year **2009**
volume **32**
part **1**

PAAT

Programme Against African Trypanosomiasis

ISSN 1812-2442

TSETSE AND TRYPANOSOMIASIS INFORMATION

DFID
Department for International Development

INSTITUTE OF TROPICAL MEDICINE ANTWERP

CIRAD

FAO FIAT PANIS

year **2009**

volume **32**

part **1**

PAAT
Programme
Against
African
Trypanosomiasis

TSETSE AND TRYPANOSOMIASIS INFORMATION

Numbers 14801–14960

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2009

ISBN 978-92-5-106373-6

TSETSE AND TRYPANOSOMIASIS INFORMATION

The Tsetse and Trypanosomiasis Information periodical has been established to disseminate current information on all aspects of tsetse and trypanosomiasis research and control to institutions and individuals involved in the problems of African trypanosomiasis. This service forms an integral part of the Programme Against African Trypanosomiasis (PAAT) and is jointly sponsored by the Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the Inter-African Bureau for Animal Resources of the African Union (AU-IBAR), the World Health Organization (WHO), the Research Department for Livestock Production and Veterinary Medicine of the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD-EMVT), the British Government's Department for International Development (DFID) and the Institute of Tropical Medicine (ITM), Antwerp.

The half-yearly periodical is prepared for publication, in both English and French editions, by the Food and Agriculture Organization of the United Nations. Each annual volume consists of two parts and an index. Subscription is free for all recipients engaged in trypanosomiasis research and control, and requests for enrolment may be sent to: Ms. Maria Grazia Solari, AGAH, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy (fax +39 06 5705 5749; e-mail MariaGrazia.Solari@fao.org).

Since the value of this information service depends to a great extent on the receipt of relevant material from research workers, campaign planners and organizers and field workers themselves, readers are requested to submit news items and copies of scientific papers and reports to the Editor: Dr James Dargie, Brunnstubengasse 43, 2102 Bisamberg, Austria (tel. +43 2262 61735; e-mail j.dargie@aon.at).

We regret that we are unable to supply photocopies of the papers quoted in the periodical.

Distribution dates and copy deadlines

	Copy deadline for news items	Distribution (English and French editions)
Part 1	15 April	July/August
Part 2	15 October	January/February

The Index will be distributed as soon as possible after the completion of each volume.

ABBREVIATIONS USED IN *TTI*

AAT	animal African trypanosomiasis
a.i.	active ingredient
ACTH	adrenocorticotrophic hormone
ALAT	alanine aminotransaminase
ARI	advanced research institute
ASAT	aspartic acid aminotransaminase
AW-IPM	area-wide insect pest management
b.w.	body weight
BIIT	blood incubation infectivity test
CATT	card agglutination test for trypanosomiasis
CD_{50}	median curative dose
CNS	central nervous system
CSF	cerebrospinal fluid
DNA	deoxyribonucleic acid
ELISA	enzyme linked immunosorbent assay
HAT	human African trypanosomiasis
HCT	haematocrit centrifugation technique
GIS	geographic information system(s)
GPS	global positioning system(s)
IPM	integrated pest management
IPVM	integrated pest and vector management
i.m.	intramuscular(ly)
i.p.	intraperitoneal(ly)
i.v.	intravenous(ly)
IFAT	indirect fluorescent antibody test
KIVI	kit for *in vitro* isolation of trypanosomes
LC	land cover
LCCS	land cover classification system
LC_{50}	median lethal concentration
LD_{50}	median lethal dose
LPI	livestock policy initiative
M	molar
mAEC	miniature anion-exchange centrifugation technique
MoAb	monoclonal antibody
MDGs	millennium development goals
MoU	memorandum of understanding
MW	molecular weight
NARS	National Agricultural Research Services/Systems
NGO	non-governmental organization
PAAT-IS	programme against animal trypanosomiasis-information system
PAG	PAAT Advisory Group Coordinators
PCMU	project coordination and management unit
PCR	polymerase chain reaction
PCV	packed cell volume
p.i.	post-infection
ppb	parts per billion (10^9)
PPLPI	pro-poor livestock policy initiative
ppm	parts per million
r.h.	relative humidity
RNA	ribonucleic acid
SARD	sustainable agricultural and rural development
SAT	sequential aerosol technique
SIT	sterile insect technique
sp(p).	species (plural)
ssp(p).	subspecies (plural)
STEP	Southern Tsetse Eradication Project
TC	technical cooperation
T&T	tsetse and trypanosomiasis
TPU	tsetse production unit
TTI	tsetse and trypanosomiasis information bulletin
UV	ultra-violet
VAT	variable antigen type
VSG	variant surface glycoprotein
WBC	white blood cell
WMS	web mapping service

Organizations

AfDB	African Development Bank
ANDE	Agence Nationale de Développement de l'Elevage
AU	African Union
AU/STRC	African Union/Scientific, Technical and Research Commission
BICOT	Biological Control of Tsetse by the Sterile Insect Technique
BMZ	German Federal Ministry for Economic Cooperation and Development
CEBV	Communauté Economique du Bétail et de la Viande
CEMV	Centre Universitaire de Formation en Entomologie Médicale et Vétérinaire

CGIAR	Consultative Group on International Agricultural Research
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CIRAD-EMVT	Département d'Elevage et de Médecine Vétérinaire des Pays Tropicaux du CIRAD
CIRDES	Centre International de Recherche-Développement sur l'Elevage en Zone Subhumide
CNERV	Centre National d'Elevage et de Recherches Vétérinaires
CNRS	Centre National de Recherche Scientifique
COCTU	Coordinating office for control of trypanosomiasis in Uganda
CREAT	Centre de Recherche et d'Elevage, Avétonou, Togo
CRSSA	Centre de Recherches du Service de Santé des Armées Emile Pardé
CTVM	Centre for Tropical Veterinary Medicine
DFID	Department for International Development (UK)
DSE	German Foundation for International Development
EC/EU	European Community/European Union
EDF	European Development Fund
ESTA	Ethiopian Science and Technology Agency
FAO	Food and Agriculture Organization of the United Nations
FIND	Foundation for Innovative New Diagnostics
FITCA	Farming in Tsetse Control Areas of Eastern Africa
GFAR	Global Forum on Agricultural Research
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IAEA	International Atomic Energy Agency
IBAR	Interafrican Bureau for Animal Resources
ICCT	Institute for the Control of Trypanosomiasis
ICIPE	International Centre of Insect Physiology and Ecology
ICPTV	Integrated Control of Pathogenic Trypanosomes and their Vectors
IFAD	International Fund for Agricultural Development
IFAH	International Federation for Animal Health
IGAD	Inter-Governmental Authority on Development
ILRI	International Livestock Research Institute
INRA	Institut National de Recherche Agronomique
IPR	Institut Pierre Richet
IRD	Institut de Recherche et de Développement (formerly ORSTOM)
ISCTRC	International Scientific Council for Trypanosomiasis Research and Control
ISRA	Institut Sénégalais de Recherches Agricoles
ITC	International Trypanotolerance Centre
ITM	Institute of Tropical Medicine
KARI-TRC	Kenya Agricultural Research Institute - Trypanosomiasis Research Centre
KETRI	Kenya Trypanosomiasis Research Institute
LCV	Laboratoire Central Vétérinaire
LNERV	Laboratoire National de l'Elevage et de Recherches Vétérinaires
LRE	Laboratoire Régional de L'Elevage
LSHTM	London School of Hygiene and Tropical Medicine
MRC	Medical Research Council
MRU	Mano River Union
NITR	Nigerian Institute for Trypanosomiasis Research
NRI	Natural Resources Institute
OCCGE	Organisation de Coopération et de Coordination pour la Lutte contre les Grande Endémies

OCEAC	Organisation de Coordination pour la Lutte contre les Endémies en Afrique Centrale
OGAPROV	Office Gabonais pour l'Amélioration de la Production de la Viande
OIE	Office International des Epizooties
OMVG	Organisation pour la Mise en Valeur du Fleuve Gambie
PAAT	Programme against African Trypanosomiasis
PATTEC	Pan-African Tsetse and Trypanosomiasis Eradication Campaign
PRCT	Projet de Recherches Cliniques sur la Trypanosomiase
PROCORDEL	Programme de Recherche et Développement
RDI	Rural Development International
RUCA	Rijksuniversitair Centrum Antwerpen
SADC	Southern African Development Community
SIDA	Swedish International Development Authority
SODEPRA	Société pour le Développement des Productions Animales
TDR	UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases
TDRC	Tropical Diseases Research Centre
TPRI	Tropical Pesticides Research Institute
TTRI	Tsetse and Trypanosomiasis Research Institute
UCLT	Unité Centrale de Lutte contre la Trypanosomiase
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UNTFHS	United Nations Trust Fund for Human Security
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UTCC	Uganda Trypanosomiasis Control Council
UTRO	Uganda Trypanosomiasis Research Organisation
WHO	World Health Organization

CONTENTS

SECTION A – NEWS

PROGRAMME AGAINST AFRICAN TRYPANOSOMIASIS: REPORT OF THE 12TH MEETING OF THE PROGRAMME COMMITTEE

Foreword

The twelfth meeting of the Programme against African Trypanosomiasis (PAAT) Programme Committee (PC) was convened at Prince Leopold Institute of Tropical Medicine (ITM), Antwerp, Belgium, 8-9 May 2008. The meeting focused on (i) achievements of PAAT mandated organizations (i.e. Food and Agriculture Organization of the United Nations (FAO), African Union / Inter-African Bureau for Animal Resources of the Organization for African Unity (AU-IBAR), International Atomic Energy Agency of the United Nations (IAEA), World Health Organization of the United Nations (WHO) and AU - Pan-African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC), (ii) implementation of the African Development Bank (AfDB)-PATTEC supported tsetse and trypanosomiasis (T&T) interventions in six sub-Saharan countries (Burkina Faso, Ghana, Mali in West Africa and Ethiopia, Kenya, Uganda in East Africa).

Mr Raffaele Mattioli, convenor of the meeting, introduced Mr Stanny Geerts who, on behalf of the director of ITM, Mr Bruno Gryseels, welcomed the participants to Antwerp and opened the meeting. Mr A.A. Ilemobade, PAAT Chairperson, joined Mr Geerts to welcome the participants. Mr Ilemobade mentioned the main issues of the meeting, including the progress of the ongoing AfDB-supported projects against T&T, the PAAT Information System (PAAT-IS) and the issue of networking, the new developments and challenges ahead for the International Trypanotolerance Centre (ITC) in The Gambia and the role of PAAT in the context of food security.

On this last subject, the PAAT Chairperson stressed the concern that surrounds the issue of food security throughout the world today. Various causes including climate change have brought rising food costs and food shortages in many countries, especially poor African countries, thus aggravating the poverty situation. The presence of T&T has been a long-standing cause of food insecurity, which African Heads of State and Governments acknowledged in their resolution of 2001. With climate change, the situation is becoming increasingly grave. It is the goal of PAAT and of all PAAT stakeholders to ensure that this is minimized by sensible and concerted action. Mr Ilemobade finally emphasized how efforts are being made to maximize the impact of PAAT activities on the Millennium Development Goals (MDGs).

Apologies were received from Ms. Pamela Olet from Kenya and Mr Charles Mahama from Ghana who could not attend the meeting.

The meeting was chaired by Mr A.A. Ilemobade. FAO provided secretarial assistance. Representatives of the private sector were present in order to facilitate solution of issues related to field operations.

Minutes of the previous meeting

The report and recommendations of the 11th PAAT-PC meeting were taken as read and, after further deliberation, adopted.

Outcomes of the 12th PAAT-PC Meeting

Representatives of FAO, IAEA, WHO and AU-IBAR reported on progress, priorities and planned activities.

FAO/PAAT – R.C. Mattioli

FAO/PAAT activities and progress in the implementation of recommendations since the 11th PAAT-PC meeting were presented.

As regards coordination of the AfDB-funded projects, FAO/PAAT participated in the "Regional meeting of National Coordinators", convened by IAEA, July 2007. The meeting acknowledged the role of PAAT and its Information System (PAAT-IS) in creating, harmonizing and sharing technical and scientific knowledge within the community of people concerned with T&T. More details on the latest developments of the PAAT-IS are given below.

FAO/PAAT announced the signing of a Memorandum of Understanding (MoU) between FAO and the International Federation for Animal Health (IFAH) on Quality Control/Quality Assurance (QC/QA) of trypanocides. FAO committed itself to enlarge the MoU to anthelmintics, antibiotics, insecticides and acaricides. FAO approached the World Organization for Animal Health (OIE) and the Union Economique et Monétaire Ouest Africaine (UEMOA) to stimulate interest in this FAO-IFAH initiative and partnership.

In the field of capacity building, training has been provided to staff of the Southern Rift Valley Tsetse Eradication Project in Ethiopia (STEP) within the framework of the Ethiopian Government IAEA/FAO joint project GCP/ETH/072/UNJ (funded by the United Nations Trust Fund for Human Security (UNTFHS)/Japanese Government). Furthermore, in March 2008 experts met at the Joint FAO/IAEA Division to elaborate a detailed programme for a Geographic Information Systems (GIS) training course for tsetse control personnel. The foreseen period to hold the course is the first quarter of 2009. Lastly, the FAO/IAEA Joint Division continues to provide regular training in tsetse mass rearing and matters related to the Sterile Insect Technique (SIT).

Progress report from AU-IBAR – Ahmed el Sawalhy

Mr Ahmed el Sawalhy reminded participants of the mandate of the AU-IBAR, whose activities focus on the component of animal resources with a view towards freeing Africa from hunger and poverty by 2015. The International Scientific Council for Trypanosomiasis Research and Control (ISCTRC) is IBAR's statutory organ that focuses on African trypanosomiasis. IBAR's representative reported on the outcomes of the 32nd Executive Committee and the 29th Conference of ISCTRC that were held in Angola, Luanda, on 30 September and 1-5 October respectively. 105 papers were accepted and included in the

programme of the conference, which was attended by over 200 participants coming from 27 out of 37 T&T affected countries, as well as from non-African countries. Fifteen international institutions were also represented.

The Executive Committee appointed six new regional country members and included one representative of the AfDB for the first time. The main issues discussed were the institutionalization and legal status of ISCTRC, implementation of a consultancy report on the strengthening of the Council and the possibility of raising funds from membership and sponsorship of the private sector.

The Committee also resolved to address the difficulties faced by ITC in the Gambia by strengthening it as a regional institution. Proposed future activities of the ISCTRC Secretariat include (i) announcement of the date of the 33rd Executive Committee meeting to be held immediately after the PAAT- PAG meeting, (ii) promotion of events for the 60th anniversary of ISCTRC to be held in Addis Ababa in 2009, (iii) re-introduction of training of middle level manpower for T&T control, (iv) initiation of a workshop for research institutions and field workers to review current control tools and identify gaps in knowledge, and (v) development of a medium and long term strategic plan for ISCTRC following the review by the PAAT Chairperson.

Progress report from IAEA – U. Feldmann

The Agency contributes to international efforts against T&T with three major mechanisms: (i) assistance to "normative" activities, (ii) research and methods development; and (iii) technical cooperation. Guidelines aimed at standardizing and harmonizing methodologies and procedures were presented. (i) standard operating procedures for mass-rearing of tsetse flies, (ii) FAO/IAEA guidelines for the collection of entomological baseline data for tsetse area-wide integrated pest management (AW-IPM), (iii) guidelines to assessing the feasibility of creating T&T-free zones, and (iv) guidelines for declaring areas free of tsetse flies and tsetse-transmitted animal trypanosomiasis.

In-house research is carried out at the FAO/IAEA Laboratory in Seibersdorf, focusing on (i) automated sexing of late-stage tsetse pupae (near infra-red scanning), (ii) alternatives to use of gamma rays for blood diet decontamination (UV irradiation), (iii) alternatives to the use of gamma irradiation for reproductive sterilization of male tsetse for use in SIT operations (a prototype X-ray machine is under testing to develop standards), and (iv) semi-automated holding and feeding of tsetse during mass production. Research is also carried out through Coordinated Research Projects (CRPs). Three CRPs relevant to the T&T problem are currently in progress: (i) improved and harmonized quality control for expanded tsetse production, sterilization and field application, (ii) improving SIT for tsetse flies though research on their symbionts and pathogens, and (iii) applying GIS and population genetics for managing livestock insect pests.

At present, the Joint FAO/IAEA Division is active in one regional Technical Cooperation Project (TCP) and 7 national TCPs, namely in Ethiopia, Botswana, Burkina Faso, Kenya, Mali, Senegal, South Africa, Uganda, United Republic of Tanzania. Within

these TCPs, FAO/IAEA focuses on the SIT package and strictly adheres to a phased, conditional approach.

Progress report from WHO – P. Simarro

WHO reported on human African trypanosomiasis (HAT) surveillance and control programmes. WHO provides support to affected countries in relation to diagnosis and treatment, logistic support and capacity building. In 2007, 260 staff were trained on diagnosis and treatment; over 2 million Card Agglutination Test for Trypanosomiasis (CATT) reagents and accessories were distributed in collaboration with ITM, as well as 2 000 m-AECT tests (mini-anion-exchange centrifugation technique) for diagnosis. Approximately 100 000 vials of drugs for treatment were distributed from warehouses to patients. Fourteen countries received support for outreach activities. WHO stressed that the number of new cases of HAT reported has continued to decrease also in the last years, reaching the lower value of the last ten years.

In collaboration with other partners, WHO has set up a project to clarify the status of trypanosomiasis in Swaziland. HAT is listed in WHO records to be endemic in Swaziland but no cases have been reported for decades. Preliminary results show that the entomological data collection has detected *Glossina austeni* in the Northern East part of the country near the Mozambique border.

In collaboration with the AfDB-funded project in Ghana, WHO carried out an HAT survey in the Upper West Region. Within this project 32 health staff were trained, including clinicians and laboratory technicians. Technical assistance was provided by two HAT experts, and logistic support has been given through the provision of diagnostic reagents, equipment, vehicles, fuel, etc. Forty villages were studied and over 10 000 people tested. No cases were detected.

In the framework of PAAT, WHO and FAO are also active in the mapping of HAT. Field data collated by WHO from HAT national control programmes, Non-Governmental Organizations (NGOs) and historical files are being harmonized and entered in a geographical database with a view to updating disease distribution maps, and estimating populations at risk and burden of the disease. More information on this activity is given below.

Developments of the PAAT Information System – G. Cecchi

Activities, studies and publications of the PAAT-IS were presented by Mr Cecchi. The new PAAT-IS structure and functionalities were developed with the support of the International Fund for Agricultural Development (IFAD) and they were presented to the international community concerned with T&T at the 29th Meeting of ISCTRC that was held in Angola. The communication given at the meeting resulted in a paper entitled “Creating, harmonizing and sharing the information: the role of the PAAT and its IS”, that will be published in the meeting’s proceedings.

A study on the relationship between vegetation and tsetse fly at different spatial scales is to be published shortly in the PAAT Technical and Scientific (T&S) Series with the title "Standardizing land cover mapping for tsetse and trypanosomiasis decision making". The main outcomes of this study are also described in the paper "Land cover and tsetse fly distributions in sub-Saharan Africa" that has been accepted for publication by Medical and Veterinary Entomology. Standardization and sharing of geographical data and metadata that is carried out within PAAT-IS are described in "The role of FAO GeoNetwork in a multinational development programme: the case of the PAAT"', that has been published by the journal of the Open Source Geospatial foundation (OSGeo).

A new issue of the PAAT T&S Series will be devoted to geospatial analysis. The paper, tentatively entitled "GIS datasets and methods for an environmental approach to African trypanosomiasis" will include a review of state-of-the-art geospatial datasets that are available in the public domain, as well as a few case studies. This publication aims at promoting the use of GIS datasets and techniques for improved decision making. PAAT-IS is also contributing to the joint Livestock Policy Initiative (LPI)/PAAT study "Mapping the benefits of tsetse and trypanosomiasis removal in the IGAD region". In particular, PAAT-IS is assembling a map of livestock oriented production systems (LPS) in the IGAD region by means of the livelihood data generated in the framework of the Household Economy Approach. More information on this activity is given below.

Mr. Cecchi and Mr. Paone jointly presented rationale, methodology and preliminary results of the WHO/FAO collaboration to map the distribution of human African trypanosomiasis in sub-Saharan Africa. Over the last ten years WHO has collated a large amount of spatially-explicit epidemiological data, whose accuracy enables envisaging the production of a harmonized, unified database (DB) of human trypanosomiasis in sub-Saharan Africa. This DB will also form the basis for the Atlas of HAT. The methodology for geo-referencing HAT data takes advantage of public domain databases of named locations, which are combined with epidemiological reports to pin down the exact position of survey villages. If available in the reports, 5 coordinates acquired with GPS (Global Positioning System) devices are checked and imported in the database.

So far, approximately 23 000 HAT cases have been analyzed and entered in the database. Cases refer to 4 200 different geographical entities, out of which approximately 3 000 have been geo-positioned at village level. Data that have been analyzed so far come from ten countries (Angola, Cameroon, Central Africa Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Sudan and Uganda) and span from 1985 to 2007.

The DB of HAT will greatly enhance our knowledge of the global distribution of HAT, as well as allowing the updating of previous estimates of population at risk and burden of the disease. It will also provide crucial information to better target interventions with a view to eliminating HAT as a public health problem.

Progress report of the IGAD/LPI-PAAT study: mapping the benefits of tsetse and trypanosomiasis in the Eastern African region – A. Shaw

The purpose of the IGAD LPI is to strengthen the capacity in IGAD countries (Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Sudan, and Uganda), and other regional organizations and stakeholders to formulate and implement livestock sector and related policies that sustainably reduce food insecurity and poverty. The present study draws on a concept developed and tested for West Africa and it provides a GIS-based tool for decision-making and prioritization in T&T control. By means of financial maps this tool adds an economic dimension to GIS-assisted decision making. The model is based on (i) a cattle production systems map, (ii) a 20-year herd and output projection, and (iii) cattle spatial expansion and/or modifications of production systems. The main model output is a map of financial benefits over 20 years.

At the present stage, considerable progress has been made in defining and mapping LPS. Valuable information concerning the spatial distribution of pastoral, agropastoral and mixed-farming systems in the IGAD region has been collected by different institutions in the framework of the Household Economy Approach. Livelihood maps are available at country-level for Djibouti, Kenya, Somalia and Uganda, as well as for some regions of Eritrea, Ethiopia and Sudan.

Harmonization of these datasets will ultimately result in a regional map of LPS, which will also include information on the use of oxen, commercial and semi-commercial dairying and ranching. This product will be matched against independent maps of production systems which are based on climate and other environmental datasets with a view to gaining insight into the relationship between livelihood options and environmental factors. The next steps in this study will concentrate on (i) completing the map of LPS and the remaining baseline herd models, (ii) investigating the extent to which cattle production systems would change in the future (e.g. through movements into new areas, intensification, etc.), (iii) combining cattle population, LPS and tsetse maps, (iv) calculating losses per head of cattle over 20 years in each production system, and (v) producing the financial maps.

Presentation of the questionnaire "Regional Designated Centres for Training relevant to addressing the T&T Problem" – U. Feldmann

Regional Designated Centres (RDC) should meet the needs for training relevant to addressing the T&T problem by making optimal use of the limited resources, avoiding duplication and assuring quality and sustainability. The African Regional Co-operative Agreement for Research, Development and Training related to nuclear science and technology (AFRA) established guidelines for identification and impartial review of candidate RDCs. As concerns the problem of training on T&T, a questionnaire aiming at identifying a limited number of RDCs and at generating information for assessing candidate centres was developed. Nine topics are proposed in the questionnaire: project management, epidemiology of livestock diseases, diagnosis of livestock diseases, T&T control, tsetse mass rearing, agricultural and livestock socio-economics, natural resources management, remote sensing and GIS, HAT diagnosis, epidemiology and control.

Assessment of questionnaires and candidate institutions will be based on the objectives of the training programme offered, detailed curriculum, deployment of human

resources, institutional infrastructure and its internal quality assurance system. Feedback to the questionnaire was obtained from FAO and WHO. AU-PATTEC was informed about the initiative.

The next phase of this activity will include: submission of applications to the National Coordinator of AFRA and subsequent transmission to IAEA, technical assessment of applications by a technical working group, pre-selection of RDCs, auditing of pre-selected RDCs and nomination of RDCs, appointment of RDCs. The process is scheduled to be completed by September 2008.

Flowchart on Guidelines for assessing the feasibility of creating tsetse and trypanosomiasis-free zones – U. Feldmann

The T&T problem is complex and the decision about intervening or not intervening on the problem has a broad range of implications for various sectors. Planners, decision makers and implementers are charged with high responsibilities that embrace politics, finance, public health, livestock and agricultural rural development, and sustainability of natural resources. The proposed Guidelines try to provide assistance to address all relevant components, avoid setbacks, decide responsibly on use of resources and generate a basis for approaching donors.

The Guidelines are based on the phased, conditional approach, which is reflected in the flowchart by five different levels of activity: (i) policy and strategy development, long-term commitment, management structures, (ii) baseline data collection, (iii) technical feasibility assessment, (iv) capacity building and pre-operational work, and (v) operational implementation of AW-IPM measures to create a T&T free zone.

Ethiopia: Review and assessment of AfDB funded project: status of implementation in relation to the proposed "phased feasibility flowchart" – T. Alemu

The report concentrated on the status of the STEP project, for which the AfDB loan and grant are complementary to ongoing efforts. The project area meets the 7 criteria for technical feasibility set by PAAT, especially with regard to the area's high agricultural potential and the presence of important natural barriers to reinvasion. AT is by far the most important problem for Ethiopia, but HAT surveillance should be encouraged particularly in the border areas with the Sudan. Within the project area expanded and intensified mixed farming are possible, especially provided that draft oxen be available. The AfDB and UNTFHS funding will allow further support for the land use and land tenure component of the project, especially in the present context of evolving practices. Since the inception of STEP the Ethiopian government was committed to integrate SIT with the support of IAEA. A thorough needs assessment was made to integrate SIT for tsetse eradication. Capacity building was undertaken and infrastructure was developed. A modern insectary was established and the new facility is now ready for mass rearing, as the colony performance has been stable since last year.

Issues that currently deserve attention are the delay in finalizing the feasibility study for the possible use of the Sequential Aerosol Technique (SAT), problems arising with operations in the NechSar National Park, lack of professional and support staff in critical areas, lack of standard insectary operating procedures, enforcement of strict bio-security to

avoid unwanted circumstances on the fly performance and irradiation source. Future plans include continuing tsetse suppression in agreement with AW-IPM concept, enhancing the tsetse colony build-up and mass rearing, starting the baseline data collection in the remaining blocks, enhancing the monitoring, data analysis and reporting.

Uganda: Review and assessment of AfDB funded project on status implementation in relation to the proposed "phased feasibility flow chart" – L. Semakula

Uganda is presently implementing the feasibility phase for the project "Creation of sustainable tsetse and trypanosomiasis free areas in East and West Africa -Uganda component". The ongoing feasibility phase includes the baseline data collection (entomological, parasitological, socio-economic, and environmental), refurbishment and equipping of the tsetse mass rearing facility at Tororo, the establishment of a tsetse seed colony and training of technical staff. Awareness on programme activities is being created through workshops. In addition, the National Steering Committee and the Parliamentary Committee on agriculture have been sensitized on the T&T subject.

A national team was formed to carry out the feasibility assessment; a team of 20 entomologists has been identified to work with the consulting firm which will undertake the baseline data collection. GIS, satellite imagery and tsetse prediction maps are being used to assess the isolation of the target tsetse population and for demarcation of intervention zones. 46 sites for tsetse population genetic studies have been identified with the assistance of IAEA.

A detailed action plan has been developed and work will begin in May 2008. Computers and satellite imagery for this activity were received from the IAEA. As to fund mobilization, additional resources have been received through a TCP from the IAEA, which has also provided funds for training 20 entomologists who will be involved in baseline data collection.

Burkina Faso: Review and assessment of AfDB funded project on status implementation in relation to the proposed "phased feasibility flow chart" – I. Sidibe

The AfDB funded project in Burkina Faso benefits from collaboration with various national institutions that are in charge of land use, land occupation, environmental impact assessment, HAT, information and sensitization of communities. Following the phased, conditional approach it has been decided to initially carry out interventions over an area of approximately 40 000 km^2 of the total intervention area (100 000 km^2). The project area has a high potential for crop production and livestock development. The zone is at the northern limit of the tsetse distribution and it is therefore suitable for suppression and elimination activities, especially during the dry season from October to May. Furthermore, human interventions are developing natural barriers through the expansion of cotton cultivation and pesticide utilisation.

In the first block of the project area, baseline data collection has been carried out for entomological, parasitological, socio-economic, environmental and land use data. A geo-database has been assembled to centralize and store all geo-spatial information that is being used along with satellite images to select sampling sites for the entomological survey. Data

collection recently started also with a view to finding possible natural barriers to reinvasion or potential sites for placing artificial barriers.

A study is assessing the feasibility of applying SAT for tsetse fly suppression for the creation of T&T-free areas in East and West Africa. The outcome of this study should tell whether SAT is to be used in the agro-ecological setting of Burkina Faso. It is possible that traps, targets, and pour-on formulations could suffice to eliminate tsetse from block 1. In view of the possible use of the SIT technique, efforts are being made to improve the capacity of the insectary at the Centre International de Recherche-Développement sur l'Elevage en Zone Subhumide (CIRDES), while a new building is being planned.

As regards HAT, assessment is in progress in the project areas in collaboration with the Institut de recherche pour le développement (IRD) and CIRDES with different support. Other research activities are focusing on population genetics of tsetse, especially in the context of degradation and fragmentation of habitats.

Mali: Review and assessment of AfDB funded project on status implementation in relation to the proposed "phased feasibility flow chart" – A. Djiteye

With the financial support of the AfDB and the Government of Mali, the project aims at eliminating the T&T problem from an area of approximately 37 000 km^2 (17 000 km^2 in the Niger basin and 28 000 km^2 in the Bani basin). The baseline data collection concerns tsetse fly distribution and population dynamics, animal and human trypanosomiasis prevalence, socio-economic studies, environmental survey and monitoring. Sensitization and raising community awareness have been pursued through regional meetings and communal workshops. Farmers' organizations have been involved through the creation of T&T control brigades in approximately 190 villages; an average of five sergeants per village have been trained in traps impregnated with deltamethrin, trap installation and surveillance. Significant reduction of tsetse densities in the intervention areas has been achieved.

Quality Control/Quality Assurance of trypanocidal drugs - F. van Gool

In the last ten years numerous papers were published indicating resistance of trypanosomes to trypanocidal drugs. However, in the vast majority of cases, investigation on the type and brand of the trypanocidal drug that was used revealed that the drug was of poor quality and even in some cases was a completely fake drug.

To tackle the problem of poor quality and fake trypanocidal drugs circulating in the African market a MoU was signed between FAO and IFAH. The aims of the MoU are (i) to develop reliable methods to control the quality of trypanocidal drugs, and (ii) to create two chemical-analytical laboratories in Africa (one in West Africa and one in East Africa) to control drugs circulating in the different countries. One of the provisions of the MoU is that stakeholders involved in the use of trypanocidal drugs can send samples to these independent laboratories for quality control. Also, samples can be sent to the representatives of the FAO and IFAH to be analyzed by the University of Strathclyde (UK) which is the Reference laboratory for the control of Trypanocidal Drugs.

The IFAH representative also encouraged stakeholders to make optimal use of the published literature concerning the quality of trypanocidal drugs.

The tsetse and trypanosomiasis R&D programme and activities, including training opportunities, at ITM – S.Geerts and collaborators

ITM concentrates on three research themes: (i) vector-parasite interaction to understand the factors determining the infection rate of tsetse, (ii) host-parasite interaction to explore factors affecting the impact of infection, and (iii) the vector host/environment interaction to clarify the effect of a changing environment on the epidemiology and impact of AAT. Research is also carried out at ITM on trypanocidal drug resistance, in particular on the development and validation of molecular techniques for the detection of drug resistant trypanosomes. ITM is the FAO reference centre for "Livestock trypanosomiasis: parasite management and diagnosis". ITM's training activities include an MSc in Tropical Animal Health, a web-based MSc in Tropical Veterinary Medicine (managed in collaboration with the University of Pretoria, the Regional Training Programme for the Southern African Development Community (SADC) Region), and various PhD programmes.

The International Trypanotolerance Centre (ITC): new developments and challenges ahead – S. Geerts

In his report, Mr. Geerts stated that ITC was founded in 1982 by an act of the Gambian Parliament and it initially focused on research, multiplication and dissemination of the trypanotolerant N'Dama cattle in Africa. The present focus is on increasing livestock productivity and utilization in the West African region through optimal and sustainable exploitation of the genetic resistance of indigenous breeds of livestock. ITC's partners are the National Agricultural Research Services (NARS) of The Gambia, Senegal, Guinea, Guinea Bissau, Sierra Leone, Liberia, ILRI and CIRDES. ITC assets include the HQ in Banjul, two field stations, laboratories, training facilities, administration, social facilities, a residential area, animal facilities and herds/flocks.

Due to lack of core funding, ITC had faced recurrent problems to pay staff, with the result that most international staff members left and the DG was replaced by an interim management committee. The Executive Committee of Council that was held in March 2008 concluded that restructuring of ITC was necessary and various options for the future were discussed based on four available reports. The option preferred by the Gambian Government was for ITC to become a Gambian livestock research institute while AU-IBAR preferred ITC to become a regional livestock research centre. The possibility of a merger between ITC and either CIRDES or ILRI was explored but it appeared that ILRI was divesting itself of field sites and CIRDES was not interested in a merger in the short term. The Council of ITC, which decides autonomously, wanted to maintain the regional status of ITC, while the Gambian Government, which owns the land and buildings of ITC, preferred ITC to become a national institute. The international community that has made considerable investments in ITC aims at safeguarding the nucleus herds. Therefore a compromise is urgently needed.

The new AfDB-Global Environment Facility (GEF) project "Sustainable management of endemic ruminant livestock in West Africa" (2008-2018) has ITC as executing agency for

the AfDB- funded component of the project. With its $ 42 million budget this provides a unique opportunity for the future of ITC.

Recommendations

The following recommendations were discussed and agreed:

On the recent agreement between FAO and IFAH on the Control of Veterinary Drugs, PAAT welcomes the signing of the Memorandum of Understanding (MoU) between FAO and IFAH on Quality Control/Quality Assurance (QC/QA), especially of trypanocides. The meeting **recommends** that:

- Awareness be raised of the services provided by reference laboratories accredited to conduct QC of trypanocides. To this end, a section of the TTI is to be devoted to the subject.

Action: PAAT, PATTEC, involved countries.

Reinvasion of reclaimed areas: The meeting notes that the issue of reinvasion is still a major concern to all the PATTEC countries. Therefore, the meeting **reiterates recommendations** made in previous PAAT meetings that:

- The risk of reinvasion be comprehensively assessed (e.g. at the time of baseline entomological surveys) and that measures be put in place aimed at minimizing this risk in a sustainable manner.

Action: PATTEC, involved countries.

Acknowledging the importance of the on-going HAT mapping exercise, the meeting **recommends** that:

- Data on HAT occurrence be submitted to WHO in a timely manner.

Action: involved countries.

Tsetse fly in Swaziland. In view of the recent findings in Swaziland, where flies were discovered although thought to be absent, the meeting **recommends** that:

- South Africa and Mozambique should consider involving Swaziland in their regional eradication project.

Action: PATTEC, involved countries.

Cooperation between countries benefiting from AfDB loans and WHO on HAT. Following the example set by the recent collaboration between WHO and the AfDB-funded tsetse elimination project in Ghana, the meeting **recommends** that:

- Countries presently involved in baseline data collection should contact WHO for support on HAT assessment.

Action: involved countries, PATTEC, WHO.

Land cover classification and sharing of GIS data and metadata. In consideration of the standardization activities carried out by PAAT (e.g. in the field of land cover classification, sharing of GIS data and metadata, etc.), the meeting **recommends** that:

- Efforts be made to adopt the international standards promoted by PAAT.

Action: involved countries, PATTEC.

The International Trypanotolerance Centre (ITC), The Gambia. PAAT recognizes the invaluable role that The Gambia has played in hosting and promoting the activities against tsetse-transmitted trypanosomiasis over the past three decades through the establishment of ITC. It appreciates the difficulties ITC has had in recent years in obtaining core funding and the support needed to carry out its mandate. Despite these difficulties, however, ITC continues to be recognised as a regional centre of excellence, with active and productive work with NARS in its core countries: The Gambia, Guinea, Guinea Bissau and Senegal.

In this context, PAAT greatly welcomes the new project "Sustainable management of endemic ruminant livestock in West Africa", which provides for funding and research. The international community has also invested substantial resources in the ITC's selectively bred herds which constitute an irreplaceable international asset that must be conserved so that their unique genetic resources can continue to be made available to the whole region. **PAAT therefore supports recent efforts by AU/ISCTRC and others** and hopes that a satisfactory regional solution can be found which ensures their continued support.

Regional Development Centres (RDCs). A questionnaire was developed by the FAO/IAEA Joint Division, aimed at (i) identifying a limited number of RDCs for training in the field of Tsetse and Trypanosomosis, and (ii) generating information for subsequent assessment of candidate centres. The meeting **recommends** that:

- Feedback and suggestions be provided by all the recipients of the questionnaire.

Action: PAAT, PATTEC, involved countries.

Flowchart on the feasibility of creating tsetse and trypanosomiasis-free zones. The meeting recognizes the usefulness of the flowchart for assessing the feasibility of creating tsetse and trypanosomiasis-free zones, which may consider the use of SIT, when and where environmentally and technically appropriate. The meeting **recommends**:

- To simplify the layout as developed to facilitate the interpretation and utilization of the flowchart.

Action: FAO/IAEA Joint Division.

The meeting recognizes the role of PAAT as a body for technical review and eventual advocacy for T&T project proposals to be submitted to potential donors. The meeting **urges member countries** that:

- Project proposals dealing with T&T and related matters be presented at PAAT-PC and PAG meetings for assistance in technical review andsubsequent support for advocacy.

Action: PATTEC, involved countries.

Standardization of fabrics and other equipment used in tsetse control. Considering the normative role of PAAT and its harmonization function in relation to T&T control techniques, the meeting **recommends**:

- To explore the possibility to standardize and define quality control and assurance methodologies for fabrics and other equipment used for constructing targets, screens, traps, etc.

Action: PAAT.

Socio-economic and environmental impact assessment. The meeting recognizes the importance of socio-economic and environmental issues/impacts related to T&T intervention programmes and acknowledges the work of the International Livestock Research Institute (ILRI) on these aspects. The meeting **recommends** that:

- A limited number of key parameters are identified which can be consistently collected in a cost-effective manner, to be used as indicators of the socio-economic and environmental impact of T&T interventions.

Action: ILRI, PAAT.

Need for flexibility in budget management of AfDB funds by countries implementing T&T interventions. The six countries (Burkina Faso, Ethiopia, Ghana, Kenya, Mali, Uganda) receiving AfDB loans and grants for T&T interventions expressed their concern about a certain lack of flexibility in adaptive budget management. This does not allow a rapid shift in budget resources to respond to changed field situations and unforeseen events. The meeting **recommends**:

- To bring this matter to the attention of the AfDB during the forthcoming-term review of the respective national AfDB T&T intervention projects.

Action: PATTEC, PAAT, involved countries.

Review of PAAT and its structures. Members expressed the need for review of PAAT and its structures after 10 years of operation. This is meant to further strengthen PAAT and ensure its continued relevance in the challenging field of T&T interventions. Members **recommend** that

- Rather than have an external review panel that may be costly, that this be done in-house.

Action: PAAT Secretariat.

Closing

Mr Ilemobade, Chairman of PAAT, heartily thanked all participants for their contributions. Thereafter, he declared the meeting closed. Mr Mattioli reminded members that the next PAAT-PAG meeting will be held in Kampala, Uganda, while the next PAAT-PC meeting is proposed to be held in Bratislava, Slovak Republic.

FAO/IAEA GUIDELINES ON THE COLLECTION OF ENTOMOLOGICAL BASE-LINE DATA FOR TSETSE AREA-WIDE INTEGRATED PEST MANAGEMENT PROGRAMMES. STEPHEN G.A. LEAK, DEJENE EJIGU AND MARC J.B. VREYSEN. 205 PP., ISSN 1810-0708. FAO ANIMAL PRODUCTION AND HEALTH GUIDELINES SERIES, ROME

Several sub-Saharan Member States have expressed the intention to embark on national or regional programmes to create sustainable tsetse-free zones under the umbrella of the PATTEC initiative. It is imperative that these programmes be implemented using an area-wide integrated pest management approach (i.e. targeting an entire population within a circumscribed area) for the results to be sustainable. Most AW-IPM programmes are technically complex and require in-depth knowledge about the ecology and population dynamics of the target insect. In that respect, new guidelines were developed on the collection of entomological base line data within the context of tsetse AW-IPM and published under the FAO Animal Production and Health series. As most Member States are in the second phase of the phased conditional approach (i.e. feasibility study), the publication of this document is timely.

The document is composed of three parts: (1) the first provides an overview of the basic biology and anatomy of the tsetse fly, and is intended for those who are new to the field of tsetse, (2) the second part covers the planning and preparation of a base line survey, and is intended for use by senior entomological staff whom will be involved in the actual development of the survey strategy, and (3) the third part deals with the implementation of a survey and targets technicians and entomologists in the field. The guidelines make reference to modern spatial tools such as GPS, RS and GIS, emphasize the need for good land use and land cover maps for the planning and implementation of a survey, and provide details of a new Access-based data base (Tsetse Intervention Recording and Reporting System) that has been specifically developed for tsetse surveys and monitoring purposes.

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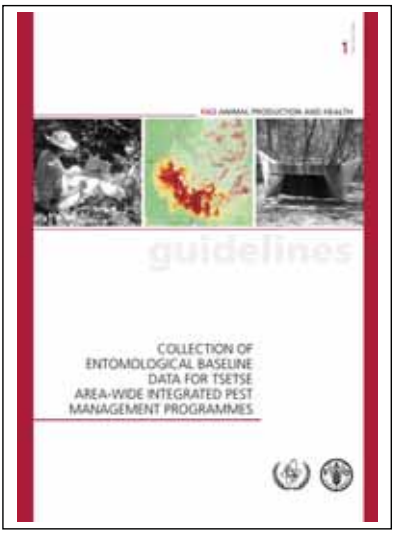

MEMORANDUM OF UNDERSTANDING BETWEEN THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS AND THE INTERNATIONAL FEDERATION FOR ANIMAL HEALTH ON COOPERATION IN THE ESTABLISHMENT OF STANDARDS AND PROTOCOLS FOR QUALITY CONTROL OF TRYPANOCIDE DRUGS[1]

PREAMBLE

Whereas the Food and Agriculture Organization of the United Nations, hereinafter referred to as FAO, carries out activities on animal health protection in developing countries, and is one of the parent institutions of the Programme Against African Trypanosomiasis (PAAT) established by FAO Conference Resolution 5/97 of 17 November 1997 and managed by a joint secretariat provided by FAO, the Inter-African Bureau for Animal Resources of the African Union (AU-IBAR), the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO);

Whereas PAAT is an international alliance comprising FAO, WHO, AU-IBAR and IAEA and its main objectives are to support action at country level to advise and assist in the coordination of research, intervention and control activities of Trypanosomiasis;

[1] Adapted from the original by the editor.

Whereas the International Federation for Animal Health, hereinafter referred to as IFAH, is a non-profit federation with liaison status with FAO and representing manufacturers of veterinary medicines, vaccines and other animal health products, in both developed and developing countries;

Whereas IFAH is prepared to provide technical expertise in support of the establishment of standards and protocols for quality control of trypanocidal drugs, while recognizing the independent nature of FAO as an intergovernmental organization of the United Nations system;

Whereas both FAO and IFAH recognize that the proposed cooperation would contribute towards the establishment of a harmonized framework on the trypanocidal drugs and should be welcomed;

Whereas the proposed cooperation was endorsed by the Programme Committee of PAAT, at its Seventh Session in November 2002, and is to be further reviewed by that Committee and its results are to be subject to comprehensive review and endorsement by the Panel of the Programme Against African Trypanosomiasis Advisory Group Coordinators and the PAAT Programme Committee.

FAO and IFAH have agreed as follows:

Article 1
Objectives of the proposed cooperation

1. The overall objective of this Memorandum of Understanding is to formalize the collaboration between FAO and IFAH in the recommendation of internationally and scientifically agreed standards to be presented to the OIE for adoption through their usual procedures and to define protocols for quality control and quality assurance of trypanocidal drugs, in line with the recognition that trypanocides are the most common and cost-effective method to reduce the impact of African animal Trypanosomiasis on livestock agricultural development in sub-Saharan Africa.

2. The specific objectives of this Memorandum of Understanding are:

a. to prepare and recommend standards and protocols for quality control of trypanocidal drugs.
b. to define the requirements of Analytical Quality Assurance (AQA).
c. to establish good laboratory practices for chemical analysis;
d. to make accessible, on an equal basis, to any company and/or stakeholders the generated scientific and technical information; and
e. to transfer the methodology and technology to West and East Africa.

3. FAO and IFAH recognize that as a result of the activities to be carried out under this Memorandum of Understanding:

a. quality control and quality assurance guidelines and principles for chemical analysis and standard operating procedures (SOPs) should be harmonized in compliance with OIE standards;
b. requirements for Analytical Quality Assurance (AQA) should be defined;
c. two laboratories in West Africa and East Africa, respectively, should be identified, and Quality Control/Quality Assurance (QC/QA) standards transferred;
d. establishment of a basis for partnerships, involving the public and private sector in support of the implementation and application of QC/QA standards on a sustainable basis.
e. the outcomes of the joint activity between FAO and IFAH will be brought by FAO to the attention of the appropriate bodies of the Codex Alimentarius Commission.

Article 2
Consultative Committee

1. FAO and IFAH will establish a Consultative Committee which will follow and supervise directly the activities to be carried out under this Memorandum of Understanding.

2. The Consultative Committee will consist of the following members: two representing FAO, one IFAH and one the International Atomic Energy Agency (IAEA), appointed by their respective organizations. The FAO representatives will be technical Officers of the Animal Health Service (AGAH), one from headquarters and the other from the Regional Office for Africa. The Chairmanship and the Secretariat of the Consultative Committee will be assured, respectively, by the Chief, AGAH and the technical Officer of AGAH based at FAO headquarters.

3. The Consultative Committee will monitor and supervise the advancement of the work, with the assistance of the two experts referred to in Article 3, in the development of the experimental design and in the validation of the results. The Consultative Committee may consult external experts as deemed necessary.

4. The Consultative Committee will assist:

(a) in the compilation of scientific reports;

(b) in the communication of the results of the activities to IFAH; and

(c) in the dissemination of the results to the international community through publications in peer reviewed scientific journals.

Article 3
Assignment of experts to laboratories

1. Two experts from public, technically reputed, non-profit institutions, with recognized scientific background in chemical analysis of pharmaceutical products, and provided by IFAH and IAEA, will be assigned to perform the analysis required by the Consultative Committee, under this Memorandum of Understanding, in consultation with the relevant institutes.

2. In liaison with the Consultative Committee, FAO will assist in the identification of the African laboratories to be involved in the proposed cooperation, one in West Africa and the other in East Africa.

3. FAO, through its network of Tsetse and Trypanosomiasis Liaison Officers and Members of the PAAT Advisory Group Coordinators, will assist the experts in the accurate collection of drug samples.

Article 4
Cost-sharing arrangements

1. Contribution of FAO

   (a) FAO will provide through PAAT, within the limits of the budgetary appropriation of the Organization's Regular Programme, adequate environment for scientific concertation and dissemination of the information through its regular statutory meetings and the PAAT-Information System (PAAT-IS) and will promote awareness on Quality Assurance/Quality Control of trypanocides among all concerned stakeholders. FAO will seek to support the presentation of results and technical data by the experts in relevant international meetings, such as the International Scientific Council for Trypanosomiasis Research and Control, ISCTRC, including meetings of its statutory bodies, such as the Panel of the PAAT Advisory Group Coordinators.

   (b) FAO, through PAAT, will act as a neutral body and ensure – through the Consultative Committee and the relevant PAAT structures – that the work is carried out in a correct manner, securing scientific and technical integrity.

2. Contribution of IFAH

   (a) IFAH will contribute, in conditions to be agreed upon within the Consultative Committee, funds to pay for national Liaison Officers for Tsetse and Trypanosomiasis for (i) the sampling, collection and shipment of drug vials encountered in the market of affected African countries and (ii) the chemical analysis by the two collaborating laboratories. These funds will not be channelled through FAO, but will be directly paid to service providers.

(b) IFAH will provide, jointly with FAO, the necessary support for the dissemination of the scientific information on agreed standards and protocols for Quality Assurance/Quality Control of trypanocides to concerned stakeholders.

Article 5
Specific provisions

1. Nothing in this Memorandum of Understanding will be interpreted as conferring upon IFAH or any of the Members of IFAH any exclusive right or any preferential treatment from FAO. In particular, FAO remains free to procure any trypanocide medicines from any producer or supplier which is not a Member of IFAH.

2. In view of the particular status of FAO as a neutral, independent, intergovernmental organization of the United Nations system, IFAH recognizes that any perceived or actual risk of conflict of interest should be avoided. FAO and IFAH will enter into such immediate consultations as may be required with a view to taking corrective action in the event of such perceived or actual risk of conflict of interest. In addition, no visibility will be given to any individual IFAH Member participating in cooperation activities under this Memorandum of Understanding.

Article 6
Programme Against African Trypanosomiasis

All activities carried out under this Memorandum of Understanding will be reviewed by the Programme Against African Trypanosomiasis and subject to such guidance as it may provide through the Consultative Committee.

Article 7
Intellectual property rights

1. Intellectual property rights on documents and materials made available by FAO and IFAH to carry out activities under this Memorandum of Understanding will remain within the originating party.

2. Intellectual property rights on information or techniques developed jointly by IFAH and FAO under this Memorandum of Understanding will be jointly vested in both parties. FAO and IFAH will have full rights to exploit such jointly-owned work, for non-commercial purposes. This shall not preclude the right of originating parties to publish scientific findings, subject to the agreement of the Consultative Committee.

Article 8
Implementation of the Memorandum of Understanding

1. This Memorandum of Understanding will enter into force on the date of signature on behalf of FAO and IFAH. It will remain in force for the period necessary for the attainment

of the objectives defined in Article 1, subject however, to the possibility for FAO or IFAH to give notice of termination of this Memorandum of Understanding to the other party. Such notice of termination will take effect three months following the date of despatch.

2. Twelve months after the entry into force of this Memorandum of Understanding, the representatives of FAO and IFAH within the Consultative Committee will make a first review of its implementation with a view to identifying possible adjustments thereto.

3. This Memorandum of Understanding may be amended by exchange of letters between duly authorized representatives of FAO and IFAH.

4. Nothing in this Memorandum of Understanding or in any document relating thereto shall be construed as constituting a waiver of privileges and immunities of FAO, nor as conferring any privileges and immunities of FAO in IFAH or any person performing services for IFAH.

5. This Memorandum of Understanding is governed by general principles of law, to the exclusion of any national system of law.

Article 9
Settlement of Disputes

1. Any dispute between FAO and IFAH arising out of the interpretation or execution of this Memorandum of Understanding shall be settled by negotiation between the parties. If the dispute is not settled by negotiation between the parties, it shall, at the request of either party, be submitted to one conciliator. Should the parties fail to reach agreement on the name of a sole conciliator, each party shall appoint one conciliator. The conciliation shall be carried out in accordance with the Conciliation Rules of the United Nations Commission on International Trade Law, as at present in force.

2. Any dispute between FAO and IFAH that is unresolved after conciliation shall, at the request of either party be settled by arbitration in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law, as at present in force.

3. The conciliation or arbitration proceedings shall be conducted in English.

4. The parties may request conciliation during the execution of this Memorandum of Understanding and anyway not later than twelve months after the cessation of activities thereunder or the termination of the Memorandum of Understanding. The parties may request arbitration not later than ninety days after the termination of the conciliation proceedings.

On behalf of the Food and Agriculture Organization of the United Nations:	On behalf of the International Federation for Animal Health:
Jim Butler, Officer-in-Charge, Agriculture and Consumer Protection Department	George Gunn President

SECTION B - ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

14801. **Bowater, R. J., Abdelmalik, S. M. & Lilford, R. J., 2009.** The methodological quality of cluster randomised controlled trials for managing tropical parasitic disease: a review of trials published from 1998 to 2007. *Transactions of the Royal Society of Tropical Medicine and Hygiene,* **103** (5): 429-436.

Department of Public Health & Epidemiology, School of Medicine, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK. [bowaterj@adf.bham.ac.uk].

The aim of this review was to assess the methodological quality of cluster randomised controlled trials (CRCT) for the management of tropical parasitic disease published between 1998 and 2007. A literature survey was conducted using Medline for CRCTs of interventions aimed at managing any one of the six major tropical parasitic diseases: malaria, leishmaniasis, lymphatic filariasis, onchocerciasis, schistosomiasis and trypanosomiasis (Chagas disease). Information was extracted from the published articles in order that, for each trial, categorical responses could be made to a pre-specified list of 12 questions concerning issues relating to the methodological quality of the trial, including choice of design, generalisability, baseline assessment, blinding, use or non-use of a matched design, and accounting for the intraclass correlation in both design and analysis. The literature survey found 38 CRCTs. Of the 35 CRCTs that reported at least one human outcome, 27 were for interventions in the management of malaria whilst the rest were for managing leishmaniasis (4 trials), lymphatic filariasis (2 trials) and schistosomiasis (2 trials). For every one of the pre-specified questions that concerned an issue associated with methodological quality, the responses were consistent with the practice of trialists in relation to the given issue and indicated poor understanding of the issues involved.

14802. **Courtin, D., Berthier, D., Thevenon, S., Dayo, G. K., Garcia, A. & Bucheton, B., 2008**. Host genetics in African trypanosomiasis. *Infection, Genetics and Evolution,* **8** (3): 229-238.

Radboud University Medical Center, Medical Parasitology, PO Box 9101, 6500 HB Nijmegen, The Netherlands. [d.courtin@gmail.com].

In Africa, the protozoan parasite of the genus *Trypanosoma* causes animal (AAT) and human African trypanosomiasis (HAT). These diseases are responsible for considerable mortality and economic losses, and until now the drugs commonly used have often been very toxic and expensive, with no vaccine available. A range of clinical presentations, from chronic to acute symptoms, is observed in both AAT and HAT. Host, parasite, and environmental factors are likely to be involved in this clinical variability. In AAT, some West African cattle (N'Dama, *Bos taurus*) have the ability to better control the disease development (and therefore to remain productive) than other taurine breeds (Zebu, *Bos indicus*). This phenomenon is called trypanotolerance and seems to have major genetic components. In humans, tolerance/resistance to the disease is suspected, however, this needs confirmation.

This review focuses on recent advances made in the field of host genetics in African trypanosomiasis in animals (mouse and bovine) and humans. The perspectives for the development of new control strategies and their applications as well as a better understanding of the physiopathology of the disease are discussed.

14803. **Courtin, F., Sidibe, I., Rouamba, J., Jamonneau, V., Gouro, A. & Solano, P., 2009**. Population growth and global warming: impacts on tsetse and trypanosomoses in West Africa. *Parasite,* **16** (1): 3-10.

Institut de Recherche pour le Développement, UMR 177 IRD-CIRAD, Centre International de Recherche Développement sur l'Elevage en zone Subhumide, 01 BP 454, Bobo-Dioulasso, Burkina Faso.

Demographic evolution, climatic change and economical development that happened in West Africa during the 20th century had a lot of consequences on human settlement and landscape. These changes have in turn an impact on the pathogenic system of human and animal trypanosomoses. Since last century, the northern tsetse distribution limit has shifted towards the south, probably due to a decrease in rainfall combined with the impact of human pressure. Sleeping sickness (SS) foci have also shifted from the savannah areas (where there is no more SS) to the forest and mangrove areas of West Africa, but animal trypanosomoses are still present in savannah areas. We show a decrease of tsetse of the *morsitans* group as a result of an increase of human densities. On the other hand, tsetse species like *Glossina palpalis* adapt to high human densities and are found in the biggest urban centres of West Africa. There is a need to promote multidisciplinary studies on this demographic-climatic-vector borne disease topic, especially in Africa to be able to define future areas of presence/absence of these diseases in order to help continental plans of control that have recently begun.

14804. **Fenwick, A., 2009**. Host-parasite relations and implications for control. *Advances in Parasitology,* **68**: 247-261.

Division of Epidemiology, Public Health and Primary Care VB1, St. Mary's Campus, Norfolk Place, London W2 1PG

This paper considers the various measures available to control several of the neglected tropical diseases (NTDs). To develop the optimum methods for controlling the parasites that cause these NTDs, knowledge of the life cycles of both the parasites and their vectors is essential. Each NTD requires its own strategy for control based on detailed knowledge of the life cycle. Vector control, chemotherapy, better water supplies and better hygiene are all components that may be appropriate. For some diseases, improved drugs are urgently required, for some the tools are available for elimination, while uniquely guinea worm could be eradicated without any chemotherapeutic drug being used. Several NTDs lend themselves to mass drug administration in which human populations are annually offered safe, effective and usually donated drugs with a view to morbidity control and/or elimination. The drugs could and should be used to improve the quality of millions of lives, prevent suffering, stigma, disfigurement and early death. The role of pharmaceutical companies which have donated their drugs for the treatment of millions of disadvantaged people in the developing world is acknowledged. One result of such drug pressure, however, is that evolutionary

change may result, and it is incumbent on scientists during monitoring and evaluation of control programmes to ensure that such changes are recognised. One other unfortunate development is that a paucity of newly trained vector-borne disease experts may constrain future control efforts.

14805. **Grab, D. J. & Kennedy, P. G., 2008**. Traversal of human and animal trypanosomes across the blood-brain barrier. *Journal of Neurovirology,* **14** (5): 344-351.

Department of Pediatrics, Division of Pediatric Infectious Diseases, Johns Hopkins School of Medicine, Baltimore, Maryland, USA.

The neurological complications of human African trypanosomiasis (HAT) in man caused by the unicellular protozoan parasites *Trypanosoma brucei gambiense* and *T. b. rhodesiense* are a consequence of the penetration of the blood-brain barrier (BBB) by trypanosomes that enter the central nervous system (CNS). Yet the mechanisms by which African trypanosomes cross the true BBB comprised of brain microvascular endothelial cells (BMECs) remain unclear. Human BBB models used to determine how African trypanosomes initially interact *in vitro* with the human BBB proper suggest that parasites cross the human BBB in part by generating Ca^{2+} activation signals in human BMECs through the activity of parasite cysteine proteases. *In vivo* murine models of HAT have suggested additional mechanisms of BBB traversal by trypanosomes, with recent compelling evidence for the important role of interferon-gamma in facilitating this process. A clear understanding of how trypanosomes enter the CNS is critical for both understanding the neuropathogenesis of HAT and in developing more effective drug therapies for late-stage disease.

14806. **John, K., Kazwala, R. & Mfinanga, G. S., 2008**. Knowledge of causes, clinical features and diagnosis of common zoonoses among medical practitioners in Tanzania. *BMC Infectious Diseases,* **8**: 162.

National Institute for Medical Research, Muhimbili Medical Research Centre, Dar es Salaam, Tanzania. [jkundas@yahoo.com].

Many factors have been mentioned as contributing to under-diagnosis and under-reporting of zoonotic diseases particularly in the sub-Sahara African region. These include poor disease surveillance coverage, poor diagnostic capacity, the geographical distribution of those most affected and lack of clear strategies to address the plight of zoonotic diseases. The current study investigates the knowledge of medical practitioners of zoonotic diseases as a potential contributing factor to their under-diagnosis and hence under-reporting. The study was designed as a cross-sectional survey. A semi-structured open-ended questionnaire was administered to medical practitioners to establish the knowledge of anthrax, rabies, brucellosis, trypanosomiasis, echinococcosis and bovine tuberculosis in selected health facilities within urban and rural settings in Tanzania between April and May 2005. Frequency data were analyzed using likelihood ratio chi-square in Minitab version 14 to compare practitioners' knowledge of transmission, clinical features and diagnosis of the zoonoses in the two settings. For each analysis, likelihood ratio chi-square p-value of less than 0.05 was considered to be significant. Fisher's exact test was used where expected results were less than five. The results showed that medical practitioners in rural health facilities had poor knowledge of transmission of sleeping sickness and clinical features of anthrax and rabies in

humans compared with their urban counterparts. In both areas the practitioners had poor knowledge of how echinococcosis is transmitted to humans, clinical features of echinococcosis in humans, and diagnosis of bovine tuberculosis in humans. It is concluded that knowledge of medical practitioners of zoonotic diseases could be a contributing factor to their under-diagnosis and under-reporting in Tanzania. Refresher courses on zoonotic diseases should be conducted particularly for practitioners in rural areas. More emphasis should be put on zoonotic diseases in teaching curricula of medical practitioners' training institutions in Tanzania to improve the diagnosis, reporting and control of zoonotic diseases. Veterinary and medical collaboration should be strengthened to enable more effective control of zoonotic diseases in Tanzania.

14807. **Muskavitch, M. A., Barteneva, N. & Gubbels, M. J., 2008**. Chemogenomics and parasitology: small molecules and cell-based assays to study infectious processes. *Combinatorial Chemistry and High Throughput Screening,* **11** (8): 624-646.

Department of Biology, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA.

Infectious diseases caused by protozoan parasites - malaria, sleeping sickness, leishmaniasis, Chagas disease, toxoplasmosis--remain chronic problems for humanity. We lack vaccines and have limited drug options effective against protozoa. Research into anti-protozoan drugs has accelerated with improved *in vitro* cultivation methods, enhanced genetic accessibility, the completed genome sequences for key protozoa, and increased prominence of protozoan diseases on the agendas of well-resourced public figures and foundations. Concurrent advances in high-throughput screening (HTS) technologies and availability of diverse small molecule libraries offer the promise of accelerated discovery of new drug targets and new drugs that will reduce disease burdens imposed on humanity by parasitic protozoa. We provide a status report on HTS technologies in hand and cell-based assays under development for biological investigations and drug discovery directed toward the three best-characterized parasitic protozoa: *Trypanosoma brucei*, *Plasmodium falciparum*, and *Toxoplasma gondii*. We emphasize cell growth assays and new insights into parasite cell biology speeding development of better cell-based assays, useful in primary screens for anti-protozoan drug leads and secondary screens to decipher mechanisms of action of leads identified in growth assays. Small molecules that interfere with specific aspects of protozoan biology, identified in such screens, will be valuable tools for dissecting parasite cell biology and developing anti-protozoan drugs. We discuss potential impacts on drug development of new consortia among academic, corporate, and public partners committed to discovery of new, effective anti-protozoan drugs.

14808. **Osorio, E. J., Robledo, S. M. & Bastida, J., 2008**. Alkaloids with antiprotozoal activity. The *Alkaloids. Chemistry and Biology,* **66**: 113-190.

Grupo de Investigación en Sustancias Bioactivas, Facultad de Quimíca-Farmacéutica, Universidad de Antioquia, A. A. 1226, Medellin, Colombia. [josorio48@yahoo.com].

No abstract available.

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

14809. **Kleynhans, E. & Terblanche, J. S., 2009**. The evolution of water balance in *Glossina* (Diptera: *Glossinidae)*: correlations with climate. *Biological Letters,* **5** (1): 93-96.

Department of Conservation Ecology and Entomology, Faculty of AgricSciences, Stellenbosch University, Private Bag X1, Matieland 7602, Republic of South Africa.

The water balance of tsetse flies (Diptera: *Glossinidae*) has significant implications for understanding biogeography and climate change responses in these African disease vectors. Although moisture is important for tsetse population dynamics, evolutionary responses of *Glossina* water balance to climate have been relatively poorly explored and earlier studies may have been confounded by several factors. Here, using a physiological and GIS climate database, we investigate potential interspecific relationships between traits of water balance and climate. We do so in conventional and phylogenetically independent approaches for both adults and pupae. Results showed that water loss rates (WLR) were significantly positively related to precipitation in pupae even after phylogenetic adjustment. Adults showed no physiology-climate correlations. Ancestral trait reconstruction suggests that a reduction in WLR and increased size probably evolved from an intermediate ancestral state and may have facilitated survival in dry environments. The results of this study therefore suggest an important role for water balance physiology of pupae in determining interspecific variation and lend support to conclusions reached by early studies of tsetse physiology.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

14810. **Abd-Alla, A. M., Cousserans, F., Parker, A. G., Jridi, C., Bergoin, M. & Robinson, A. S., 2009**. Quantitative PCR analysis of the salivary gland hypertrophy virus (GpSGHV) in a laboratory colony of *Glossina pallidipes*. *Virus Research,* **139** (1): 48-53.

Entomology Unit, FAO/IAEA Agriculture & Biotechnology Laboratory, IAEA Laboratories Seibersdorf, A-2444 Seibersdorf, Austria. [a.m.m.abd-alla@iaea.org].

Many species of tsetse flies can be infected by a virus that causes salivary gland hypertrophy (SGH) and virus isolated from *Glossina pallidipes* (GpSGHV) has recently been sequenced. Flies having SGH have a reduced fecundity and fertility. To better understand the impact of this virus in a laboratory colony of *G. pallidipes*, where the majority of flies are

infected but asymptomatic, and to follow the development of SGH in symptomatic flies in relation to virus copy number, a quantitative PCR (qPCR) method was developed. The qPCR analyses revealed that in asymptomatic flies virus copy number averaged 1.68E+5, 2.05E+5 and 1.07E+7$\log_{10}$ in DNA from an excised leg, salivary glands and a whole fly, respectively. In symptomatic flies the virus copy number in the same organs averaged 1.34E+7, 1.42E+10 and 1.5E+9, respectively. Despite these statistically significant differences ($p<0.0001$) in virus copy number between asymptomatic and symptomatic flies, there was no correlation between age and virus copy number for either sets in adult flies. A clear correlation between virus copy number in pupae and their mothers was observed. Reverse transcription quantitative PCR (RT-qPCR) of the viral messenger RNA encoding ODV-E66, an envelope protein, revealed a clear correlation between virus copy number and the level of gene expression with values of 2.77$\log_{10}$ in asymptomatic males and 6.10$\log_{10}$ in symptomatic males. Taken together these results confirm the close relationship between virus copy number and SGH syndrome. They demonstrate the vertical transmission of GpSGHV from mother to progeny, and suggest that the development of SGH may be correlated to the virus copy number acquired by the larva during its intra-uterine development.

14811. **Cecchi, G., Paone, M., Franco, J. R., Fevre, E. M., Diarra, A., Ruiz, J. A., Mattioli, R. C. & Simarro, P. P., 2009**. Towards the atlas of human African trypanosomiasis. *International Journal of Health Geographics,* **8**: 15.

Food and Agriculture Organization of the United Nations, Animal Production and Health Division, Rome, Italy. [giuliano.cecchi@fao.org].

Updated, accurate and comprehensive information on the distribution of human African trypanosomiasis (HAT), also known as sleeping sickness, is critically important to plan and monitor control activities. We describe input data, methodology, preliminary results and future prospects of the HAT Atlas initiative, which will allow major improvements in the understanding of the spatial distribution of the disease. Up-to-date as well as historical data collected by national sleeping sickness control programmes, non-governmental organizations and research institutes have been collated over many years by the HAT Control and Surveillance Programme of the World Health Organization. This body of information, unpublished for the most part, is now being screened, harmonized, and analysed by means of database management systems and geographical information systems (GIS). The number of new HAT cases and the number of people screened within a defined geographical entity were chosen as the key variables to map disease distribution in sub-Saharan Africa. At the time of writing, over 600 epidemiological reports and files from seventeen countries were collated and included in the data repository. The reports contain information on approximately 20 000 HAT cases, associated to over 7 000 different geographical entities. The oldest epidemiological records considered so far date back to 1985, the most recent having been gathered in 2008. Data from Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea and Gabon from the year 2000 onwards were fully processed and the preliminary regional map of HAT distribution is presented. In conclusion, the use of GIS tools and geo-referenced, village-level epidemiological data allow the production of maps that substantially improve on the spatial quality of previous cartographic products of similar scope. The significant differences between our preliminary outputs and earlier maps of HAT transmission areas demonstrate the strong need for this systematic approach to mapping sleeping sickness and point to the inaccuracy of any calculation of population at risk based on

previous maps of HAT transmission areas. The Atlas of HAT will lay the basis for novel, evidence-based methodologies to estimate the population at risk and the burden of disease, ultimately leading to more efficient targeting of interventions. Also, the Atlas will help streamline future field data collection in those parts of Africa that still require it.

14812. **Garcia-Maruniak, A., Abd-Alla, A. M., Salem, T. Z., Parker, A. G., Lietze, V. U., van Oers, M. M., Maruniak, J. E., Kim, W., Burand, J. P., Cousserans, F., Robinson, A. S., Vlak, J. M., Bergoin, M. & Boucias, D. G., 2009.** Two viruses that cause salivary gland hypertrophy in *Glossina pallidipes* and *Musca domestica* are related and form a distinct phylogenetic clade. *Journal of General Virology,* **90** (Pt 2): 334-346.

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Glossina pallidipes and *Musca domestica* salivary gland hypertrophy viruses (GpSGHV and MdSGHV) replicate in the nucleus of salivary gland cells causing distinct tissue hypertrophy and reduction of host fertility. They share general characteristics with the non-occluded insect nudiviruses, such as being insect-pathogenic, having enveloped, rod-shaped virions, and large circular double-stranded DNA genomes. MdSGHV measures 65x550 nm and contains a 124 279 bp genome (approximately 44 mol percent G+C content) that codes for 108 putative open reading frames (ORFs). GpSGHV, measuring 50x1 000 nm, contains a 190 032 bp genome (28 mol percent G+C content) with 160 putative ORFs. Comparative genomic analysis demonstrates that 37 MdSGHV ORFs have homology to 42 GpSGHV ORFs, as some MdSGHV ORFs have homology to two different GpSGHV ORFs. Nine genes with known functions (dnapol, ts, pif-1, pif-2, pif-3, mmp, p74, odv-e66 and helicase-2), a homologue of the conserved baculovirus gene Ac81 and at least 13 virion proteins are present in both SGHVs. The amino acid identity ranged from 19 to 39 percent among ORFs. An (A/T/G)TAAG motif, similar to the baculovirus late promoter motif, was enriched 100 bp upstream of the ORF transcription initiation sites of both viruses. Six and seven putative microRNA sequences were found in MdSGHV and GpSGHV genomes, respectively. There was genome co-linearity between the two SGHVs, but not between the SGHVs and the nudiviruses. Phylogenetic analysis of conserved genes clustered both SGHVs in a single clade separated from the nudiviruses and baculoviruses. Although MdSGHV and GpSGHV are different viruses, their pathology, host range and genome composition indicate that they are related.

14813. **Guerrini, L., Bord, J. P., Ducheyne, E. & Bouyer, J., 2008**. Fragmentation analysis for prediction of suitable habitat for vectors: example of riverine tsetse flies in Burkina Faso. *Journal of Medical Entomology,* **45** (6): 1180-1186.

CIRAD, UPR Epidémiologie, Montpellier, F-34398, France.
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Tsetse flies are the cyclic vectors of sleeping sickness and African animal trypanosomosis. The possibility to classify the natural habitat of riverine tsetse species is explored in the Mouhoun River basin, Burkina Faso: the objectives were to discriminate the riverine forests community types and their fragmentation levels by using Landsat 7 enhanced

thematic mapper images, to map tsetse densities. *Glossina palpalis gambiensis* Vanderplank 1949 (Diptera: *Glossinidae*) and *G. tachinoides* Westwood, 1850 are the vectors of trypanosomoses in this area. After a supervised classification, the community types were discriminated using the water area in 400-m-wide polygons around the river. A fragmentation analysis of the swamp forest unit, cross-tabulated with the community types, lead to identification of the final landscapes where tsetse apparent densities (ADT) were implemented using a training data set of 608 trap locations. The predicted ADT were then compared with an independent validation data set of 78 trap locations. The correlation between the model predictions and the validation data set was high, validating this approach ($p < 0.001$). The riverine forest community type and fragmentation level are critical factors for riverine tsetse species, which should be taken into consideration to map their suitable habitat.

14814. **Koffi, M., De Meeus, T., Bucheton, B., Solano, P., Camara, M., Kaba, D., Cuny, G., Ayala, F. J. & Jamonneau, V., 2009**. Population genetics of *Trypanosoma brucei gambiense,* the agent of sleeping sickness in Western Africa. *Proceedings of the National Academy of Sciences U S A,* **106** (1): 209-214.

Institut de Recherche pour le Développement, Unité Mixte de Recherche IRD-CIRAD 177, Campus International de Baillarguet, 34398 Montpellier, Cedex 5, France. [math_kof@yahoo.fr].

Human African trypanosomiasis, or sleeping sickness caused by *Trypanosoma brucei gambiense*, occurs in Western and Central Africa. *T. brucei s.l.* displays a huge diversity of adaptations and host specificities, and questions about its reproductive mode, dispersal abilities, and effective size remain under debate. We have investigated genetic variation at 8 microsatellite loci of *T. b. gambiense* strains isolated from human African trypanosomiasis patients in the Ivory Coast and Guinea, with the aim of knowing how genetic information was partitioned within and between individuals in both temporal and spatial scales. The results indicate that (i) migration of *T. b. gambiense* group 1 strains does not occur at the scale of West Africa, and that even at a finer scale (e.g., within Guinea) migration is restricted; (ii) effective population sizes of trypanosomes, as reflected by infected hosts, are probably higher than what the epidemiological surveys suggest; and (iii) *T. b. gambiense* group 1 is most likely a strictly clonally reproducing organism.

14815. **Solano, P., Ravel, S., Bouyer, J., Camara, M., Kagbadouno, M. S., Dyer, N., Gardes, L., Herault, D., Donnelly, M. J. & De Meeus, T., 2009.** The population structure of *Glossina palpalis gambiensis* from island and continental locations in coastal Guinea. *PLoS Neglected Tropical Diseases,* **3** (3), 392. **e-Publication ahead of print.**

CIRDES/IRD UMR 177 IRD-CIRAD, Bobo-Dioulasso, Burkina Faso.

We undertook a population genetics analysis of the tsetse fly *Glossina palpalis gambiensis*, a major vector of sleeping sickness in West Africa, using microsatellite and mitochondrial DNA markers. Our aims were to estimate effective population size and the degree of isolation between coastal sites on the mainland of Guinea and Loos Islands. The sampling locations encompassed Dubreka, the area with the highest human African

trypanosomosis (HAT) prevalence in West Africa, mangrove and savannah sites on the mainland, and two islands, Fotoba and Kassa, within the Loos archipelago. These data are discussed with respect to the feasibility and sustainability of control strategies in those sites currently experiencing, or at risk of, sleeping sickness. We found very low migration rates between sites except between those sampled around the Dubreka area that seems to contain a widely dispersed and panmictic population. In the Kassa island samples, various effective population size estimates all converged on surprisingly small values that suggest either a recent bottleneck, and/or other biological or ecological factors such as strong variance in the reproductive success of individuals. Whatever their origin, the small effective population sizes suggest high levels of inbreeding in tsetse flies within the island samples in marked contrast to the large diffuse deme in Dubreka zones. We discuss how these genetic results suggest that different tsetse control strategies should be applied on the mainland and islands.

14816. **Walshe, D. P., Lehane, S. M., Lehane, M. J. & Haines, L. R., 2009**. Prolonged gene knockdown in the tsetse fly *Glossina* by feeding double stranded RNA. *Insect Molecular Biology,* **18** (1): 11-19.

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Reverse genetic studies based on RNA interference (RNAi) have revolutionized analysis of gene function in most insects. However the necessity of injecting double stranded RNA (dsRNA) inevitably compromises many investigations particularly those on immunity. Additionally, injection of tsetse flies often causes significant mortality. We demonstrate, at transcript and protein level, that delivering dsRNA in the blood meal to *Glossina morsitans morsitans* is as effective as injection in knockdown of the immunoresponsive midgut-expressed gene, tsetseEP. However, feeding dsRNA fails to knockdown the fat body expressed transferrin gene, 2A192, previously shown to be silenced by dsRNA injection. Mortality rates of the dsRNA fed flies were significantly reduced compared to injected flies 14 days after treatment (fed: 10.1 percent+/- 1.8 percent; injected: 37.9 percent +/- 3.6 percent (mean +/- s.e.m). This is the first demonstration in Diptera of gene knockdown by feeding and the first example of knockdown in a blood-sucking insect by including dsRNA in the bloodmeal.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE EFFECTS)

14817. **Bouyer, J., Stachurski, F., Gouro, A. S. & Lancelot, R., 2009**. Control of bovine trypanosomosis by restricted application of insecticides to cattle using footbaths. *Veterinary Parasitology,* **161** (3-4): 187-193.

UMR Contrôle des maladies animales exotiques et émergentes, Centre de Coopération Internationale en Recherche Agronomique pour le Développement (Cirad), Campus International de Baillarguet, 34398 Montpellier Cedex 5, France; Centre International de Recherche-Développement de l'Elevage en Zone Sub-humide (Cirdes), 01 BP 454, Bobo Dioulasso, Burkina Faso.

African animal trypanosomoses are the main parasitological constraints to livestock production in many sub-Saharan African countries infested with tsetse flies. A prospective survey was implemented in Dafinso (Burkina Faso) to assess the effect of deltamethrin 0.005 percent (Vectocid (ND), CEVA Santé Animale) impregnation of cattle on trypanosomes transmission in cattle. Two herds were involved in the survey. They were watered at two different waterpoints located on the same river harbouring a Guinean riparian forest infested with two different species of tsetse flies (Diptera: *Glossinidae*), *Glossina palpalis gambiensis* Vanderplank and *G. tachinoides* Westwood. Animals belonging to one of the herds were impregnated with deltamethrin applied with a footbath whereas the other herd was used as control. The overall incidence of cattle trypanosomoses was reduced ($p=0.01$) from 0.76 (control group) to 0.11 (footbath-treated group). A positive effect of the footbath treatment on packed-cell volume was observed ($p<0.001$). The conditions requested to use a footbath to prevent cattle trypanosomoses are discussed.

14818. **Sindato, C., Kimbita, E. N. & Kibona, S. N., 2008.** Factors influencing individual and community participation in the control of tsetse flies and human African trypanosomiasis in Urambo District, Tanzania. *Tanzanian Journal of Health Research*, **10** (1): 20-27.

National Institute for Medical Research, P.O. Box 482, Tabora, Tanzania. [kndato@yahoo.co.uk].

This study was carried out to assess the knowledge and level of individual and community participation in the control of human African trypanosomiasis in Urambo District, western Tanzania. Semi structured questionnaires were used to collect information from individuals at household level. Retrospective data of HAT was sought from the medical officers-in-charge of health facilities. The results indicate that, 191 (90.5 percent, n = 211) individuals knew tsetse flies and 187 (88.6 percent, n = 211) knew HAT. All nine key informants reported that, the communities were aware of HAT while seven key informants reported that, the communities were aware of health risks associated with tsetse bites in human. There was poor knowledge about the role played by animals in the transmission of HAT (26.7 percent, n = 187). Majority of those who knew HAT (n = 187) were willing to contribute labour (70.1 percent) and money (64.2 percent) to tsetse and HAT control whereas amongst those who knew tsetse flies, 66.5 percent and 60.7 percent were willing to contribute labour and money, respectively. Amongst those who knew any HAT control technique (n = 108), 78.7 percent and 82.4 percent were willing to contribute money and labour respectively. A total of 454 cases of HAT were reported in the area from 1999 to 2006. It is concluded that, the factors influencing individual and community participation include the knowledge of tsetse, HAT and control measures.

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

[See also **32**:14803, 14811]

14819. **Bartlett-Healy, K., Crans, W. & Gaugler, R., 2008**. Vertebrate hosts and phylogenetic relationships of amphibian trypanosomes from a potential

invertebrate vector, *Culex territans* Walker (Diptera: *Culicidae*). *Journal of Parasitology,* **1**: **e-Publication ahead of print October 13.**

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The bloodmeals of field-collected female *Culex territans* (Diptera: *Culicidae*) were concurrently assayed for the presence of trypanosomes and for vertebrate host identification. We amplified vertebrate DNA in 42 of 119 females, and made positive identification to the host species level in 29 of those samples. Of the 119 field-collected *C. territans* females, 24 were infected with trypanosomes. Phylogenetic analysis placed the trypanosomes in the amphibian portion of the aquatic clade of the *Trypanosomatidae.* These trypanosomes were isolated from *C. territans* females that had fed on the frog species, *Rana clamitans, R. catesbeiana, R. virgatipes,* and *Rana* sp. Results support a potential new lineage of Dipteran transmitted amphibian trypanosomes may occur within the aquatic clade. The frequency in which female *C. territans* acquire trypanosomes, through diverse feeding habits, indicates a new relationship between amphibian trypanosomes and mosquitoes that has not been previously examined. Combining *Trypanosoma* species, invertebrate, and vertebrate hosts to existing phylogenies can elucidate trypanosome and host relationships.

14820. **Cortez, A. P., Rodrigues, A. C., Garcia, H. A., Neves, L., Batista, J. S., Bengaly, Z., Paiva, F. & Teixeira, M. M., 2009**. Cathepsin L-like genes of *Trypanosoma vivax* from Africa and South America-characterization, relationships and diagnostic implications. *Molecular and Cellular Probes,* **23** (1): 44-51.

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We characterized sequences from genes encoding cathepsin L-like (CatL-like) cysteine proteases from African and South American isolates of *Trypanosoma vivax* and *T. vivax*-like organisms, and evaluated their suitability as genetic markers for population structure analysis and diagnosis. Phylogenetic analysis of sequences corresponding to CatL-like catalytic domains revealed substantial polymorphism, and clades of sequences (*Tvi*CatL1-9) were separated by large genetic distances. *Tvi*CatL1-4 sequences were from cattle isolates from West Africa (Nigeria and Burkina Faso) and South America (Brazil and Venezuela), which belonged to the same *T. vivax* genotype. *T. vivax*-like genotypes from East Africa showed divergent sequences, including *Tvi*CatL5-7 for isolates from Mozambique and *Tvi*CatL8-9 for an isolate from Kenya. Phylogenetic analysis of CatL-like gene data supported the relationships among trypanosome species reflected in the phylogenies based on the analysis of small subunit (SSU) of ribosomal RNA gene sequence data. The discovery of different CatL-like sequences for each genotype, defined previously by ribosomal DNA data, indicate that these sequences provide useful targets for epidemiological and population genetic studies. Regions in CatL-like sequences shared by all *T. vivax* genotypes but not by other trypanosomes allowed the establishment of a specific and sensitive diagnostic PCR for epidemiological studies in South America and Africa.

14821. **Grebaut, P., Bena, J. M., Manzambi, E. Z., Mansinsa, P., Khande, V., Ollivier, G., Cuny, G. & Simo, G., 2009**. Characterization of sleeping sickness

transmission sites in rural and periurban areas of Kinshasa (Democratic Republic of Congo). *Vector Borne Zoonotic Diseases.* **e-Publication ahead of print March 9.**

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To characterize the potential transmission sites of sleeping sickness in Kinshasa, two entomologic surveys were carried out during the dry and the rainy seasons in rural and periurban areas of Kinshasa in 2005. About 610 pyramidal traps were set up, and 897 *Glossina fuscipes quanzensis* were captured. Environmental and biologic factors were reported, and relationships between these factors were evaluated using logistic regression and multiple correspondence analysis. The biologic factors (the presence of tsetse flies, human blood meals, and teneral flies) were progressively accumulated at each capture site to permit the characterization of the sleeping sickness transmission risk. The dry season was found to be a more favourable period for the disease transmission than the rainy season. Moreover, the landscapes characterized by the presence of argillaceous soils and raised ground cover with forest residues and rivers were identified as types of environments with greater risk of sleeping sickness transmission. Pig breeding appeared as an important factor increasing the disease transmission. If vector control is continuously performed along rivers segments at high risk, the transmission of sleeping sickness in rural and periurban areas of Kinshasa will considerably decrease.

14822. **Opara, M. N. & Fagbemi, B. O., 2008**. Haematological and plasma biochemistry of the adult wild African grasscutter (*Thryonomys swinderianus*). *Annals of the New York Academy of Sciences,* **1149**: 394-397.

Tropical Animal Health and Production, Department of Animal Science and Technology, Federal University of Technology, Owerri, Nigeria. [oparamax@yahoo.com].

Haematological and plasma biochemical values of wild grasscutters were evaluated to determine their potential to transmit zoonotic pathogens. Three 5-mL blood samples were collected from each of 1 000 grasscutters caught in the wild for haematology, biochemical, and parasitological tests. Haematological and biochemical values were compared with those from captive-reared grasscutters. There are significantly ($p < 0.05$) higher lymphocyte, eosinophil, and basophil values for wild grasscutters compared to those that are captive reared. Parasitological examination revealed a 15 percent prevalence of blood protozoa in the wild grasscutters. Blood pathogens encountered were *Trypanosoma* sp. (66.7 percent) and *Plasmodium* sp. (33.3 percent), with 20.7 percent mixed infection. Sex does not significantly ($p > 0.05$) affect blood protozoa infection, while season does. We therefore concluded that wild grasscutters serve as efficient reservoir hosts for agents of African trypanosomiasis and malaria in the tropical humid rainforest region of Nigeria.

14823. **Rayaisse, J. B., Courtin, F., Akoundjin, M., Cesar, J. & Solano, P., 2009**. Influence of anthropisation on local vegetation and tsetse abundance in southern Burkina Faso. *Parasite,* **16** (1): 21-28.

Centre International de Recherche-Développement sur l'Elevage en zone Subhumide, 01 BP 454 Bobo Dioulasso 01, Burkina Faso.

Entomological and phyto-sociological surveys were undertaken in Folonzo, southern Burkina Faso, along the Comoe river. The purpose of this survey was to compare densities and diversity of tsetse species in a protected versus a non protected area, by the mean of transects going from the river bank to the savannah. A detailed phytological description was made in all the trapping sites. The entomological data were also compared to what was obtained in 1980 in the same trapping sites. The phytogeographical study showed great vegetation homogeneity between transects, particularly in the forest gallery, while savannah showed more heterogeneity. Four tsetse species were caught in the area, with 74 percent *G. tachinoides*, 20 percent *G. m. submorsitans*, 4 percent *G. p. gambiensis* and 2 percent *G. medicorum*. There was a significant difference in tsetse densities between the protected and the non-protected area, with in average, four times more tsetse in the protected one. This difference was particularly high for *G. m. submorsitans* with a ratio of 1:9. This decrease was attributed to the reduction in wildlife density in the non protected area, and can be applied to the situation of the whole country where this tsetse species is of decreasing importance. It is one of the consequences of the increase in human densities, this latter causing much less visible changes in phytological species composition. From the comparison between old (1980) and new data collected on the river bank, we see a general trend of decrease in density, which affects less *G. palpalis gambiensis.*

14824. **Rouamba, J., Jamonneau, V., Sidibe, I., Solano, P. & Courtin, F., 2009**. Impact of the dynamics of human settlement on tsetse and trypanosomosis distribution in the Mouhoun river basin (Burkina Faso). *Parasite,* **16** (1): 11-19.

Centre Muraz, 01 BP 390, Bobo-Dioulasso, Burkina Faso.

In Burkina Faso, the Mouhoun river basin (formerly "Black Volta") constitutes a historical focus of human (HAT) and animal (AAT) African trypanosomoses, both transmitted by tsetse flies. Nowadays, HAT seems to have disappeared from this area, while AAT still causes severe economic losses. In order to explain these different epidemiological situations, we undertook a geographical study based on the analysis of aerial pictures between 1952 and 2007, and field surveys to collect medical, entomological, and veterinary data on trypanosomoses. Our results suggest that in this area, landscapes have been dramatically modified as a consequence of population growth, and in turn have had an impact on the number and distribution of tsetse flies. Combined with the historical medical action on HAT which probably led to the disappearance of *T. b. gambiense*, this environmental degradation and the development of hydrological structures provide explanations for the local disappearance of HAT, and for the maintenance of AAT. It appears necessary to extrapolate these studies to other areas in order to identify the factors explaining the presence/absence of trypanosomoses in the context of human population growth and climatic changes, in order to help to target priority areas for the control of these diseases.

14825. **Rutto, J. J. & Karuga, J. W., 2009**. Temporal and spatial epidemiology of sleeping sickness and use of geographical information system (GIS) in Kenya. *Journal of Vector Borne Diseases,* **46** (1): 18-25.

Kenya Agricultural Research Institute-Trypanosomiasis Research Centre, Kikuyu, Kenya. [jjrutto@yahoo.co.uk].

In Kenya, sleeping sickness (SS) caused by *Trypanosoma brucei rhodesiense* is confined to the Nyanza and Western Provinces tsetse belts. Over the last two decades, the disease has exhibited great spatial variability in its spread and distribution. The objectives of the study were to map the spatial and temporal distribution of SS and determine possible risk factors associated with the disease in western Kenya. Geographical coordinates of villages were obtained using a Global Positioning System (GPS). SS data were analyzed retrospectively and the mapping of villages was done using MapInfo Software. Epidemiological data of villages affected by SS were then correlated to human and cattle population. The results showed that SS has spread northwards affecting the western parts of Busia, Teso, and of Bungoma districts in the late 1990s. Most of the SS cases were reported between March and June. The mainly affected age groups were from 20 to 49 years. SS was highest in areas with low human population density, ranging from 0-340/km^2 and high livestock population, ranging from 5 000 to 10 000 cattle. In conclusion, there was a shift of SS occurrence from the old foci into new foci occurring at low transmission levels and causing occasional epidemic outbreaks. The study concludes that seasons influenced disease incidences with higher numbers of SS cases being recorded during the wet seasons. Gender and age determined the disease occurrence with most productive age groups being at higher risk. Areas with high livestock populations had low human population densities and had higher SS cases.

14826. **Vassella, E., Oberle, M., Urwyler, S., Renggli, C. K., Studer, E., Hemphill, A., Fragoso, C., Butikofer, P., Brun, R. & Roditi, I., 2009**. Major surface glycoproteins of insect forms of *Trypanosoma brucei* are not essential for cyclical transmission by tsetse. *PLoS ONE,* **4** (2): e4493.

Institut für Zellbiologie, Universität Bern, Bern, Switzerland.

Procyclic forms of *Trypanosoma brucei* reside in the midgut of tsetse flies where they are covered by several million copies of glycosylphosphatidylinositol-anchored proteins known as procyclins. It has been proposed that procyclins protect parasites against proteases and/or participate in tropism, directing them from the midgut to the salivary glands. There are four different procyclin genes, each subject to elaborate levels of regulation. To determine if procyclins are essential for survival and transmission of *T. brucei*, all four genes were deleted and parasite fitness was compared *in vitro* and *in vivo*. When co-cultured *in vitro*, the null mutant and wild type trypanosomes (tagged with cyan fluorescent protein) maintained a near-constant equilibrium. In contrast, when flies were infected with the same mixture, the null mutant was rapidly overgrown in the midgut, reflecting a reduction in fitness *in vivo*. Although the null mutant is patently defective in competition with procyclin-positive parasites, on its own it can complete the life cycle and generate infectious metacyclic forms. The procyclic form of *T. brucei* thus differs strikingly from the bloodstream form, which does not tolerate any perturbation of its variant surface glycoprotein coat, and from other parasites such as *Plasmodium berghei*, which requires the circumsporozoite protein for successful transmission to a new host.

14827. **Wyatt, K. B., Campos, P. F., Gilbert, M. T., Kolokotronis, S. O., Hynes, W. H., DeSalle, R., Ball, S. J., Daszak, P., MacPhee, R. D. & Greenwood, A. D., 2008.** Historical mammal extinction on Christmas Island (Indian Ocean) correlates with introduced infectious disease. *PLoS ONE,* **3** (11): e3602.

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It is now widely accepted that novel infectious disease can be a leading cause of serious population decline and even outright extinction in some invertebrate and vertebrate groups (e.g., amphibians). In the case of mammals, however, there are still no well-corroborated instances of such diseases having caused or significantly contributed to the complete collapse of species. A case in point is the extinction of the endemic Christmas Island rat (*Rattus macleari*): although it has been argued that its disappearance ca. AD 1900 may have been partly or wholly caused by a pathogenic trypanosome carried by fleas hosted on recently-introduced black rats (*Rattus rattus*), no decisive evidence for this scenario has ever been adduced. Using ancient DNA methods on samples from museum specimens of these rodents collected during the extinction window (AD 1888-1908), we were able to resolve unambiguously sequence evidence of murid trypanosomes in both endemic and invasive rats. Importantly, endemic rats collected prior to the introduction of black rats were devoid of trypanosome signal. Hybridization between endemic and black rats was also previously hypothesized, but we found no evidence of this in examined specimens, and conclude that hybridization cannot account for the disappearance of the endemic species. This is the first molecular evidence for a pathogen emerging in a naive mammal species immediately prior to its final collapse.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

(b) PATHOLOGY AND IMMUNOLOGY

[See also **32**: 14805]

14828. **Blum, J. A., Schmid, C., Burri, C., Hatz, C., Olson, C., Fungula, B., Kazumba, L., Mangoni, P., Mbo, F., Deo, K., Mpanya, A., Dala, A., Franco, J. R., Pohlig, G. & Zellweger, M. J., 2009.** Cardiac alterations in human African trypanosomiasis (*T. b. gambiense*) with respect to the disease stage and antiparasitic treatment. *PLoS Neglected Tropical Diseases,* **3** (2): e 383.

Swiss Tropical Institute, Basel, Switzerland.

In human African trypanosomiasis, neurological symptoms dominate and cardiac involvement has been suggested. Because of increasing resistance to the available drugs for HAT, new compounds are desperately needed. Evaluation of cardiotoxicity is one parameter of drug safety, but without knowledge of the baseline heart involvement in HAT, cardiologic

findings and drug-induced alterations will be difficult to interpret. The aims of the study were to assess the frequency and characteristics of electrocardiographic findings in the first stage of HAT, to compare these findings to those of second stage patients and healthy controls and to assess any potential effects of different therapeutic antiparasitic compounds with respect to ECG changes after treatment. Four hundred and six patients with first stage HAT were recruited in the Democratic Republic of Congo, Angola and Sudan between 2002 and 2007 in a series of clinical trials comparing the efficacy and safety of the experimental treatment DB289 to the standard first stage treatment, pentamidine. These ECGs were compared to the ECGs of healthy volunteers (n = 61) and to those of second stage HAT patients (n = 56). In first and second stage HAT, a prolonged QTc interval, repolarization changes and low voltage were significantly more frequent than in healthy controls. Treatment in first stage was associated with repolarization changes in both the DB289 and the pentamidine group to a similar extent. The QTc interval did not change during treatment. On the basis of these results, cardiac involvement in HAT, as demonstrated by ECG alterations, appears early in the evolution of the disease. The prolongation of the QTc interval comprises a risk of fatal arrhythmias if new drugs with an additional potential of QTc prolongation will be used. During treatment ECG abnormalities such as repolarization changes consistent with peri-myocarditis occur frequently and appear to be associated with the disease stage, but not with a specific drug.

14829. **Checchi, F., Filipe, J. A., Barrett, M. P. & Chandramohan, D., 2008.** The natural progression of *gambiense* sleeping sickness: what is the evidence? *PLoS Neglected Tropical Diseases*, **2** (12): e303.

Department of Infectious and Tropical Diseases, London School of Hygiene and Tropical Medicine, London, UK.

Gambiense human African trypanosomiasis (HAT, sleeping sickness) is widely assumed to be 100 percent pathogenic and fatal. However, reports to the contrary exist, and human trypano-tolerance has been postulated. Furthermore, there is uncertainty about the actual duration of both stage 1 and stage 2 infections, particularly with respect to how long a patient remains infectious. Understanding such basic parameters of HAT infection is essential for optimising control strategies based on case detection. We considered the potential existence and relevance of human trypanotolerance, and explored the duration of infectiousness, through a review of published evidence on the natural progression of *gambiense* HAT in the absence of treatment, and biological considerations. Published reports indicate that most *gambiense* HAT cases are fatal if untreated. Self-resolving and asymptomatic chronic infections probably constitute a minority if they do indeed exist. Chronic carriage, however, deserves further study, as it could seed renewed epidemics after control programmes cease.

14830. **Courtioux, B., Pervieux, L., Vatunga, G., Marin, B., Josenando, T., Jauberteau-Marchan, M. O., Bouteille, B. & Bisser, S., 2009.** Increased CXCL-13 levels in human African trypanosomiasis meningo-encephalitis. *Tropical Medicine and International Health*. **e Publication ahead of print, March 2.**

Institut de Neurologie Tropicale, Université de Limoges, Limoges, France.

To determine the role of the B-cell attracting chemokine CXCL-13, which may initiate B-cell trafficking and IgM production in diagnosing HAT meningo-encephalitis, we determined CXCL-13 levels by ELISA on paired sera and CSF of 26 patients from Angola and of 16 controls (six endemic and ten non-endemic). Results were compared to standard stage determination markers and IgM intrathecal synthesis. CXCL-13 levels in patients' sera had a median value of 386.6 pg/ml and increased levels were associated with presence of trypanosomes in the CSF but not with other stage markers. CXCL-13 levels in patients' CSF had a median value of 80.9 pg/ml and increased levels were associated with all standard stage determination markers and IgM intrathecal synthesis. In conclusion, CXCL-13 levels in CSF increased significantly during the course of HAT. Hence the value of CXCL-13 for diagnosis, follow-up or as a marker of disease severity should be tested in a well-defined cohort study.

14831. **Darby, J. D., Huber, M. G., Sieling, W. L. & Spelman, D. W., 2008**. African trypanosomiasis in two short-term Australian travelers to Malawi. *Journal of Travel Medicine,* **15** (5): 375-377.

Department of Infectious Diseases, The Alfred Hospital, Melbourne, Victoria, Australia.[jondarby76@yahoo.com.au].

We report two microbiologically confirmed cases of trypanosomiasis in short-term Australian travelers to Malawi. The initial diagnosis was followed by medical evacuation to South Africa where suramin therapy was commenced. The treatment course was completed on return to Australia, with subsequent follow-up. This diagnosis should be considered in travelers returning from an endemic region.

14832. **Fevre, E. M., Wissmann, B. V., Welburn, S. C. & Lutumba, P., 2008**. The burden of human African trypanosomiasis. *PLoS Neglected Tropical Diseases,* **2** (12): e333.

Centre for Infectious Diseases, University of Edinburgh, Ashworth Laboratories, Edinburgh, UK.

Human African trypanosomiasis (HAT, or sleeping sickness) is a protozoan parasitic infection caused by *Trypanosoma brucei rhodesiense* or *Trypanosoma brucei gambiense*. These are neglected tropical diseases, and *T. b. rhodesiense* HAT is a zoonosis. We review current knowledge on the burden of HAT in sub-Saharan Africa, with an emphasis on the disability-adjusted life year (DALY), data sources, and methodological issues relating to the use of this metric for assessing the burden of this disease. We highlight areas where data are lacking to properly quantify the impact of these diseases, mainly relating to quantifying under-reporting and disability associated with infection, and challenge the HAT research community to tackle the neglect in data gathering to enable better evidence-based assessments of burden using DALYs or other appropriate measures.

14833. **Hope-Rapp, E., Moussa Coulibaly, O., Klement, E., Danis, M., Bricaire, F. & Caumes, E., 2009**. Double trypanosomal chancre revealing West African trypanosomiasis in a Frenchman living in Gabon. *Annales de dermatologie et de vénéréologie,* **136** (4): 341-345.

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Human African trypanosomiasis (sleeping sickness), an endemic disease, is currently reemerging in Africa with an estimated incidence of 45 000 new cases per year. It is caused by *Trypanosoma brucei* subspecies and transmitted by day-biting tsetse flies. We report a case of West African trypanosomiasis due to *Trypanosoma brucei gambiense* involving a Frenchman living in Libreville, Gabon. The patient presented with fever and polyadenopathies as well as two skin ulcerations highly suggestive of trypanosomiasis. Microscopic examination of cutaneous and peripheral blood smears confirmed the diagnosis of haemolymphatic infection with *T. b. gambiense* with trypanosomal chancres. Examination of the cerebrospinal fluid was normal. The patient was successfully treated with pentamidine isethionate. It is concluded that recognition of cutaneous manifestations may allow a rapid diagnosis of African trypanosomiasis that is essential for timely and efficient treatment and survival.

14834. **Lun, Z. R., Reid, S. A., Lai, D. H. & Li, F. J., 2009**. Atypical human trypanosomiasis: a neglected disease or just an unlucky accident? *Trends in Parasitology,* **25** (3): 107-108.

Center for Parasitic Organisms, State Key Laboratory of Biocontrol, School of Life Sciences, and Key Laboratory of Tropical Diseases Control (the Ministry of Education), Sun Yat-Sen (Zhongshan) University, Guangzhou 510275, China.

No abstract available.

14835. **Pays, E. & Vanhollebeke, B., 2008**. The controversial story of the human trypanolytic factor. *Médecine sciences (Paris),* **24** (10): 792-793.

Laboratory of Molecular Parasitology, Université Libre de Bruxelles, Gosselies, Belgium. [epays@ulb.ac.be].

No abstract available

(c) TREATMENT

[See also: 14807]

14836. **Bukachi, S. A., Wandibba, S. & Nyamongo, I. K., 2009**. The treatment pathways followed by cases of human African trypanosomiasis in western Kenya and eastern Uganda. *Annals of Tropical Medicine and Parasitology,* **103** (3): 211-220.

Institute of Anthropology, Gender and African Studies, University of Nairobi, P.O. Box, 30197-00100, Nairobi, Kenya.

Although early diagnosis and treatment are key factors in the effective control of human African trypanosomiasis (HAT), many cases of the disease delay taking appropriate

action, leading to untold suffering. As a better understanding of treatment-seeking behaviour should help in identifying the obstacles to early diagnosis and effective treatment, the treatment pathways followed by 203 former HAT cases in western Kenya and eastern Uganda have recently been explored. About 86 percent of the HAT cases had utilized more than two different healthcare options before being correctly diagnosed for HAT, with about 70 percent each using more than three different health facilities. Only about 8 percent of the cases reported that they had been correctly diagnosed the first time they sought treatment. Just over half (51 percent) of the HAT cases had been symptomatic for >2 months before being correctly diagnosed for HAT, and such time lags in diagnosis contributed to 72 percent of the cases receiving their first appropriate treatment only in the late stage of the disease. The likelihood of a correct diagnosis increased with the time the case had been symptomatic. These observations indicate an urgent need to build the diagnostic capacity of the primary healthcare facilities in the study area, so that all HAT cases can be identified and treated in the early stage of the disease.

14837. **d'Alessandro, E., 2009**. Médecins Sans Frontières (MSF) and sleeping sickness control. From bush to international health space. *Bulletin de la Société de Pathologie Exotiqu*e (Paris)*,* **102** (1): 41-48.

CNRS UMR 6578 et Fondation MSF. [eugeniealessandro@hotmail.com]

In this article, we provide a history of the management of HAT by Médecins Sans Frontières since the 1980's. Through this, we highlight medical innovations in the field of diagnosis and treatment. MSF's efforts have been successfully invested in (1) epidemiological and clinical diagnosis, (2) evaluation of available drugs and (3) development of new treatment protocols. After working in isolation, MSF will have to collaborate with other international health organizations. Specific problems for medical practice and research in Southern countries should be the major challenges for medical innovations.

14838. **Mumba Ngoyi, D., Lejon, V., N'Siesi, F. X., Boelaert, M. & Buscher, P., 2009**. Comparison of operational criteria for treatment outcome in *gambiense* human African trypanosomiasis. *Tropical Medicine and International Health,* **14** (4): 438-444.

Institut National de Recherche Biomédicale, Avenue de la Démocratie, Kinshasa, Democratic Republic of the Congo.

The objective of this study was to develop a simple and standard operational decision tool for the diagnosis of relapse after treatment for human African trypanosomiasis (HAT), by evaluating the performance of several criteria currently used by HAT control programs and research projects. We identified 10 different criteria for relapse, based on trypanosome presence and/or white blood cell count in cerebrospinal fluid, and compared their specificity, sensitivity and time to diagnosis on a data set containing 63 relapsed and 247 cured *T. b. gambiense* patients. The results showed that at any time point, the criterion 'Trypanosomes present and/or a cerebrospinal white blood cell count > or =50/µL' allowed accurate and timely detection of HAT relapse, irrespective of disease stage. This criterion was 13-25 percent more sensitive ($p <$ or $= 0.013$) than trypanosome detection alone and was >97 percent specific. Lumbar punctures at the end of treatment and at 3-month post-treatment

provided limited clinical information. It was concluded that adequate detection of relapse was possible with a simple criterion but these findings should be validated in a prospective study before adoption in clinical practice.

14839. **Rodgers, J., 2009**. Human African trypanosomiasis, chemotherapy and CNS disease. *Journal of Neuroimmunology*. **Available on line 9 March.**

Institute of Comparative Medicine, Faculty of Veterinary Medicine, University of Glasgow, Bearsden Road, Glasgow, G61 1QH, UK.

Trypanosomes have been recognised as human pathogens for over a century. Human African trypanosomiasis is endemic in an area sustaining 60 million people and is fatal without chemotherapeutic intervention. Available trypanocidal drugs require parenteral administration and are associated with adverse reactions including the development of a severe post-treatment reactive encephalopathy (PTRE). Following infection the parasites proliferate in the systemic compartment before invading the CNS where a cascade of events results in neuroinflammation. This review summarises the clinical manifestations of the infection and chemotherapeutic regimens as well as the current research findings and hypotheses regarding the neuropathogenesis of the disease.

14840. **Sindato, C., Kibona, S. N., Nkya, G. M., Mbilu, T. J., Manga, C., Kaboya, J. S. & Rawille, F., 2008**. Challenges in the diagnosis and management of sleeping sickness in Tanzania: a case report. *Tanzanian Journal of Health Research,* **10** (3): 177-181.

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In Tanzania sleeping sickness presents a serious threat to human health with a country-wide average of 400 cases reported annually. Both wild and domestic animals have been found to play a significant role in the epidemiology of sleeping sickness. Serengeti National Park in northern Tanzania, has experienced a number of sleeping sickness epidemics since 1922. The epidemics were associated with abundant game animals in the areas and *Glossina swynnertoni* was incriminated as the main vector. However since 2001 there has been no case of sleeping sickness reported from the park. This case report highlights on the possibility of resurgence and challenges in the diagnosis and management of sleeping sickness in Serengeti. A 38 years old Tanzanian man working in the Serengeti National Park who had experienced various tsetse bites was presented with a febrile condition and history of unsuccessful case management at different health facilities. Blood and cerebrospinal fluid (CSF) samples were examined for the presence of trypanosomes using wet film, Field's stain and concentration techniques. *Trypanosoma brucei rhodesiense* were detected in both the blood and CSF samples. The patient was treated successfully with melarsoprol. The results of this case study highlight the possibility of resurgence of sleeping sickness in the park hence call for the need to create more awareness among the community and clinicians. There is need for early reporting to health facility and strengthening the diagnostic capacity of healthcare facilities in and around national parks endemic for sleeping sickness.

14841. **Tshimungu, K., Kalambayi, B. B., Kiyombo, M., Okenge, L. N. & Mol, P. D., 2008**. Knowledge, behaviours, practices and beliefs regarding human African trypanosomiasis (HAT) among inhabitants of Kinshasa (Democratic Republic of Congo). *Santé,* **18** (3): 141-147.

Laboratory of Medical Microbiology Faculty of Medicine University Hospital University of Liege, Kingdom of Belgium, Department of Epidemiology and Biostatistics Faculty of Medicine University Notre-Dame of Kasai Kananga Democratic Republic of Congo, School of Public Health Faculty of Medicine University of Kinshasa Democratic Republic of Congo, Demography Faculty of Economic Sciences University of Kinshasa Kinshasa Democratic Republic of Congo.

In Kinshasa, an average of less than 50 new cases of human African trypanosomiasis was notified, per year, between 1969 and 1995. The situation of endemic sleeping sickness suddenly worsened in 1996 with 254 new cases identified thanks to passive detection. No study dealing with conceptions relative to sleeping sickness was ever listed to date. The objective of this study was to determine the level of knowledge, behaviours, practices and local beliefs about sleeping sickness among residents of the endemic zone of Kinshasa. The investigation relied on a case/control study. We used a quantitative and qualitative methodology (structured questionnaire and focus on discussion groups). Case-patients were people affected by trypanosomiasis between the 1 January 2004 and the 31 December 2005 and who registered to the National Human African Trypanosomiasis Program (PNLTHA-RDC). Controls were sero negative residents. The case/control ratio was 1/2. A total of 437 case patients and 874 controls were included in the study. Level of knowledge of elementary concepts about trypanosomiasis was low among case-patients (44 percent). The proportion of participants with a low level of education was more important in the group of case-patients (40 percent) than in the control group (25.6 percent). The supernatural origin of trypanosomiasis was evoked such as divine, sorcery and transgression of rules. Many respondents (31.4 percent) call on churches for help when they are not satisfied with the health centre where first therapeutic aid is provided. An important proportion of people who participated to the study (87 percent) were in favour of a passive detection. After testing the degree of statistical significance, several variables appeared to be determining factors for the acquisition of knowledge of human African trypanosomiasis in the city of Kinshasa: education level (elevated: 81 percent, low: 19 percent; $p < 0.0001$), age (>/=20 years old: 89.9 percent, < 20 years old: 10.1 percent; $p < 0.0001$), sex (57.2 percent of patients were male and 42.8 percent were female; $p < 0.001$), birth place (51.4 percent were not native of Kinshasa and 48.6 percent were indigenous or born in Kinshasa; $p < 0.05$) and travel/stay in endemic areas (yes: 56.3 percent, no: 43.7 percent; $p < 0.0001$). The very restrained knowledge of people involves a generalized lack of interest. Their behaviour illustrates their lack of concern by the fight against trypanosomiasis. Beliefs and practices of Kinshasa's inhabitants (coming from their conceptions) also stand in the way of plans meant to fight the disease. It is necessary to improve the knowledge of preventive strategies and to fight social prejudice and false beliefs by informing and educating populations.