables. This analysis showed an increase in growth rate of 3.9 ± 1.4 g/day per percentage unit decrease in overall trypanosome prevalence ($P < 0.01$). When the two species were considered separately this significant increase appeared to be primarily associated with reductions in *T. vivax* prevalence.

9191 **Twinamasiko, E.K. and Kakaire, D.W., 1995.** The impact of bovine trypanosomiasis on the antibody response to rinderpest vaccination under field conditions. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 184-185.

Animal Health Research Centre, P.O. Box 24, Entebbe, Uganda.

Pathogenic trypanosomes were found to cause a delay in antibody development following rinderpest vaccination. Treatment of animals with Samorin 30 days before vaccination resulted in earlier development of antibodies, but when Samorin was given concurrently with the rinderpest vaccine, antibody response was delayed for a period of up to 2 months.

9192 **Winstanley, F.P., Holmes, P.H., Katunguka-Rwakishaya, E., Parkins, J.J., Fishwick, G. and Murray, M., 1995.** Tumour necrosis [factor] alpha receptor activity on peripheral blood leucocytes of sheep infected with *Trypanosoma congolense* and allowed either a high or a low energy intake. (Poster; abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), p. 170.

Winstanley: Institute of Biochemistry, University of Glasgow, Glasgow, UK.

The activity of tumour necrosis factor alpha (TNF- α) on peripheral blood leucocytes was studied in sheep infected with *T. congolense* over a period of 72 days. Groups of twin lambs were used in this study and the uninfected twin provided the reference control value. The greatest changes were observed in the granulocyte population and these changes followed the development of parasitaemic waves. Whereas the granulocytes showed increased TNF- α relative to the uninfected control twin as the infection progressed, little variation was observed in the lymphocyte fraction. This pattern of high TNF- α activity on granulocytes and low TNF- α activity on monocytes was found in infected animals on high energy diets. This was associated with greater resistance of these animals to the disease.

9193 **Woudyalew Mulatu, Rowlands, G.J., d'Ieteren, G.D.M. and Nagda, S.M., 1995.** Effects of trypanosomiasis on productivity of East African Zebu cattle exposed to drug resistant trypanosomes. (Poster; abstract only.) *In:* OAU/STRC, 1995 (see **18**: no. 9123), p. 172.
Woudyalew Mulatu: ILRI, P.O. Box 5689, Addis Ababa, Ethiopia.

Research has been undertaken since 1986 in the Ghibe Valley, south-west Ethiopia, monitoring approximately 840 village East African Zebu cattle monthly to assess the effects of trypanosomiasis on productivity. The average monthly trypanosome prevalence between 1986 and 1989 was about 30%. Many cases of parasitaemia that were treated were found parasitaemic again the following month, pointing to the possible existence of drug resistance; this was confirmed in the laboratory with all trypanosome isolates tested showing resistance to diminazene aceturate. With such a high incidence of drug resistance, a higher monthly trypanosome prevalence might have been expected in the village cattle. Thus, whilst treatment was not eliminating infections, it may have helped to limit the trypanosome growth and allowed the cattle to maintain reasonable levels of health and productivity. This was confirmed by statistical analysis of the productivity data. Although there were statistically significant effects of trypanosomiasis on productivity the effects were generally small or transient. The most significant effect of trypanosomiasis appeared to be on calf and foetal mortality, particularly during periods of very high tsetse challenge or increased trypanosomiasis risk brought about by other stress-related factors.

(c) TRYPANOTOLERANCE

[See also **18**: nos. 9185, 9213.]

9194 **Mwangi, E., Stevenson, P., Gettinby, G. and Murray, M., 1995.** Variation in susceptibility to tsetse-borne trypanosomiasis among *Bos indicus* cattle breeds in East Africa. *In:* OAU/STRC, 1995 (see **18**: no. 9123), pp. 125-128.

Mwangi: KETRI, P.O. Box 362, Kikuyu, Kenya.
During a four-year period (1989-1992), epidemiological studies to evaluate the variation in susceptibility to trypanosomiasis in three East African *Bos indicus* cattle breeds (Maasai Zebu, Orma Boran and Galana Boran) were carried out in two tsetse-infested areas of Kenya, the Nguruman escarpment in the south-west and the Galana Ranch on the coast. In the first part of the study,

groups of young Orma Boran and Galana Boran were transported from the Tana River District and Galana Ranch, respectively, to the Nguruman escarpment to join a matching group of local Maasai Zebu. The three groups were introduced into an area of natural tsetse challenge and monitored for one year commencing September 1989. In the second part of the study, a group of young Maasai Zebu from Nguruman were transferred to the Galana Ranch where, together with matching groups of Orma Boran and Galana Boran, they were introduced into a high tsetse challenge area and monitored for 9 months commencing May 1991. The results of both parts of the study showed that the Maasai Zebu and Orma Boran were less susceptible to trypanosomiasis than the Galana Boran as reflected by the significantly lower disease incidence, less severe degree of anaemia and higher growth rates. This study confirms the lower susceptibility of the Orma Boran compared with the Galana Boran, and shows that the Maasai Zebu is as resistant as the Orma Boran. This resistance is not limited to one or other of the study areas and therefore has a genetic basis.

9195 **Rowlands, G.J., Woudyalew Mulatu, d'Ieteren, G.D.M. and Nagda, S.M., 1995.** Evidence of differences in trypanosusceptibility in East African Zebu cattle. (Poster; abstract only.) *In:* OAU/STRC, 1995 (see 18: no. 9123), p. 167.

Rowlands: ILRI, P.O. Box 46847, Nairobi, Kenya.

An average of 840 East African Zebu cattle have been monitored in the Ghibe Valley, south-west Ethiopia, since 1986. Despite a high prevalence of drug resistance, regular Berenil treatment appears to have maintained these cattle at reasonable levels of productivity. However, when corrected for frequencies of parasitaemia and treatment, there was a significant association between the PCV maintained by an individual and its productivity in terms of growth rate, calving interval or risk of abortion. For example, there was an average reduction in calving interval of 8.4 ± 2.6 (s.e.) days for each % unit increase in PCV maintained during the first 5 months post partum. Similarly, there was a decrease in abortion rate of $0.8 \pm 0.3\%$ for each % unit increase in PCV maintained during the last 3 months of pregnancy. Despite deficiencies in these data brought about by the high levels of drug resistance, dam-offspring regression analysis indicated genetic associations between dam and offspring PCV when corrected for parasitaemia and treatment frequency. In

other words, cows with abilities to maintain PCVs at higher levels than others appeared to pass on this same characteristic to their calves, particularly once calves approached two years of age. The co-heritability between the PCV of a dam and the PCV of her two-year-old offspring measured simultaneously over a 6-month period was 0.43 ± 0.16 when corrected for frequencies of parasitaemia and treatment. These results demonstrate individual differences in the susceptibility of cattle to the effects of trypanosomiasis in this environment.

(d) TREATMENT

[See also **18**: no. 9184.]

9196 **Burudi, E.M.E., Peregrine, A.S., Majiwa, P.A.O. and Murphy, N.B., 1995.** Evaluation of response to treatment of mixed trypanosome infections in goats using the polymerase chain reaction. (Abstract only.) *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 158-159.

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

This study was initiated to examine whether a drug-resistant population of *Trypanosoma congolense* (IL 3274) could influence the survival of a drug-sensitive population (IL 1180) in mixed infections in goats. A PCR technique was developed to distinguish the two populations using a DNA sequence that is present only in the diminazene-sensitive clone, IL 1180. Three groups of five goats each were infected i.v. with either IL 1180 (group A), IL 3274 (group B) or both clones simultaneously (group C), and treated with diminazene aceturate at a dose of 7.0 mg/kg body weight following development of parasitaemia. Animals in group C were treated after all animals in groups A and B had become parasitaemic. Three other groups (D, E and F), consisting of three goats each, were similarly infected and kept as untreated controls. All group A animals were cured, while all in B and four in C relapsed. Trypanosomes were harvested from all animals every 2 weeks up to 60 days post-treatment.

Trypanosome DNA was analysed for the presence of IL 1180 DNA using PCR to differentiate the two parasite populations. From the results, IL 1180 DNA was absent in any post-treatment sample. It was therefore concluded that IL 1180 is unable to survive treatment with diminazene aceturate when mixed with IL 3274.

9197 **Eisler, M.C., Maloo, S.H., Peregrine, A.S., Holmes, P.H. and Thorpe, W., 1995.** Use of the isometamidium ELISA to measure serum concentrations of the drug in Jersey dairy cattle

in Kenya. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 160-165.

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

Breakdowns in isometamidium prophylaxis have been observed in the field, but it is not usually apparent whether these are due to inadequate drug dosage regimens, or to the development of drug resistance in trypanosomes. A recently developed ELISA for the detection of isometamidium provides a means of resolving this question in field situations. This was tested using sera from Jersey cattle under isometamidium prophylaxis (0.5 mg/kg body weight by i.m. injection at 3 monthly intervals), which were exposed to natural tsetse challenge in coastal Kenya. Although isometamidium could be quantified in the sera of the treated cattle, the incidence of trypanosomiasis, determined by the presence of parasites in the buffy coat, was not lower in these cattle than in untreated controls. It was concluded that the dosage regimen was inadequate to prevent infections occurring, perhaps because the drug concentrations were too low during the last third of inter-treatment intervals. It was recommended that isometamidium prophylaxis at 1.0 mg/kg body weight should be evaluated.

9198 **Mamman, M., McKeever, D.J. and Peregrine, A.S., 1995.**

Comparative pharmacokinetics of diminazene in plasma, cerebrospinal fluid and lymph of goats. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 155-157.

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

A study was undertaken to compare the absorption and distribution of diminazene aceturate in plasma, cerebrospinal fluid (CSF) and lymph of three groups of three goats each treated with a single i.m. dose of 3.5 mg diminazene base/kg body weight. In general, concentrations of diminazene in plasma were 2.3 times higher than in lymph and CSF. The observed maximum concentration of diminazene in plasma, 4.53 ± 0.41 $\mu\text{g/ml}$, was significantly higher than in the CSF, 0.96 ± 0.59 $\mu\text{g/ml}$, and lymph, 1.21 ± 0.58 $\mu\text{g/ml}$. In addition, the maximum concentration occurred earlier in plasma, at 0.44 ± 0.10 h, compared to 1.33 ± 0.58 h in CSF, and 1.11 ± 0.77 h in lymph. Total body clearance of diminazene determined for the plasma, 0.69 ± 0.11 ml/min/kg, was significantly greater than in the CSF, 0.23 ± 0.10 ml/min/kg, and lymph, 0.13 ± 0.11 ml/min/kg. Consequently, the mean residence time of

the drug determined for the plasma, 57.27 ± 16.49 h, was shorter than in the CSF, 892.72 ± 12.34 h, and lymph, 2432 ± 3080.39 h. These findings suggest that, although diminazene attains significantly higher levels in the plasma than in the CSF and lymph, it persists longer in the CSF and lymph than in plasma.

9199 **Murilla, G., Mdachi, R.E. and Karanja, W.M., 1995.**

Disposition of ^{14}C homidium bromide in cattle. *In*: OAU/STRC, 1995 (see **18**: no. 9123), pp. 153-154.

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

The absorption, distribution and elimination characteristics of ^{14}C -homidium have been described in cattle given the drug by i.m. and i.v. injection at a dose rate of 1 mg/kg body weight. Results showed that the disappearance of the drug from plasma followed a bi-exponential process with half lives of 15.63 ± 3.93 and 325 ± 83.48 h for phases 1 and 2, respectively, for the i.m. treated cattle. The values were 0.084 ± 0.006 and 97.66 ± 16.28 for the i.v. treated cattle. The major route of excretion was via faeces. Between 75 and 85% of total dose given was excreted between 14 and 21 days. Residues remained high in major excretory organs, with the liver having a concentration of 1132.46 ± 248.26 ng/g and 1243.61 ± 516.73 ng/g after 14 and 28 days, respectively. For this same period the values were 567.27 ± 81.57 and 448.87 ± 42.91 ng/g in the kidneys. These results indicate that there was no significant difference between residues at 14 and 28 days, suggesting that once in the organs the rate of movement of the drug back into circulation is extremely low.

9200 **Mutugi, M.W., Boid, R. and Luckins, A.G., 1995.** What limits drug resistance? The case of suramin. (Poster; abstract only.) *In*: OAU/ STRC, 1995 (see **18**: no. 9123), p. 177.

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

Resistance to suramin, the oldest drug used in the control of cameline *Trypanosoma evansi* infections, was found in 20% of 41 stocks from four areas in Kenya from which isolations were made. As suramin resistance is relatively easy to induce in experimental animals, the level of resistance observed may be considered low, especially considering the period suramin has been used in Kenya. The reason for this may be due to a negative selection pressure in the field which discriminates suramin-resistant trypanosomes. The results of the present study suggest that suramin-resistant trypanosomes do not survive as well as suramin-

sensitive ones. Slower growth rates, lower cloning success rates and a competition between suramin-sensitive and resistant trypanosomes are factors that may contribute to a negative selection pressure which limits the spread of suramin resistance.

9201 **Mutugi, M.W., Boid, R. and Luckins, A.G., 1995.** The distribution of trypanocide resistance in *T. evansi* stocks from Kenya. (Poster; abstract only.) In: OAU/STRC, 1995 (see **18**: no. 9123), p. 178.

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

Forty-one *Trypanosoma evansi* stocks isolated from naturally infected camels from various areas of Kenya were tested for resistance to four trypanocidal drugs active against this trypanosome species. These stocks exhibited resistance to Berenil (57%), Samorin (7%), suramin (20%) and Trypacide (18%). Some stocks were resistant to more than one of the drugs tested. The results obtained in this study indicate that drug resistance in *T. evansi* might be an under-estimated problem with potentially serious implications for the future control of trypanosomiasis owing to the withdrawal of drugs from the world market.

9202 **Okuna, N.M., Magona, J. and Mayende, J.S.P., 1995.**

Preliminary observations on the impact of trypanosomiasis on sheep and goats in an enzootic area in Uganda and the need for prophylactic treatment. (Poster; abstract only.) In: OAU/STRC, 1995 (see **18**: no. 9123), p. 176.

UTRO, P.O. Box 96, Tororo, Uganda.

In this study, 60 sheep and 60 goats in an enzootic area were screened for trypanosomiasis by both the buffy coat technique (BCT) and Ag-ELISA. The point prevalence of trypanosomiasis was 6 (5.0%) by BCT and 53 (44.2%) by Ag-ELISA. The animals were divided into two groups, A and B, each with 30 sheep and 30 goats. Animals in group A were kept under prophylactic treatment, Samorin 0.3 mg/kg body weight every 3 months, for 10 months. Animals in group B were treated with Berenil if parasitologically positive. Group A animals had better monthly mean weight gains and higher mean PCV, and also had more lambs and kids.

Trypanosomiasis in sheep and goats is more prevalent in enzootic areas of Uganda than is generally presumed. The negative effect of the disease on production may be partly offset by prophylactic treatment with Samorin.

9203 **Okuna, N.M., Magona, J., Okiria, R. and Mayende, J.S.P., 1995.**

Observations, in the field, on a herd of trypanosome infected cattle treated with isometamidium chloride or

diminazene aceturate and kept under deltamethrin cover in Tororo District. (Poster; abstract only.) *In:* OAU/STRC, 1995 (see **18**: no. 9123), p. 174. UTRO, P.O. Box 96, Tororo, Uganda. Isometamidium chloride (Samorin) and diminazene aceturate (Berenil) are widely used to control nagana in south-eastern Uganda. The aim of this study was to check for strains of trypanosomes resistant to these trypanocides. A total of 66 cattle, of which 26 each were infected with *Trypanosoma brucei* and *T. vivax* and 14 with *T. congolense*, were treated once with Samorin, 0.5 mg/kg body weight. Fifty-seven cattle, of which 24 were infected with *T. brucei*, 18 with *T. vivax* and 15 with *T. congolense*, were treated once with Berenil, 0.7 mg/kg body weight. Deltamethrin 1% w/v spray, 1 ml/kg body weight, was applied on the cattle every 3 weeks for 24 weeks. Initially, tsetse fly density in the area was 5.9 flies/trap/day. This declined rapidly to 0.1 fly/trap/day 18 months later. All cattle were free of trypanosomiasis for the first 24 weeks. Subsequently, some cattle were found infected but with trypanosome species other than the original one. This shows that in the area there were no trypanosome species resistant to either Samorin or Berenil.

9204 **Stevenson, P., Munga, L. and Dolan, R.B., 1995.** The detrimental effects of frequent treatment of cattle with trypanocidal drugs. *In:* OAU/STRC, 1995 (see **18**: no. 9123), pp. 130-135. Stevenson: KETRI, P.O. Box 362, Kikuyu, Kenya. Cases of disease and death observed in ranch cattle receiving prophylactic treatment with isometamidium chloride followed closely by diminazene aceturate were suspected of being caused by drug toxicity. Two experiments were performed to investigate the factors leading to the appearance of the disease. In the first experiment, cattle given isometamidium at 1 mg/kg body weight monthly had a significantly lower growth rate than either the cattle treated every 2 months or untreated cattle. In a second experiment, cattle kept under ranch conditions during a dry year when grazing was scarce were treated at monthly intervals with isometamidium at 1 mg/kg with or without supplementary treatment with diminazene at 7 mg/kg. Nutrition was so poor that all cattle, both treated and untreated, were losing weight during the experiment. Signs of liver damage and deaths were recorded in the group of cattle given treatment with both isometamidium and diminazene. Cattle in another group, again given both drugs, but in

better body condition at the start of the experiment and kept in a better grazing area, took longer to develop disease. A group of cattle treated with isometamidium alone also showed signs of disease but at a reduced level compared to the groups receiving both isometamidium and diminazene. Untreated cattle, or animals given diminazene only, showed no signs of liver damage and no deaths were recorded in the groups. These results illustrate the risks associated with frequent treatment of cattle with trypanocidal drugs, especially if the animals are in poor body condition.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

9205 **Ndung'u, J.M., Olaho-Mukani, W., Ngure, R.M. and Nyanyuma, A.R., 1995.** Application of Ag ELISA in assessment of cure in African trypanosomiasis. [*T. b. rhodesiense*; vervet monkeys.] *In: OAU/STRC, 1995* (see **18**: no. 9123), pp. 107-112.

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

(b) PATHOLOGY AND IMMUNOLOGY

[See also **18**: nos. 9246, 9251.]

9206 **Akingbemi, B.T., Ogwuegbu, S.O., Onwuka, S.K., Oke, B.O. and Aire, T.A., 1995.** The effects of protein malnutrition and experimental infection with *Trypanosoma brucei* on gossypol treatment in the rat: haematological and serum biochemical changes. *Journal of Comparative Pathology*, **112** (4): 361-371.

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

9207 **Balaban, N., Waithaka, H.K., Njogu, A.R. and Goldman, R., 1995.** Intracellular antigens (microtubule-associated protein copurified with glycosomal enzymes) - possible vaccines against trypanosomiasis. [*T. brucei*; rats, mice.] *Journal of Infectious Diseases*, **172** (3): 845-850.

Balaban: Primate Regional Research Center, University of California, Davis, CA 95616, USA.

9208 **Gichuki, C.W., Burke, J.M., Ngure, R.M., Jennings, F.W., Hunter, C.A., Rodgers, J., Ndung'u, J.M., Omuse, J.K., Kennedy, P.G.E. and**

Murray, M., 1995. Do astrocytes have a role in the neuro-pathogenesis of African trypanosomiasis? [*T. b. brucei*; mice.] In: OAU/STRC, 1995 (see **18**: no. 9123), pp. 113-118.

Gichuki: Department of Veterinary Medicine, University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK.

9209 **Gitonga, L.M. and Orago, A.S.S., 1995.** Effects of dexamethasone on antibody response and anaemia in Sprague Dawley rats infected with *Trypanosoma brucei brucei*. *Biomedical Letters*, **50** (200): 243-253.

Orago: Department of Zoology, Immunology Unit, Kenyatta University, P.O. Box 43844, Nairobi, Kenya.

9210 **Lomo, P.O., Makawiti, D.W. and Konji, V.N., 1995.** The effect of L-thyroxine on the anaemia response in *Trypanosoma congolense* infected rabbits. *Veterinary Parasitology*, **58** (3): 227-234.

Makawiti: Department of Biochemistry, University of Nairobi, P.O. Box 30197, Nairobi, Kenya.

9211 **Lorenz, P., Betschart, B. and Owen, J.S., 1995.** *Trypanosoma brucei brucei* and high-density lipoproteins: old and new thoughts on the identity and mechanism of the trypanocidal factor in human serum. *Parasitology Today*, **11** (9): 348-352.

Owen: University Department of Medicine, Royal Free Hospital School of Medicine, Rowland Hill Street, London NW3 2PF, UK.

9212 **Mwangi, S.M., McOdimba, F. and Logan-Henfrey, L., 1995.** The effect of *Trypanosoma brucei brucei* infection on rabbit plasma iron and zinc concentrations. *Acta Tropica*, **59** (4): 283-291.

Logan-Henfrey: ILRI, P.O. Box 30709, Nairobi, Kenya.

9213 **Seed, J.R. and Sechelski, J., 1995.** The inheritance of factors controlling resistance in mice infected with *Trypanosoma brucei rhodesiense*. *Journal of Parasitology*, **81** (4): 653-657.

Department of Epidemiology, School of Public Health, University of North Carolina, Chapel Hill, NC 27599, USA.

(c) CHEMOTHERAPEUTICS

[See also **18**: nos. 9205, 9242, 9243, 9250.]

9214 **Anika, S.M., Odika, I.E., Udem, S.C., Asuzu, I.U. and Madubunyi, I., 1995.** The use of hyperosmolar agents and medicinal plant extracts in relapsing *Trypanosoma brucei brucei* and *Trypanosoma congolense* infections in rats. In: OAU/STRC,

- 1995 (see **18**: no. 9123), pp. 141-147.
 EEC Trypanosomiasis Project, Department of
 Veterinary Physiology and Pharmacology,
 University of Nigeria, Nsukka, Nigeria.
- 9215 **Bodley, A.L., McGarry, M.W. and Shapiro, T.A., 1995.** Drug
 cytotoxicity assay for African trypanosomes and
Leishmania species. [*T. b. brucei*.] *Journal of Infectious Diseases*,
172 (4): 1157-1159.
 Shapiro: Department of Medicine, Johns Hopkins
 University School of Medicine, 301 Hunterian
 Building, 725 N. Wolfe Street, Baltimore, MD
 21205, USA.
- 9216 **Joshua, R.A., Obwolo, M.J. and Bwangamoi, O., 1995.**
 Preliminary observations on infectivity and drug
 sensitivity of *Trypanosoma congolense* isolates from cattle
 in Zimbabwe. (Poster; abstract only.) *In*: OAU/STRC,
 1995 (see **18**: no. 9123), p. 175.
 Paraclinical Veterinary Studies, University of
 Zimbabwe, P.O. Box MP 167, Mount Pleasant,
 Harare, Zimbabwe.
- 9217 **Kageruka, P., Kazadi, J.M. and Bossche, P. van den, 1995.**
 Trypano-cidal activity of ronidazole (Ridzol-S[®]) on
Trypanosoma congolense, *T. brucei* and *T. evansi* infections.
 [Rats, rabbits.] (Abstract only.) *In*: OAU/STRC, 1995
 (see **18**: no. 9123), p. 152.
 Institute of Tropical Medicine,
 Nationalestraat 155, B-2000 Antwerp, Belgium.
- 9218 **Kageruka, P., Marcotty, T., Deken, R. de, Geerts, S. and Schacht, E., 1995.**
 Chemoprophylaxis for *T. congolense* infection using
 an isometamidium chloride slow release delivery
 system. [Rabbits.] (Abstract only.) *In*: OAU/STRC,
 1995 (see **18**: no. 9123), p. 166.
 Kageruka: Department of Veterinary Medicine,
 Institute of Tropical Medicine,
 Nationalestraat 155, B-2000 Antwerp, Belgium.
- 9219 **Loiseau, P.M., Trabelsi, M., Gayral, P. and Wolf, J.G., 1995.** The
 incorporation of N,N'-bis (2,3-dihydroxybenzoyl)-1,6
 diazahexane or octane as the ligands of spiroarsoranones:
 their effect on trypanocidal activity. [*T. b. brucei*;
 mice.] *Acta Tropica*, **59** (3): 237-241.
 Loiseau: Biologie et Contrôle des Organismes
 Parasites, Université de Paris Sud, 92296
 Châtenay-Malabry, France.
- 9220 **Odika, I.E., Asuzu, I.U. and Anika, S.M., 1995.** The
 chemotherapeutic efficacy of diminazene aceturate and
 lithium chloride against relapse infection of
Trypanosoma brucei brucei in rats. *Tropical Medicine and Parasitology*,

46 (2): 99-102.

Asuzu: Department of Veterinary Physiology and Pharmacology, University of Nigeria, P.M.B. 011, Nsukka, Nigeria.

9221 **Peregrine, A.S., Eisler, M.C., Flynn, J.N., Katende, J., Gault, E.A., Kinabo, L.D.B. and Holmes, P.H., 1995.** Generation of monoclonal antibodies to the anti-trypanosomal drug Samorin. (Poster.) *In: OAU/ STRC, 1995 (see 18: no. 9123), pp. 179-181.*

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

9222 **Sutherland, D.V., Barns, A.M. and Ross, C.A., 1995.** *Trypanosoma evansi*: measurement of pyruvate production as an indicator of the drug sensitivity of isolates *in vitro*. *Tropical Medicine and Parasitology*, **46** (2): 93-98.

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

9223 **Sutherland, D.V., Olaho-Mukani, W., Auma, J., Taylor, A.M., Stevenson, P. and Ross, C.A., 1995.** *Trypanosoma evansi*: *in vitro* studies of the epidemiology of drug resistance in camels in Kenya. (Poster; abstract only.) *In: OAU/STRC, 1995 (see 18: no. 9123), pp. 182-183.*

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

8. trypanosome research

(a) CULTIVATION OF TRYPANOSOMES

[See **18**: no. 9248.]

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

[See also **18**: no. 9170.]

9224 **Enyaru, J.C.K., Allingham, R., Bromidge, T., Kanmogne, G.D., Pospichal, H. and Carasco, J.F., 1995.** Genetic heterogeneity in *Trypanosoma brucei gambiense* from north-west Uganda. *In: OAU/STRC, 1995 (see 18: no. 9123), pp. 96-99.*

Enyaru: UTRO, P.O. Box 96, Tororo, Uganda.

9225 **Mathieu-Daudé, F., Stevens, J., Welsh, J., Tibayrenc, M. and McClelland, M., 1995.** Genetic diversity and population structure of *Trypanosoma brucei*: clonality versus sexuality. *Molecular and Biochemical Parasitology*, **72** (1-2): 89-101.

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(c) LIFE CYCLE, MORPHOLOGY, BIOCHEMICAL AND MOLECULAR STUDIES

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