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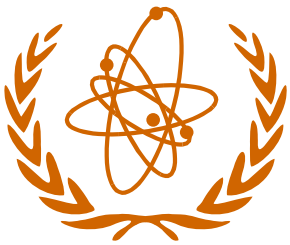

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SECTION A – NEWS

PROGRAMME AGAINST AFRICAN TRYPANOSOMIASIS

PAAT web site

The PAAT web site address is now: http://www.fao.org/paat. This replaces the previously announced address of http://www.fao.org/WAICENT/Faoinfo/Agricult/AGA/AGAH/PD/Paat_l/index.htm.

Firstly, it must be stressed that the PAAT web site is still under construction. I am aware that there are inconsistencies when viewed with different web browsers and/or operating systems, but I felt it was important to get the basic backbone of the site released as soon as possible.

The internet address takes the visitor to the joint home page of PAAT and the EU Concerted Action 'Integrated Control of Pathogenic Trypanosomes and their Vectors' (see item below). The relationship between PAAT and the EU Concerted Action is explained on this joint home page.

Over the coming months I will try to resolve any technical problems and endeavour to increase the quality and quantity of the PAAT web site. Please do not hesitate to contact me (chris.jenner@fao.org) if you have any comments or additions.

What will visitors be able to access?

- PAAT-L: catch up on messages that you missed, download file attachments and see how the membership is growing in different geographical regions of the world.
- PAAT Meetings: order, view or download PAAT Meeting Reports and find out details of future PAAT Meetings.
- PAAT Programme Members: contact details and structure of the Joint Secretariat, Programme Committee and Advisory Group Co-ordinators.
- PAAT Position Papers: download electronic versions and read associated comments posted on the PAAT-L e-mail forum.
- PAAT Memorandum: in the light of recent PAAT Meetings, this section is currently being revised.
- Electronic Training Resources: order, view or download the FAO Training Manuals for Tsetse Control Personnel and obtain details of other resources such as the WHO Information System CD-ROM and the ORSTOM/CIRAD CD-ROM on tsetse species identification.
- *TTIQ*: a bibliographic database of the last 8 years of *TTIQ* now exists (contains over 6000 records), but this service is not on-line yet. However, you can submit any queries by e-mail to receive a listing of matching records containing Author name(s), Year, Title, Journal name, Volume, Pages, Address of author(s) and Abstract. In addition, you can download *TTIQ* backcopies (Vols. 12-20) in Word format.
- Newsletters: read newsletters from different tsetse and trypanosomiasis organisations, including the first edition of the PAAT Newsletter.
- Links: discover other Internet resources on tsetse and trypanosomiasis.
- Country factsheets: a wide variety of tsetse and trypanosomiasis data will be made available in a standard format for each affected country in Africa. This section is still

under construction, but visitors can help with providing missing data by downloading and returning a country template.

- Progress to date: read about the capabilities and progress of the GIS component. Further news about the development of this component will be released in due course.

Please contact me with any ideas of additional items you would like to see included. One example which I hope to include in the coming months is an electronic tsetse and trypanosomiasis picture library.

Chris Jenner, PAAT Information System Developer

TTIQ free subscriptions

We are pleased to announce that the *Tsetse and Trypanosomiasis Information Quarterly*, which forms part of PAAT, is now free for all tsetse and trypanosomiasis workers.

One of the results of the creation of PAAT is that FAO, IAEA, OAU-IBAR and WHO, and other organisations, are increasingly streamlining their diverse information and communication services. *TTIQ* already formed an important communication channel for PAAT announcements, and the PAAT-*TTIQ* link became further enhanced with the simultaneous distribution of *TTIQ* and the PAAT Newsletter. The fact that *TTIQ* is now an integral component of PAAT is illustrated also by the PAAT logo on the *TTIQ* cover.

Financial contributions for the 1999 volume of *TTIQ* come from FAO, IAEA, OAU-IBAR, WHO, CIRAD-EMVT, EU-RTTCP and DFID. The stronger financial basis enhances the continuity of *TTIQ* and has made it possible to abolish subscription fees for recipients living outside Africa. *TTIQ* is now distributed free to all the members of the PAAT Programme Committee, the PAAT Co-ordinators, Chief Veterinary Officers in sub-Saharan Africa and many new subscribers mainly from Europe and the Americas.

Please note that requests for *TTIQ* should now be addressed to Mrs L. Pino, AGAH, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy (e-mail letizia.pino@fao.org).

Brian Hursey retirement

In January, Brian Hursey retired from FAO after a very distinguished career in tsetse control spanning over 34 years. Brian first went to Africa in1964 to join the Tsetse Control Department in Kenya and was based at Kiboko. In 1970 he moved to the Tsetse Control Branch in Zimbabwe (then Southern Rhodesia) and became Assistant Director Veterinary Services in 1982. In 1987 he moved to FAO headquarters in Rome where he worked for 11 years.

During his 17 years in Zimbabwe Brian was the driving force behind the introduction and development of aerial spraying. He was instrumental in bringing the RTTCP to the region and to Harare.

Brian's most recent achievement has been the development of PAAT from its early embryonic stages to the international programme it is today. We all owe Brian an enormous debt of gratitude for his unstinting dedication to PAAT and send him our warmest thanks and best wishes for a long and happy retirement in his Welsh homeland.

PAAT secretariat

INTEGRATED CONTROL OF PATHOGENIC TRYPANOSOMES AND THEIR VECTORS (ICPTV)

We are pleased to announce the launch of the European Union Concerted Action 'ICPTV' web site at the following address: http://www.dis.strath.ac.uk/vie/icptv/.

ICPTV is closely linked to PAAT and will provide strong support to the Research and Development Module of PAAT. PAAT-L will provide further details on PAAT-CA integration in the near future. The URL given above is for the joint home page of these two programmes, also available at: http://www.fao.org/paat.

In association with the web site, ICPTV now has its own moderated discussion list (icptv-l). This discussion list has a specific role in the lead-in to and follow-up from the Concerted Action workshops. As such, its purpose is quite distinct from those of more general discussion lists such as 'paat-l' or 'tryplink-l'. It is also available to those with e-mail but not internet access.

The next two ICPTV workshops will be held in May and June 1999. The first, on Drug Delivery and Resistance in the Context of Integrated Disease Management, will be held at ILRI, Nairobi, from 31 May to 4 June. The second, on Data Management and Decision Support Systems, Including Risk Assessment and Disease Impact Evaluation, will be held at Harare from 21 to 25 June in conjunction with RTTCP.

For further information on any of the above, please contact Mark Eisler: m.eisler@vet.gla.ac.uk.

FARMING IN TSETSE CONTROL AREAS OF EAST AFRICA (FITCA)

The FITCA programme aims to remove the constraint imposed by tsetse flies, sleeping sickness and trypanosomiasis and thus contribute to the welfare of the rural people in the densely populated, fertile region of eastern Africa, namely the areas of western Kenya and south-eastern Uganda which border the north-eastern shore of Lake Victoria, and the south-western part of Ethiopia. The programme, which will be co-ordinated through the Organization of African Unity (OAU) at the Inter African Bureau for Animal Resources (IBAR) in Nairobi, will be the beginning of a regional programme which will at a later stage involve other areas and countries in the region, such as Tanzania and eventually Rwanda and Burundi. The total cost of the four-year programme is estimated at ECU 20,000,000.

After some long administrative delays, evaluation of tender documents for the Regional, Kenya and Uganda components was finalised by the end of January 1999. The contract for the Regional component was won by the NRI consortium. Dr Heinz Politzar started work in March 1999, under a long-term TA contract, as Technical Co-ordinator. The Regional project will have four major areas of activity: (i) technical co-ordination of the country projects; (ii) supervision of the environmental impact analysis component, which is to be implemented in collaboration with ILRI, the Scientific Environmental Monitoring Group (SEMG) and probably other stakeholders; (iii) co-ordination of the research component of FITCA; and (iv) organisation of various training and workshops for the region. The Technical Assistant will initially organise meetings with Directors of Research for tsetse and trypanosomiasis in the region to develop a project work plan, and also liaise with ILRI and SEMG to review the proposal for environmental impact analysis.

The contract for the Kenya country project was won by the RDI consortium. The Technical Assistant, Dr Julian Hopkins, has been on duty since February 1999 and has visited five districts in western Kenya. The technical work plan will be completed soon to enable field activities to start shortly.

The Uganda country project tender was also won by the RDI consortium, and a Technical Assistant will be in place shortly.

The Ethiopian project, which was written by consultants in close co-operation with Ethiopian experts and the OAU-IBAR a few years ago, is being revised to meet the felt need of several regions. Dr Bob Connor of RTTCP visited Ethiopia in February 1999 to assist in the revision and will visit Ethiopia again in May 1999 to finalise the document.

The Tanzanian project was revised and officially submitted to the EU in September 1998. Because adequate financial provision could not be committed for this project at present, it will be scaled into several phases and OAU-IBAR will use the existing financial arrangement for the Regional component to fund the Tanzanian project. The regional co-ordinator in Nairobi will assist in revision of the project and preparation of a work plan to facilitate early implementation of the project.

The FITCA project will be officially launched at the next East African FITCA Co-ordination meeting which is scheduled to take place in August 1999 at Busia.

Solomon Haile Mariam, Chief Livestock Projects Officer, OAU-IBAR

CURRENT RESEARCH

Infectivity and virulence of *Trypanosoma evansi* isolates in the Sudan

In the Sudan, camels (about 3 million) represent the main livestock resource for nomadic tribes in the arid and semi-arid areas of Kordofan, Darfur, Kassala and Blue Nile. Among the constraints facing the development of camel production are trypanosomiasis, haemonchosis and mange. Most of the research on trypanosomiasis, caused by *T. evansi*, has focused on prevalence and chemotherapy. This report summarises the results of experiments to compare the virulence of isolates from different parts of the country.

Five *T. evansi* isolates were obtained from naturally infected camels at Nyala (far west), Obied (mid-west), Kassala (east), Shambat and Khogalab (centre). The isolates were inoculated into Swiss mice and transported to Khartoum. In the laboratory, the infected blood was diluted in phosphate buffered glucose (pH 7.2) and inoculated into five groups of 10 mice each. Each mouse received 0.5 ml of blood containing 1.0×10^5 parasites/ml.

All isolates were infective to mice but pre-patent period and intensity of parasitaemia varied among the isolates. Obied and to a lesser extent Khogalab isolates were highly virulent, giving highest peak parasitaemias and mortalities of 80% and 60%, respectively, while the virulence of Shambat trypanosomes was extremely low, all the mice surviving infection. Parasites from Nyala and Kassala were of moderate virulence, causing mortalities of 30% and 50%, respectively. Ongoing research involves experiments to determine the ability of clones derived from these isolates to initiate infection in mice and to titrate their virulence.

Hamid S. Abdalla, Department of Parasitology,
Faculty of Veterinary Science, University of Khartoum, Sudan

INDIRECT ENVIRONMENTAL EFFECTS OF DISEASE CONTROL

Although the direct effects that tsetse control methods have on non-target organisms are negligible under most circumstances, the indirect environmental impact that tsetse eradication can have is of much concern to the many institutions, specialists and rural populations involved in natural resource management. The indirect effects include an extension of settlements, increase of livestock populations and opening of new roads and tracks which lead to land fragmentation and degradation. The rapid increase of human populations in communal areas causes over-exploitation of woodlands and an increase in cultivation, soil loss, overgrazing, stream-bank cultivation and siltation of rivers, so threatening bio-diversity and the welfare of local communities that depend on natural resources.

In the new Regional Programme that is expected to replace the present RTTCP in central and southern Africa, it is appreciated that the control of tsetse, trypanosomosis and other livestock diseases must give high priority to avoiding the indirect effects of interventions. Although it is recognised that rural populations and farmers must participate in decisions for control operations and land-use plans, the decisions should rely on environmental studies, linked with socio-economic surveys, to assess the environmental risks of the available options.

Pierre Poilicot, RTTCP

NEW BOOKS

Tsetse Biology and Ecology: Their Role in the Epidemiology and Control of Trypanosomiasis by S.G.A. Leak

The publication presents a comprehensive review of African tsetse and trypanosomiasis and includes over 100 pages of references. It usefully provides the reader with a résumé of the most recent progress in research and development into both the vector and the disease. Unfortunately, due to the ambitious attempt to cover such a broad range of technical aspects in one manageable volume, many of the subjects addressed within each sub-heading are of necessity very brief and may not satisfy the needs of those seeking detailed and specific information. The exhaustive references provided, however, to a large extent compensate for this.

There has been a significant increase in studies into the problems posed by tsetse and trypanosomiasis on African agriculture in recent years and the book is particularly useful in documenting these in one volume. Notably the main topics covered include the role of modern genetics in vectorial capacity, the application of mathematical modelling and remote sensing to tsetse sampling, disease risk and economic impact. There is also a useful summary on how recent studies into pheromones and hormones may contribute to the development of model tsetse control approaches.

The section on epidemiology gives equal emphasis to both the animal and the human forms of the disease and provides an excellent summary of the present state of our knowledge. Of particular interest here is the way in which the author highlights the present questions and controversies over the epidemiology and origins of sleeping

sickness epidemics as well as re-opening the debate over the possible role of mechanical transmission in animal trypanosomiasis.

The final two sections address the issue of vector and disease control. Again they both provide an excellent and updated review of recent progress and the current approaches currently being adopted for practical field use. However, one feels that in this section, although they are included, the opportunity to highlight current controversies over control versus eradication, area-wide versus farmer-based, the role of community participation and privatisation has largely been missed. It is also felt that the sections devoted particularly to aerial spraying, environmental impact of control, economics and land use are rather sparse.

Overall the book is well presented and as the first major publication in this very specific technical field for several years will prove useful, if not invaluable, for medical and veterinary entomologists, particularly those technically and scientifically tasked with the alleviation of the disease throughout sub-Saharan Africa.

[Published by CABI Publishing; 592 pp; ISBN 0-85199-300-1; £65.00. Available from CAB International, Wallingford OX10 8DE, UK; e-mail orders@cabi.org. See also *TTIQ*, **22**: no. 10828.]

Review by Brian Hursey

A Field Guide for the Diagnosis, Treatment and Prevention of African Animal Trypanosomiasis: new edition by G. Uilenberg

This new edition of the well-known FAO field guide has been adapted from the original edition by W.P. Boyt and adheres as much as possible to the original style and, particularly, to the intention of that author in that it is essentially meant to be a guide for field control personnel. Its scope has been extended somewhat to include trypanosomes of African origin which have spread to the Americas and Asia, but the main emphasis remains on Africa. More attention is also given to methods of disease control other than chemo-therapy and chemoprophylaxis, such as vector control, within an integrated multi-disciplinary and flexible approach to disease control.

Published by FAO; ISBN 92-5-104238-1. Request for a free copy (please quote title and ISBN) can be directed to FAO Distribution Unit, Viale delle Terme di Caracalla, 00100 Rome, Italy; e-mail claire.majastre@fao.org.

Progress in Human African Trypanosomiasis, Sleeping Sickness by M. Dumas, B. Bouteille and A. Buguet

This publication covers new findings about human African trypanosomiasis, from biology to clinical features, diagnosis and treatment. Written by specialists who are very experienced in their respective fields, the contributions provide an indispensable tool for all practitioners and scientists as well as those working in this field or interested in host-parasite relationships or chemotherapy.

Published by Springer-Verlag; *c*. 350 pp; ISBN 2-287-59655-0; soft cover; price DM 249/FF 750/$159. Available from Springer-Verlag, P.O. Box 31 13 40, D-10643 Berlin, Germany; fax + 49 30-82787-715; e-mail orders@springer.de.

SECTION B – ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

10824 **Dávila, A.M.R. and Aguilar, R., 1999.** Second Internet Conference on Salivarian Trypanosomes – Foreword. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 189.

Dávila: DBBM/Instituto Oswaldo Cruz/FIOCRUZ, Rio de Janeiro, RJ 21045-900, Brazil. [davila@gene.dbbm.fiocruz.br]

The Second Internet Conference on Salivarian Trypanosomes was held in the Tryplink-L discussion list from 9-19 March 1998. The 27 'lectures' presented during this virtual conference came from 13 countries in five continents and covered a wide variety of topics such as classical and molecular epidemiology/epizootiology, molecular biology, phylogeny and evolution, control measures, remote sensing, diagnosis and therapy. Of the 17 presentations published in *Memórias do Instituto Oswaldo Cruz*, **94** (2), 11 relating to African trypanosomiasis are included in this issue of *TTIQ* (see nos. 10835, 10843, 10850, 10864, 10866, 10879, 10886, 10890, 10917, 10948, 10951).

10825 **Edeghere, H., Elhassan, E., Ukah, J.C.A., Sanda, S., Ikenga, M. and Audu, G., 1998.** The scourge of human African trypanosomiasis in Abraka: possible control strategies. (Meeting abstract no. 46.) *Nigerian Society for Parasitology Abstracts*, **1998**: 43.

NITR, P.M.B. 2077, Kaduna, Nigeria.

Only about 20% of the population at risk of being afflicted with human African trypanosomiasis have access to health services for diagnostic and therapeutic purposes or are protected by control measures. The trend in the last decade has been a dramatic increase in prevalence resulting from resurgence, and levels of the disease may increase unnoticed to even epidemic proportions, causing loss in manpower, depopulation and reduction in agricultural production. Studies between 1989 and 1996 in old Abraka District in Delta State present a picture of high endemicity. Out of 3583 volunteers from 24 communities scattered around this focus, 359 subjects were seropositive and 104 parasitologically positive for sleeping sickness. This dangerous situation needs a combined integrated and multitargeted approach, aimed at breaking the transmission cycle.

10826 **Hoppe, K.A., 1997.** Lords of the fly: colonial visions and revisions of African sleeping sickness environments on Ugandan Lake Victoria, 1906-61. *Africa*, **67** (1): 86-105.

Sleeping sickness control in southern Uganda created ideological openings for the articulation of colonial visions of African environments. Competing colonial agendas, Ugandans' positions in their own environments and Ugandans' resistance and responses to colonial schemes determined how such visions played themselves out in practice. The

emerging power of colonial science played an important role in colonial attempts at constructing nature and defining Africans' relationship with their environments through disease control. The combination of forced depopulations, strategic clearings and planned resettlement in British sleeping sickness control schemes in southern Uganda set in motion a cycle of long-term land alienation from 1906 to 1962 that reflected the particular relations between British science, environmental intervention and colonisation.

10827 **Lawani, F.A.G., Thompson, G. and Osue, H.O., 1998.** Socio-economic status and awareness of animal trypanosomiasis among livestock farmers in Ikara and Chikun LGAs of Kaduna State, Nigeria. (Meeting abstract no. 75.) *Nigerian Society for Parasitology Abstracts*, **1998**: 75.

NITR, P.M.B. 2077, Kaduna, Nigeria.

Livestock farmers/herdsmen (n = 25) were interviewed in two Local Government Areas of Kaduna State, within the sub-humid ecological zone. Individual social and economic data, and their knowledge of animal trypanosomiasis, the tsetse fly vector and available control technologies were evaluated. The majority of the respondents were Fulani by tribe, and illiterate by Western standards of education. Ten (40%) can read and write hausa in arabic; 88% of those interviewed own a transistor radio, and live in thatched houses remote from the village settlement; 68% of them own a bicycle. The majority have resided in their location for more than 10 years (assumed permanent residence) and practise mixed agro-pastoral farming. 68% of them knew the disease as 'samore', while 48% gave acceptable clinical diagnosis of the disease, which included emaciation, poor hair coat and loss of appetite. Many of them confuse tsetse with other biting flies. A few of them patronise veterinary clinics and rely on ethnoveterinary medication. The use of tsetse traps is unknown to most of them. The paper provides data on herd size and calving rates, and also suggests how control technologies could be introduced to this category of end-users.

10828 **Leak, S.G.A., 1998.** *Tsetse biology and ecology: their role in the epidemiology and control of trypanosomosis.* Wallingford, UK; CAB International, in association with ILRI, Nairobi, Kenya. xxiii + 568 pp. (ISBN 0-85199-300-1.)

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

Although alternative methods of trypanosomiasis control in animals and humans are being investigated, only eradication or control of the tsetse vector will remove the threat of the disease rather than providing a better means of living with it. This book provides a comprehensive review of recent literature on tsetse flies and will be of interest to medical and veterinary entomologists, parasitologists and epidemiologists. The text is divided into three main parts and a short final part. Part I, on tsetse biology and ecology, is subdivided into: classification and anatomy; biology; physiology; genetics; sampling tsetse populations; ecology – distribution and habitats; behavioural ecology; population dynamics; odour attractants. Part II, on epidemiology, has sections on: host-parasite interactions; epidemiology of sleeping sickness; epidemiology of trypanosomiasis in domestic livestock; estimation of disease risk: models of disease transmission. Part III, on

vector control, covers: insecticidal spraying; traps and targets; application of insecticides to livestock; non-insecticidal methods of tsetse control; general issues relating to the successful use of tsetse control techniques. Part IV is about control of trypanosomiasis in domestic livestock. (See also review in News section, p. 53, for further details.)

10829 **Makumyaviri, A.M., 1998.** Les trypanosomoses africaines: un point fuyant de la recherche scientifique. [The African trypanosomiases: a subject defying scientific research.] *Cahiers vétérinaires du Congo*, **1** (3): 102-104

Makumyaviri: Faculté de Médecine Vétérinaire, Université de Lubumbashi, B.P. 1825, Lubumbashi, République Démocratique du Congo.

At the present time, the control of the African trypanosomiases rests essentially on chemical and genetic methods that aim at a reduction of vector populations, the prevention of infections and the treatment of infected individuals. However, the high cost of interventions, the absence of a vaccine and the spread of resistance to drugs have stifled hope of appreciably reducing the number of cases of infection. Adequate integrated control of trypanosomiasis would require (i) sincere mobilisation of the international community, (ii) the prior characterisation of different epidemiological situations, and (iii) sustained complementarity of the work to be carried out in the laboratory and in the field.

10830 **Molyneux, D.H., 1998.** The Liverpool School of Tropical Medicine: 100 years of parasitological achievement. *Parasitology Today*, **14** (11): 440-443.

Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK. [fahy@liv.ac.uk]

In November 1998, the Liverpool School of Tropical Medicine celebrated its centenary. This article provides a brief account of the achievements, personalities, historic trends and current activities of the School that have made a significant contribution to parasitology. Key achievements in trypanosomiasis are: discovery by Dutton of trypanosomes in human blood (1902); Atoxyl shown to be the first effective drug in sleeping sickness (1905); distinction between Rhodesian and Gambian disease made (1910); zoonotic nature of *Trypanosoma brucei rhodesiense* suggested; transmission by savanna tsetse flies defined (1912); suramin demonstrated effective in clinical trial (1921); monograph on tsetse flies published (1924); diamidines (pentamidine) shown to be effective against trypanosomes (1939); School assists in controlling epidemic in Uganda (1980s). The School continues to play a major role in research and training in parasitic diseases and insect vectors, both at home and overseas.

10831 **Njoku, C.I., Thompson, G.A., Sanda, S.A.U., Zakari, M.E., Igwe, A.C. and Osue, H.O., 1997.** Local perception of human African trypanosomiasis as a public health problem in Donga LGA of Taraba State. (Meeting abstract no. 33.) *Nigerian Society for Parasitology Abstracts*, **1997**: 35.

Njoku: Parasitology Section, Entomology and Parasitology Division, NITR, P.M.B. 03, Vom, Plateau State, Nigeria.

The position of human African trypanosomiasis (HAT) or sleeping sickness (SS) among the major public health problems in Donga Local Government Area (LGA) of Taraba State was studied. The area is an old SS endemic focus. A prepared focus group discussion guide was administered to patients in health care clinics, residents of the community and rural health workers. Also Unit and Sectional Heads, the Head of the Local Government Council (LGC) Primary Health Care (PHC) Department, and some administrators in the LGC, were interviewed. Results show that patients, residents and non-subject matter administrators (e.g. the Directors of Personnel Management, Finance, etc.) did not mention SS or HAT as an important public health problem in the LGA. However, they listed signs and symptoms such as headache, fever, general body weakness, joint pains, itching, paleness (anaemia), oedema and emaciation, which are often observed in patients with the disease, as important health problems. Rural health workers, Heads of Units and Sections and the Head of the PHC Department identified SS as an important public health problem. Starting with the most important, rural health workers placed the disease as 17th out of the 27 mentioned, while Unit and Sectional Heads listed it 18th out of 26. The Head of the PHC Department listed it 17th out of 30 public health problems afflicting people in the community. The significance of these findings against a background of a 25% trypanosome infection rate in tsetse flies, 2% enlarged cervical gland rate in humans, one parasitologically positive case, found during the study, and the notion that SS is no longer a public health problem in Nigeria, is discussed.

10832 **Njoku, C.I., Thompson, G.A., Sanda, S.A.U., Zakari, M.E., Igweh, A.C. and Osue, H.O., 1998.** Community perception of the social and economic risk factors for the acquisition of human African trypanosomiasis through the bite of the vector, *Glossina* sp., in Takum Local Government Area of Taraba State, Nigeria. (Meeting abstract no. 54.) *Nigerian Society for Parasitology Abstracts*, **1998**: 52.

Njoku: Parasitology Section, Entomology and Parasitology Division, NITR, P.M.B. 03, Vom, Plateau State, Nigeria.

The community's perceived social and economic risk factors for the acquisition of human African trypanosomiasis (HAT), through the bite of the fly vector, *Glossina* species, were studied in Takum LGA of Taraba State, Nigeria. The LGA is one of the old HAT endemic foci in the country. Male and female residents, rural health workers, Unit/Sectional Heads and other administrators (e.g. Chairman, Directors of Personnel Management, Finance, etc.) in the Local Government Council (LGC) were interviewed using focus group discussion guides, prepared by the Project Team. Analysis of the data/information showed that all of the focus groups listed farming, fishing and hunting as major economic risk factors for the acquisition of HAT, 80% mentioned cattle rearing, and 20%, housekeeping. Their perception of the social risk factors included bathing (100%), laundering (80%), washing household equipment/ materials (80%), fetching water and firewood (100%) and swimming in rivers and streams (60%). They further mentioned living in endemic rural areas (80%) especially near rivers and streams (60%). Regarding the community's perception of the time of day the flies bite, all of the focus groups mentioned morning and evening as the most important periods for the fly bites, 80% also

listed midday and afternoon, while 20% mentioned night. As to their perception of the season of the year when the flies bite, all the groups agreed that the flies bite most in the late dry season/early rains, rainy season and late rainy season/harmattan; 80% mentioned the dry season and 20%, the harmattan period. The community's attitude to the bite of the flies ranged from not bothering at all, to seeing it as a major source of worry to the people. The significance of these findings in the development of control strategies against HAT in Takum LGA of Taraba State, Nigeria, is discussed.

10833 **Pender, J., Mills, A.P. and Rosenberg, L.J., 1997.** *Impact of tsetse control on land use in the semi-arid zone of Zimbabwe. Phase 2: analysis of land use change by remote sensing imagery.* Chatham, UK; Natural Resources Institute (NRI Bulletin no. 70). v + 40 pp. (ISBN 0-85954-469-9.)

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

Tsetse control is carried out to facilitate the expansion of livestock-based production systems in areas cleared of the threat of bovine trypanosomiasis. There is a growing awareness of the need for tsetse control to be considered an integral component of rural development and of the importance of monitoring and evaluating both the causes and consequences of potential land-use changes as a prerequisite for planning control operations. As part of an international programme to evaluate the environmental and socio-economic effects of tsetse control in southern Africa, changes in land cover over a 20-year period are being assessed in an area of Zimbabwe with a long and varied history of tsetse control and agricultural development. The study area, adjacent to Lake Kariba, covers approximately 8300 km^2 and comprises Reserved, Communal and State Lands. The first phase of the study established the baseline land-use and vegetation patterns, using satellite imagery (see *TTIQ*, **19**: no. 9403). In Phase 2, changes in land cover, particularly human-dominated land use (HDLU), are examined from 1972 to 1993, using four Landsat TM and five MSS images, integrated with other datasets in ARC/INFO GIS. Seven land cover classes were derived – four woodland groups, two related to grass and naturally occurring bare soil and a HDLU class. Only 1.8% of the total land cover was permanently under HDLU throughout the study, although the proportion varied between 5.7% and 9.7%. In general, there had been a fairly steady increase in the proportion of HDLU throughout the study period, interspersed with periods of decrease or little change, but underlying this apparent relative stability there was a pattern of highly variable change with simultaneous expansions and contractions on many fronts and considerable differences in the pattern of HDLU change between the different Communal Lands and between the Communal and State Lands. Similar proportions of the four woodland vegetation classes were affected by changes in HDLU, although there were pronounced local differences. Importantly, agricultural land abandoned in *Colophospermum mopane* woodland did not regenerate into mopane woodland but into mixed woodland or scrub during the 20-year study period. There is little evidence of a direct relationship between patterns of HDLU change and either tsetse control operations or changes in livestock numbers and composition, indicating that there is a complex series of factors, including tsetse control, which influence agricultural development in the area.

10834 **Robinson, T.P., 1998.** Geographic information systems and the selection of priority areas for control of tsetse-transmitted trypanosomiasis in Africa. *Parasitology Today*, **14** (11): 457-461.

Robinson: Department of Zoology, University of Oxford, South Parks Road, Oxford OX1 3PS, UK. [tim.robinson@zoo.ox.ac.uk]

This paper describes the use of geographic information systems (GIS) to prioritise areas for tsetse and trypanosomiasis control in Zambia, where the emphasis has changed from widespread eradication to smaller-scale, community-based interventions. Digital maps of land tenure, percentage agriculture, stocking rates and relative arable potential are combined within a GIS to identify areas where trypanosomiasis is a direct constraint to agricultural development and where the presence of tsetse prevents access to areas adjacent to those under high pressure from livestock and agriculture. The main limitation of such models is the lack of high quality primary data but they may be used to direct more detailed surveys to areas of importance. Ultimately, GIS should be used to help quantify the expected costs and benefits associated with different strategies so that areas for sustainable tsetse and trypanosomiasis control can be prioritised on sound economic criteria.

10835 **Touratier, L., 1999.** The Office International des Epizooties *ad hoc* group on Non Tsetse Animal Trypanosomoses: its origin, scope and perspectives. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 191-194.

OIE, 12 rue de Prony, F-75017 Paris, France. [louis.touratier@club.francetelecom.fr]

In May 1983, a working group on *Trypanosoma evansi* was set up by OIE with the aim of furthering research on this trypanosome species. Main achievements of the group included: genetic and molecular studies of *T. evansi* strains from different areas; difficulty of distinguishing *T. evansi* from *T. equiperdum*; collection of epidemiological data for refining and expanding distribution maps for *T. evansi* in Africa, Asia and South America; free distribution of diagnostic kits for detecting *T. evansi* in the field; greater interest in study of *T. evansi* infections by many countries especially in relation to camel breeding and other animal species; development of melarsomine (Cymelarsan) for camel treatment. In 1991 the scope of this working group was extended to include all non-tsetse transmitted animal trypanosomoses (NTTAT) around the world including *T. vivax* infections in tsetse-free areas. The expanded terms of reference of this OIE *ad hoc* group are to study, discuss and inform OIE Member States of: the pathological and economic impact of NTTAT in Africa, Asia and America; the possible interference of NTTAT with other diseases and immune responses to vaccinations for other diseases; reliability and cost of diagnostic tests and differentiation of species and strains; chemoresistance and research into new drugs; new means of control of NTTAT.

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

[See also **22**: nos. 10828, 10855.]

10836 **Cappello, M., Li, S., Chen, X.-O., Li, C.-B., Harrison, L., Narashimhan, S., Beard, C.B. and Aksoy, S., 1998.** Tsetse thrombin inhibitor: bloodmeal-induced expression of an anticoagulant in salivary glands and gut tissue of *Glossina morsitans morsitans*. *Proceedings of the National Academy of Sciences of the United States of America*, **95** (24): 14290-14295.

Aksoy: Department of Epidemiology and Public Health, Sector of Vector Biology, Yale University School of Medicine, 60 College Street, New Haven, CT 06510, USA.

The tsetse thrombin inhibitor, a potent and specific low molecular mass (3,530 Da) anticoagulant peptide, was purified previously from salivary gland extracts of *G. m. morsitans*. A 303-bp coding sequence corresponding to the inhibitor has now been isolated from a tsetse salivary gland cDNA library by using degenerate oligonucleotide probes. The full-length cDNA contains a 26-bp untranslated segment at its 5′ end, followed by a 63-bp sequence corresponding to a putative secretory signal peptide. A 96-bp segment codes for the mature tsetse thrombin inhibitor, whose predicted molecular weight matches that of the purified native protein. Based on its lack of homology to any previously described family of molecules, the tsetse thrombin inhibitor appears to represent a unique class of naturally occurring protease inhibitors. Recombinant tsetse thrombin inhibitor expressed in *Escherichia coli* and the chemically synthesised peptide are both substantially less active than the purified native protein, suggesting that post-translational modification(s) may be necessary for optimal inhibitory activity. The tsetse thrombin inhibitor gene, which is present as a single copy in the tsetse genome, is expressed at high levels in salivary glands and midguts of adult tsetse flies, suggesting a possible role for the anticoagulant in both feeding and processing of the bloodmeal.

10837 **Dale, C. and Maudlin, I., 1999.** *Sodalis* gen. nov. and *Sodalis glossinidius* sp. nov., a microaerophilic secondary endosymbiont of the tsetse fly *Glossina morsitans morsitans*. *International Journal of Systematic Bacteriology*, **49** (1): 267-275.

Dale: Department of Biology, University of York, Heslington, York YO1 5YW, UK. [cd15@york.ac.uk]

A secondary intracellular symbiotic bacterium was isolated from the haemolymph of the tsetse fly *G. m. morsitans* and cultured in *Aedes albopictus* cell line C6/36. Pure-culture isolation of this bacterium was achieved through the use of solid-phase culture under a microaerobic atmosphere. After isolation of strain $M1^T$, a range of tests was performed to determine the phenotypic properties of this bacterium. Considering the results of these tests, along with the phylogenetic position of this micro-organism, it is proposed that this intracellular symbiont from *G. m. morsitans* should be classified in a

new genus *Sodalis* gen. nov., as *Sodalis glossinidius* gen. nov., sp. nov. Strain $M1^T$ is the type strain for this new species.

10838 **Elsen, P. and Roelants, P., 1999.** Isozymic comparison of five laboratory lines of tsetse flies belonging to the two subspecies of *Glossina palpalis* (Diptera: Glossinidae). *Annals of Tropical Medicine and Parasitology*, **93** (1): 97-104.

Elsen: Prince Leopold Institute of Tropical Medicine, 155 Nationalestraat, B-2000 Antwerp, Belgium. [pelsen@entom.itg.be]

Three laboratory colonies of *G. p. palpalis* (originating from Kaduna, TAN and Zaire) and two of *G. p. gambiensis* (from Maisons-Alfort and Bobo-Dioulasso) have been characterised by means of 14 polymorphic enzyme loci. The presence/absence of some alleles for three enzymes (octanol dehydrogenase, phosphoglucomutase and aldehyde oxidase) distinguished the two subspecies. Other differences in allozymes could not be used to discriminate between subspecies but could be used to distinguish populations within each of the subspecies. The genetic differences between populations of a given subspecies are briefly discussed.

10839 **Gooding, R.H. and McIntyre, G.S., 1998.** *Glossina morsitans morsitans* and *Glossina palpalis palpalis*: dosage compensation raises questions about the Milligan model for control of trypanosome development. *Experimental Parasitology*, **90** (3): 244-249.

Gooding: Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9, Canada. [rgooding@gpu.srv.ualberta.ca]

Evidence that dosage compensation occurs in tsetse flies was obtained by comparing the activities of X chromosome-linked enzymes, arginine phosphokinase and glucose-6-phosphate dehydrogenase in *G. m. morsitans* and hexokinase and phosphoglucomutase in *G. p. palpalis*, with the activity of an autosome-linked enzyme, malate dehydrogenase, in each species. The shortcomings of the X chromosome model for the control of *Trypanozoon* maturation in tsetse are discussed in the light of these findings and previously published reports on the lack of fitness effects of mature *Trypanozoon* infections in tsetse and published results on antitrypanosomal factors in male and female tsetse flies.

10840 **Klingenberg, C.P. and McIntyre, G.S., 1998.** Geometric morphometrics of developmental instability: analyzing patterns of fluctuating asymmetry with Procrustes methods. *Evolution*, **52** (5): 1363-1375.

Klingenberg: Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9, Canada. [cpk@acpub.duke.edu]

Although fluctuating asymmetry has become popular as a measure of developmental instability, few studies have examined its developmental basis. We propose an approach to investigating the role of development for morphological asymmetry by means of morphometric methods. Our approach combines geometric morphometrics with the two-

way ANOVA customary for conventional analyses of fluctuating asymmetry and can discover localised features of shape variation by examining the patterns of covariance among landmarks. This approach extends the notion of form used in studies of fluctuating asymmetry from collections of distances between morphological landmarks to an explicitly geometric concept of shape characterised by the configuration of landmarks. We demonstrate this approach with a study of asymmetry in the wings of *Glossina palpalis gambiensis*. The analysis revealed significant fluctuating and directional asymmetry for shape as well as ample shape variation among individuals and between the offspring of young and old females. The morphological landmarks differed markedly in their degree of variability, but multivariate patterns of landmark covariation identified by principal component analysis were generally similar between fluctuating asymmetry (within-individual variability) and variation among individuals. Therefore, there is no evidence that special developmental processes control fluctuating asymmetry. We relate some of the morphometric patterns to processes known to be involved in the development of fly wings.

10841 **Sang, R.C., Jura, W.G.Z.O., Otieno, L.H. and Mwangi, R.W., 1998.** The effects of a DNA virus infection on the reproductive potential of female tsetse flies, *Glossina morsitans centralis* and *Glossina morsitans morsitans*. *Memórias do Instituto Oswaldo Cruz*, **93** (6): 861-864.

Sang: Virus Research Centre, Kenya Medical Research Institute, P.O. Box 54628, Nairobi, Kenya. [kemrilib@ken.healthnet.org]

Reproductive anomalies associated with tsetse DNA virus infection in female *G. m. centralis* and *G. m. morsitans*, inoculated with the virus during the 3rd instar larval stage, were studied and the data compared to those obtained from control females injected with sterile physiological saline. Virus-infected flies had significantly longer first and second pregnancy cycles ($P < 0.0001$) and produced pupae that were of significantly lower weight ($P < 0.0001$) compared to controls. Transmission of the virus to progeny was not absolute and only 21% of *G. m. centralis* and 48% of *G. m. morsitans* first progeny flies from infected females developed salivary gland hypertrophy. The virus-infected females produced significantly fewer pupae compared to the controls during the experimental period ($P < 0.00001$).

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **22**: nos. 10828, 10848, 10873.]

10842 **Hariyama, T., Fukushi, T., Tsukahara, Y. and Saini, R.K., 1996.** Odour bait change the attractiveness of colour in tsetse fly. (Meeting abstract.) *Zoological Science* (*Tokyo*), **13** (Suppl.): 105.

Hariyama: GSIS, Tohoku University, Sendai, Japan.

Blue cloth has been used to make traps for tsetse control. We examined the colour choice behaviour of tsetse with and without odour bait in the field in Nguruman, Kenya.

We investigated the trapping efficiency of new traps consisting of a mixture of blue and green cloth in different ratios. The efficiency of green cloth without odour bait was the same as previously reported for blue cloth compared with other colours. With odour bait, the attractiveness to tsetse was increased but the trapping efficiency of the pure blue cloth was decreased compared with green/blue cloths.

10843 **Hendrickx, G., Napala, A., Rogers, D., Bastiaensen, P. and Slingenbergh, J., 1999.** Can remotely sensed meteorological data significantly contribute to reduce costs of tsetse surveys? *Memórias do Instituto Oswaldo Cruz*, **94** (2): 273-276.

Hendrickx: FAO Trypanosomosis Project GCP-RAF-347-BEL, B.P. 2034, Bobo Dioulasso, Burkina Faso. [trypfaso@fasonet.bf]

A 0.125 degree raster or grid-based Geographic Information System with data on tsetse, trypanosomosis, animal production, agriculture and land use has recently been developed in Togo. This paper addresses the problem of generating tsetse distribution and abundance maps from remotely sensed data, using a restricted amount of field data. A discriminant analysis model is tested using contemporary tsetse data and remotely sensed, low resolution data acquired from the National Oceanographic and Atmospheric Administration and Meteosat platforms. A split sample technique is adopted where a randomly selected part of the field measured data (training set) serves to predict the other part (predicted set). The obtained results are then compared with field measured data per corresponding grid-square. Depending on the size of the training set the percentage of concording predictions varies from 80 to 95 for distribution figures and from 63 to 74 for abundance. These results confirm the potential of satellite data application and multivariate analysis for the prediction, not only of the tsetse distribution, but more importantly of their abundance. This opens up new avenues because satellite predictions and field data may be combined to strengthen or substitute one another and thus reduce costs of field surveys.

10844 **Makumi, J.N., Green, C. and Baylis, M., 1998.** Activity patterns in *Glossina longipennis*: a field study using different sampling methods. *Medical and Veterinary Entomology*, **12** (4): 399-406.

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

Studies on the daily activity of *G. longipennis* at Galana Ranch using a black odour-baited electrocuting target confirmed its crepuscular activity profile. Activity started at 05.00-05.30 h and peaked at 06.00-06.30 h, stopped by 09.00 h, then started again at 17.00-17.30 h with a peak at 18.30-19.00 h, ceasing by 19.30 h. Females made up 60% of the overall catch, and tended to arrive later than males. Other stationary sampling methods (F3 trap, stationary ox) gave similar results. With the stationary methods, very few flies were caught outside the periods of peak activity (only 1.5% of the total between 09.00 and 17.00 h); the ox was the only stationary bait to catch any flies between 10.00 and 16.00 h. At mobile baits (towed electrocuting target, led ox) more flies were caught throughout the day (8.3% of the male and 2.3% of the female catch was taken between

09.00 and 17.00 h). Mobile baits caught considerably more males than females (females were 17% of the catch). These males had on average higher fat and haematin reserves. Similar nutritional differences were not observed for females. There were fewer older females (ovarian category 3 or more) in mobile compared to stationary baits, and a lower proportion of the youngest males (wing fray category 1) at natural compared with artificial baits.

10845 **Vale, G.A., 1998.** Responses of tsetse flies (Diptera: Glossinidae) to vegetation in Zimbabwe: implications for population distribution and bait siting. *Bulletin of Entomological Research*, **88** (Suppl. 1): 59 pp.

c/o RTTCP, Box A560, Harare, Zimbabwe.

In Zimbabwe, *Glossina morsitans morsitans* and *G. pallidipes* were caught from traps (mainly Epsilon) and targets baited with ketones, phenols and 1-octen-3-ol. Averaged over a year, catches in mopane woodland, thicket and scrubland were much the same, but the catches in the mopane relative to the thicket changed several-fold from one season to another. Within vegetation types, catches varied up to ten-fold between separate sites 200 m apart and showed site × day interactions. Continuous use of a site for 3 weeks showed no catching-out of the flies in the immediate vicinity. Catches were depressed by about 40% when traps were beside fallen trees, by up to 82% when under leafy bushes, and by 39% when the trap entrance faced upwind. Catches doubled when traps were in clearings. Oblique shade from distant trees reduced catches by 30%, due to a reduced dose of odour from cooler dispensers. Artificial canopies of leaves above traps reduced catches by depressing the light-orientated movement inside the trap. The canopies stopped flies from showing their normal preference for initially alighting on the black half of blue-black targets. Representations of fallen trees and leafy bushes reduced catches by obstructing visual stimuli and denying access. Tsetse flew readily through gaps in hedged enclosures provided the gap was at least 1 m wide, on the downwind side, and odour was present. Catches from sites in dense vegetation were enhanced up to four times by reducing the canopy and clearing bushes. Tsetse did not persist near odour sources. A computerised model of tsetse moving randomly in space restricted by dense bushes suggested that: (i) the speed of dispersal within any one vegetation type is not affected greatly by the abundance of bushes, but can be changed ten-fold where vegetation types mix; (ii) active flies tend to concentrate in areas with few dense bushes; (iii) the most reliable indices of tsetse abundance are produced by targets, at sites which maximise catches and which may be so open as to be atypical of the vegetation type; and (iv) the response to bushes cannot alone account for tsetse distribution between vegetation types. Siting rules for catch maximisation are offered, allowing catches to be increased up to ten times. Bait sampling alone is unsatisfactory for elucidating tsetse distribution. The model of movement offers a new starting point for interpreting catches and predicting the distributions and invasion rates of *G. m. morsitans* and *G. pallidipes* but needs refinement before application to other tsetse species, stomoxyines, non-biting muscoids and tabanids. Experimental aids for developing better models are suggested.

10846 **Vreysen, M.J.B., Zhu, Z.-R. and Saleh, K.M., 1998.** Field responses of *Glossina austeni* to sticky panels on Unguja Island, Zanzibar. *Medical and Veterinary Entomology*, **12** (4): 407-416.

Vreysen: IAEA Project RAF/5/040, c/o Ethiopian Science and Technology Commission, P.O. Box 19917, Addis Ababa, Ethiopia.

Two designs of cross-shaped sticky panels (XT and XLP) were compared with the royal blue-white legpanel (LPBuWh) in the Jozani forest on Unguja Island as trapping devices for male *G. austeni*. Single coloured royal blue (XTBu) and bi-coloured royal blue-white XT (XTBuWh) caught more than twice as many male *G. austeni* as the LPBuWh, whereas single coloured black XT trapped significantly fewer flies (10%) than the control LPBuWh. XTs in various horizontal and diagonal blue-white configurations likewise trapped more flies than the LPBuWh, except a horizontally striped blue-white XT which trapped fivefold fewer flies than the LPBuWh. Cross-shaped LP in the blue-white (XLPBuWh) and black-white (XLPBlWh) combination scored significantly better than the control LPBuWh. Similar fly numbers were trapped with XTBuWh and XLPBuWh. Long-term trapping data indicated that the XTBu, XTBuWh and XLPBuWh were three- to fourfold more effective in trapping female flies than the LPBuWh. The landing bias on bi-coloured panels was low in the blue-white but more pronounced in the blue-black and white-black combinations and was affected by the type of sticky panel used. A high proportion (49%) of the flies alighted on the bottom corners of the XTBu panel, but landing positions were more scattered if white was added. Increasing the width of the XTBu from 70 to 120 cm improved the catch by a factor of two as compared with standard sized XTBu. The effect of doubling the height of the XT on total fly catch was negligible. At present, it is the XTBu which can be recommended as the best trapping device for male and female *G. austeni*.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE-EFFECTS)

[See also **22**: nos. 10828, 10833, 10834, 10868-10871, 10876.]

10847 **Jones, O. and Langley, P., 1998.** Target technology – bring the insect to the insecticide not the insecticide to the insect. *In*: *Brighton Crop Protection Conference: Pests and Diseases – 1998: Volume 2: Proceedings of an International Conference, Brighton, UK, 16-19 November 1998* (Farnham, UK; British Crop Protection Council), pp. 433-440.

AgriSenseBCS Ltd, Treforest Industrial Estate, Pontypridd, CF37 5SU, UK.

Inefficiencies in spray application have encouraged the development of target technology where pest insects are attracted by olfactory and visual cues to an insecticide-treated target device where they receive either a lethal dose of conventional insecticide or a sterilising dose of an appropriate insect growth regulator. Examples given of the successful application of the technology include tsetse flies.

10848 **Laveissière, C., Penchenier, L., Sinda, D. and Zoulani, A., 1998.** Comparaison de systèmes attractifs pour la lutte contre les glossines au Congo. [Comparison of attractive devices for tsetse control in Congo.] *Insect Science and its Application*, **18** (1): 1-7.

Laveissière: OCEAC, B.P. 288, Yaoundé, Cameroon.

Various trap designs (biconical, pyramidal, Vavoua and new pyramidal (Lancien) traps, and black/blue/black screen) were tested in the Bouenza human trypanosomiasis focus in Congo P.R. in order to assess their cost *v.* effectiveness for the control of *Glossina palpalis palpalis*. Three series of tests were carried out at three different sites and at different seasons. The Vavoua trap was the most effective at all sites, catching more than twice as many tsetse as the biconical trap. Vavoua and pyramidal traps suspended by a string from a branch or pole were less effective than those fixed to an iron stake because movement in the wind prevented tsetse from landing. The performance of the new pyramidal trap approached that of the Vavoua trap. When costs were compared, the Vavoua trap was almost two times cheaper than the biconical. The use of nylon material in the new pyramidal trap cut its cost appreciably compared with the standard version. The screen was the least expensive, and for this reason, and for its robustness, should be considered for tsetse control in Congo despite being less effective than the Vavoua trap, though considerably more effective than the biconical trap. Trials of different models of traps using locally available materials, and modified to take account of sizes of local fabrics, are recommended, including testing any novel fabrics for adequate insecticide impregnation and resistance to weathering.

10849 **Rozendaal, J.A., 1997.** *Vector control: methods for use by individuals and communities.* Geneva, Switzerland; WHO. xiii + 412 pp. (ISBN 92-4-154494-5.)

Division of Vector Biology and Control, WHO, 1211 Geneva 27, Switzerland.

Incorporating data collected by the author between 1988 and 1991, this 10 chapter manual provides information on the control of various types of disease vectors and pests affecting man. The book is intended for use by individuals and communities. Techniques described in the book are simple and cheap, do not require much training, and can be adapted to local situations. The chapter on tsetse flies (pp. 178-209) covers biology (life cycle, resting places, food), public health importance (sleeping sickness transmission, clinical symptoms, treatment, prevention and control) and control measures (mode of action and design of biconical, Vavoua and pyramidal traps and insecticide-impregnated screens; their use by individuals or communities, their advantages and disadvantages, placement, maintenance, assembly and insecticide impregnation; ground and aerial insecticide spraying). Numerous clear line drawings are given so that traps can be manufactured locally, but the use of olfactory attractants is hardly mentioned. Other chapters deal with: mosquitoes and other biting flies; triatomine bugs; bedbugs, fleas, lice, ticks and mites; cockroaches; houseflies; cyclopoid crustaceans; freshwater snails; house-spraying with residual insecticides; and safe use of pesticides.

4. EPIDEMIOLOGY: VECTOR-HOST AND VECTOR-PARASITE INTERACTIONS

[See also **22**: nos. 10828, 10839, 10876, 10892.]

10850 **Duvallet, G., La Rocque, S. de, Reifenberg, J.M., Solano, P., Lefrançois, T., Michel, J.F., Bengaly, Z., Sidibe, I., Cuisance, D. and Cuny, G., 1999.** Review on the molecular tools for the understanding of the epidemiology of animal trypanosomosis in West Africa. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 245-248.

Duvallet: CIRAD-EMVT, B.P. 5035, F-34032 Montpellier Cedex 1, France. [duvallet@cirad.fr]

The study of the epidemiology of animal trypanosomosis around Bobo-Dioulasso, Burkina Faso, has benefited a lot in recent years from the progress of molecular tools. The two most used molecular techniques were the polymerase chain reaction for the diagnosis of the disease in cattle and the characterisation of trypanosomes in the host and the vector on the one hand, and microsatellite DNA polymorphism in tsetse flies to study intraspecific genetic variability of the vector on the other hand. Results obtained in the Sideradougou area during a recent two-year survey with these techniques, together with many other georeferenced data on vector and cattle distribution, natural environment, land use, ground occupation and livestock management, were combined in a GIS. This new approach to a complex pathogenic system has led to a better evaluation of the risk of trypanosome transmission.

10851 **Lefrançois, T., Solano, P., Bauer, B., Kabore, I., Touré, S.M., Cuny, G. and Duvallet, G., 1999.** Polymerase chain reaction characterization of trypanosomes in *Glossina morsitans submorsitans* and *G. tachinoides* collected on the game ranch of Nazinga, Burkina Faso. *Acta Tropica*, **72** (1): 65-77.

Solano: CIRDES, 01 B.P. 454, Bobo Dioulasso 01, Burkina Faso. [duvallet@cirad.fr]

The polymerase chain reaction was used to characterise the trypanosomes infecting *G. m. submorsitans* and *G. tachinoides* in the game ranch of Nazinga, Burkina Faso, situated near an agropastoral zone. Dissection of 435 tsetse flies, and PCR analysis of 166 infected flies, were conducted to assess the epidemiological situation. Trypanosomes of the *Nannomonas* subgenus were the most abundant in the two tsetse species (80.4% and 73.7% of identified infections in *G. m. submorsitans* and *G. tachinoides* respectively). *Trypanosoma vivax* and *T. brucei* infection rates were comparable between the two tsetse species. The mature infection pattern identified by PCR differed from overall infections, mainly because *T. simiae* infections did not mature, whereas *T. vivax* represented the predominant taxon. Parasitological and PCR results showed some discrepancies; possibly some typical *Duttonella* strains could not be recognised by the sets of primers used. The

technologies used in this work helped to determine the high trypanosomosis risk in this area.

10852 **Makumyaviri, A.M. and Le Ray, D., 1998.** *Trypanosoma brucei brucei*: caractérisation de la transmissibilité d'un stock congolais par *Glossina morsitans morsitans*, *G. palpalis* et *G. p. gambiensis*. [*T. b. brucei*: characterisation of the transmissibility of a congolese stock by *G. m. morsitans*, *G. p. palpalis* and *G. p. gambiensis*.] *Cahiers vétérinaires du Congo*, **1** (1): 27-29.

Makumyaviri: Faculté de Médecine Vétérinaire, Université de Lubumbashi, B.P. 1825, Lubumbashi, République Démocratique du Congo.

The transmissibility of a congolese stock of *T. b. brucei* was evaluated using *G. m. morsitans*, *G. p. palpalis* and *G. p. gambiensis*. This stock proved only slightly infectious to *palpalis* group tsetse flies: less than 6.5% developed procyclic infections with no mature infections. In contrast, 53.3% of *G. m. morsitans* developed procyclic infections, of which 5.4% progressed to the metacyclic stage in the salivary glands. The number of syringe passages of the trypanosomes in mice (from 3 to 30) had no significant effect on the infection rates in the flies.

10853 **Moloo, S.K., Kabata, J.M., Waweru, F. and Gooding, R.H., 1998.** Selection of susceptible and refractory lines of *Glossina morsitans centralis* for *Trypanosoma congolense* infection and their susceptibility to different pathogenic *Trypano-soma* species. *Medical and Veterinary Entomology*, **12** (4): 391-398.

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

In a single generation of selection, two lines of *G. m. centralis* were established that differed significantly in susceptibility to *T. congolense* clone IL 1180. Reciprocal crosses demonstrated that susceptibility was a maternally inherited trait. Differences between the lines, to all phases of the trypanosome infection, were maintained for eight generations, whereas differences in susceptibility to midgut infections were maintained for twenty-eight generations. Thereafter, the lines did not differ in susceptibility to *T. congolense* IL 1180. Susceptibility to infections with *T. congolense* IL 1180 was only a weak predictor of susceptibility to *T. congolense* clones IL 13-E3 and K60/1, as well as clone *T. brucei brucei* STIB 247-L. However, the susceptible and refractory lines displayed these phenotypes when tested with *T. vivax*, indicating that the factors that affect susceptibility to trypanosomes are expressed both within and outside the midgut.

10854 **Moloo, S.K., Orinda, G.O., Sabwa, C.L., Minja, S.H. and Masake, R.A., 1999.** Study on the sequential tsetse-transmitted *Trypanosoma congolense*, *T. brucei brucei* and *T. vivax* infections to African buffalo, eland, waterbuck, N'Dama and Boran cattle. *Veterinary Parasitology*, **80** (3): 197-213.

Moloo: ILRI, P.O. Box 30709, Nairobi, Kenya. [d.moloo@cgnet.com]

The susceptibility of African buffalo, eland, waterbuck, N'Dama and Boran cattle to sequential *Glossina morsitans centralis*-transmitted infections of *T. congolense*, *T. b. brucei* and *T. vivax* was compared, and their possible role as reservoirs of these parasites for *G. m. centralis*, *G. pallidipes*, *G. austeni*, *G. brevipalpis* and *G. longipennis* determined. The buffalo, eland, waterbuck and N'Dama controlled *T. congolense* parasitaemias and were able to prevent anaemia. By contrast, one Boran became severely anaemic whilst the other controlled parasitaemia and anaemia. When the above five species of Bovidae were rechallenged with *T. b. brucei* they showed persistent parasitaemias but did not develop anaemia. The buffalo died of other causes. When the remaining four bovids were rechallenged with *T. vivax* they became infected with mixed *T. vivax*/*T. b. brucei* parasites. Eland, waterbuck and N'Dama controlled parasitaemias and anaemia whereas the Boran became anaemic. Cyclical development of *T. congolense* occurred in *G. m. centralis* when fed on the bovid hosts, with buffalo being infective for tsetse flies for a much longer period. There was no relationship between the levels of *T. congolense* parasitaemia in the bovid hosts and the resultant infection rates in tsetse flies. *G. m. centralis* was more susceptible than *G. pallidipes* to *T. b. brucei* whilst *G. austeni* was the least; *G. brevipalpis* and *G. longipennis* were refractory to the mature infection. Again there was no relationship between *T. b. brucei* parasitaemia levels in the hosts and infection rates in the flies. *G. m. centralis* and *G. pallidipes* showed mixed *T. b. brucei*/*T. vivax* infections whilst *G. austeni*, *G. brevipalpis* and *G. longipennis* became infected with *T. vivax* alone. Tsetse flies showed higher *T. vivax* infection rates when fed on the hosts with high parasitaemias than on those with low parasitaemias. Thus trypanotolerant African buffalo, eland, waterbuck, N'Dama as well as some trypanosusceptible Boran cattle can serve as reservoirs of single or mixed trypanosome infections for tsetse flies. This study has also shown that the Ag-ELISA on the sera from the five bovid hosts had low sensitivity and species-specificity. Examinations of thin wet blood films and buffy coats with a phase-contrast microscope were not sensitive enough to detect the parasites on all occasions. Xenodiagnosis using mice for *T. b. brucei* and *T. congolense* infections, and tsetse flies for all the three trypanosome species, was most sensitive for the detection of trypanosome infections in the bovid hosts.

10855 **Solano, P., Cuny, G., Duvallet, G., Cuisance, D., Ravel, S., Sidibé, I. and Touré, S.M., 1997.** Les techniques de génétique moléculaire au service de l'épidémiologie des trypanosomoses. Intérêt de l'étude du polymorphisme des microsatellites des glossines. [Molecular genetic techniques applied to the epidemiology of trypanosomoses. Significance of the study of microsatellite polymorphism in tsetse flies.] *Revue d'Elevage et de Médecine vétérinaire des Pays tropicaux*, **50** (4): 297-301.

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

The development of molecular techniques has brought a new understanding of the epidemiology of trypanosomosis. The polymerase chain reaction (PCR) is more sensitive than classical diagnostic techniques and has been used in tsetse to differentiate between trypanosomes with similar morphology but a very different economic impact. Different

populations of tsetse species/subspecies are thought to vary in their preferences for different host animals, to have different spatial and temporal preferences, to differ in their behaviour towards traps and screens or insecticide-treated livestock (resistance to control measures) and to vary in their susceptibility to trypanosome infection and maturation (vectorial competence). The authors describe the technique of microsatellite DNA polymorphism and discuss how it may be used to study tsetse populations and evaluate the consequences of intraspecific variability on the epidemiology of trypanosomosis.

10856 **Sumba, A.L., Mihok, S. and Oyieke, F.A., 1998.** Mechanical transmission of *Trypanosoma evansi* and *T. congolense* by *Stomoxys niger* and *S. taeniatus* in a laboratory mouse model. *Medical and Veterinary Entomology*, **12** (4): 417-422.

Oyieke: Department of Zoology, University of Nairobi, P.O. Box 30197, Nairobi, Kenya.

Mechanical transmission of *T. evansi* (South American origin) and *T. congolense* of Kilifi DNA type (Kenyan origin) was studied in laboratory mice using the African stable flies *S. n. niger* and *S. taeniatus*. Altogether, 355 flies were interrupted after feeding on infected blood and then transferred immediately to an uninfected mouse to complete feeding. Microscopy and subinoculation of triturated flies into uninfected mice demonstrated the survival of *T. congolense* in *Stomoxys* for up to 210 min and *T. evansi* for up to 480 min. Parasites survived for much longer periods in the digestive tract than inside or on the mouthparts. *T. congolense* was transmitted only by *S. n. niger*, and only at low rates of 3, 8 and 10% using flies of different feeding histories: fed on blood the previous day, freshly caught, and teneral. *T. evansi* was transmitted by both *Stomoxys* species at higher rates: *S. taeniatus* range 13-18%; *S. n. niger* range 17-35%. The highest trans-mission rate occurred with the combination of teneral *S. n. niger* and *T. evansi*.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

[See also **22**: no. 10825.]

10857 **Asonganyi, T., Doua, F., Kibona, S.N., Nyasulu, Y.M.Z., Masake, R. and Kuzoe, F., 1998.** A multi-centre evaluation of the card indirect agglutination test for trypanosomiasis (*Trypa*Tect CIATT®). *Annals of Tropical Medicine and Parasitology*, **92** (8): 837-844.

Asonganyi: Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon.

A version of the card indirect agglutination test for trypanosomiasis, the *Trypa*Tect CIATT, was evaluated for the diagnosis of *Trypanosoma brucei gambiense* and *T. b. rhodesiense* sleeping sickness. The results of this antigen-detection test indicated high relative sensitivity (99.3%) and specificity (99.4%), and also much higher prevalences of

infection in the general populations of endemic foci (27.9% for *T. b. gambiense* and 21.8% for *T. b. rhodesiense*) than detected by parasitological diagnosis (1.6% and 1.1%, respectively). *Tryp*Tect CIATT detected (and could therefore be used for the diagnosis of) non-patent infections. Among the suspected cases (i.e. those initially found to be parasite-negative but antigen-positive), trypanosomes were detected in 29 (4.2%) of those checked at a 3-month follow-up, and in 17 more such suspects when they were followed up at 6-18 months. Moreover, a high proportion of blood samples from a random sample of the rest of the suspects tested positive for trypanosome-specific DNA by PCR (79.9% for *T. b. gambiense* and 13.9% for *T. b. rhodesiense*). ELISA also demonstrated the presence of anti-trypanosome antibodies in many of the suspects tested (63%, 38%, 24% and 66.9% of those in Cameroon, Côte d'Ivoire, Tanzania and Malawi, respectively). A follow-up of 164 patients treated with melarsoprol revealed that, by 9 months post-treatment, 113 (69.0%) had no detectable trypanosome antigens in their peripheral blood. The test could therefore be used for evaluating chemotherapeutic cure, as well as for diagnosis.

10858 **Enyaru, J.C.K., Matovu, E., Akol, M., Sebikali, C., Kyambadde, J., Schmidt, C., Brun, R., Kaminsky, R., Ogwal, L.M. and Kansiime, F., 1998.** Parasitological detection of *Trypanosoma brucei gambiense* in serologically negative sleeping-sickness suspects from north-western Uganda. *Annals of Tropical Medicine and Parasitology*, **92** (8): 845-850.

Enyaru: Livestock Health Research Institute, P.O. Box 96, Tororo, Uganda.

Forty-five parasitologically confirmed cases of sleeping sickness were diagnosed in north-western Uganda using a combination of two or three techniques. Forty of the cases were positive by the card agglutination test for trypanosomiasis (CATT), four were negative and one was not screened by the CATT. Trypanosomes isolated from the four CATT-negative but parasitologically positive cases were propagated for detailed biochemical genetic analysis. The aim was to demonstrate whether these four stocks lacked the LiTat 1.3 gene which encodes the antigen on which the CATT is based. All the DNA extracts isolated from these CATT-negative stocks and from six CATT-positive stocks of *T. b. gambiense* were targeted for amplification by the three variable surface glycoprotein genes thought to be ubiquitous in *T. b. gambiense*. The LiTat 1.3 gene was shown to be present in all 10 stocks. Trypanosome carriers may be CATT-negative because the CATT is not sensitive enough, because their parasites lack the LiTat 1.3 gene, or because their parasites have this gene but do not express it. The four sleeping sickness cases who gave negative CATT results in the present study have very important implications in the diagnosis of *T. b. gambiense* infections using the CATT. Following treatment of the CATT-positive cases, the CATT-negative carriers of the trypanosomes remain as human reservoir hosts for continuous infection of the population. Because CATT-negative individuals are rarely examined further, the general prevalence of parasitologically positive but CATT-negative cases is unclear. This study demonstrates the value of co-ordinated use of serological and parasitological techniques in the diagnosis of Gambian sleeping sickness.

10859 **Kirchhoff, L.V., 1998.** Use of a PCR assay for diagnosing African trypanosomiasis of the CNS: a case report. *Central African Journal of Medicine*, **44** (5): 134-136.

300G EMRB, University of Iowa, Iowa City, IA 52242, USA.

The case is reported of a West African immigrant into the USA who presented with neurological symptoms more than 12 years after he had last been in Africa. The patient's historical and physical findings, as well as abnormal CSF parameters, suggested a diagnosis of *gambiense* sleeping sickness. The diagnosis was confirmed when a *T. brucei*-specific PCR assay demonstrated the presence of parasite DNA in CSF and blood. Several months after curative therapy the CSF continued to be positive by PCR. These findings suggest that the PCR assay may be useful for sensitive and specific diagnosis of sleeping sickness, but that it may not be helpful for assessing the effect of drug treatment.

10860 **Truc, P., Jamonneau, V., N'Guessan, P., N'Dri, L., Diallo, P.B. and Butigieg, X., 1998.** Simplification of the miniature anion-exchange centrifugation technique for the parasitological diagnosis of human African trypanosomiasis. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **92** (5): 512.

Truc: ORSTOM, B.P. 5045, F-34032 Montpellier Cedex 01, France.

A modification to the sterile m-AECT field kit using a Pasteur pipette is described. Seventy-one individuals who had given positive results by CATT using whole blood and plasma during surveys in Guinea and Côte d'Ivoire were subsequently tested by the original and the modified m-AECT: 27 had trypanosomes demonstrated in their blood by the original m-AECT kit, and 26 did so with the Pasteur pipette version. The use of the new version (manufactured at the Institut Pierre Richet, 01 B.P. 1500, Bouaké, Côte d'Ivoire) is suggested to reduce substantially the cost of this diagnostic procedure.

10861 **Truc, P., Jamonneau, V., N'Guessan, P., N'Dri, L., Diallo, P.B. and Cuny, G., 1998.** *Trypanosoma brucei* ssp. and *T. congolense*: mixed human infection in Côte d'Ivoire. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, **92** (5): 537-538.

Truc: ORSTOM, B.P. 5045, F-34032 Montpellier Cedex 01, France.

A 50-year-old woman in the Aboisso HAT focus in south-eastern Côte d'Ivoire gave a weakly positive CATT result. Parasites were detected by the m-AECT but their morphology was different from that of *T. brucei* ssp. The patient was in an extremely bad physical condition but no trypanosomes were found in her CSF by double centrifugation. DNA amplification gave clearly positive results using primers for *T. brucei* ssp. and *T. congolense* savanna group. The patient was successfully treated with pentamidine. This is thought to be the first description of a mixed infection in a human involving allegedly non-infective trypanosomes.

(b) PATHOLOGY AND IMMUNOLOGY

10862 **Aroke, A.H., Asonganyi, T. and Mbonda, E., 1998.** Influence of a past history of Gambian sleeping sickness on physical growth, sexual maturity and academic performance of children in Fontem, Cameroon. *Annals of Tropical Medicine and Parasitology*, **92** (8): 829-835.

Asonganyi: Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, P.O. Box 1364, Yaoundé, Cameroon.

Little has been published on the long-term complications of Gambian sleeping sickness (GSS) following treatment. A case-control study to compare physical growth, sexual maturity and academic performance of children with and without a past history of GSS was therefore conducted. The study took place over a period of 6 months, in the 10 villages of the Fontem GSS focus, which is known to be very endemic for the disease. Overall, 100 young subjects (aged 6-20 years) with a past history of GSS were pair-matched for age (± 5 months), sex, place of residence, and socio-economic and cultural backgrounds with 100 other, control subjects who had no history of GSS and who were sero-negative for GSS when checked with a card agglutination test (Testryp-CATT). On average, the cases weighed 4.25 kg less, were 3 cm shorter and had 1.15-cm smaller mid-upper-arm circumferences than the controls ($P < 0.05$ for each). The mean sexual-maturity rating of the two groups was similar but the controls tended to have attained puberty earlier than the cases. When the cases were subdivided into those treated with melarsoprol and those given pentamidine, only the melarsoprol-treated sub-goup was significantly different from the corresponding controls in terms of physical growth and sexual maturity.

10863 **Lejon, V., Rosengren, L.E., Buscher, P., Karlsson, J.-E. and Sema, H.N., 1999.** Detection of light subunit neurofilament and glial fibrillary acidic protein in cerebrospinal fluid of *Trypanosoma brucei gambiense*-infected patients. *American Journal of Tropical Medicine and Hygiene*, **60** (1): 94-98.

Lejon: Department of Parasitology, Institute of Tropical Medicine, Nationale-straat 155, B-2000 Antwerp, Belgium.

Light subunit neurofilament (NFL) and glial fibrillary acidic protein (GFAP) concentrations were determined in CSF of 34 patients with human African trypanosomiasis (HAT), five serologically positive but parasitologically unconfirmed individuals, and four healthy controls without evidence of HAT. In patients with second stage HAT ($n = 30$), NFL levels were abnormally elevated in 10 cases and GFAP levels in five. The astrogliosis observed in HAT and experimental models of HAT is confirmed in our study by the presence of increased GFAP levels in the CSF. The abnormal NFL CSF levels reflect structural damage of nerve cells in 33% of the second-stage patients studied. To our knowledge, this is the first time neuronal damage in HAT patients has been demonstrated by using biochemical markers of brain damage in the CSF.

(c) TREATMENT

[See also **22**: no. 10857.]

10864 **Atouguia, J. and Costa, J., 1999.** Therapy of human African trypanosomiasis: current situation. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 221-224.

Atouguia: Centro de Malária e Outras Doenças Tropicais, Instituto de Higiene e Medicina Tropical, R. da Junqueira 96, 1400 Lisbon, Portugal. [jma@ihmt.unl.pt]

This paper reviews the current situation regarding the treatment of human African trypanosomiasis. The existing approved drugs are old, toxic and/or expensive, and therapeutic failures are common. Several factors may contribute to the problems of chemotherapy, including differences in the epidemiology of the disease, difficulties in the diagnosis and staging of the infection, availability, distribution and pharmacological properties of drugs, standardisation of treatment regimens, response to therapy, follow-up period, relapses and clinical trials. New therapeutic approaches include the development and approval of new drugs, the use of new therapeutic regimens, the study of drug combinations, and the development of new formulations.

10865 **Bronner, U., Brun, R., Doua, F., Ericsson, O., Burri, C., Keiser, J., Miezan, T.W., Boa, Y.F., Rombo, L. and Gustafsson, L.L., 1998.** Discrepancy in plasma melarsoprol concentrations between HPLC and bioassay methods in patients with *T. gambiense* sleeping sickness indicates that melarsoprol is metabolized. *Tropical Medicine and International Health*, **3** (11): 913-917.

Bronner: Division of Infectious Diseases, Karolinska Institute, Huddinge University Hospital, S-14186 Huddinge, Sweden.

Using a specific high-performance liquid chromatography (HPLC) method and a bioassay which determines trypanocidal activity, concentrations of melarsoprol were assessed in plasma, urine and CSF from eight patients in Côte d'Ivoire with late-stage *Trypanosoma brucei gambiense* sleeping sickness. The aim was to unravel to what extent the bioassay codetermines biologically active metabolites of melarsoprol. Subjects were given one dose of melarsoprol i.v. per day for 4 days (1.2, 2.4, 3.0-3.6 and 3.0-3.6 mg/kg b.w. respectively). Plasma samples were obtained before the first melarsoprol injection, immediately after and at 1 h, 24 h and 5 days after the 4th injection. Urine was collected before melarsoprol therapy and at 24 h after the 4th injection. CSF samples were taken once before treatment and at 24 h after the 4th injection. HPLC analyses showed that plasma concentrations immediately after the 4th injection varied from 2200 to 15,900 nmol/l, dropping to 0-1800 nmol/l at 1 h, and to undetectable levels at 24 h. Small amounts of melarsoprol were recovered from urine. Melarsoprol could not be detected in CSF by HPLC. Immediately after injection, bioassay analyses showed plasma concentrations of the same magnitude as HPLC assays but at 1 h they were 4-65-fold higher than the levels assessed by HPLC. Even 24 h and 5 days after the 4th injection there was significant but decreasing activity. Urine levels were 40-260-fold higher than the measured HPLC concentrations, whereas there was low but detectable activity in CSF.

Results indicate that melarsoprol is rapidly eliminated from plasma. The significant trypanocidal activity determined by bioassay and simultaneous low or undetectable levels of melarsoprol assayed by HPLC indicate that the compound is transformed into metabolites with trypanocidal activity.

10866 **Croft, S.L., 1999.** Pharmacological approaches to antitrypanosomal chemotherapy. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 215-220.

Department of Infectious and Tropical Diseases, LSHTM, Keppel Street, London WC1E 7HT, UK. [s.croft@lshtm.ac.uk]

There is an urgent need for new drugs for the chemotherapy of human African trypanosomiasis, Chagas disease and leishmaniasis. Progress has been made in the identification and characterisation of novel drug targets for rational chemotherapy and inhibitors of trypanosomatid glycosomal enzymes, trypanothione reductase, ornithine decarboxylase, *S*-adenosylmethionine decarboxylase, cysteine proteases and of the purine and sterol biosynthetic pathways. However, less attention has been paid to the pharmacological aspects of drug design or to the use of drug delivery systems in the chemotherapy of African trypanosomiasis and Chagas disease. A review of research on pharmacology and drug delivery systems shows that there are new opportunities for improving the chemotherapy of these diseases.

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

10867 **Abegunde, T.T. and Mafuyai, H.B., 1994.** Prevalence and distribution of bovine trypanosomiasis around the summit areas of Jos Plateau. (Meeting abstract no. 23.) *Nigerian Society for Parasitology Abstracts*, **1994**: 18.

A parasitological survey of blood samples of 200 cattle of varying ages around the Jos towns of Babale, Naraguta and Federe, using thin blood film and haematocrit centrifugation techniques, indicated an overall trypanosome prevalence of 7.5%. Males were significantly more infected than females ($P < 0.05$) and adults had a higher prevalence than other age groups. HCT was more accurate and sensitive for diagnosis than the thin blood film technique.

10868 **Agbede, R.I.S., Maikaje, D.B., Lawal, I.A. and Otobo, S., 1994.** Tsetse and trypanosomiasis control using traps and the transfer of technology to resource poor farmers in Kaura Local Government Area in Nigeria. (Meeting abstract no. 26.) *Nigerian Society for Parasitology Abstracts*, **1994**: 22.

Department of Parasitology and Entomology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria.

The seasonal prevalence of tsetse flies and trypanosomiasis in Kaura LGA was investigated after the chief of the area made a passionate appeal to the government for help in combating the menace of trypanosomiasis. A total of 2011 animals (1963 cattle and 48 pigs) were bled during the dry and wet seasons in 1992. Standard parasitological and entomological methods were used to determine the prevalence of the disease and its vector. The dry season prevalence was 18.4% while that of the wet season was 55.7%. *Trypanosoma congolense* was more common than *T. vivax*, while *T. brucei* had a very low prevalence. *Glossina palpalis* and *G. tachinoides* were the tsetse flies encountered. Large numbers of *Haematopota* sp. were caught in the traps and in the survey vehicle. A point prevalence study of 48 pigs slaughtered at the abattoir in the wet season revealed a prevalence rate of 2.1% for *T. congolense* and 1.89% for *T. brucei*. One isolated case of human infection was detected. A separate study is planned to evaluate the role of pigs in the epizootiology of the disease in man and cattle. An attempt was made to reduce the fly population with the cooperation of the farmers, using both biconical and NITSE traps. The farmers were encouraged to purchase the traps and adopt the technology in fly control. The *G. tachinoides* in this area appeared to be a peri-domestic species. Our survey confirmed that trypanosomiasis is the single most important disease limiting livestock production in this humid zone. It is suggested that, if the transfer of technology is successful and sustained, the prevalence of tsetse and trypanosomiasis in this locality may be reduced to zero with time.

10869 **Ajayi, S.A., Ogedengbe, J.D. and Dogo, G.I., 1995.** Monitoring of tsetse and trypanosomiasis control programme on the Plateau and Bauchi States of Nigeria, using Ag-ELISA and related techniques. (Meeting abstract no. 41.) *Nigerian Society for Parasitology Abstracts*, **1995**: 25.

Parasitology Division, National Veterinary Research Institute, Vom, Plateau State, Nigeria.

Between July 1994 and January 1995, a total of 1175 blood samples were collected from 50 herds of cattle located in 14 Local Government Areas of Plateau and Bauchi States of Nigeria. Breeds of cattle sampled included Bunaji, Sokoto Gandali, Wadara, Friesian and crosses. The standard methods used were simple random and jugular/caudal venipuncture, and the blood/serum samples were analysed for the presence of trypanosome infection using parasitological and serological diagnostic techniques. Survey for tsetse and other biting flies was also carried out during the same period using NITSE and biconical traps. Parasitological examination gave a trypanosomiasis prevalence of 5.6% in Plateau State and 6.0% in Bauchi State. The antigen-capture sandwich ELISA technique was employed to screen 280 parasitologically negative samples; this showed 4 (1.4%) positive for *Trypanosoma brucei* and 7 (2.5%) for *T. vivax*, while none was positive for *T. congolense*. The Ag-ELISA test specificity was 97.5% for *T. vivax*, 98.3% for *T. brucei* and 100% for *T. congolense*. Twenty-two tsetse flies, consisting of *Glossina palpalis*, *G. tachinoides* and *G. longipalpis*, were trapped and dissected for possible trypanosome infection. Other biting flies also trapped included tabanids, *Stomoxys* spp., *Chrysops* spp. and *Haematopota* spp. The significance of these findings to the monitoring of the tsetse and trypanosomiasis control programme in Nigeria is discussed.

10870 **Ajayi, S.A., Ogedengbe, J.D., Dogo, G.I. and Ogunnote, M., 1996.** Use of enzyme immunoassay technique for improved diagnosis of animal trypanosomosis in Nigeria. (Meeting abstract no. 52.) *Nigerian Society for Parasitology Abstracts*, **1996**: 51.

Parasitology Division, National Veterinary Research Institute, Vom, Plateau State, Nigeria.

Monitoring of tsetse and animal trypanosomosis control/eradication in Plateau and Bauchi States was carried out. The direct sandwich ELISA technique was employed for the detection of antigens of *Trypanosoma brucei*, *T. congolense* and *T. vivax* from test serum samples obtained from tsetse-reclaimed and unreclaimed study areas. A total of 880 serum samples were screened for antigens of *T. congolense* and *T. vivax*, while 572 were screened for antigens of *T. brucei*. Of the former, 84 (9.5%) and 143 (16.3%) were positive for *T. congolense* and *T. vivax* antigens, respectively, and of those tested for *T. brucei* antigen, only 30 (5.2%) were positive. The sensitivity and specificity of the Ag-ELISA test were compared with those of parasitological diagnostic techniques.

10871 **Ajayi, S.A., Ogedengbe, J.D., Dogo, G.I. and Ogunnote, M.E., 1997.** Monitoring of tsetse and trypanosomosis control programme in Plateau and Bauchi States of Nigeria using Ag-ELISA related techniques. (Meeting abstract no. 37.) *Nigerian Society for Parasitology Abstracts*, **1997**: 40.

Parasitology Division, National Veterinary Research Institute, Vom, Plateau State, Nigeria.

The objective of this study was to test an Ag-ELISA-based approach to assess the success achieved in the tsetse and trypanosomosis control programme in Plateau and Bauchi States. The direct sandwich ELISA was employed for the detection of antigens of *Trypanosoma brucei*, *T. congolense* and *T. vivax* in test serum samples obtained from tsetse-reclaimed and unreclaimed study areas. Tsetse trapping using biconical and NITSE traps was also used to monitor tsetse challenge in the study areas. Other laboratory techniques used to assess the control programme included thin and thick films and the BCT/darkground method. A total of 442 and 177 serum samples obtained from tsetse-reclaimed and unreclaimed areas respectively were screened for antigens of *T. brucei*, *T. congolense* and *T. vivax*. Out of the 442 samples from the reclaimed area, 6 (1.35%), 5 (1.13%) and 19 (4.30%) were positive for antigens of *T. brucei*, *T. congolense* and *T. vivax* respectively, and out of 177 samples from tsetse unreclaimed/endemic areas, 25 (14.12%), 63 (35.59%) and 83 (46.14%) were positive for *T. brucei*, *T. congolense* and *T. vivax* antigens respectively. The incidence of tsetse challenge in the reclaimed areas was zero as against a high incidence in the unreclaimed area. The difference in trypanosomosis incidence between the tsetse-reclaimed and unreclaimed areas was highly significant. Based on our findings, there is evidence of success in the control programme in the areas studied. The sensitivity and specificity of the Ag-ELISA test were compared with those of parasitological diagnostic techniques. The significance of the findings via-à-vis tsetse eradication is discussed.

10872 **Almeida, P.J.L.P. de, Ndao, M., Goossens, B. and Osaer, S., 1998.** PCR primer evaluation for the detection of trypanosome DNA in naturally infected goats. *Veterinary Parasitology*, **80** (2): 111-116.

Almeida: Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium. [palmeid@itg.be]

Blood samples from 76 roaming goats, from the Bansang and Missira regions in Gambia, were examined by the buffy coat technique for the presence of trypanosomes. Extractions from dry blood samples from these animals on filter paper were subjected to PCR using three different primer sets, ORPHON5J, GOL and TVW, specific for *Trypanosoma brucei*/*T. evansi*, *T. congolense* and *T. vivax*, respectively. PCR results for *T. congolense* were 100% concordant with buffy coat examination. Besides three *T. vivax* buffy coat-positive samples, another 15 yielded positive with the TVW primers. The ORPHON5J primers yielded no positive results. Analyses with the GOL primers of putatively negative samples yielded aberrant band patterns whose diagnostic significance still remains to be determined.

10873 **Daniel, A.D. and Kalejaiye, J.O., 1992.** Prevalence of bovine trypanosomiasis in Northern Nigeria. (Meeting abstract no. 14.) *Nigerian Society for Parasitology Abstracts*, **1992**: 12.

Veterinary and Livestock Studies Division, NITR, Vom, Jos, Nigeria.

The prevalence of bovine trypanosomiasis was studied in a supposedly tsetse-free region of Northern Nigeria during April-July 1990. Blood samples were collected from 1065 cattle and examined by buffy coat and stained smear methods. PCVs were determined simultaneously. Forty-two (3.9%) of the animals examined were infected with trypanosomes, *Trypanosoma vivax* being more frequently encountered than other species. The infection rate of tsetse flies was high: 27 *Glossina tachinoides* (34.3%) caught and examined were positive for trypanosomes. Further studies are desirable, especially in areas thought to be free of tsetse, in order to ascertain the current status of animal trypanosomiasis in Nigeria.

10874 **David, K. and Abenga, J.N., 1995.** The prevalence of trypanosomiasis in indigenous cattle slaughtered in Kaduna. (Meeting abstract no. 16.) *Nigerian Society for Parasitology Abstracts*, **1995**: 11.

Pathology, Epidemiology and Statistics Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

A parasitological survey was undertaken to determine the prevalence of trypanosomiasis in indigenous cattle slaughtered at the Kaduna abattoir and its effect on carcass quality. Of 1000 animals examined, 7.5% were positive for either single or mixed infections of *Trypanosoma vivax*, *T. congolense* and *T. brucei*. The infection rate was highest in the Red Bororo breed, and least in the Adamawa breed. Animals diagnosed

parasitologically positive were also anaemic, emaciated and had ocular discharges. The prevalence of bovine trypanosomiasis observed in this study was lower than hitherto reported, suggesting a reduced potential risk posed by this disease.

10875 **Eisler, M.C., Lessard, P., Masake, R.A., Moloo, S.K. and Peregrine, A.S., 1998.** Sensitivity and specificity of antigen-capture ELISAs for diagnosis of *Trypanosoma congolense* and *Trypanosoma vivax* infections in cattle. *Veterinary Parasitology*, **79** (3): 187-201.

Eisler: Department of Veterinary Physiology, University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK. [m.eisler@vet.gla.ac.uk]

Sensitivity and specificity of the FAO/IAEA antigen-ELISA kits for diagnosis of bovine trypanosomosis were investigated using sera from experimental cattle infected by tsetse challenge with cloned populations of *T. congolense* (three populations) or *T. vivax* (one population). The kits are based on monoclonal antibodies that recognise internal antigens of tsetse-transmitted trypanosomes. Ten cattle were infected with each trypanosome population for at least 60 days, and in combination with uninfected cohorts (n = 16) were used in a double-blind study design. Sensitivity and specificity of the tests depended on the choice of positive-negative thresholds expressed as percent positivity with respect to the median OD of four replicates of the strong positive reference serum provided with the kit. In general, while overall specificities were high, sensitivities of the antigen-ELISAs were poor. For example, at a cut-off of 5% positivity, the sensitivities of the antigen-ELISAs were 11% for samples (n = 1162) from *T. congolense*-infected cattle (n = 30), and 24% for samples (n = 283) from *T. vivax*-infected cattle (n = 10). The corresponding specificity values were 95% and 79%, respectively. At a cut-off of 2.5% positivity, sensitivity for *T. congolense* was 25% and for *T. vivax* 35%; corresponding specificity values were 85% and 63%, respectively. There were no values of the positive-negative threshold at which both sensitivity and specificity were satisfactory. Restricting the analyses to samples taken more than 2 weeks after tsetse challenge did little to improve sensitivity estimates. Trypanosome species specificities of the antigen-ELISAs were also poor. Sensitivity and species specificity of the antigen-ELISA for *T. brucei* infections were not investigated. In contrast to the antigen-ELISA, the sensitivity of the buffy-coat technique when applied to the same experimental animals was fairly high at 67% for *T. congolense* infections and 60% for *T. vivax* infections. For samples taken more than 2 weeks after tsetse challenge, high sensitivity estimates of 96% for *T. congolense* and 76% for *T. vivax* infections were obtained.

10876 **Ezebuiro, O.G.C., Abenga, J.N., Ahmed, A.B. and Lawani, F.A.G., 1998.** An observation on the prevalence of animal trypanosomiasis in Agaie integrated tsetse control pilot study area. (Meeting abstract no. 17.) *Nigerian Society for Parasitology Abstracts*, **1998**: 18.

Ezebuiro: Entomology and Parasitology Division, NITR, Kaduna, Nigeria.

Efforts were made to bring down the tsetse population in Agaie livestock settlement area, with the aim of controlling animal trypanosomiasis, using NITSE and biconical traps and impregnated screens. Farmers were taught how to harvest and record tsetse flies caught from the traps. At the end of one year, the tsetse population was reduced drastically. However, random sampling of a few cattle from some of the Fulani herds indicated a prevalence rate of 26.59%. *Trypanosoma vivax* accounted for 86.96%, *T. congolense* for 6.52%, *T. brucei* for 4.35% and mixed infections for 2.17% of the total number of trypanosome-infected animals. The result suggests that despite a drop in the tsetse population, transmission may have persisted through mechanical agents such as *Stomoxys* and tabanids.

10877 **Makumyaviri, A.M., Maunga, G.M. and Paluku, E.K., 1998.** Prévalence des trypanosomoses chez les bovins et caprins dans les secteurs d'élevage Beni et Lubero de la province du Nord-Kivu, Congo. [Prevalence of trypanosomiasis in cattle and goats in Beni and Lubero livestock sectors of the Northern Kivu province of Congo.] *Cahiers vétérinaires du Congo*, **1** (1): 24-26.

Makumyaviri: Faculté de Médecine Vétérinaire, Université de Lubumbashi, B.P. 1825, Lubumbashi, République Démocratique du Congo.

The prevalence of trypanosomiasis in livestock was evaluated in two livestock sectors of Northern Kivu province of Congo D.R. Using thin blood films, the study revealed infections in 57.9% of cattle (n = 183) and in 8.4% of goats (n = 201) in Beni district, while in the adjoining Lubero district only 2.6% of cattle were infected (n = 196) and no infection was seen in goats (n = 154). Statistical analysis of the results showed significant differences ($0.001 \leq P \leq 0.01$) in infection rates between districts, between farms and between cattle and goats although they shared the same pasture. These differences may be attributed to the geographical distribution of tsetse species able to transmit trypanosomes to livestock (*Glossina fuscipes fuscipes* rare in Lubero; *G. f. fuscipes* and *G. pallidipes* abundant in Beni), to the level of exposure of the animals to infection and to the efficiency of their immune response. The existence of high infection rates in cattle in Beni district indicates an urgent need to reconsider the control strategy against the disease in this area.

10878 **Rebeski, D.E., Winger, E.M., Aigner, H., Wright, P., Crowther, J. and Dwinger, R.H., 1998.** Study of the effect of γ-irradiation on bovine serum samples on the ability of monoclonal antibodies to detect invariant antigens of *Trypanosoma congolense*, *T. vivax* and *T. brucei* in enzyme-linked immunosorbent assays. *Veterinary Parasitology*, **79** (2): 109-122.

Rebeski: FAO/IAEA Agriculture and Biotechnology Laboratory, P.O. Box 100, A-1400 Vienna, Austria. [D.Rebeski@iaea.org]

Samples of serum from cattle in Kenya and Mali naturally infected with *T. congolense*, *T. vivax* and *T. brucei* and from uninfected animals were tested before and after γ-irradiation, using three sandwich ELISAs. Each test system used a different monoclonal antibody to allow the specific detection of conserved-invariant cytoplasmic

antigens of the three species. Two groups of samples were identified. The first gave unequivocal positive or negative ELISA results before irradiation. In this group, irradiation had no effect on the diagnostic sensitivity of the assays: all samples positive before irradiation remained positive and those that were negative remained negative. There was, however, a statistically significant reduction in signal in each of the ELISAs following irradiation. The second group consisted of samples identified before irradiation as flanking the diagnostic negative/positive threshold of OD ≥ 0.05. These showed a negative bias after irradiation of the order of OD –0.01, which was shown to be statistically significant by paired *t*-test. Without correction of the given diagnostic negative/positive threshold, bovine sera with OD values around the threshold were expected to deliver more false negative test results upon irradiation. This was confirmed when serological data were compared with parasit-ological findings, where three times more false negative results were found from irradiated serum samples. For this group of irradiated bovine samples, therefore, re-adjustment of the diagnostic negative/positive threshold of the ELISAs using defined irradiated serum samples is recommended to avoid an increase in the frequency of false negative results.

10879 **Rebeski, D.E., Winger, E.M., Rogovic, B., Robinson, M.M., Crowther, J.R. and Dwinger, R.H., 1999.** Improved methods for the diagnosis of African trypanosomosis. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 249-253.

Rebeski: FAO/IAEA Agriculture and Biotechnology Laboratory, P.O. Box 100, A-1400 Vienna, Austria. [D.Rebeski@iaea.org]

The diagnosis of trypanosomosis in animals with low parasitaemia is hampered by low diagnostic sensitivity of traditional detection methods. An immunodiagnostic method based on a direct sandwich enzyme-linked immunosorbent assay (ELISA), using mono-clonal antibodies, has been examined in a number of African laboratories for its suitability for monitoring tsetse control and eradication programmes. Generally the direct sandwich ELISAs for the detection of trypanosomal antigens in serum samples have proved to be unsatisfactory with respect to diagnostic sensitivity when compared with traditional parasitological methods such as the dark ground/phase contrast buffy-coat technique. Consequently antigen-detection systems exploiting various other direct, indirect and sandwich ELISA systems and sets of reagents are being developed to improve diagnosis. In addition, an existing indirect ELISA for the detection of antibodies has been improved and is being evaluated in the field in order to detect cattle that are or have been recently infected with trypanosomes. Developments and advantages of other diagnostic techniques, such as dip-stick assay and tests based on the polymerase chain reaction, are also considered.

10880 **Tangwan, E.E. and Audu, P.A., 1998.** Prevalence of *Trypanosoma evansi* infections in camels slaughtered at Kano State abattoir, Kano, Nigeria, as determined by parasitological methods. (Meeting abstract no. 14.) *Nigerian Society for Parasitology Abstracts*, **1998**: 17.

Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria.

The prevalence of *T. evansi* infections in camels was investigated in slaughtered camels at Kano State abattoir, Kano, Nigeria, using wet and stained thin film examinations as well as the haematocrit centrifugation technique to detect trypanosomes in the jugular blood of the animals. Out of a total of 255 blood samples examined between April and July 1997, 8 (3.1%) were positive for *T. evansi*. The mean PCV of the infected camels was 22.0% while that of non-infected camels was 23.9%. Although the prevalence of *T. evansi* in the camels was low, trypanosomiasis of camels could be of great economic importance, particularly in this area.

10881 **Tarimo-Nesbitt, R.A., Golder, T.K., Dransfield, R.D., Chaudhury, M.F. and Brightwell, R., 1999.** Trypanosome infection rate in cattle at Nguruman, Kenya. *Veterinary Parasitology*, **81** (2): 107-117.

Tarimo-Nesbitt: Biology Building, Howard University, Washington, DC 20059, USA. [fnesb29280@aol.com]

Trypanosome infection rate in cattle at Nguruman was investigated in a study conducted in 1984-1986. Shifting pastoralism significantly reduced trypanosome infections in cattle. The cattle were more heavily infected with *Trypanosoma congolense* (16.5%) than *T. vivax* (4.95%) and *T. brucei* (0.19%). *T. theileri* was observed only once among the cattle examined. Mixed trypanosome infections in cattle were observed to be 2.75% and 0.014% for *T. congolense*/*T. vivax* and *T. congolense*/*T. brucei*, respectively. The duration of infection in the cattle was 55 days for *T. congolense* and 79 days for *T. vivax*. High infection rates in cattle were observed 2 months after the rains, which were concomitant with high tsetse densities.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **22**: no. 10889.]

10882 **Goossens, B., Osaer, S., Kora, S. and Ndao, M., 1998.** Haematological changes and antibody response in trypanotolerant sheep and goats following experimental *Trypanosoma congolense* infection. *Veterinary Parasitology*, **79** (4): 283-297.

Goossens: ITC, P.M.B. 14, Banjul, Gambia. [106307.3451@compuserve.com]

Ten West African Dwarf (WAD) female goats and twelve Djallonké ewes were artificially infected with a West African strain of *T. congolense* and monitored during 36 weeks over an acute phase (weeks 0-12) and a chronic phase (weeks 13-36) to evaluate their haematological and immunological response. Parasitaemia, PCV, red blood cells, haemoglobin, white blood cells (WBC) and trypanosomal antibodies were assessed. Mean corpuscular volume and mean corpuscular haemoglobin concentration were calculated. The infected animals showed a persistent parasitaemia together with a chronic anaemia and significantly lower PCV, red blood cell count and haemoglobin. The infected sheep developed a macrocytic, hypochromic anaemia during the acute phase, changing to

normocytic, hypochromic during the chronic phase, whereas the infected goats developed a normocytic, normochromic anaemia during the acute phase and normocytic, hypochromic during the chronic phase. A significant increase in WBC counts was observed only in the infected sheep during the chronic phase. Trypanosomal antibody titres were significantly higher in the infected sheep than in the infected goats. Both species are regarded as trypanotolerant but Djallonké sheep mount a better haematopoietic and immunological response to infection with *T. congolense* than WAD goats.

10883 **Mwangi, E.K., Stevenson, P., Gettinby, G., Reid, S.W.J. and Murray, M., 1998.** Susceptibility to trypanosomosis of three *Bos indicus* cattle breeds in areas of differing tsetse fly challenge. *Veterinary Parasitology,* **79** (1): 1-17.

Murray: Department of Veterinary Clinical Studies, University of Glasgow Veterinary School, Bearsden Road, Glasgow G61 1QH, UK. [b.gillies@ vet.gla.ac.uk]

Studies to assess the differences in susceptibility to trypanosomosis among *Bos indicus* cattle breeds (Maasai Zebu, Orma Boran and Galana Boran) were conducted under conditions of varying tsetse fly challenge at the Nguruman escarpment in south-western Kenya, for a period of 1 year. It was found that under tsetse challenge quantified as high, Maasai Zebu and Orma Boran were less susceptible than Galana Boran to trypanosome infections, as judged by the significantly lower incidence of infection, development of less severe anaemia, fewer requirements for trypanocidal drug treatments, higher growth rates and fewer mortalities. In the area where tsetse challenge was considered low as a result of a tsetse fly control operation using odour-baited traps, only the Maasai Zebu and Orma Boran were compared. No significant differences in the incidence of infection, degree of anaemia or growth rates were observed between the two breeds, but all were significantly different from their counterparts in the high tsetse challenge area. These results suggest that there is variation in resistance to trypanosomosis among *B. indicus* cattle breeds that could be exploited as part of the integrated trypanosomosis control programmes in East Africa.

10884 **Omotainse, S.O., Edeghere, H. and Anosa, V.O., 1992.** Peripheral bone-marrow response in ovine trypanosomiasis. (Meeting abstract no. 28.) *Nigerian Society for Parasitology Abstracts*, **1992**: 24.

Omotainse: Veterinary and Livestock Studies Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

Yankassa rams were infected with *Trypanosoma brucei*, *T. congolense* and *T. vivax*. Blood was taken to monitor bone-marrow reactions and anaemia resulting from infection. At 4 and 6 weeks p.i., animals in each infection group were treated with Berenil (diminazene aceturate), Samorin (isometamidium chloride) and Novidium (homidium chloride). Blood examination for immature red blood cells (reticulocytes) continued before and after treatment and through the periods of relapse. The three trypanosome

species elicited anaemia, but bone-marrow responses were delayed and inadequate. This suggests inefficient bone-marrow response and/or malfunctioning of organs responsible for erythropoiesis.

10885 **Osaer, S., Goossens, B., Kora, S. and Jeffcoate, I., 1999.** Effects of *Trypanosoma congolense* infection and diet on puberty, age at first lambing and haematology changes in Djallonké ewe lambs. *Veterinary Parasitology*, **80** (3): 215-230.

Osaer: ITC, P.M.B. 14, Banjul, Gambia. [bakt.sabine@commit.gm]

The interactions between *T. congolense* infection and nutritional supplements on onset of puberty and age at first lambing were observed in 24 young Djallonké ewes. As experimental design, a randomised complete block design was used with four treatment combinations, of which two were kept on a restricted diet (L), the remainder on an unrestricted diet (H), half of each nutritional group being infected with *T. congolense* (LI and HI), the remainder serving as controls (LC and HC). Infection with *T. congolense* took place at an average age of 6 months and 15 days. Mortality due to trypanosome infection was zero and clinical symptoms were not obvious. Intensity of parasitaemia and PCV drop following trypanosome infection were similar in both infected groups (HI and LI). High dietary supplementation resulted temporarily in a better haematopoietic response following trypanosome infection, measured as a macrocytic anaemia. Dry matter intake was significantly depressed in the HI group immediately following infection. Trypanosome infection had a negative effect on live weight gain during the chronic phase, with the difference being most obvious in the HI group (interaction diet × infection; $P \leq 0.05$). Whereas trypanosome infection had no significant effect, high supplementary feeding significantly reduced the age at first cycling. Age at first lambing was similarly reduced by the diet. Trypanosome infection tended ($P \leq 0.09$) to delay age at first lambing with a mean difference of 31.5 ± 22.4 days between infected and controls. Interactions between diet and infection for age at first cycling/lambing were not significant, indicating that these effects were just additive. Neither birth weights nor growth rates of offspring born to the experimental animals were significantly affected by previous trypanosome infection, nor by the diet of the dam. In contrast, lamb mortality up to 3 months of age was significantly increased by infection of the dam and most losses arose in group LI. In conclusion, the effects of trypanosome infection on puberty and age at first lambing were indirectly mediated through depression of growth rates. Nutritional supplementation enabled a better erythropoietic response to *T. congolense* infection and better offspring survival rates but resulted in more depressed weight gains. The results, however, clearly indicated the delaying effect of insufficient feeding on onset of puberty and reproductive performance in young Djallonké sheep.

10886 **Taylor, K.A. and Mertens, B., 1999.** Immune response of cattle infected with African trypanosomes. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 239-244.

Taylor: ILRI, P.O. Box 30709, Nairobi, Kenya. [k.taylor@cgiar.org]

Trypanosomosis is the most economically important disease constraint to livestock productivity in sub-Saharan Africa and has significant negative impact in other parts of the world. Livestock are an integral component of farming systems and thus contribute significantly to food and economic security in developing countries. Current methods of control for trypanosomosis are inadequate to prevent the enormous socioeconomic losses resulting from this disease. A vaccine has been viewed as the most desirable control option. However, the complexity of the parasite's antigenic repertoire made development of a vaccine based on the variable surface glycoprotein coat unlikely. As a result, research is now focused on identifying invariant trypanosome components as potential targets for interrupting infection or infection-mediated disease. Immunosuppression appears to be a nearly universal feature of infection with African trypanosomes and thus may represent an essential element of the host-parasite relationship, possibly by reducing the host's ability to mount a protective immune response. Antibody, T cell and macrophage/monocyte responses of infected cattle are depressed in both trypanosusceptible and trypanotolerant breeds of cattle. This review describes the specific T cell and monocyte/macrophage functions that are altered in trypanosome-infected cattle and compares these disorders with those that have been described in the murine model of trypanosomosis. The identification of parasite factors that induce immunosuppression and the mechanisms that mediate depressed immune responses might suggest novel disease intervention strategies.

10887 **Uzoigwe, N.R., 1998.** Acquired resistance in the Zebu cattle against challenge with strains of *Trypanosoma vivax*. (Meeting abstract no. 60.) *Nigerian Society for Parasitology Abstracts*, **1998**: 59.

NITR, P.M.B. 03, Vom, Plateau State, Nigeria.

Four White Fulani Zebu cows aged 15-18 months were subjected to challenge infection with two (homologous and heterologous) strains of *T. vivax* 120 days after self cure against an initial infection. Three other cows of the same age range which had no previous exposure to trypanosome infection were also infected as a control. All four animals which had earlier self cured infection were refractive to challenge with the homologous strain of *T. vivax* for a period of 10 weeks. The three control cows became infected after prepatent periods ranging between 5 and 7 days. When the refractive cows were re-challenged with a mice-adapted *T. vivax* they became infected. Although no evidence of absolute protective immunity was observed against the heterologous challenge, the resultant infection was mild and characterised by a low and short parasitaemic profile.

(c) TRYPANOTOLERANCE

[See also **22**: nos. 10883, 10897.]

10888 **Kemp, S.J. and Teale, A.J., 1998.** Genetic basis of trypanotolerance in cattle and mice. *Parasitology Today*, **14** (11): 450-454.

Kemp: School of Biological Sciences, Donnan Laboratories, University of Liverpool, Liverpool L69 7DZ, UK. [Kempsj@liv.ac.uk]

This review covers the history and current use of trypanotolerant livestock, particularly cattle, the mouse model, the immunology and the genetic basis of trypanotolerance. The gene mapping approach is finally helping to clarify the genetic control of this phenomenon. Genetic regions determining susceptibility to trypanosomiasis in mice have been identified and parallel studies are well advanced in cattle. There is growing evidence that only modest numbers of genes are involved in determining the difference between a susceptible and a resistant animal. These observations raise a new series of important questions concerning the possible exploitation of major trypanotolerance genes and the way that they might function in different genetic and physical environments.

10889 **Taylor, K., Mertens, B., Lutje, V. and Saya, R., 1998.** *Trypanosoma congolense* infection of trypanotolerant N'Dama (*Bos taurus*) cattle is associated with decreased secretion of nitric oxide by interferon-γ-activated monocytes and increased transcription of interleukin-10. *Parasite Immunology*, **20** (9): 421-429.

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

The mechanisms whereby trypanotolerant N'Dama cattle control infection with *T. congolense* are unknown. Previous studies have suggested that the monocytes of N'Dama cattle are more highly activated during infection than those of trypanosusceptible Boran cattle. However, we have recently reported that the monocytes of Boran cattle have a reduced capacity to secrete nitric oxide during trypanosome infection. We therefore evaluated the production of nitric oxide by monocytes of trypanotolerant N'Dama cattle infected with *T. congolense* in response to interferon-γ, bacterial lipopolysaccharide or trypanosome antigens. IFN-γ-induced nitric oxide production was decreased between days 25 and 76 of infection, while lipopolysaccharide-induced secretion of nitric oxide was increased at day 13 and again at day 76 p.i. Trypanosome antigens did not elicit nitric oxide production. Analysis of interleukin-10 mRNA transcription in peripheral blood leukocytes revealed an increase at time points that coincided with decreased IFN-γ-induced nitric oxide synthesis. In contrast, IFN-γ mRNA expression was not changed during infection while tumour necrosis factor-α was slightly reduced at day 32 p.i. Recombinant IL-10 suppressed IFN-γ-induced nitric oxide and TNF-α secretion, but not lipopolysaccharide-induced nitric oxide secretion in cultures of peripheral blood mononuclear cells and monocytes of uninfected cattle. These results suggest that the nitric oxide response of monocytes to IFN-γ, but not lipopolysaccharide, is suppressed during infection. The kinetics of the upregulation of IL-10 and its biological activity indicate a possible association with the depression of nitric oxide production and control of TNF-α.

(d) TREATMENT

[See also **22**: nos. 10828, 10908.]

10890 **Geerts, S., Brandt, J.R.A. and Deken, R. de, 1999.** Laboratory and field evaluation of biodegradable polyesters for sustained release of isometamidium and ethidium – Minireview. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 211-214.

Geerts: Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium. [sgeerts@itg.be]

An overview is presented of the results obtained with biodegradable sustained release devices (SRDs) containing a mixture of polymers and either isometamidium (ISMM) or ethidium. Under controlled laboratory conditions (monthly challenge with tsetse flies infected with *Trypanosoma congolense*) the protection period in SRD treated cattle could be extended by a factor of 2.8 (for ethidium) up to 4.2 (for ISMM) as compared to animals treated intramuscularly with the same drugs. Using a competitive drug ELISA, ISMM concentrations were detected up to 330 days after the implantation of the SRDs, whereas after i.m. injection the drug was no longer present 3-4 months post treatment. Two field trials carried out in Mali under heavy tsetse challenge showed that the cumulative infection rate was significantly lower in the ISMM-SRD implanted cattle than in those which received ISMM i.m. Using the ethidium SRD, however, contradictory results were obtained in field trials in Zambia and Mali. The potential advantages and inconveniences of the use of SRDs are discussed and suggestions made to further improve the currently available devices.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

[See also **22**: no. 10918.]

10891 **Ezebuiro, O.G.C., Agbenga, J.N. and Mshelia, J.L., 1995.** Comparison of parasitological techniques for diagnosis of *Trypanosoma brucei brucei* in albino rats. (Meeting abstract no. 17.) *Nigerian Society for Parasitology Abstracts*, **1995**: 12.

Ezebuiro: Pathology, Epidemiology and Statistics Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **22**: nos. 10913, 10942, 10953.]

10892 **Dede, P.M., Nock, I.H., Onah, J.A. and Omoogun, G.A., 1998.** Transmission of *Trypanosoma brucei brucei* in mice, rats and dogs through oral ingestion of infected blood and/or carcass. (Meeting abstract no. 64.) *Nigerian Society for Parasitology Abstracts*, **1998**: 63.

Dede: Entomology/Parasitology Division, NITR, P.M.B. 03, Vom, Plateau State, Nigeria.

10893 **Dowu, B.T. and Okaka, C.E., 1995.** The pathogenicity of experimental *Trypanosoma brucei brucei* infection in the rabbit. (Meeting abstract no. 69.) *Nigerian Society for Parasitology Abstracts*, **1995**: 42.

Dowu: Pathology, Epidemiology and Statistics Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

10894 **Ezebuiro, O.G.C., Abenga, J.N. and Sanda, S.A., 1997.** Bone marrow responses in experimental single and mixed infections of *Trypanosoma congolense* and *Trypanosoma brucei brucei*. [Rats.] (Meeting abstract no. 46.) *Nigerian Society for Parasitology Abstracts*, **1997**: 52.

NITR, P.M.B. 2077, Kaduna, Nigeria.

10895 **Ezebuiro, O.G.C., Sanda, S.A. and Abenga, J.N., 1996.** The effect of mixed infections of *Trypanosoma congolense* and *T. brucei brucei* on the course of anaemia in experimental trypanosomiasis. [Rats.] (Meeting abstracts nos. 22 and 51.) *Nigerian Society for Parasitology Abstracts*, **1996**: 20 and 50.

NITR, P.M.B. 2077, Kaduna, Nigeria.

10896 **Ezeonu, F.C. and Udedi, S.C., 1994.** Blood sugar and serum protein profile of albino Wistar rats infected with *Trypanosoma brucei*. (Meeting abstract no. 43.) *Nigerian Society for Parasitology Abstracts*, **1994**: 40.

Department of Applied Biochemistry, Namdi Azikiwe University, Awka, Nigeria.

10897 **Hertz, C.J., Filutowicz, H. and Mansfield, J.M., 1998.** Resistance to the African trypanosomes is IFN-γ dependent. [*T. b. rhodesiense*; mice.] *Journal of Immunology*, **161** (12): 6775-6783.

Mansfield: Department of Bacteriology, University of Wisconsin, Madison, WI 53706, USA.

10898 **Idowu, B.T. and Okaka, C.E., 1998.** Haematological responses in rabbits infected with *T. brucei brucei*. (Meeting abstract no. 45.) *Nigerian Society for Parasitology Abstracts*, **1998**: 42.

Idowu: Pathology, Epidemiology and Statistics Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

10899 **Igbokwe, I.O., Shamaki, L.S., Hamza, H. and Gidado, A., 1999.** Fasting hyperglycaemia with oral glucose tolerance in acute *Trypanosoma congolense* infection of rats. *Veterinary Parasitology*, **81** (2): 167-171.

Igbokwe: Department of Veterinary Pathology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Nigeria.

10900 **Nakamura, Y., 1998.** Alterations of serum lipid, lipoprotein and inflammatory cytokine profiles of rabbits infected with *Trypanosoma brucei brucei*. *Veterinary Parasitology*, **80** (2): 117-125.

National Institute of Animal Health, Shichinohe, Aomori 039-2586, Japan. [yoshion@niah.affrc.go.jp]

10901 **Onoja, O., Chukwuekezie, J.O., Uzoigwe, R. and Ogedengbe, J.D., 1997.** Suppression of immunological response to *Brucella abortus* (S19) vaccine by *Trypanosoma brucei brucei*. [Rats.] (Meeting abstract no. 47.) *Nigerian Society for Parasitology Abstracts*, **1997**: 52.

Onoja: Parasitology Division, National Veterinary Research Institute, Vom, Nigeria.

10902 **Sanda, S.A. and Ameh, D.A., 1995.** Parasitaemia, anaemia and serum free fatty acid levels in single and mixed *T. b. brucei* and *T. congolense* infection of rabbits. (Meeting abstract no. 75.) *Nigerian Society for Parasitology Abstracts*, **1995**: 46.

Sanda: Pathology, Epidemiology and Statistics Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

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Tabel: Department of Veterinary Microbiology, Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, SK S7N 5B4, Canada.

(c) CHEMOTHERAPEUTICS

[See also **22**: nos. 10921, 10927, 10944.]

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Bacchi: Haskins Laboratories, Pace University, 41 Park Row, New York, NY 10038-1598, USA. [cbacchi@fsmail.pace.edu]

10907 **Bonay, P., Durán-Chica, I., Fresno, M., Alarcón, B. and Alcina, A., 1998.** Antiparasitic effects of the intra-Golgi transport inhibitor megalomicin. [Incl. *T. brucei*.] *Antimicrobial Agents and Chemotherapy*, **42** (10): 2668-2673.

Alcina: Calle Ventanilla 11, 18001 Granada, Spain. [Pulgoso@IPB.CSIC.ES]

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Clausen: Institute for Parasitology and Tropical Veterinary Medicine, Freie Universität Berlin, Königsweg 67, D-14163 Berlin, Germany. [tropvetm@komma.zedat.fu-berlin.de]

Blood was collected from two Sahelian goats, experimentally infected with either a drug-sensitive cloned population of *T. congolense* (IL 1180) or a multiple drug-resistant *T. congolense* stock (Samorogouan/89/CRTA/267) and incubated at 37°C for 30 min and 12 h, respectively, in the presence of different drug concentrations (0.5, 1.0, 10.0 and 100.0 µg/ml blood) of diminazene aceturate or isometamidium chloride. The trypanosome/blood/ drug suspensions were then offered to tsetse flies (2100 teneral *Glossina morsitans submorsitans*) through an *in vitro* feeding system, using a silicone membrane. All tsetse flies were dissected and examined for the presence of trypanosomes in labrum, hypopharynx and midgut 20 days after their infective blood meals. Infectivity of the drug-sensitive cloned population was already completely abolished after incubation with 0.5 µg/ml of both drugs; however, 13.6-42.2% of tsetse which had been fed on untreated blood had developed an infection. In contrast, no significant differences were observed in the infection rates between the experimental groups and their control groups when fed on blood infected with the multiple drug-resistant stock after incubation for 30

min with up to 10 µg/ml of diminazene or isometamidium. Tsetse thus appear to be a useful tool in the assessment of drug susceptibility of typanosome populations.

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Department of Zoology, University of Jos, Jos, Nigeria.

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Sulyman: Entomology/Parasitology Division, NITR, P.M.B. 2077, Kaduna, Nigeria.

8. TRYPANOSOME RESEARCH

(a) CULTIVATION OF TRYPANOSOMES

10915 **Okenu, D.M.N. and Opara, K.N., 1994.** An *in vitro* technique for the maintenance of the integrity of African trypanosomes. [*T. brucei*.] (Meeting abstract no. 38.) *Nigerian Society for Parasitology Abstracts*, **1994**: 37.

Okenu: Division of Biochemistry, Nigerian Institute of Medical Research, P.M.B. 2013, Yaba, Lagos, Nigeria.

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

10916 **Brun, R., Hecker, H. and Lun, Z.-R., 1998.** *Trypanosoma evansi* and *T. equiperdum*: distribution, biology, treatment and phylogenetic relationship (a review). *Veterinary Parasitology*, **79** (2): 95-107.

Brun: Swiss Tropical Institute, Socinstrasse 57, CH-4002 Basel, Switzerland. [brun@ubaclu.unibas.ch]

This review compares *T. evansi* and *T. equiperdum* with regard to their morphology and ultrastructure, susceptibility of their mammalian hosts, route of transmission, pathogenicity, diagnosis and treatment, *in vitro* cultivation, and biochemical and molecular characteristics. Electron microscopic investigation revealed no ultrastructural differences between the two species except that there were more coated vesicles in the flagellar pocket of *T. equiperdum*. Many biological, biochemical and molecular similarities between *T. evansi* and *T. equiperdum* were seen. The most prominent differences between the two species are the presence of kDNA maxicircles in *T. equiperdum*, which are missing in *T. evansi*, and the route of transmission, *T. evansi* being transmitted by biting flies, *T. equiperdum* being transmitted from one equine host to another during copulation. The phylogenetic relationship between the two species and *T. b. brucei* is discussed, and the hypothesis is proposed that *T. evansi* arose from a clone of *T. equiperdum* which lost its maxicircles.

10917 **Stevens, J. and Gibson, W., 1999.** The evolution of Salivarian trypanosomes. *Memórias do Instituto Oswaldo Cruz*, **94** (2): 225-226 (discussion and comments 226-228).

Stevens: Hatherly Laboratories, Department of Biological Sciences, University of Exeter, Prince of Wales Road, Exeter EX4 4PS, UK. [j.r.stevens@exeter.ac.uk]

Phylogenetic analysis of published ribosomal RNA 18S sequences, supplemented with data from the authors' own studies, was undertaken, the aim being to re-examine the

evolutionary relationships of Salivarian trypanosomes of mammals and other vertebrates. The analysis confirmed the monophyly of African Salivarian trypanosomes and indicated that the various types of *Trypanosoma congolense* share a common ancestry. It also indicated a close evolutionary relationship between *T. rangeli* and *T. cruzi* (*Schizotrypanum*) and confirmed the non-Salivarian status of *T. grayi*. (Short contributions from H. Momen, D. Maslov, S. Brisse, J. Shaw and E. Grisard follow the paper.)

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Campbell: Department of Microbiology and Immunology, University of California School of Medicine, Los Angeles, CA 90095, USA.

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

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Tielens: Laboratory of Veterinary Biochemistry, University of Utrecht, P.O. Box 80176, NL-3508 TD Utrecht, Netherlands.

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Matthews: University of Manchester, 2.205 Stopford Building, Oxford Road, Manchester M13 9PT, UK.

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Wang: Department of Pharmaceutical Chemistry, University of California, 513 Parnassus Avenue, San Francisco, CA 94143-0446, USA. [ccwang@cgl.ucsf.edu]

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