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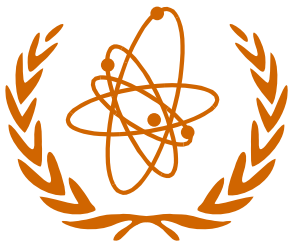

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SECTION A – NEWS

STATEMENT BY THE PAAT COMMUNITY

This statement reflects the consensus reached at the 8th Meeting of the Panel of PAAT Advisory Group (PAG) Co-ordinators, 24-25 September, 2002, Nairobi, Kenya, which included members from the mandated international organizations (AU/IBAR, FAO, IAEA, WHO), tsetse-affected countries, NARS, ARIs and relevant international institutes (ILRI, ICIPE, CIRAD and IFAD).

Following the decision of African Heads of State and Government, the broad Tsetse and Trypanosomiasis (T&T) community as represented by the Programme against African Trypanosomiasis (PAAT) is united in its resolve to reduce and ultimately eliminate the constraint of tsetse-transmitted trypanosomiasis in man and animals.

The PAAT community believes that progress towards the final objective is best achieved through concerted efforts towards intervention, in a sequential fashion, with the focus on those areas where the disease impact is most severe and where control provides the greatest benefits to human health, well-being and sustainable agriculture and rural development (SARD).

It is recognized that the scale and impact of trypanosomiasis in man and animals vary between African countries and progress towards the ultimate objective will also vary.

It is also recognized that in the case of human trypanosomiasis, disease management will continue to depend on disease surveillance, detection and treatment as the principal priority for the foreseeable future, with tsetse suppression as a complementary tool. Tsetse intervention strategies need to be developed as a component of longer-term human trypanosomiasis prevention measures.

In animal trypanosomiasis tsetse intervention has a key role to play in the effective control and eventual elimination of the disease. A significant stage in achieving this objective is the creation of tsetse-free zones through the integration of appropriate and environmentally acceptable technologies, including SAT and SIT as economically justified. In this context the PAAT community supports the outcome and the associated joint press release resulting from the PAAT-PATTEC harmonization workshop, Rome, 2-3 May 2002. The workshop identified criteria for selecting priority areas for joint international action. Governments, international and funding agencies are encouraged to also apply these criteria.

The PAAT community also recognizes the need to continue encouraging livestock producer-based practices against T&T wherever the diseases present themselves a problem.

In order to more effectively combat the diseases, both in man and animals, and their vectors, further concerted efforts are needed with a view to develop and implement joint field programmes for sleeping sickness and animal trypanosomiasis interventions.

In this regard, it is opportune to consider refinement of T&T intervention policies, and enhance synergies and complementarities among all concerned international agencies and governments.

MEETING REPORT

Report of the eighth PAAT Advisory Group Coordinators' Meeting, Nairobi, Kenya

The eighth PAAT Advisory Group Coordinators' meeting was held at ILRI, Nairobi, Kenya, 24-25 September, 2002. The following is a summary of the proceedings of the meeting, starting with the draft conclusions and recommendations.

Participants' draft conclusions and recommendations

1. PAAT criteria are reasonable and effective, and verify the choice of two current priority areas in Burkina Faso and Ethiopia. The choice of these two regions does not preclude selection of additional priority areas, according to the agreed criteria; indeed many delegates stressed the need for new areas to be seen to be chosen on a regular basis to demonstrate effective planning capability.
2. PAAT/PATTEC harmonization and Edinburgh meeting conclusions have many points of similarity, most obviously that there is in the main broad consensus on the need for T&T interventions to alleviate poverty, and the range of implementation options available. It is also broadly agreed that tsetse control in isolation is both technically undesirable and also unacceptable to the donors; rather it must be carried out in the context of sustainable agricultural rural development in the broadest sense.
3. It is also broadly agreed that local and area wide tsetse interventions are both economically justifiable.
4. The AU declaration has led to widespread and repeated political support in Africa and UN for T&T control activities. This is now best interpreted so that eradication is the 'vision' or political aim, which is not and cannot be timebound. The operational strategy is time limited step-wise control of T&T in objectively delimited areas. All concerned stakeholders should be involved, from national and local government to farmers, in all stages of planning and implementation. This is reflected in a general move away from technology-driven to demand-led and integrated programmes.
5. Issues relevant to sleeping sickness should be more closely integrated into PAAT/PATTEC initiatives. It is important that trypanosomiasis be promoted from the neglected list; that appropriate use be made of the tools already available and that these must be made more accessible to the people. Formation of global public private partnerships is an effective strategy.
6. There is a need to encourage countries to act to use or raise their own funds as a demonstration of intent.
7. Training and capacity building at all levels (e.g. policy-makers, technicians, communities) form the key to successful implementation.
8. There must be a common policy and a single message to the wider community, to be identified soon, in order to end the current confusion as to the desirability and technical feasibility of T&T interventions.

9. Success stories, especially self-funded ones like that of Botswana, should be publicized and environmental impacts documented.
10. Policy formulation and collaboration at regional level should be strongly encouraged.
11. Strategies, plans and techniques must be chosen objectively according to the specific conditions and characteristics of each individual intervention area. These are likely to differ between areas, according to many factors, including resources and time available, scale of implementation, likely impact and stakeholder requirements. A holistic and integrated approach is essential. Some strategies may suit one area but not another.
12. Baseline data and environmental monitoring are desirable, and efforts should be made to standardize or at least ensure compatibility of information, to allow exchange between projects; however there must be national ownership.
13. There is an urgent requirement to acquire data on disease risk and vectors. Governments should be encouraged to allocate adequate resources for this purpose.
14. The epidemiological/epizootical situation is not static – continuous updates are essential. In addition, demographic and climatic changes are affecting tsetse challenge and disease risk, and should be assessed to provide projections.
15. T&T intervention activities should capitalize on existing trends in land-use change, climate change and settlement patterns and try and facilitate autonomous control of T&T by active measures.
16. The development of TCPs in support of PATTEC was widely welcomed.

Opening addresses

With Professor P. Holmes in the Chair, the first address was given by David Taylor, Deputy Director General of ILRI, on behalf of the new Director Carlos Sere. Welcoming delegates, he stressed that ILRI undertakes many activities in Tsetse and Trypanosomiasis (T&T) control, which are one of the Institute's flagship themes, and highlighted ILRI's good contacts with local and national institutes. Three policy strands were emphasized: 1) to help the poor to build their assets, which implies a focus on preventing disease to maintain livestock-based assets; 2) to build productivity by, for example, addressing T&T; and 3) to maximize access to markets. ILRI increasingly acts as a project facilitator, and so is a partner rather than leader in most projects. Sharing resources and information is a high priority.

The Director of KETRI, Dr Joseph Ndung'u, gave the second address. He said he was attending the meeting as the official representative of the Ministry of Agriculture and Rural Development. He stated that Kenya supports T&T control related agencies, such as ISCTRC, PAAT, and PAATEC. The existence of KETRI, and ILRI and ICIPE within Kenya demonstrates Kenya's commitment to T&T control. African governments in general are coming to appreciate T&T's significance to livestock and human health. Dr Ndung'u emphasized that the community must look forward and not dwell on past problems, and stressed that T&T control will significantly contribute to poverty reduction. The choice of ILRI as the meeting's venue is most appropriate given its distinguished role in T&T control. Dr Ndung'u was also present in his capacity as KETRI Director. Delegates were very welcome to visit KETRI projects. Dr Ndung'u then declared the meeting open.

Introduction – Professor P. Holmes

PAAT was formed 5 years ago as an international forum to take forward T&T control activities. It is unique in its composition of four mandated organizations (WHO, IAEA, FAO, AU/IBAR). WHO deals with Human African Trypanosomiasis, whilst FAO and AU/IBAR are more concerned with livestock. T&T control is now positioned as central to poverty and poverty reduction, and is increasingly placed in the context of sustainable development.

Last year's PAG meeting in Ouagadougou focussed on West Africa. The present meeting was concentrated on Ethiopia and dealt with a wide range of topics, such as the harmonization of PAAT and PATTEC, social development, disease and vector status, and the technical aspects of prioritization.

PATTEC has successfully raised the political profile of the problems caused by T&T. PAAT experts are well placed to set international technical policy, and to assist national programmes, as well as to identify project guidelines, research priorities, and strategies. It is essential to have a clear message to give donors and the public, which PAAT experts can assist in developing.

Report of the PAAT Secretariat and FAO/PAAT Activities – report from FAO, R. Mattioli

PAAT has made significant achievements since 2001. The report of the workshop "*Strategic planning of area-wide tsetse and trypanosomiasis control in West Africa*" and the PAAT T&S Series No. 3 "*Integrating the SIT as a key component of area-wide tsetse and trypanosomiasis intervention*" have been published. Progress has been made on four additional PAAT *Technical & Scientific Series* Papers (these concern economic principles in planning control and intervention in West Africa, role of trypanotolerance, role of socio-economic and cultural factors, landscape and fly ecology in West Africa). It is intended to move on to East Africa related papers next year.

A PAAT/PATTEC Harmonization Workshop was held in Rome, May 2002, where criteria and guidelines for joint international effort against T&T were developed in the context of Sustainable Agricultural Rural Development; factors contributing to increased feasibility and the early success of project activities and sustainable outcomes were identified.

Two Technical Cooperation Programmes, 'Capacity Building and Programme Development in support of PATTEC' to be implemented January 2003; and 'Sustainable control of tsetse and trypanosomiasis' are in progress. FAO participated in the 2nd Meeting of the Policy and Mobilization Committee of PATTEC, Addis Ababa, August 2002. A joint IAEA/FAO Regional Training Course on GIS was held in Ouagadougou, May 2002. It focussed on GIS requirements for planning and data manipulation needed for implementing tsetse interventions. Participants from seven West African countries were trained in GIS, and provided with data and software.

Issues of *TTIQ* were produced, and the Livestock Geography CD disseminated. Spatial CD with two reports entitled '*Spatial information for concerted tsetse and trypanosomiasis control in West Africa*' and '*Assessment of priority areas for trypanosomiasis control actions by satellite data and fuzzy logic'* was produced. The PAAT Information System is available on CD and the web, and continues to be updated; it consists of the Web site, PAAT-L, PAATIS, and *TTIQ* bibliography. A range of communiqués (Cairo, Johannesburg) and press announcements have been released. Conference resolutions (FAO on PATTEC) and letters of collaboration (IAEA collaboration in PAAT) have been formalized. FAO looks forward to signing a letter of formal collaboration agreement with AU.

National capacity building has been reinforced through holding a strategic planning workshop and a GIS training course in East Africa by FAO/IAEA, and a sustainable agricultural rural development (SARD) dimension introduced into existing programmes in current priority areas of Mali/Burkina Faso, and Ethiopia, as well as into the implementation of ongoing TC Programmes.

Updating and reinforcing PAATIS, and modernizing and restructuring the PAAT website have continued; new features for communication, integrated pest management strategies and developing novel analysis tools have been established; distance learning and access to training on GIS and remote sensing have been enhanced; facilitating e-library and enhancing regional e-conference moderation capabilities are on-going as well as linking PAAT to the media, rural radio and the press.

The Chair stressed that PAAT was especially grateful to FAO for support it has given to PAAT over the last year.

Report on Further PAAT-PATTEC Harmonization – Prof A. Ilemobade

FAO organized a PAAT/PATTEC harmonization workshop in Rome in May, 2002, and a press statement on the outcome was released. A series of guidelines for prioritizing areas was agreed. These guidelines were:

1. The impact of tsetse should be high and evident.
2. Any intervention must be supported by farmers and by Government.
3. Intervention goals must include poverty reduction and an increase in food security within a SARD context, through an expansion of farming and by enhancing land tenure.
4. Any project must have a 5-7 year cycle.
5. There must be natural barriers to fly dispersal or artificial confinement to minimize the risk of re-invasion.
6. There must be a favourable ecological production trend, with evidence of existing land pressure.
7. There must be favourable climate trends.
8. There must be demonstrable commitment of the stakeholder communities.

Two major project areas were identified that conformed to the guidelines, one in Burkina Faso/Mali and another in the Ethiopian Rift Valley system.

The speaker suggested that the outcomes of the recent DFID sponsored conference in Edinburgh and that in Lisbon are likely to be of interest. It was understood that the

discussions at these meetings were full and frank, but that areas of compromise and agreement were much more significant than areas of disagreement.

Delegates who had attended either or both these meetings summarized their understanding of the main conclusions reached at Edinburgh. These were that the PAAT prioritization guidelines were useful; that tsetse control alone was no longer acceptable to the donors, and that T&T control activities must be sustainable and conducted in an holistic context of farmer involvement and SARD; that fly eradication, though possible in certain areas, was generally a long term goal, eventually reached by means of vector control; that DFID accepted a country perspective; that T&T interventions to create tsetse free zones were economically justifiable and cost up to US$2 000 per square kilometre; that the T&T community must be seen by donors and the public to have a single voice; that there should be a technical advisory body (perhaps a modified PAAT) with significant funding able to commission research as needed by field programmes; and that details of any intervention must be identified on a project-by-project basis, as appropriate to technical constraints and national policies. Finally it was noted that there was a serious lack of human and financial resources for T&T control activities which needed to be urgently addressed.

The speaker then continued to describe the harmonisation activities including the FAO conference resolution in support of the PATTEC initiative, the identification of two priority field projects and two TC Programmes. One of these, in support of PATTEC, will develop an historical T&T database for the two identified project areas, and with input from ILRI provide strategic support in the preparation of proposals in the context of SARD, food security and poverty alleviation.

PAAT/PATTEC harmonisation is intended to promote capacity building, identify sound field programmes and provide technical support to intervention projects and policy makers. It ensures interlocking log-frames, and encourages strategic planning beyond the prioritized hotspots. One of its consequences is that it may be necessary to review PAAT structures to enable it to respond to emerging issues.

It was mentioned that the successful application of the guidelines relied on the availability of current data; re-using out of date information should be avoided. The agricultural situation, particularly in West Africa, is very dynamic, meaning that priorities might change rapidly.

It was noted that countries should now be strongly encouraged to act, and provide some indication of commitment to action. They should use the PAAT guidelines, but insofar as they focussed largely on livestock and crops, then for some countries, especially those where HAT is the major T&T problem, they might not be appropriate unless broadened to include criteria related to sleeping sickness.

Report from AU/IBAR and PATTEC – H.M. Solomon

IBAR is now more than fifty years old. It is an AU Initiative on Livestock Development in the context of the recently developed NEPAD. Poverty reduction is central to NEPAD's objectives, and livestock related issues are being considered for inclusion.

The AU is being restructured and its livestock policies will focus on major trans-boundary issues, and on marketing and trade by, for example, setting up a livestock trade

commission, in the context of exports to the Gulf States. It will also focus on harmonising cross cutting policy issues and on environmental sustainability. The AU will strongly encourage the development of national programmes, and has re-affirmed its policy of cooperating with international agencies.

FITCA has a budget of €20m of which €13m is committed and 25 percent has been disbursed to date. It is concerned with farming in tsetse controlled areas and has a complex range of objectives focussing on sustainability and integration. National priorities vary: FITCA Ethiopia's emphasis is on capacity building and training, while FITCA Kenya is concentrating on measures to increase agricultural productivity. FITCA Uganda's primary concern is human sleeping sickness, and FITCA Tanzania's focal theme is disease control in rural areas. FITCA may eventually incorporate Rwanda and Burundi, and may expand into Sudan.

PATTEC, an African initiative, owned by Africans, has been launched with the highest of political profiles. It has been allocated seed money by AU, which ensures its continuing existence. AU Heads of State have now made three statements declaring war on tsetse and have instructed that all countries must include PATTEC in National Development Strategies. There have been many other political statements in support of PATTEC from UN agencies and from the UN Secretary General.

PATTEC is an IBAR 'grandchild' with new parents in the four UN agencies mandated within PAAT. Its children are the country and regional programmes such as those in West Africa, Ethiopia, Botswana, and the Great Lakes region. It would like more children.

PAATEC has matured very rapidly. The Mombasa Declaration of 1999 stated that human sleeping sickness is increasing and must be brought to attention of Heads of States through AU. After one year the SIT forum was launched and an Action Plan formulated, a concept that will be modified and implemented over perhaps 50 years. After two years PATTEC was officially launched in Ouagadougou.

AU has set up a Policy and Resource Mobilisation Committee (PRMC), with five appointed ambassadors. One is the Ambassador of Botswana which country has a self-financed tsetse control programme. Others are eminent scientists. The committee considers trypanosomiasis to be a major disease and T&T control activities should be brought to the level of the very successful Roll Back Malaria campaign.

The ISCTRC 27th conference is scheduled to take place on 29 September-3 October 2003, in Pretoria, South Africa. It will build on the successes of the 25th and 26th meetings in Mombasa and Ouagadougou, particularly in the harmonisation of a wide range of satellite meetings. PAAT is strongly encouraged to contribute.

PATTEC is hoping to start a project in West and Central Africa along the lines of FITCA. After rejection of the original proposal five years ago, a new concept note was formulated and sent to the EU. EU made significant changes to ensure a focus on poverty reduction with T&T control activities as the major entry point. This EU-endorsed concept note has now been sent to national bodies to ensure involvement of national stakeholders.

In summary, PAATEC is an African initiative with a remarkable level of political support.

Brief on the Sleeping Sickness Situation – WHO, J. Jannin

WHO is undergoing some major personnel and structural changes. There will be a new Director General and a Director for the Africa Office, and Sleeping Sickness has been moved to a new Department.

There is often a significant gap between real situations and research tools such as regional maps. As a result more innovative tools are not needed: rather the available tools (e.g. GIS) must be made more accessible and relevant to the people. In this context, WHO have expanded HQ staff numbers to enhance networks with regional staff (Cairo, Abidjan, Yaoundé, Kinshasa, Kampala and Harare).

A new concept of 'neglected diseases' has arisen, defined as those diseases with broken links for treatment which therefore need restoring; the concept is linked to a parallel concept of a neglected population. A neglected disease (of which sleeping sickness is one) is fatal, affects rural populations, and as it affects a small part of the population, is difficult to diagnose. Sleeping sickness needs to be rescued from the neglected list. To this end, the 55th World Health Assembly produced document entitled '*WHO programme to eliminate sleeping sickness: Building a global alliance*', which describes a global alliance of public private partnerships between Arventis, Bayer Myers Squibb, Bayer, the Gates foundation (supporting clinical research), DNDi (allied to MSF), and national agencies of Belgium and France. This alliance provides sleeping sickness drugs free of charge, with a process administered by WHO HQ, which also provides a bi-annual drug forecast for pharmaceutical companies. Distribution is implemented by MSF.

WHO has developed a strategy to improve organizational aspects, maximize human resources and to raise funds. This involves coordination, support to country field activities (surveying, screening, diagnosis, treatment) and logistics, as well as support to funding initiatives and research. A major goal is to convince African governments to allocate their own resources towards combating sleeping sickness.

WHO is undertaking a range of activities and initiatives to restore broken links for sleeping sickness treatment. It is providing training through workshops, and is working towards establishing a consensus of treatment techniques, as well as promoting a multi-pronged diagnosis approach. A series of networks are being developed – such as the sleeping sickness treatment and drug resistance network, and a new network to promote drug development. A new Continental surveillance programme and a new Human African Trypanosomiasis economics and disease burden working group have been established. There are also plans to set up initiatives to develop diagnostic tools and stage determination, and to improve the management of drug supply.

WHO is fully involved in PAAT. It is also involved in advocacy programmes, so that trypanosomiasis now ranks seventh according to its DALY impact. Of global parasitic diseases, it comes second just below malaria. Numerous press releases have been produced, and programmes with school children and medical students in developed countries set up.

There is now a unique team, with WHO at its head, which has established a global alliance to eliminate sleeping sickness. It still faces serious constraints, however: there is a lack of human resources, of research, and of demonstrable involvement by the countries

affected, all exacerbated by political instability. Coordination is essential. Finding funds is not the problem, but spending the funds sensibly and sustainably is.

The Chairman congratulated WHO on providing such a clear message on the value of consensus, publicity and partnership.

Botswana: report of aerial spray operation, present and future perspectives – Patrick Kgori

Only *Glossina morsitans centralis* is present in the Okavango Delta. The affected area amounts to 25 000 square kilometres which was reduced to 5 000 sq. km, by aerial spraying up to 1991, after which 25 000 targets were deployed over a ten year period. These were dogged by problems with strong winds, destruction by wildlife, and in 1999, the majority of the targets were flooded. By 2001 the fly range had expanded to 12 000 sq. km., cattle north of Delta were dying from nagana, and tourism in the Delta was beginning to be adversely affected.

In response to this resurgence, a three stage programme was established, involving drug treatment of sick animals; a reintroduction of aerial spraying (perhaps with targets); and finally the use of SIT if it proved necessary. The spraying programme was executed over two years, with a maximum designed programme life of three years. Spray blocks were delineated to reduce re-invasion risk by minimising boundaries. The programme started in the northern half of the infested area, and the spray block was protected by concentrating available targets within a 15 km wide barrier. Fly pickets were also employed.

The aerial spraying was carried out by four Thrush crop sprayer aircraft modified with lights for night flight, rotary atomizers, and a SATLOC guidance system which logs and controls the spray system. It is accurate to 1m. If the pilot goes off track, then spraying is shut down. The pilot programmes the SATLOC computer with spray block coordinates, and spray application is controlled accordingly. The spray block is further protected by boundary spraying to mop up stray flies.

Late in preparation of the first year's programme, stakeholder consultations led to a change in the selection of insecticide to Deltamethrin B. This entailed equipment and formula modification to optimize droplet size, which caused a delay of the planned first cycle, after which surviving flies were detected by manned fly rounds, and cycle 2 was advanced. After five cycles teneral flies were detected, and so a sixth spray cycle was flown. No flies have been detected in the northern block since August 2001.

The second phase programme, in 2002, covered the southern block and consisted only five spray cycles. No flies have been found since the fourth cycle. It therefore seems that there has been no reinvasion, which means that the target barrier continues to be effective, and will therefore be maintained. Fly surveys will also be maintained.

The major lessons learned are that the insecticide formulations are effective and that the SATLOC system is absolutely essential. It is hoped to extend operations to the remaining northern distribution and to include the Namibian Caprivi fly populations. It remains to establish and quantify the residual effects of insecticide on aquatic and terrestrial fauna.

The discussion was started by the Chairman who stressed that this was a major success story, and is self-funded. The need for publicity was raised, and the possibility of

setting up sub-regional programmes and integrating southern Africa into PATTEC was discussed. The question of environmental monitoring was raised, and it was noted that a temporary drop in abundance but no significant compositional changes in invertebrate fauna had been found by the Okavango Research Centre.

The environmental and agricultural constraints to spraying were discussed. The former mean that spraying must be at night during cold season, and that average daily temperatures must be closely monitored to calculate the pupal period estimates needed to time spray intervals. The fact that the Okavango is flat and contains no agriculture means that aerial spraying is an appropriate technique.

Report on Tsetse and Trypanosomiasis activities in Sudan (FAO TCP/SUD/0069) – A.H.A. Rahman.

Animal trypanosomiasis is increasing in Sudan as a result of drought-induced changes in transhumance patterns, increased drug resistance, a spread of vectors, and an increase in peri-urban cattle farming. In response an FAO Technical Cooperation Programme (TCP) has been initiated recently to draft a national strategic programme for T&T control activities. The TCP focuses on capacity building, raising awareness, and making an epidemiological survey of the major cattle producing areas of Blue Nile, West Kordofan, White Nile and South Darfur Provinces. The ecological characteristics of these four areas are markedly different and are set out at some length in the written version of the presentation.

A dry season survey has been completed, during which 4 000 cattle were examined for trypanosomiasis, and modified epsilon traps were used to estimate tabanid fly and tsetse numbers. A wet season survey is currently in progress. The dry season results show that the tsetse is present only in South Darfur, which also suffers the highest mean trypanosomiasis infection rate (11.7 percent), caused by *Trypanosoma vivax* and *T. congolense*. In the absence of tsetse flies, the other areas suffered infection rates of between 1.2 percent and 4.2 percent, and only from *T. vivax*. A number of locations were surveyed in each Province, and it was found that high tabanid fly catches generally coincided with comparatively high trypanosomiasis infection rates.

Considerable efforts were made to find the northern limit of the tsetse belt in the vicinity of Radom, Southern Darfur. Though flies were found near Radom itself, significant densities were only found some 50 km to the south-west. The effectiveness of various types of traps was also assessed under a range of conditions. None were as effective as manned fly rounds.

The Chairman congratulated Dr Rahman on his work, and expressed his pleasure that Sudan was now generating field data. The spread of the disease to zero-grazing units near Khartoum, and the consequent collapse of the milk production in Gezira, was flagged as the reason underlying Sudan's national plan to implement large scale T&T control. There was then a discussion on the influence of transhumance and seasonality on the disease, especially noting the fact that infected cattle were often found in areas without the tsetse fly, and that the pastoralists' strategy was to use preventative treatment before entering a fly belt and then curative ones on leaving it.

This led to a discussion on the trans-boundary nature of transhumance and trypanosomiasis, during which the importance of trans-boundary agreements and

strategies, for example to implement measures preventing the spread of drug resistant strains of the disease, was emphasized.

Report from IAEA – U. Feldman

After the recent signing of accords, IAEA is now fully behind PAAT. This is because there is now sufficient ownership of the programme by Africans, and because both the area wide approach and the concept of local tsetse free zones have been accepted.

The IAEA general conference has passed a resolution in favour of PATTEC. The Agency's normative functions are very active and there is an energetic Research and Development suite in place in-house, exemplified by the tsetse genetic studies at the rearing facility in Siebersdorf. A five- to six-year co-ordinated research programme is underway, embracing projects to:

1. improve rearing techniques
2. improve the effectiveness of tsetse attractants
3. use fly genetic characters to identify genetically isolated populations, and thus areas of potential population confinement, and possibly
4. to address outstanding issues of quality assurance.

The Agency considers capacity building to be absolutely essential, and is supporting relevant projects in ten countries. It is also active in helping to advocate T&T control activities in the developed world, particularly the United States, and is pleased to report that both The Turner Fund and the United Nations Foundation (UNF) have agreed to provide financial support to PATTEC.

ICPTV Achievements – Prof. P. Holmes

The EU Concerted Action on Integrated Control of Pathogenic Trypanosomes and their Vectors (ICPTV) was set up three years ago, in support of T&T control activities in context of agricultural development. It works largely through organizing a series of workshops, each generating a newsletter containing the workshop proceedings, and supplemented by articles of interest to the T&T Community and a degree of scientific exchange. ICPTV also has a website (http://www.icptv.org) from which the newsletter can be downloaded. The newsletters have a circulation of about 700.

There have now been seven workshops and six newsletters; the most recent workshop was on integration of tsetse and tick control, in Antwerp. The resulting newsletter is available to participants. Two more workshops are planned, the next one on "Tsetse and Trypanosomiasis Research and Control in Southern Africa: Past, Present and Future", to be held at Onderstepoort Veterinary Institute, 11-13 November 2002.

ICPTV has two years funding, some of which is used to support PAAT's Research and Development Module. There may be further funding when EU Framework Six is established.

FITCA report on status of work, achievements and future plans – F. Oloo and B. Bauer

Farming in Tsetse Controlled Areas (FITCA) is an EU funded project currently covering four countries, namely Ethiopia, Kenya, Tanzania and Uganda. There is also FITCA Regional Office responsible for regional coordination: it embraces an area-wide approach, with activities over 150 000 sq km in Ethiopia; 6 500 sq km in Kenya, and 50 000 sq km in Uganda.

The presentation focussed on the activities of FITCA Kenya. Substantial efforts have been made to assess the baseline situation for T&T and agricultural productivity and to set adequate surveillance in place. Raising awareness has also been a priority, and has made it more possible to base the project work-plans on extensive stakeholder involvement, and a considerable amount of detailed stakeholder analysis.

The Project has now achieved widespread Participatory Rural Appraisal, and has conducted entomological surveys, traction surveys, household surveys and livestock surveys. The tsetse survey concentrated on *Glossina pallidipes* but recorded *G. fuscipes* where it was caught. The surveys used two baited biconical traps per square kilometre, checked every 48 hours. All data are geo-referenced within kilometre grid systems,

Glossina pallidipes was caught mostly on high ground (unlike in earlier years). Very high densities of more than 1 500 flies per trap per day were found in northern Teso District, and high densities of about 200 flies per trap per day were recorded in the southern Bondo District. Elsewhere densities were fairly low.

The fly control techniques used relied upon, and were largely implemented by, the communities. Following extended and extensive raising of awareness, each village appointed two trap/target attendants. The project therefore trained over 1 000 attendants in techniques of monthly monitoring and the servicing and placing of targets. Once the communities had sited their traps, project staff validated the placement (and found 90 percent to be properly placed). The communities provided cow urine, and FITCA gave acetone. These control efforts reduced fly densities significantly, especially those in initially high and moderate density populations. Some flies do remain but at very low remnant densities.

Once target/trap control phases had been completed, the communities were trained in ground spraying techniques and were organized to build and manage crush pens. The communities provided the resources needed for the pens and paid for the spraying.

A 1.5m high pyrethroid-impregnated net was developed for use with 45 zero-grazing cattle units. Again, community involvement was central to the implementation. These nets reduced infection rates from 64 percent to 2 percent if the cattle were kept permanently inside the netted areas and by half if the cattle were taken outside the nets for part of the day. A lower, and therefore cheaper, net is now being tested with apparently similar results.

An important side effect of the treated nets is a marked reduction on the number of nuisance flies, such as *Stomoxys,* as well as tsetse. There also appears to be a reduction in flies for some considerable distance around the treated zero-grazing units, though this has yet to be properly quantified.

Other integrated FITCA activities concern improved tillage in freshly cleared areas to promote food security, the support of private animal health practitioners through

training in diagnosis and transport, and the promotion of poultry production and addressing the problem of Newcastle disease.

There was a Mid-Term review in mid 2002, which has resulted in a no-cost extension for one year, to be used to prepare a second phase.

The discussion initially concerned the cost of impregnated nets (US$30-50), which would last a year. Private sector companies were looking at extending the life of these to two years, although it was noted that this might persuade the communities that the nets were a one-off measure, rather than one that requires repeated application, and that this might be counter-productive in terms of long-term sustainability. A number of participants discussed the use of nets as a control measure, and it was stressed that there is sufficient demand for livestock produce, particularly milk, to persuade farmers to enrol in tsetse control.

Lies or flies? Satellites, climate and tsetse mapping for Ethiopia – W. Wint

The presentation reported on a project funded by the FAO/IAEA Joint Division in support of PATTEC. It aims to build on previous work of the PAATIS project and the DFID/FAO funded production of continental tsetse fly probability of presence maps at 5 km resolution, using a range of predictor variables including satellite derived measures of climate. The current work aims to improve upon the earlier maps in several ways: by increasing the resolution of the modelled distributions by a factor of five, to 1 km; by updating the known presence absence data in the light of the most recent information; and by using climate related masks to modify both the input data and predicted output maps.

The first Phase, completed at the end of 2001, produced distributions of two fly species in a substantial portion of West Africa, and of three species in Uganda. The current phase has produced draft maps of four fly species (*Glossina morsitans, G. fuscipes fuscipes, G. pallidipes* and *G. tachinoides*) for Ethiopia and bordering parts of the Sudan.

The method relies on establishing statistical relationships between fly presence or absence and a wide range of predictor variables for a series of sample points evenly distributed (about every 25 km) throughout the study area. These relationships are established using step-wise linear regression and then applied to every pixel of the kilometre resolution predictor variable images.

The input data are based on the classic Ford and Katondo distribution maps, modified by information from more recent sources, and overlain by a series of masks of areas where the fly can be safely assumed to be absent. These include areas of high minimum temperature, high altitude, and very low vegetation cover as derived from kilometre resolution satellite imagery and land use maps.

The potential uses and pitfalls of these masks (temperature, length of growing period, vegetation cover and elevation) to modify input training data were discussed and illustrated at some length.

The draft maps for Ethiopia and south eastern Sudan were presented, and comments invited. It was then pointed out that there were several large areas where the predicted probability of presence was unity, giving large areas with little detail or variation. Various methods of providing further detail were discussed, again based on the use of masks, but derived from climatic conditions at the borders of fly distributions. The use of

unconventional parameters, such as the rate of vegetation change (high rates possibly reflecting riverine forests) or very high resolution (LANDSAT or SPOT) satellite image overlays, to identify suitable and unsuitable habitats within potential fly habitats was discussed as a possible way to improve the method further.

A more certain way was to use the draft maps to site field fly surveys in areas of interest, to test the predictions by ground truth. This is now being implemented for the Ethiopian project. When these data are available, which will include some information on the genetic characteristics of the flies, they will be used to revise the drafts to produce final ground truthed fly distribution maps.

This two stage approach will be used in the next project phases: for northern Kenya and western Somalia (three species, starting 2002) and southern Kenya and coastal Tanzania (five species, starting 2003). The speaker emphasized his need for the most recent fly distribution data available, and stressed that any contributors would, in return, receive the outputs from all of the project phases, not just those relevant to their own region.

The discussion centred on the importance of seasonality and movement of both flies and livestock, and on the problems of identifying patches of habitat that supported riverine flies, which were seen to need considerable attention. Work was also needed to move towards mapping disease risk, not just vector distributions. There was some discussion about the use different types of temperature indicators such as interpolated meteorological station data rather than satellite derived indicators, especially in regions well served with weather stations.

East Africa tsetse-trypanosomiasis intervention and environment. Ethiopia as a study case – J. Maitima

The project is still in the planning phases, and will focus on reducing the T&T impact on livestock, settlement, cultivation, and community welfare. The major project stakeholders are FITCA, ILRI, CIRAD, and the Environmental Monitoring Management Component (EMMC), together with national students, as well as staff from national institutions such as KETRI.

A number of landscape components will be monitored including water, soils, vegetation composition, and overall biodiversity. The measurable indicators are remotely sensed land cover classes, vegetation structure, vegetation composition and abundance, soil erosion and vegetative indicators of erosion and fertility, water quality and availability, and the biodiversity of birds and mammals. The potential negative impacts of increased biodiversity on human settlements (through, for example, nuisance animals) will also be investigated.

To date, a series of consultancies (from CIRAD) have been implemented to select a number of study sites (3 sites in Kenya, 3 in Uganda, and 2 in Ethiopia). They have been selected to reflect a range of land use and land cover types, such as peri-urban, intensive and recently increased cultivation, open grazing and swamp.

The project will address a number of aspects including the fact that if the disease risk is reduced, then livestock and human populations rise, and land use patterns are altered. Initial indications are that the nature of the changes appears to be dependent on the intervention methods used. Land use intensification leads to changes in cropping systems

as the number of native plant species declines, and as does the number of species in cropping systems themselves. Wildlife diversity increases with settlement, whilst natural vegetation decreases with tsetse control, and cropping increases – as illustrated by the events in the Lambwe valley.

The question then arises as to whether tsetse control measures themselves are responsible for these changes or whether other processes are involved. Initial results suggest that in low challenge areas, cropping increases after control has been implemented, but in high challenge areas, the amount of bush increases substantially.

To summarize, EMMC plans to acquire baseline data to produce indicators of land productivity, degradation and biodiversity that farmers can use to detect changes in their land. Communities will therefore acquire a tool that allows them to understand and monitor the complex processes of land use change.

A number of questions were raised about the consequences of increased settlement on animal diversity. It was pointed out that a number of bird and mammal species were closely associated with certain man-made land use types e.g. grazing areas and gardens.

The possible methods of environmental monitoring were also discussed, in particular the appropriateness of using arthropods or microbial genotypes as environmental indicators. It was noted that these techniques, whilst desirable, were very labour intensive, and would only be feasible within projects with substantial skills and resources available. Alternative strategies might be to involve school children or students in monitoring programmes, as has been done in Europe.

It was stressed that an environmental impact assessment needed reliable baseline data. Some interventions are more rigidly planned than others, which may affect the type of monitoring possible, and means that it is usually necessary to identify area-specific indicators of change. However, it was widely agreed that monitoring should be standardized whenever possible.

The proposed reduction in the environmental monitoring budget by the FITCA mid-term review was discussed and criticized, and the support of the meeting for such studies requested. It was noted that AU does not have the capacity to mount such operations itself, but is intending to establish a Nairobi cluster for livestock and environment interactions

The Chairman warned that the role of autonomous vector and disease control could be overplayed. A number of participants stated that human activity, particularly intensive and mechanized cultivation, with its attendant use of insecticides, does tend to reduce fly numbers, though remnant riverine populations often remain a danger. The dynamism of the changes is also an important factor, and the wisdom of capitalising on current trends was widely accepted.

Report of the FAO Liaison Officers' meeting – H. G. Chizyuka

The session commenced with Dr Chizyuka presenting the participants with the conclusions of the FAO liaison officers meeting. These are set out in the next part of Section A. The participants' comments for each recommendation are set out below.

Training: The recommendation was welcomed. The need for training the private sector was highlighted, and the serious loss of trained personnel in recent years, particularly in Southern Africa, emphasized. Thus there is an urgent necessity for training

and capacity building across the whole range of T&T control activities, which PAAT should facilitate in line with its existing proposals.

Focal points: A number of participants suggested that FAO Liaison Officers could become PATTEC focal points, though it was accepted that was only possible if PATTEC liaison functions were compatible with FAO policy. However, such an arrangement, if temporary, might be feasible, until more permanent arrangements could be made. It was, however, pointed out that a proliferation of T&T related focal points might confuse both administrations and donors, but that in any case it was government not the agencies that appointed liaison officers. The Chairman stressed that any PATTEC advocacy must embrace issues related to Human Sleeping Sickness, and not be limited to purely livestock related topics.

PATTEC publicity: The Chairman noted that some progress has been made on this in various fora, such as the recent DFID-sponsored Edinburgh meeting.

Consultation with stakeholders: It was suggested that consultations must broaden to establish what has caused poverty or livestock mortality.

Regional collaboration: No observations were made from the floor.

Resource mobilisation: It was pointed out that the lack of resources available to T&T control activities may be due to budget allocation priorities rather than a general lack of resources. However PAAT and PATTEC have developed criteria for projects which should and could be used to attract national and international funds.

Finally, a Vote of Thanks was offered to Professor P. Holmes for his achievements. The Chairman then expressed his thanks on behalf of the participants to ILRI and the Kenyan Government for hosting such a successful meeting, and then closed the meeting.

FAO LIAISON OFFICERS MEETING, NAIROBI, SEPTEMBER 2002

Recommendations of the FAO Liaison Officers meeting on African Trypanosomiasis, held at ILRI, Nairobi, 23-24 September 2002.

Training and capacity building

The Liaison Officers' meeting recognized that the shortage of suitably trained tsetse personnel in member countries was a major constraint to achieving the ideals and vision of the PATTEC initiatives.

Accordingly, the meeting recommended that:

(i) The PAAT Secretariat in collaboration with the PATTEC Secretariat should compile an inventory of tsetse/trypanosomiasis training programmes available within and outside the African continent and circulate it to member countries.

(ii) The PAAT Secretariat in collaboration with the PATTEC Secretariat should identify possible regional training institutions and in conjunction with African governments look for possible ways of facilitating the development of training programmes for tsetse and trypanosomiasis personnel from tsetse affected countries.

(iii) National governments should recognize the need for training of not only technical staff but also should sensitize and train the policy makers/planners and

administrators in policy measures and strategies for tsetse and trypanosomiasis intervention.

Establishment of focal point/contact person

Liaison Officers noted that there are gaps in the information flow between tsetse control personnel and policy makers/planners and administrators in member countries. The meeting recommended that member states should designate respective PATTEC Focal Points as soon as possible. The meeting further recommends that the possibility for the FAO Liaison Officers to act as temporary PATTEC Focal points where compatible with their functions should be explored, pending the setting up of the PATTEC Focal points.

PATTEC publicity

The meeting expressed reservations at the negative sentiments given voice recently in the British Parliament with regard to the viability of the PATTEC initiative and requested the PATTEC Secretariat to prepare an appropriate reply which should be forwarded to the African Union Secretary General, for submission to the British Government, EU and other potential donors.

Consultation with stakeholders

The meeting recommended that member states ensure that all socio-economic studies that are carried out prior to tsetse interventions, be fully integrated into development plans and that existing elements, which may be possible factors contributing to poverty in the area, should be taken into account.

Regional collaboration

In recognizing that tsetse distribution is trans-boundary in nature, the meeting recommended that the PATTEC Secretariat should become more involved in the facilitation of regional co-operation, particularly when one country has started intervention.

Resource mobilization

The meeting noted with concern that due to decreasing national resources, tsetse control activities have gone down drastically in some member countries. The meeting recommended that the PATTEC Secretariat should take an active part in assisting member states in mobilising resources for tsetse and trypanosomiasis control.

FITCA programme

The meeting noted with appreciation the progress achieved by the FITCA projects in the participating countries and recognized the possibility of using these projects for capacity building of all stakeholders within the region.

Further details of this meeting and related matters may be obtained from Dr. H.George Chizyuka, Animal Health Officer, FAO Regional Office for Africa, P.O. Box 1628, Accra, Ghana (Tel.: 233-21 7010930/675000; 233-21-773924 (Residence); fax No.: 233-21-7010943/668427); e-mail: George.Chizyuka@fao.org

RESEARCH ACTIVITIES AT PRINCE LEOPOLD INSTITUTE OF TROPICAL MEDICINE

An update on the tsetse and trypanosomosis research activities at the Prince Leopold Institute of Tropical Medicine in Antwerp, Belgium (2002)

Tsetse rearing

Research in the fields of human and animal trypanosomosis at the Institute of Tropical Medicine is assisted by output from a highly productive tsetsebreeding unit. A line of *Glossina morsitans morsitans* (originating from Zimbabwe) and one line of *G. palpalis gambiensis* (originating from Burkina Faso) are maintained *in vivo*. *Glossina morsitans morsitans* has an exceptionally high vectorial capacity for *T. brucei*, which makes it an indispensable tool in the experimental study of tsetse-trypanosome interactions and permits the cyclical transmission of trypanosomes, even those with low transmissibility. The international interest in this *G. m. morsitans* colony is growing steadily. Over the last year, more than 16 000 pupae were shipped to various laboratories around the world.

Tsetse/trypanosome interactions

During the past five years the activities of the Entomology Unit of the Department of Parasitology have focused on elucidating the developmental cycle of the trypanosome in the tsetse fly and the determination of the different developmental stages based upon morphology, ploidy, cell-cycle status and the modulation of the surface coat within the insect. This research has made it possible to identify the 'missing link' in the life cycle of *T. brucei* in the tsetse fly. Current research activities aim at identifying the molecular mechanisms underlying this vector-parasite relationship. The working hypothesis is that the success of trypanosome development is determined, at least at some stages, by the molecular interplay between the tsetse fly and the parasite surface. Ultimately, the understanding of the parasite life cycle in the vector and the elucidation of the molecular mechanisms that determine the parasite transmission will contribute to a better understanding of the epidemiology of sleeping sickness and will lead to improved strategies for disease control.

Human trypanosomiasis

The Serology Unit of the Department of Parasitology is well known for its contribution to the development of diagnostic tests for human sleeping sickness. Different diagnostic tools based on parasite detection including the PNA (Peptide Nucleic Acid) technique, antibody detection (CATT, ELISA, IFAT) and DNA detection have been developed. Emphasis has, however, been put on the development, evaluation and

production of simple tests for individual diagnosis in the field. Research on the important topic of stage determination and follow-up of serologically positive but parasitologically negative individuals is also ongoing. During the last decade, the unit has widened the spectrum of its research activities and participates in studies on treatment, immunology, neuropathology and serum resistance of human infective trypanosomes. Special attention is paid to the validation of diagnostic tests with Bayesian techniques in the absence of a gold standard**.**

Animal trypanosomiasis

In this domain, the Serology Unit is active in the development and improvement of serological, parasitological, and molecular diagnostic methods for epidemiological and clinical purposes. Research focuses on all aspects of *T. evansi* diagnosis (serodiagnostics and molecular tools) and differential diagnosis between *T. equiperdum* and *T. evansi*. The Veterinary Department has, in collaboration with the International Livestock Research Institute (ILRI), focused part of its activities on the identification of genetic markers for the detection of isometamidium resistance in trypanosomes. The aim is to develop a simple and quick PCR for the detection of isometamidium resistant trypanosome strains and determine the process by which trypanosomes develop resistance to isometamidium. A PCR-RFLP that allows the identification of the most important pathogenic trypanosome species in ruminants was developed and is currently under evaluation. The test has also been used successfully for the identification of trypanosomal infections in the mouthparts, salivary glands and midgut of tsetse. Recently, research in the development of *T. brucei* and mixed *T. brucei* and *T. congolense* infections in cattle and tsetse has started. In collaboration with the International Trypanotolerance Centre (ITC), the Veterinary Department is involved in studies to determine the trypanotolerant properties of West African dwarf goats.

Training

The Institute offers the possibility of post-graduate MSc training. Within the Veterinary Department, a one year MSc course on “Animal Disease Control”, with emphasis on the control of vector-borne diseases (including trypanosomosis), helminth infections (including helminth zoonosis) and epidemiology, is planned for the academic year 2003 –2004. The course will be given alternatively in English and French. A limited amount of scholarships are available. For more information, contact Mrs D. Debois (ddebois@itg.be).

For further information on specific topics please contact:
S. Geerts (Veterinary Department): sgeerts@itg.be
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CONFERENCE NEWS

Conference news: Seventh Biennial Conference of the STVM

The organizing committee is pleased to advise that the first announcement of the 2003 Biennial Conference of the Society for Tropical Veterinary Medicine is now available on http://www.eventus.com.br/stvm/.

The conference theme for this biennial conference will be "Impact of Ecological Changes on Tropical Animal Health and Disease Control" and will be held 22-27 June 2003, at Iguazu Falls, Brazil.

The organizing committee comprises: Gervasio Bechara [bechara@fcav.unesp.br]; Edward Blouin [Blouin@okstate.edu]; Bob Bokma [Bob.H.Bokma@aphis.usda.gov]; Paul Gibbs [pgibbs@ufl.edu]; and Tom Walton [Thomas.E.Walton@aphis.usda.gov].

Those interested are invited to e-mail: stvm@eventus.com.br.

SECTION B - ABSTRACTS

1. GENERAL (INCLUDING LAND USE)

[See also **25**: nos. 12340, 12357, 12340]

12288 **Bauer, B., 2001.** Improved strategies for sustainable trypanosomosis management within the context of primary animal health care. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 123-130.

FITCA (Kenya), Nairobi, Kenya.

The management of African animal trypanosomosis at farmers' level has been, and still is, predominantly dependent on the use of trypanocidal drugs. Block treatment without a preliminary diagnosis rather than the treatment of individual, clinically sick cases is the standard approach, and there is increasing evidence of chemoresistance in cattle. Training of farming communities to improve recognition of symptoms, preferably through the use of pictograms and coloured charts to indicate PCV level, should facilitate not only the appropriate use of trypanocides but also the selection of breeding animals with disease resistance. Treatment with trypanocides and the use of the live bait technique ('pour-on') are considered by farmers as a private good, which they are more willing to adopt and pay for, as opposed to large-scale tsetse control techniques and insecticide-impregnated targets or traps which are considered to be a public good, with resultant problems of sustained funding. As regards the live bait technique, it appears that the potential and limits of this control method are not fully understood, especially the need for herdsmen to direct the movement of treated animals. The future of trypanosomosis management, based on integrated approaches for the control of tsetse and trypanosomosis, is discussed. It is suggested that there is no longer a need for so much of projects' budgets to be spent on environmental monitoring, and also that there is little justification in continuing to spend large amounts on research into tsetse control when there are effective techniques already available. There is a need for more socio-economic data in the selection of priority areas. More pragmatism is urged in decisions regarding eradication and sustainability. Emphasis must be put on acceptable levels of effective disease suppression with methods that are appropriate, sustainable and cost-effective, with less attention to donors' personal preferences or institutional philosophies. It should be accepted that the private sector will play an increasingly important role, for example in the devolution of control techniques to rural communities, standardisation and mass production of targets, and tsetse rearing for SIT programmes.

12289 **Getachew Tikubet, 2001.** Community driven sustainable tsetse and trypanosomiasis management in southern Ethiopia in the context of holistic development. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 379-385.

ICIPE, P.O. Box 3893, Addis Ababa, Ethiopia.

The extent of the tsetse and trypanosomiasis problem in Ethiopia, and past efforts to control it, are described. Until recently, the main approach has been through chemotherapy and chemoprophylaxis but, with the increasing problem of resistance, current efforts are directed towards the integrated control of tsetse. The community has fully participated in trap/target setting, odour baiting and insecticide impregnation in the Didessa Valley since 1986. A successful pilot study comprising community-based tsetse control, trap technology uptake and sustainability has been conducted in two areas of southern Ethiopia from 1995 to 1998 within the context of a holistic rural development package. Over 3 000 NG2G traps were used for *Glossina pallidipes* suppression and a socio-economic survey showed that, as a result, milk production had doubled, livestock mortality and abortion were reduced significantly and calving rate increased. Current efforts are aimed at increasing the efficiency and reducing the cost of trapping by using local materials. The use of live targets has been tested in the Ghibe Valley using cypermethrin on cattle and in the Upper Didessa using deltamethrin. A ten-year programme in the Southern Rift Valley using SIT for the area-wide eradication of *Glossina pallidipes* has been begun. Meanwhile, lethal insect technology (LIT) is being tested with the aim of (i) using contaminating devices for tsetse rather than insecticidal traps, and (ii) rearing tsetse for contamination and mass release. Details are also given of a proposed BioVillage Initiative developed by ICIPE. This is a comprehensive community-driven integrated approach, combining several strategies aimed at addressing economic development problems of rural communities in Ethiopia.

12290 **Olubai, W.A. and Woodhouse, P., 2001.** Community participation and the planning and management of trypanosomosis [control]: the case of Kenya Trypanosomiasis Research Institute (KETRI). *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 373-378.

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

Community participation is increasingly seen as one of the basic elements of tsetse and trypanosomosis control programmes. However, attempts by KETRI to promote participatory approaches in control projects in the Busia, Lambwe Valley and Transmara areas of Kenya have not been very successful in attaining sustainability. A study, based on a review of books, reports, journals and other relevant materials, aimed to ascertain the extent to which participation can improve the planning and management of trypanosomosis control. The results suggest that, although community participation is a necessary factor in any development project, it is not in itself a sufficient determinant of sustainability of tsetse and trypanosomosis projects. On a scale of participation ranging from passive, in which people are told what is going to happen, to self-mobilisation, when people take initiatives independent of external institutions, the most common scenario in the projects studied entailed local provision of labour for trap/target maintenance, i.e. participation for material incentives. It is suggested that interactive participation at the planning stage would help to ensure that strategies for achieving sustainability are well grounded in the context of local decision making and are based on the awareness of local constraints.

12291 **Organization of African Unity/Scientific, Technical and Research Commission, 2001.** *Twenty-fifth Meeting of the International Scientific Council for Trypanosomiasis Research and Control, Mombasa, Kenya, [27 September – 1 October] 1999.* Nairobi; OAU/STRC. OAU/STRC publication no. 120. 474 pp.

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

The texts of 71 papers and posters presented at the Twenty-fifth ISCTRC Meeting are published under the following headings: Human trypanosomiasis (17); Animal trypanosomiasis (14); Vector biology and control (10); Trypanotolerance (8); Socio-economics and environmental impact (7); Community participation in tsetse and trypanosomiasis management (7); and Molecular biology and biochemistry (8). Introductory sections include brief reports of regional projects (RTTCP, Central and West Africa, FITCA) and international organizations (AU/IBAR, FAO, WHO, FAO/IAEA, PAAT, ITC, ILRI, ICIPE, CIRDES, OIE/NTTAT). Summaries of the plenary sessions are also given, with recommendations. The meeting commemorated the Golden Anniversary of the Council and gold and silver medals and two special awards were presented to 20 persons (listed) in recognition of their contributions to advances in the understanding and control of African trypanosomiases and their tsetse fly vectors. Abstracts of all presentations published in these proceedings are included in this issue of *TTIQ*.

2. TSETSE BIOLOGY

(a) REARING OF TSETSE FLIES

12292 **Opiyo, E., Mutika, G. and Robinson, A., 2001.** Effect of low temperature treatment on *Glossina pallidipes* pupae. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 197-201.

Opiyo: Entomology Unit, FAO/IAEA Agriculture and Biotechnology Laboratory, IAEA Laboratories, A-2444 Seibersdorf, Austria.

The success of insect control programmes integrating the sterile insect technique (SIT) depends on the ability of the sterile males to seek out wild females and compete with wild males for mating opportunities. Since only male insects require to be released, sex separation at some stage of development can be very important. For tsetse, sex separation was only possible in the adult stage where flies are immobilised by chilling and individually sexed. With the development of an automated sexing technique based on differences in emergence pattern of females and males and the direct stocking of fly production cages for *Glossina austeni* and *G. pallidipes*, it is now possible to obtain pupae which are almost 100 percent male. With some species of tsetse, e.g. *G. pallidipes*, it is important that males attain sexual maturity before they are released and therefore a planned and synchronised emergence of males would be beneficial. A protocol for controlled

emergence based on low temperature treatment of mature male pupae of *G. pallidipes* is under development. Mature male pupae, obtained after the females and a proportion of the males have been introduced into production cages, were incubated at different temperatures between 15 and 20°C for 24-72 h and thereafter allowed to emerge at either 23-24°C or 26.5°C. Emergence rate, adult male survival without blood and male mating behaviour were monitored. There was no significant difference due to low temperature treatment on emergence rate ($F = 0.02$, $df = 7,74$, $P > 0.05$), survival without blood and insemination capacity. Low temperature treatment delayed eclosion of *G. pallidipes* by 2-3 days. The potential advantages of the procedure to an operational SIT programme are discussed.

(b) TAXONOMY, ANATOMY, PHYSIOLOGY, BIOCHEMISTRY

12293 **Osir, E.O., Abakar, M. and Abubakar, L., 2001.** The role of trypanolysin in the development of trypanosomes in tsetse. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 417-421.

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

A trypanolysin molecule that lyses bloodstream trypanosomes in the midguts of the tsetse fly, *Glossina fuscipes*, was isolated by anion-exchange chromatography and its properties studied *in vitro*. Trypanolysin activity was stimulated by blood meal, with twice-fed flies showing the highest trypanolysin activity against bloodstream trypanosomes compared to once-fed and unfed flies. Activity of the molecule was not inhibited by protease inhibitors such as soybean trypsin inhibitor, N-α-p-tosyl-L-lysine chloromethyl ketone, phenyl methyl sulphonyl fluoride, diisopropylfluorophosphate and tosylamide-2-phenylethyl chloromethyl ketone. However, the activity was completely inhibited by diethyl pyrocarbonate and partially inhibited by aprotinin. Storage of trypanolysin at either 4°C for 15 days or at 27°C for 32 days resulted in loss of activity. Exposure to high temperatures also led to loss of activity (25 percent loss at 50°C, 100 percent loss at 80°C). A relatively low concentration of trypanolysin lysed bloodstream *Trypanosoma brucei brucei*, a much higher concentration was required to lyse procyclic trypanosomes and *Leishmania*, while the trypanolysin had no effect on *Plasmodium*. These results suggest that the midgut trypanolysin may play an important role in governing the establishment and development of trypanosomes in tsetse.

(c) DISTRIBUTION, ECOLOGY, BEHAVIOUR, POPULATION STUDIES

[See also **25**: no. 12295]

12294 **Gidudu, A.M., Robinson, A.S. and Stamenova, A., 2001.** Initial studies on RAPD polymorphisms in *Glossina fuscipes fuscipes*. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 214-215.

Gidudu: Entomology Division, MAAIF, P.O. Box 102, Entebbe, Uganda.

The *G. f. fuscipes* population on the Buvuma islands, Lake Victoria, is targeted for eradication using SIT. This study aimed to establish the degree of isolation of the Buvuma tsetse population from the Ugandan mainland (Mukono) population using RAPD primers to analyse their genomes. One hundred RAPD oligonucleotide primers (10 mers each) were tested for their ability to amplify *G. f. fuscipes* DNA. Those which did were screened for their sex specificity and polymorphic nature by testing each primer on a set of 16 DNA samples comprising 8 males and 8 females. A similar analysis was applied to another set of 60 primers. One male specific primer and 7 polymorphic primers from the first set and 15 polymorphic primers from the second set were selected and used in comparisons of DNA of *G. f. fuscipes* from the Seibersdorf colony and from the Buvuma and Mukono populations. The male and species specificity of primer 77 was confirmed by testing it with DNA from *G. brevipalpis*, *G. pallidipes*, *G. austeni*, *G. morsitans morsitans*, *G. palpalis palpalis* and *G. tachinoides*. Genetically similar individuals were found in the two Ugandan populations, indicating that the Buvuma island population is not completely isolated from the Mukono mainland fly population.

12295 **Krafsur, E.S., Baker, M.D., Wohlford, D.L. and Griffiths, N.T., 2001.** Population genetics of some *morsitans* group tsetse flies (Diptera: Glossinidae). *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 220-225.

Krafsur: Department of Entomology, Iowa State University, Ames, IA 50011-3222, USA.

Studies were carried out on the genetic diversity of four taxa of the *morsitans* group of tsetse (*Glossina pallidipes*, *G. morsitans morsitans*, *G. m. submorsitans* and *G. m. centralis*) from different parts of Africa using three classes of genetic markers: allozyme loci, microsatellite genomic DNA loci and mitochondrial DNA loci. Moderate levels of genetic polymorphism at allozyme loci and elevated levels of genomic and mitochondrial DNA diversity were found. The variation allowed good estimates to be made of gene flow within and between populations. The spatial distribution of this variation showed a large genetic differentiation of *G. pallidipes* populations and a corresponding reduction in gene flow. Elevated levels of genetic differentiation were also observed in *G. m. centralis*, moderate levels in *G. m. morsitans* and very little in *G. m. submorsitans*. Experimental ecological studies and observations already published have shown that *morsitans* group tsetse disperse at great speed, which seems to be in contradiction with the existence of genetically differentiated populations. This contradiction is particularly marked for *G. pallidipes*. The genetic data possibly reflect recent expansions of small isolated populations of tsetse remaining after the rinderpest epizootics at the end of the nineteenth and beginning of the twentieth century.

12296 **Muangirwa, C.J., Kimaro, E.E., Mujuni, P., Assey, T., Lugembe, K.K.M., Sikay, M. and Mwitumba, A., 2001.** Distribution of tsetse flies in Mara Region, north western Tanzania and appraisal of community based intervention. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 398-406.

Muangirwa: TPRI, P.O. Box 3024, Arusha, Tanzania.

Tsetse surveys were carried out in Mara Region so as to form a basis for advising the Mara Farmers Initiative Project (MFIP) on how to undertake community-based tsetse and trypanosomiasis control as part of a regional programme aimed at alleviating poverty and ensuring adequate food supply. It was observed that: (i) the area along Rubana River, bordering the Ikorongo Game Reserve (a corridor of Serengeti National Park) up to the Kenya border, was infested with *Glossina pallidipes*, *G. swynnertoni* and *G. brevipalpis*; trypanosomiasis prevalence was high in Makundusi and Nata villages; (ii) the area along Mara River, around Iseresere and Magatini villages, was infested with *G. pallidipes* and *G. brevipalpis*; and (iii) the northern shore of Lake Victoria, around Bubombi and Sota villages and Thowa Island, up to the Kenya border was infested with *G. fuscipes fuscipes*. Livestock keepers in the tsetse-infested areas stated that cattle were kept as wealth (as at Sarakwa and Nata), for ploughing (at Rwamchanga and Miseki), and as a bank (among the fishing communities at Bubombi). With the exception of those at Bubombi, livestock keepers in the tsetse-infested areas complained about animal trypanosomiasis. Cattle were mainly exposed to tsetse flies while drinking water along Rubana and Mara Rivers during the dry season, and while ploughing and grazing at Miseki and Rwamchanga. Other problems faced by livestock keepers in the tsetse-infested areas included ticks and tick-borne diseases, cattle theft, and degradation of soils in areas where emphasis was placed on cultivation. Livestock keepers in the tsetse-infested areas treated cattle haphazardly with trypanocides and antibiotics on suspicion of trypanosomiasis or tick-borne diseases. They had not participated in tsetse control but were willing to do so. It was noted that other sectors are touched directly or indirectly by the tsetse problem. A programme was suggested for Mara Region including intervention, training at all levels, monitoring of tsetse dispersal from Serengeti National Park and multisectoral collaboration in tsetse and trypanosomiasis control.

12297 **Solano, P., La Rocque, S. de, Meeus, T. de, Cuny, G., Duvallet, G. and Cuisance, D., 2001.** Microsatellite DNA markers reveal genetic differentiation among populations of *Glossina palpalis gambiensis* at various geographic scales. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 216-219.

Solano: IRD, B.P. 5045, Montpellier, France.

Genetic (microsatellite DNA polymorphism) and morphometric (wing measurement) analyses were carried out on populations of *G. p. gambiensis* captured in West Africa. At the scale of the distribution range of this tsetse species, individuals from Senegal and from Burkina Faso showed significant differences in two microsatellite loci. These genetic differences were reinforced by significant differences in wing size between the same individuals, the flies from Senegal being smaller. At a regional level, in the Sidéradougou area of Burkina Faso, genetic results showed a structuring of tsetse populations within the same hydrographic network at a distance of a few kilometres. These genetically distinct populations were not infected with the same trypanosomes. In one part of this area, a Wahlund effect (presence of a mixture of genetically distinct populations) was detected. The implications of this genetic structuring of populations of *G. p. gambiensis* are

discussed in relation to the epidemiology of African trypanosomoses and possible control methods.

12298 **Vreysen, M.J.B., Mebrate, A., Menjeta, M., Bancha, B., Woldeyes, G., Musie, K., Bekele, K. and Aboset, G., 2001.** The distribution and relative abundance of tsetse flies in the Southern Rift Valley of Ethiopia: preliminary survey results. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 202-213.

Vreysen: IAEA, P.O. Box 100, A-1400 Vienna, Austria.

In 1998, the Government of Ethiopia, with the technical assistance of the IAEA, initiated the collection of baseline data to assess the potential for an area-wide integrated tsetse eradication programme in the Southern Rift Valley of Ethiopia. The programme uses a phased dynamic approach with the sterile insect technique (SIT) as the final eradication component. As part of a major effort of entomological, veterinary, socio-economic and environmental baseline data collection, an intensive entomological survey was initiated in the first 6 000 -7 000 km^2 of the project area in October 1998, to collect data on (i) the occurrence of different tsetse species, (ii) the seasonal fluctuations in apparent density and distribution of the tsetse flies, with special emphasis on the altitudinal spread, and (iii) the ecology and behaviour of the flies. This first block of the project area was divided into 105 10 × 10 km UTM grid squares, in which acetone/urine-baited NG2G traps were deployed in more than 1800 sites every 3 months. Of the two tsetse species sampled, *Glossina pallidipes* was present in 52.4 percent of the area surveyed. *G. fuscipes fuscipes* was trapped in the river systems of 12.4 percent of the grids and its distribution was confined to the Deme river catchment basin in the north-western part of the project area. No tsetse flies were detected in 43.8 percent of the surveyed area. The apparent density of the fly population, as calculated per grid, fluctuated between 0.01 and 68.6 flies/trap/day. Most of the *G. pallidipes* were trapped in forests, woody grassland and bushland areas up to an altitude of 1992 m, indicating that this species has extended its distribution 200 m higher and 100 km northwards in the last 25 years. *G. f. fuscipes* was trapped mainly in riparian forests and bushland close to the rivers at a maximum altitude of 1690 m. All entomological geo-referenced data will be incorporated in a GIS together with parasitological and other data to facilitate a decision on whether an area-wide eradication programme is feasible, and subsequently to select appropriate fly suppression strategies.

3. TSETSE CONTROL (INCLUDING ENVIRONMENTAL SIDE EFFECTS)

[See also **25**: nos. 12288, 12289, 12290, 12296]

12299 **Kamuanga, M., Antoine, C., Brasselle, A.-S., Swallow, B.M., d'Ieteren, G. and Bauer, B., 2001.** Impacts of tsetse control on migration, livestock production, cropping practices and farmer-herder conflicts in the Mouhoun Valley of southern Burkina Faso. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 239-253.

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

African animal trypanosomosis is particularly important in southern Burkina Faso where at least 2 million cattle are affected. Between 1987 and 1996 a successful tsetse fly control programme was implemented in the Mouhoun Valley of southern Burkina Faso. The intervention consisted of monthly treatments of cattle with a pour-on formulation of flumethrin and deployment of monoconical traps. A socio-economic study was undertaken in 1996-97 to determine how tsetse control had affected migration of people, livestock productivity, cropping practices, use of animal traction, access to pastures and water, and farmer-herder conflicts over access to pastures lands and nearby forestry reserves. Survey results indicated that tsetse control did not attract new migrants to the valley: their decision to settle appeared to have been driven by such factors as drought and poverty that pushed people out of the Central Plateau of Burkina Faso. Tsetse control improved animal health and productivity, especially through reductions in cattle mortality. Cattle ownership increased by 26 percent and 9 percent in Satiri and Bekuy Divisions, respectively. Proportions of owners who experienced cattle losses due to trypanosomosis decreased from 59 percent to 15 percent in Satiri, and from 58 percent to 47 percent in Bekuy. Animal traction users increased from 64 percent to 93 percent between 1987 and 1996. More than 60 percent of households had easy access to grazing areas over the same period, although this more often benefited pastoralists (76 percent) than crop-livestock farmers (53 percent). An econometric analysis of the determinants of the probability of conflicts following tsetse control revealed herd size, intensity of animal traction use, ethnicity, village location and wealth as significant factors. These results are essential for policy recommendations to improve natural resource management in tsetse controlled areas in southern Burkina Faso.

12300 **Kappmeier, K., 2001.** The development of a new trap for *Glossina brevipalpis* and *G. austeni* in South Africa. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 226-230.

Onderstepoort Veterinary Institute, Private Bag X5, Onderstepoort 0110, South Africa.

A new trap, named the H trap, was developed in South Africa for the simultaneous collection of live *G. brevipalpis* and *G. austeni.* Its design followed an evaluation of the responses of the two species towards traps that are used elsewhere in Africa for other tsetse species and which have been found unsuitable for capturing *G. brevipalpis* and *G. austeni* in South Africa. Initially these traps included the Epsilon, Pyramidal, Biconical, Vavoua, Ngu and Siamese. The best of these were the Ngu (Ng2f) and Siamese, which caught mean daily numbers of 8.2 and 5.8 *G. brevipalpis*, respectively, and 0.4 *G. austeni.* The reason for their ineffectiveness was explained during further trap-orientated behavioural studies where it was shown that the upward flight responses were very low. The blue and black H trap presents a totally new and different approach for tsetse flies as it is fitted with lateral cones of white netting so that the flies take a more horizontal flight path once they have entered the trap, instead of the vertical flight paths of the existing tsetse traps. A number of modifications of the prototype H trap were devised. Comparisons were made against the

Nzi trap using the best odours. The Nzi trap caught a mean of 13.2 *G. brevipalpis* and 0.6 *G. austeni* compared to the H trap's means of 45.1 *G. brevipalpis* and 6.4 *G. austeni.* More modifications followed to improve the design. The efficiency of the final trap design was estimated, with an electric net placed next to the trap, at 31.9-47.9 percent of total *G. brevipalpis* and 29.0-38.4 percent of total *G. austeni.* Record catches of the H trap to date are 180 *G. brevipalpis* and 57 *G. austeni* per trap per day.

12301 **Krüger, W., Seydou, K., Yao, S., Dehi, P. and Kouakou, G., 2001.** La prise en charge de la lutte antitsétsé par les bénéficiaires: l'expérience de la Côte d'Ivoire. [Farmer based tsetse control: recent experience in Côte d'Ivoire.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 393-397.

Krüger: GTZ Mission Allemande, Service de Lutte contre la Trypanosomiase Animale et les Vecteurs, B.P. 3301, Bouaké 01, Côte d'Ivoire.

Until 1993, the Service for the Control of Animal Trypanosomosis and its Vectors (SLTAV) deployed and maintained every year 12 000 to 14 000 traps in its project area in the northern, central and north-central regions of Côte d'Ivoire. Contributions from beneficiaries were marginal and obtained only from some private farmers. Following the government's policy of withdrawal of the public sector and the promotion of participation by local communities in the cost of agricultural services, it was decided to educate and inform farmers to allow them to undertake responsibility for deployment, maintenance and financing of traps and targets placed on their pasture land. To this end, an extension unit was created within the SLTAV and the first meetings with the target groups took place in 1994. After the preparation of educational material, a campaign to increase awareness was started in 1996. By the end of 1998, 454 villages and some 150 individual farms had been visited by the extension teams. In the first year after the campaign, about 70 percent of the villages had agreed to take over responsibility for traps in their areas. The participation of private farms was smaller. It is clear that the organization of trap maintenance and the collection of monetary contributions at the village level are laborious and need intensive and sustained assistance from SLTAV staff. In order to maintain community-based tsetse control, the support of other partners working in the field of rural development will be important.

12302 **La Rocque, S. de, Augusseau, X., Guillobez, S., Michel, V., Wispelaere, G. de, Bauer, B. and Cuisance, D., 2001.** Glossines riveraines et anthropisation de l'espace: évolution sur 15 ans dans la zone agropastorale de Sidéradougou (Burkina Faso). [Riverine tsetse flies and land use: 15 years of change in the agropastoral area of Sidéradougou, Burkina Faso.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 316-323.

La Rocque: CIRAD-EMVT, B.P. 5035, 34032 Montpellier, France.

The objective of the work presented here was to identify the nature of the environmental changes which have taken place in the past 15 years in the Sidéradougou agropastoral area south of Bob-Dioulasso, Burkina Faso, and to evaluate their impact on tsetse populations. The work compares the results of two entomological investigations, following the same protocol, carried out in the same 120 km hydrographic network (Koba-Tolé river system), the first in 1980-1982 and the second in 1996. In the first, two riverine tsetse species, *Glossina tachinoides* and *G. palpalis gambiensis*, and a savanna species, *G. morsitans submorsitans*, were caught. A control campaign over a period of 3 years using traps and SIT successfully eradicated all three species but reinvasion occurred due to lack of maintenance of the traps and screens surrounding the cleared area. Over the 15 years since the first survey, the area has been under intense pressure from farmers and agropastoralists. Changes in land use have been mapped over the years using various remote-sensing techniques, and ecological surveys have also been undertaken on the ground. In 1996 no *G. m. submorsitans* were seen. Overall, the numbers of the two riverine species caught in the whole network were comparable although there were important differences in distribution and density compared with 1982. In the western branch of the Koba, populations of both were slightly increased, while, in the eastern branch, densities were greatly increased (>5 flies/trap/day). *Glossina. p. gambiensis* disappeared from the length of the Tolé while *G. tachinoides* was present but at lower density than in the past. These changes correspond with significant human pressure from migrants seeking favourable conditions for cotton cultivation and agriculture in the past 20 years. As a result, there has been a reduction in woody forest species along the banks and the invasion of typical savanna species. In places, agricultural plots are found right up to the river, with erosion and collapse of the banks, especially along the Tolé. Tsetse populations, especially of *G. p. gambiensis*, have clearly diminished in such places; *G. tachinoides* seems to adapt better to the man-made environment. In the eastern part of the Koba, cultivated plots are limited, for geomorphological reasons, to more than 300 m from the river. Here the arrival of migrants with small herds of draught cattle has benefited tsetse by providing them with an additional food source, resulting in increased tsetse density. These results show the diversity of the existing situations and the importance of the scale of observation for studies of vector distribution. Human pressure does not always result in a decline of riverine tsetse populations but in a modification of the epidemiological situation.

12303 **Magona, J.W., Odiit, M., Olaho-Mukani, W. and Ogwal, L.W., 2001.** Farmers' views about participation in the tsetse and trypanosomosis control program along Uganda-Kenya border: a preliminary survey. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 407-414.

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

Surveys were carried out in Mukujju, Kwapa, Osukuru, Buteba, Iyolwa, Buhehe, Lumino and Lunyo subcounties along the Uganda-Kenya border to collect farmers' views about participation in the tsetse and trypanosomosis control programme. In each subcounty, at least 10 livestock farmers were interviewed in person using a structured

questionnaire. Of the 81 farmers interviewed, 92.5 percent were aware of tsetse flies and animal trypanosomosis, 87.6 percent considered the disease to be a problem in the area, and 85.2 percent were aware of various tsetse and trypanosomosis control methods. Most farmers (76.5 percent) knew of the use of tsetse trapping, while 55.5 percent knew of the use of isometamidium chloride, 48.1 percent knew of the use of diminazene aceturate and only 18.5 percent knew of pour-on application. Almost as many had actual experience of using isometamidium chloride (53 percent) and diminazene aceturate (48 percent), but considerably fewer had experience of tsetse trapping (7.4 percent) and pour-on (1.2 percent). Most (97.5 percent) of the farmers were willing to participate in tsetse and trypanosomosis control programmes. Many farmers (71.6 percent) favoured a programme in which the government would buy tsetse traps and the community would care for them, and a similar proportion favoured a programme in which they would contribute labour. A substantial proportion (69.1 percent) of farmers favoured buying and applying isometamidium chloride and diminazene aceturate, 25.9 percent favoured buying and applying pour-on combined with periodic treatment of sick animals, and 4.9 percent favoured only treating sick animals with diminazene aceturate. Only 2.5 percent favoured buying and caring for tsetse traps, and the same proportion favoured a combination of purchase and application of trypanocides and traps. All were reluctant to take over the operations of the entire tsetse-trapping programme. Most farmers (85.2 percent) favoured participating in the tsetse and trypanosomosis control programme on a group basis rather than as individuals (14.8 percent).

12304 **Msangi, A.R., Kiwia, N.E., Mramba, F., Malele, I.I., Kitwika, W.A., Byamungu, M., Chalo, O., Athuman, J., Parker, A.G. and Feldmann, U., 2001.** After the successful eradication of tsetse fly on Zanzibar using sterile insect technique (SIT) - Mafia Island is the next. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 254-257.

Msangi: TTRI, P.O. Box 1026, Tanga, Tanzania.

In Tanzania, tsetse flies have effectively prevented the establishment of sustainable development of viable mixed, usually smallholder, livestock farming systems in many areas of great agricultural potential such as Mafia Island, an area of approximately 700 km^2 situated about 20 km off the Tanzanian coast. After the successful eradication of tsetse flies from Zanzibar using an integrated area-wide approach involving SIT, representatives of the people of Mafia Island requested the Tanzanian Government to explore the possibility of eradicating *Glossina brevipalpis*, the only tsetse species reported on Mafia Island where *Trypanosoma congolense* infection is a serious livestock problem. This paper outlines the phased and conditional approach of the planned programme. There will be four main phases. The pre-suppression phase of baseline data collection and feasibility assessment involves planning meetings, an economic assessment of the current impact of trypanosomosis and the potential benefits of tsetse eradication, surveys of tsetse and trypanosomosis and an environmental survey for monitoring land use changes. The second phase is tsetse population suppression and monitoring using appropriate conventional control techniques to reduce the population before SIT. The third phase is tsetse eradication which involves the establishment of a laboratory colony and mass rearing of *G. brevipalpis* at TTRI, Tanga, followed by aerial release of sterile males, first on a pilot scale

and then over the entire island, with monitoring to check progress. The fourth, post-eradication phase will involve a period of verification of fly eradication. Progress to date is noted.

12305 **Munsimbwe, L., Bossche, P. van den, Jooste, R. and Lumamba, D., 2001.** Preliminary results of a large-scale field trial to assess the effect of 1% cyfluthrin pour-on (Cylence®, Bayer) treatments of cattle on the incidence of bovine trypanosomosis in a tsetse-infested area of Eastern Zambia. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 187-191.

Munsimbwe: RTTCP, P.O. Box 350001, Chilanga, Zambia.

A large-scale trial was carried out in Petauke and Nyimba Districts of Eastern Province, Zambia, to evaluate the effectiveness of insecticide-treated cattle to control tsetse-transmitted bovine trypanosomosis. The experimental area of around 2 000 km^2 has a cattle population of about 10 head of Angoni cattle/km^2 and a high prevalence of trypanosomosis. Before the start of the trial, baseline data on the distribution and density of tsetse (*Glossina morsitans morsitans*) were collected, and eight sentinel herds, consisting of 20 adult cattle each, were set up and sampled monthly to monitor the incidence of bovine trypanosomosis. In November 1998, adult animals in the study area received their first pour-on application of 1 percent cyfluthrin, with further treatments at 7 week intervals. Preliminary results show that the proportion of the total cattle population treated was initially low but increased during the trial period. The incidence of trypanosomosis in the sentinel cattle underwent little variation from its pre-trial monthly mean of 9.7 percent during the first 6 months of the trial but declined gradually from May/June 1999 onwards to reach a minimum of 0.9 percent in August 1999. From March 1999 onwards, the herd monthly average PCV was either equal to or higher than the maximum monthly average PCV before the trial started. Sales of the trypanocidal drug diminazene aceturate were 71 percent lower between January and June 1999 compared with the same period the previous year.

12306 **Saleh, K.M., Mussa, W.A., Juma, K.G. and Vreysen, M.J.B., 2001.** Eradication of *Glossina austeni* from the island of Unguja confirmed: results of 2 years of post-eradication monitoring activities. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 231-238.

Saleh: Commission of Agriculture and Livestock, P.O. Box 159, Zanzibar, Tanzania.

Following the official completion of the SIT-based tsetse eradication project on the island of Unguja in December 1997, an intensive entomological and parasitological monitoring programme was set up to expose potential relic *G. austeni* populations and to assess trypanosomosis prevalence. The most efficient sticky panels (crossed XT and XLP) currently available for sampling *G. austeni* were used to assess the absence or presence of tsetse flies. The panels were deployed during both dry and rainy seasons in more than 200

trapping sites, selected in those areas which used to harbour the flies in the highest densities, and were checked and replaced every week. No tsetse flies were trapped during a total of over 150 trapping days. More than 3 000 cattle, aged between 6 months and 2 years, were selected at random from the entire island and their blood was screened parasitologically for trypanosome infections using the buffy coat technique following the MHCT. All samples examined were negative for the presence of *Trypanosoma vivax*, *T. congolense* and *T. brucei brucei*. In addition, fluctuations in the apparent density of the stable fly population on the island were monitored in 27 locations with unbaited standard Vavoua traps. Apparent densities of the *Stomoxys* population fluctuated from over 1 000 flies/trap/day in the sugar cane fields of Mahonda, to under 1.0 fly/trap/day on the East Coast. The epidemiological significance of the results obtained, i.e. a widespread *Stomoxys* population which, in the absence of tsetse flies, failed to sustain a trypanosome prevalence rate in domestic livestock through mechanical transmission, is discussed.

12307 **Shereni, W., Bossche, P. van den and Lovemore, D.F., 2001.** The control of tsetse in Zimbabwe: an integrated area-wide approach. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 258-261.

Shereni: Tsetse and Trypanosomosis Control Branch, P.O. Box CY52, Harare, Zimbabwe.

An area of 20 400 km^2 in north-eastern Zimbabwe was cleared of tsetse (*Glossina morsitans morsitans* and *G. pallidipes*) following 13 years (1986-1998) of area-wide control activities financed jointly by the EC and the Zimbabwean Government. A combination of techniques was used, including ground and aerial spraying as well as baited targets placed at appropriate locations. One area of 9 900 km^2 and another of 7 230 km^2 were treated with aerial and ground spraying, respectively. Odour-baited insecticide-impregnated targets were deployed over an area of 12 415 km^2. Experience in Zimbabwe has shown that integrated control of a whole zone is effective for the eradication of tsetse over a wide area. However, this method requires continued contributions on the part of the government and/or aid donors. Effective defensive methods are necessary for the prevention of reinvasion of cleared areas. This has been achieved by the maintenance of a barrier of targets extending 350 km along the whole length of the frontier with Mozambique. This barrier is reinforced by the treatment with deltamethrin of all animals grazing in the area within 30 km of the barrier. This method of area-wide integrated control has achieved the protection against tsetse and trypanosomiasis of 1.1 million head of cattle in communal areas and 92 000 on commercial farms. The prevalence of trypanosomiasis in this tsetse-freed area is low and limited to animals close to the barrier.

12308 **Ssennyonga, J.W., Wawire, N., Ayugi, M. and Tumba, R.O., 2001.** Developing a methodology for evaluating participation in community manage-ment of tsetse and trypanosomosis. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 386-392.

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

There is a lack of a methodology for assessing community participation in the research, development and management of technology in general and in trypanosomosis control in particular. Methodology used earlier has now been refined and applied on a larger scale encompassing all the participating members of the KISABE community engaged in tsetse control in the Lambwe Valley, western Kenya. The methodology entails the performance of five major tasks: (i) Determination of the unit of analysis (community and/or individuals); (ii) Operationalisation of participation (24 activities grouped into four clusters: management of the organization, mobilisation and control of resources, performance of trap deployment tasks, impact assessment); (iii) Identification of factors influencing participation (13); (iv) Data collection; and (v) Selection of appropriate analytical tools. Data were collected in 1998 on a restricted number of activities and participation variables. Results showed that farmers residing in the low-challenge zone attended more meetings, spent more time in them and also contributed more money than did farmers in the high-risk zone. The single most important factor influencing the largest number of control activities was training. Training in the biology of tsetse and trapping (TBTT) had a significant relationship with knowledge of tsetse and trapping. Training in management and finance (TMF) had a positively strong and significant relationship with the number of meetings attended and the time spent in them. Ownership of livestock had a significant relationship with time spent at meetings and number attended, but its relationship with TMF was negative and significant, suggesting that livestock owners were not well represented at the TMF. Those people who spent more time on KISABE meetings were those who received TMF, those who spent more time on trapping, and those who contributed more funds. TBTT had a strong impact on time spent on trap work. Although the total time budget for management has not yet been calculated, it is likely to be high, if not higher than that spent on trap work. Because of this, estimates of the cost of trypanosomosis control which exclude the time budget for management are gravely flawed.

4. EPIDEMIOLOGY: VECTOR-HOST AND VECTOR PARASITE INTERACTIONS

[See also **25**: nos. 12296, 12357]

12309 **Bengaly, Z., La Rocque, S. de, Michel, J.F., Solano, P., Sidibé, I., Touré, S.M. and Cuisance, D., 2001.** Importance des interfaces spatiales et temporelles entre les bovins et les glossines dans la transmission de la trypanosomose animale en Afrique de l'Ouest. Le cas de la région de Sidéradougou, Burkina Faso. [Importance of spatial and temporal contacts between cattle and tsetse flies in the transmission of animal trypanosomosis in West Africa. The case of the Sidéradougou area, Burkina Faso.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 137-143.

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

As part of a risk assessment study of trypanosomosis transmission carried out in the agropastoral zone of Sidéradougou, Burkina Faso, sentinel herds from two different farming systems were sampled and followed up for two years. The monthly incidences of infections were measured and interpreted according to the movements of herds, their watering practices and their contact with riverine tsetse flies (*Glossina tachinoides* and *G. palpalis gambiensis*). In Nakaka, a Fulani breeders' village 4 km away from the river, trypanosomes are transmitted during the dry season at permanent watering places inside the forest gallery. In the rainy season, the tsetse flies disperse through the savanna and infect cattle right into the village. In Péfrou, a group of farmers' settlements, herds consist mainly of draught cattle. Animals from settlements located near the hydrographic network drink in the river and are regularly infected throughout the year. Incidences are higher during the rainy season and the beginning of the dry season when tsetse flies are the most abundant. Conversely, herds from settlements far away from the hydrographic network (3 km) drink at wells and do not frequent tsetse habitats. In such an agricultural landscape, tsetse flies do not disperse even in the rainy season. Incidences in these herds are almost nil. These results show the importance of spatial and temporal contacts between hosts and vectors in the epidemiology of trypanosomosis in West Africa.

12310 **Codjia, V., Dao, B., Manigui, S. and Houngbedji, T., 2001.** Systèmes d'information géographiques (SIG) et contrôle de la trypanosomose animale, avantages et désavantages: le cas du Bénin. [GIS and control of animal trypanosomosis, advantages and disadvantages: a case study in Benin.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 334-342.

Codjia: Direction de l'Elevage, B.P. 032036, Cotonou, Benin.

The Republic of Benin covers a surface area of 112 600 km^2. With a total cattle population estimated at 1 345 000 head, and an annual cotton production of approximately 400 000 metric tonnes, the country ranks second in West Africa. Despite the fact that numbers of draught oxen show a net increase, animal trypanosomoses (AAT) remain a major constraint for the socio-economic development of the country. Aware of the scarcity of available resources and of the fact that the country is lagging behind with regard to integrated control of AAT, the Department of Rural Development started the development of a GIS. This system aims at (i) making a national inventory, and (ii) defining future AAT control policies to improve animal health and production and the integration of cattle and agriculture. This approach was inspired by results obtained by the FAO AAT control project in Togo and Burkina Faso. At this stage different data available on cattle, agricultural production and tsetse and trypanosomosis were identified and digitised, and maps were produced. Overlays of different data layers allowed the highlighting of potential priority areas. The results obtained are discussed, missing data are identified and improvements for gathering other data are suggested. Particular emphasis is given to the problems encountered and to the pros and cons of such an approach in Benin.

12311 **La Rocque, S. de, Michel, J.F., Michel, V., Solano, P., Wispelaere, G. de, Arnaud, M. and Cuisance, D., 2001.** Du système pathogène à l'évaluation du

risque: cas des trypanosomoses animales dans une zone du Burkina Faso. [From pathogenic system to risk evaluation: application to animal trypanosomosis in an area of Burkina Faso.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 329-333.

La Rocque: CIRAD-EMVT, B.P. 5035, 34032 Montpellier, France.

Recent studies undertaken in the Sidéradougou agropastoral area of Burkina Faso showed that the riverine tsetse species *Glossina tachinoides* and *G. palpalis gambiensis* are present along the main hydrographic network. However, depending on their location, they are infected by different species of trypanosomes. In places with few human settlements (western part of the area), tsetse feed frequently on reptiles and are infected with non-pathogenic trypanosomes. On the other hand, in sites regularly used by domestic animals (eastern part), most tsetse feed on these animals and transmit pathogenic trypanosomes. Thus, very different epidemiological situations can occur a few kilometres apart, the risk of transmission depending essentially on the intensity of contact between the hosts and the vectors. In a comprehensive approach incorporating entomology, parasitology, ecology, land cover and breeding management, all the environmental factors which affect the interfaces between hosts and vectors were integrated using GIS. High-resolution remote sensing data (SPOT) and original methods of modelling were used to reveal the most favourable areas for tsetse along the hydrographic network, the location of settlements, the type of cattle rearing practised and the daily movements of the animals, particularly their arrangements for watering. Overlays of the different data layers revealed the places with greatest vector-host contact. The sites of highest epidemiological risk were shown to represent approximately 10 percent of the 120 km of hydrographic network initially surveyed.

12312 **Mattioli, R.C. and Mehlitz, D., 2001.** Preliminary note on Woula and Dasso, vector-borne haemoparasite complexes recently reported as a major potential disease risk factor impairing cattle health and production in tsetse-infested areas of West Africa. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 155-158.

Mattioli: FAO, Viale delle Terme di Caracalla, Rome, Italy.

Repeated trypanosome infections render both trypanosusceptible and trypanotolerant cattle more susceptible to tick attack and consequently increase their risk of infection by tick-borne micro-organisms. In such a situation, enzootic stability to tick-transmitted infections may vanish. Recently, three pathological syndromes, responsible for high mortality, have been reported in N'Dama cattle populations living in sub-humid and humid zones of Guinea and Senegal infested by tsetse flies and ticks. These syndromes are denominated, in vernacular language, Red and Black Woula in Guinea, and Dasso in Senegal. The names Red and Black Woula appear to be related, respectively, to haemoglobinuria and the cyanotic appearance of mucous membranes in sick animals. Woula *per se* signifies, in local language, 'unpopulated remote area located far off in the savanna'. Dasso designates an ill-defined animal pathological status. The description of a delineated geographical area in the definition of Red and Black Woula merits attention as it

indicates that the pathogens involved are confined to well-defined zones. Preliminary information suggests that these syndromes are caused by a common infective haemoparasitic complex composed of trypanosomes and tick-borne anaplasmosis and/or babesiosis. Investigations are needed to obtain epidemiological data to identify the micro-organisms involved, the density and seasonality of potential vectors and to assess the impact of the pathological challenge in order to set up, if necessary, adequate and economically profitable control measures.

12313 **Michel, J.F., La Rocque, S. de, Michel, V., Toure, I., Augusseau, X. and Richard, D., 2001.** Bétail et modélisation spatiale: une information de base pour la gestion du risque d'infection trypanosomienne. [Cattle and spatial modelling: basic information for trypanosomosis risk management.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 343-349.

Michel: CIRAD-EMVT, B.P. 5035, 34032 Montpellier Cedex 01, France.

For all vector-transmitted parasitic diseases such as animal trypanosomosis, transmission risk is directly related to the intensity of contacts between infected vectors and animal hosts. In an agropastoral area of 1 200 km^2 in Burkina Faso, the study of bovine trypanosomosis is based on the exploration of spatial relationships between these two elements of the pathogenic system. Cattle constitute the basis of multi-source spatial data which were integrated in a GIS. To identify the locations of contacts between hosts and vectors, a detailed knowledge of areas occupied by cattle is necessary so that their movements can be represented cartographically. An exhaustive and georeferenced census of cattle, based on household surveys, showed up two noteworthy points: cattle pens and watering points at the end of the dry season. Daily cattle movements at this season were modelled, based on these two obligatory points. For each herd, a polygon, corresponding to the area occupied by the animals, was drawn around the line connecting these points. These polygons, validated by surveys of the movements of real herds, were projected onto a grid of 0.25 km^2 quadrats to eliminate the effects of overlap. The representations obtained, corresponding to the areas frequented by cattle, can be related to the areas occupied by tsetse flies so as to identify contact areas. It is also possible to layer these representations with other data (economic, environmental, human) in order to obtain a diagnostic tool for agricultural systems which would aid decision-makers in making informed choices of intervention.

12314 **Muturi, K.S., Msangi, S., Münstermann, S., Clausen, P.-H., Getachew, A., Getachew, T., Bergenie, B. and Assefa, M., 2001.** Trypanosomosis risk assessment in selected sites of the Southern Rift Valley of Ethiopia: i. Distribution, density and infection rates of tsetse flies; ii. Epidemiology of bovine trypanosomosis. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 159-164.

Muturi: Faculty of Veterinary Medicine, Addis Ababa University, P.O. Box 34, Debre Zeit, Ethiopia.

In Ethiopia, a phased tsetse control programme, using SIT as the final eradication component, was begun in 1997 in an area of 25 000 km^2 situated in the Southern Rift Valley area. As part of baseline data collection, a joint tsetse and trypanosomosis survey was carried out over a period of 6 months in 1999 to give a preliminary estimate of the risk of trypanosomosis in the north-western part of the project area. Twenty-nine 100 km^2 grid units, covering lowland (< 1 600 m), midland (1 600-2 000 m) and highland (> 2 000 m) altitude levels, were selected for this study. NG2G traps, baited with cow urine, were used for the tsetse survey and bloodmeals were collected for host identification using ELISA. For the trypanosomosis survey, 50 animals were sampled at each of 20 collection points. *Glossina pallidipes* was the predominant species, found in all lowland areas and in the midlands up to 1 990 m, and in all types of vegetation, including forest (44.25 flies/trap/day), grassland (0.05 flies/trap/day), wooded grassland, cultivated land, bushland and riverine forests. *Glossina fuscipes* was mainly confined to riverine type vegetation (0.4 flies/trap/day) but was also found in wooded grassland near rivers (0.08 flies/trap/day); it was detected up to 1 710 m. The mean trypanosome infection rate of *G. pallidipes* was 7.6 percent (69.4 percent *Trypanosoma vivax*, 27.8 percent *T. congolense*, 2.8 percent *T. brucei*); that of *G. fuscipes* was 7.8 percent (96 percent *T. vivax*, 4 percent *T. congolense*). In both fly species, there was a higher infection rate in females and in older flies. The main sources of bloodmeals for *G. pallidipes* were ruminants (63 percent, mainly cattle) and Suidae (25 percent), and for *G. fuscipes* man (61 percent) and ruminants (33 percent). A parasitological survey of 1953 cattle showed infections with *T. congolense* (predominant), *T. vivax*, *T. brucei* and mixed infections. Overall prevalences by altitude were: lowland 25.9 percent, midland 9.4 percent and highland 0 percent. Overall PCV values were within normal range but values in positive animals were below 20 percent. Cattle older than 3 years carried most infections.

12315 **Mwendia, C.M.T. and James, A., 2001.** Economic evaluation of the productivity of pastoral sheep and goats in Olkiramatian Group Ranch in Kajiado, Kenya. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 324-328.

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

Pastoralism is a self-sustaining way of life practised in remote areas all over the world but it has not been economically evaluated due to its subsistence nature. A first study was undertaken between 1992 and 1995 in Olkiramatian Group Ranch, Kajiado district, Kenya, to investigate the productivity and the economic returns on capital invested in pastoral livestock. This was done by monitoring all the production parameters, namely flock/herd structures, offtake and mortality rates. These data were then subjected to an economic analysis using Livestock Production Efficiency Calculator (LPEC) software. The study indicated that goats had a significantly higher return on capital invested compared to sheep. This was attributed to no milk offtake, lower disease control costs (especially trypanosomosis) and lower offtake in sheep. The offtake value/breeding female/year was KSh1 419 (US$24) and KSh1 016 (US$17) for goats and sheep, respectively. The annual rate of return on capital invested was calculated as 42.2 percent for goats and 35.1 percent for sheep. Better performance was observed in migratory flocks/herds than in sedentary ones, and small flocks performed better than large ones. It was concluded that the methods of trypanosomosis control employed by different farmers in the area had a direct

relationship to the returns on the capital invested for both sheep and goats. The pastoral livestock enterprise was observed to give a higher rate of return compared to other investments both locally and nationally. The study emphasises the need for tsetse and trypanosomosis control to enhance livestock productivity.

12316 **Ngare, P.M. and Mwendia, C.M.T., 2001.** Tsetse and trypanosomosis: an epidemiological survey in Osupuko and Mara Division of Narok District. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 183-186.

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

A survey was conducted in June 1998 in four sub-locations (Megwara, Sekenani, Talek and Aitong) of the Narok District of Kenya in order to establish the extent of tsetse infestation and livestock trypanosomosis, the current control initiatives by the local community and their awareness of other modern control techniques. Tsetse density was estimated using baited biconical traps. Blood was collected from the ear vein of 336 animals to determine the PCV and presence of trypanosomes, and the point prevalence of trypanosomosis per region was calculated. Group discussions and interviews were held with farmers to elicit their perceptions and experience of the tsetse and trypanosomosis problem. Results showed an overall trypanosomosis prevalence of 5.7 percent (Sekenani 9.0 percent, Aitong 5.5 percent, Talek 4.0 percent). The trypanosome species encountered were *Trypanosoma congolense* and *T. vivax*. A total of 75 *Glossina pallidipes*, 9 biting flies and 13 tabanids were caught in Sekenani and Talek. The numbers of tsetse per trap per day were 0, 2.6 and 5.1 in Megwara, Sekenani and Talek respectively. Farmers described trypanosomosis, anaplasmosis, theileriosis, lumpy skin disease, malignant catarrhal fever and tick infestation as the most common diseases in livestock, with trypanosomosis ranked top. They lamented the breakdown of the acaricide dipping programme. The main trypanocides used were homidium (Ethidium, Novidium) and diminazene aceturate. Although farmers knew the symptoms of trypanosomosis, and which drugs to use and when, they frequently mixed drugs and did not administer them correctly. Pour-on was introduced in the area in 1997 but, despite agreement on its efficacy, its cost had limited its widespread use.

12317 **Odiit, M. and Enyaru, J., 2001.** Human African trypanosomiasis in south eastern Uganda, 1988 to 1998: a comparative epidemiological analysis. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 114-119.

Odiit: Sleeping Sickness Programme, Livestock Health Research Institute, P.O. Box 96, Tororo, Uganda.

This paper describes the importance of human African trypanosomiasis as a public health problem in south-east Uganda and compares the situation during 1988-1992, when an EU-funded tsetse control project was operating in five districts, and 1993-1998. During the first period, a total of 4 649 new cases of sleeping sickness were recorded in south-east Uganda, with an annual incidence of 46 per 100 000 population, and the disease was

endemic throughout the region. The control campaign led to a gradual improvement, reducing the average annual incidence to 15 per 100 000 in the second period. The distribution of sleeping sickness was characterised as sporadic and of low endemicity. A new EU-funded project (FITCA), running from 1999 to 2003, aims to reduce the incidence still further. Calculation of the cost of traps and their maintenance in the new project area indicates that the nine districts involved will be able to afford only a fraction of the cost, so sustainability of the strategy after donor funding ends must be questioned. Suggestions for a more cost-effective and efficacious approach to sleeping sickness control in the future are presented.

12318 **Politzar, H., Were Omamo, S. and d'Ieteren, G., 2001.** Issues related to sustainable tsetse and trypanosomosis management strategies and rural development. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 365-372.

Politzar: FITCA, OAU/IBAR, P.O. Box 30786, Nairobi, Kenya.

After presenting a broad review of recent trends in tsetse and trypanosomosis control in Africa, this paper explores the elements of a sound policy towards tsetse and trypanosomosis control by highlighting key issues in design and implementation. These include a country's philosophy of national development and its rural development objectives, the factors impeding or promoting attainment of these objectives, the role of the rural sector in national development and the rural policy objectives that spring from this role, the potential contribution of trypanosomosis control to achieving these agricultural policy objectives, and the objectives of the trypanosomosis control policy. Based on these objectives, a policy framework is proposed which comprises the following elements: an agenda for trypanosomosis control, a strategy for funding, a strategy for international acquisition and exchange of control innovations and information, structures and processes for interaction among domestic trypanosomosis control institutions, a strategy for control technology dissemination within the country, and a supporting legal framework. Examples of policy design and implementation in Nigeria, Côte d'Ivoire, Ethiopia, Zaire (present Congo D.R.) and the FITCA Project in East Africa serve to illustrate the points raised. It is concluded that a consistent policy towards tsetse and trypanosomosis control hinges on strong links with broad rural development objectives and strategies, and in particular on the potential for increasing agricultural productivity via control. The need for policy coherence and transparency is stressed.

12319 **Robinson, T.P., Harris, R.S., Hopkins, J.S. and Williams, B.G., 2001.** Decision support for trypanosomiasis control: an example using a geographic information system in eastern Zambia. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 350-361.

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

In many African countries where Government resources for livestock disease control are declining and donor aid towards the control of tsetse-transmitted trypanosomiasis is less forthcoming, there is an increasing need to identify areas where intervention is most likely to be technically, economically and environmentally sustainable. Activities must be focused in these areas so that the maximum benefits are obtained from limited resources. This paper provides an example of how geographic information systems can be used to identify areas of high priority, and presents a decision-support framework through which this can be achieved. Digital coverages were generated for six environmental variables: (1) cattle density, (2) human population density, (3) land designation, (4) relative arable potential, (5) crop use intensity, and (6) proximity to existing control operations. The distribution of tsetse in the area was predicted using a multivariate (maximum likelihood) analysis of areas of known presence and absence and a series of environmental data. Experienced veterinarians and biologists working in the region established criteria weights for the input variables and the data were integrated using weighted linear combination to prioritise part of the common fly belt in Zambia for trypanosomiasis control. The results of this exercise, estimates of the errors involved and the implications that follow for achieving sustainable tsetse control are discussed. Through this exercise it was possible to make recommendations to the Regional Tsetse and Trypanosomiasis Control Programme (RTTCP) regarding the optimal location of a community-based control programme in the Eastern Province of Zambia.

12320 **Simarro, P.P., Franco, J.R. and Ndongo, P., 2001.** Qu'est-ce qui ne marche pas dans le contrôle de la maladie du sommeil dans le foyer de Mbini (Guinée Equatoriale)? [What's wrong with sleeping sickness control in Mbini focus (Equatorial Guinea)?] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 55-60.

Simarro: Centro Control Tripanosomiasis, Fundació CIDOB-AECI, Barcelona, Spain.

Since 1985, control activities, based on the reduction of the human reservoir by means of periodic sero-parasitological surveys, have been carried out in the Mbini human trypanosomiasis focus in Equatorial Guinea. Every year, the frequency and selected areas are determined by the epidemiological situation. According to the 1998 census, 9 096 persons live in this focus, and 2 880 of them are currently considered at risk of sleeping sickness. From 1985 to 1998, fifteen surveys were performed (twice a year in some places) of 38 382 people and 382 patients were detected and treated. In 1985, the prevalence was 0.61 percent in twenty endemic villages, while in 1998, after 14 years of control, the prevalence remains at 0.34 percent in ten endemic villages. In spite of a geographical reduction of the focus, the decrease in prevalence cannot be considered satisfactory, especially when it is compared with the results obtained in Luba focus, in Bioka island, where the same control strategy was used and where the prevalence fell from 6.2 percent in 1985 to 0.05 percent in 1992, and currently remains around 0.01 percent. The possible reasons for these poor results, and the stagnation in sleeping sickness control in Mbini focus, are discussed. These include differences in the ecosystem (cocoa plantations in

Luba; mangroves in Mbini leading to close man-fly contact in nearby villages), presence of pigs in Mbini acting as a reservoir of infection, and mobility of the human population.

5. HUMAN TRYPANOSOMIASIS

(a) SURVEILLANCE

[See also **25**: nos. 12317, 12320, 12375]

12321 **Airauhi, L., Unuigbe, E.I. and Okaka, C.E., 2001.** Human African trypanosomosis: knowledge, attitude and beliefs in a focus in the Niger Delta of Nigeria. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 63-67.

Airauhi: Department of Medical Microbiology, Faculty of Medicine, University of Benin, Nigeria.

A study of the knowledge, attitude and beliefs regarding human African trypanosomiasis was carried out in three villages in the Niger Delta area of Nigeria between June and December 1998 using a structured questionnaire. The villages, Orhuoka, Umuaja and Obeti, are located between 5°30 and 6°00N. The inhabitants are mainly farmers, rubber tappers, traders and junior workers in government offices. Two hundred and sixty three volunteers, aged 16 years and above, were enrolled for the study: 130 (49.4 percent) had no formal education, 62 (23.6 percent) and 71 (27 percent) had primary and secondary school education, respectively. Eighty (30.4 percent) were aware of the existence of HAT in the communities but only 53 (20.2 percent) had the correct knowledge of the etiology of the disease; 110 (42 percent) of the subjects knew that tsetse flies are the vectors of the disease. The level of knowledge and awareness increased with level of education. However, the general attitude and beliefs were poor: 6 (2.3 percent) believed that infected people were witches while 22 (8.4 percent) believed infected people were bewitched. Only 25 (9.5 percent) believed that trapping flies could help control the disease, 28 (10.6 percent) believed that HAT could be cured by orthodox medicines, and 88 (33.5 percent) felt that people with the disease should not be hospitalised. In conclusion, the knowledge, attitude and beliefs regarding HAT in the areas studied are important factors to consider when instituting control measures against the disease in the various foci of infection in Nigeria.

12322 **El Rayah, I.E., Gadir, A.E.A., Mysara, M.O., Suliman, S.M., El Sayed, B.B. and El Malik, K.H., 2001.** Prevalence of sleeping sickness in Sudan. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 107-110.

El Rayah: Tropical Medicine Research Institute, P.O. Box 1304, Khartoum, Sudan.

A brief history of sleeping sickness in Sudan is given, including an overview of the recent disease situation in Eastern Equatoria and Baher El Jabel States in the south of the

country. Surveys were carried out in Eastern Equatoria during September 1998 and in Eastern Equatoria and Bahr El Jabel in January-February 1999 using CATT and Giemsa-stained blood smears. A total of 444 blood samples were collected from indigenous residents and refugees. In the first survey, 99 out of 100 samples from refugee camps in Juba were CATT-negative and one doubtful reaction was confirmed clinically. In the second survey, no parasitologically positive cases of trypanosomiasis were detected in a total of 344 samples but serological prevalence rates of 19.5 percent and 30.3 percent were seen in Eastern Equatoria and Bahr El Jabel respectively. There is concern that refugees from the Moyo district of north-west Uganda, where Gambian sleeping sickness is endemic, might spread infection to the indigenous population in Eastern Equatoria. There is also alarm that Rhodesian sleeping sickness, which is currently raging in central Uganda, might also be introduced into southern Sudan through the movement of refugees and that infections might not be detected by the CATT currently in use. Variations in prevalence have been observed between villages in the areas surveyed. Since people visit wells in gallery forest or riverine woodland, where *Glossina fuscipes* occurs, there are fears that old transmission sites have been reactivated. Tsetse survey and control is recommended.

12323 **Hewison, C., 2002.** A success against sleeping sickness. *Current Therapeutics*, **43** (5): 43.

Hewison: Médicins sans Frontières (Australia)

Sleeping sickness, or Human African Trypanosomiasis (HAT), is 100 percent fatal if not treated. The disease is caused by the protozoan parasite *Trypanosoma brucei*, and is spread by the bite of the vector, the tsetse fly (genus *Glossina*). It is a debilitating illness present in epidemic proportions in some areas of Africa (causative agents *T. b. gambiense* in Central and West Africa and *T. b. rhodesiense* in Central and East Africa). Some details of clinical experience gained in the Ibba sleeping sickness hospital, Western Equitoria Province, southern Sudan, are given.

12324 **Jelinek, T., Bisoffi, Z., Bonazzi, L., van Thiel, P., Bronner, U., de Frey, A., Gundersen, S.G., McWhinney, P. and Ripamonti, D., 2002.** Cluster of African trypanosomiasis in travellers to Tanzanian national parks. *Emerging Infectious Diseases*, **8** (6): 634-635.

Jelinek: Department of Infectious Diseases and Tropical medicine, Leopoldstrasse 5, 80802, Munich, Germany.

Game parks in Tanzania have long been considered to be at low risk for African trypanosomiasis; however, nine cases of the disease associated with these parks were recently reported. The outbreak was detected through TropNetEurop, a sentinel surveillance network of clinical sites throughout Europe.

12325 **Kande, V.B., Miaka, C.M.B., Mansinsa, P.D., Lutumba, P.T. and Declercq, J., 2001.** La maladie du sommeil en milieu urbain en République Démocratique du

Congo. [Sleeping sickness in urban areas of the Democratic Republic of Congo.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 78-84.

Kande: Bureau Central de la Trypanosomiase (BCT), 123 Avenue de la Justice, Kinshasa/Gomba, Democratic Republic of Congo.

The authors describe a phenomenon more and more frequently encountered in several towns of the Congo D.R.: an increasing number of new cases of sleeping sickness are diagnosed in urban areas. From 1970 to 1995, sporadic cases were reported by passive case-finding in Kinshasa Province. New cases increased to 254 in 1996 and 226 in 1997. In 1998, a mobile team started active screening in four health areas of Kinshasa (Kinkole-Maluku, Kimbanseke, Kinsenso and Ngaba) using CATT on whole blood. Serological suspects were later tested parasitologically. In 1998, 433 new cases were found, rising to 735 in the first half of 1999. In 1998, 65 percent of cases were in the second stage, while, in 1999, 71 percent were in the first stage. Taking both years together, 66.3 percent of patients were women and children. By occupation, the most affected groups were those engaged in agricultural activities and fishing. Since 82 percent of new cases in the whole of Kinshasa came from health areas where active case-finding had been carried out, it appears that the disease is well and truly established in Kinshasa. As it would take the mobile team 7 years to examine the suspected population at risk (400 000), other options, such as vector control with community participation, are discussed. However, resources are scarce.

12326 **Lejon, V., Büscher, P., Bisser, S., Legros, D., Richer, M., Truc, P., Jamonneau, V., N'Siesi, X. and Doua, F., 2001.** Further improvement of the LATEX/IgM assay for cerebrospinal fluid of sleeping sickness patients. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 43-48.

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

The presence of IgM in cerebrospinal fluid (CSF) of sleeping sickness patients is highly indicative for second-stage trypanosomiasis. The IgM in CSF is, however, not assayed for stage determination or follow-up of patients, since it is difficult to measure under field conditions. To solve this problem, we developed a card agglutination test, LATEX/IgM, for IgM quantification in CSF of sleeping sickness patients. The test consists of a reagent (IgM-specific polyclonal antibodies covalently coupled to latex particles) that is mixed with CSF dilutions on an agglutination card. Results can be read after 10 min of rocking. LATEX/IgM has been evaluated on large series of CSF samples from *Trypanosoma brucei gambiense*-infected patients in sleeping sickness control centres in Congo D.R. and Sudan. Cut-off titres between 4 and 16 cells/µl resulted in acceptable sensitivity of LATEX/IgM for second-stage trypanosomiasis. Using a cut-off of 8, a screening of CSF dilutions 1:16 and 1:128 combines a maximum of information with a minimum of work, and false negatives due to prozone are omitted. Recently, the reagent has been improved by replacing the polyclonal anti-IgM by monoclonals, in order to reduce batch-to-batch variation. Test time could also be reduced to 5 min. Preliminary

results of incomplete sample series obtained using this improved reagent during follow-up after treatment confirmed the decrease in IgM concentration after successful treatment.

12327 **Maiso, F. and Kansiime, F., 2001.** Human African trypanosomiasis among serologically positive but parasitologically negative individuals in north-west Uganda. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 68-70.

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

In this retrospective study, records of persons in the *Trypanosoma brucei gambiense* endemic area of Arua District, north-west Uganda, who tested positive to the card agglutination trypanosomiasis test (CATT), but who were parasitologically negative, were looked at. According to the protocol, these individuals, diagnosed between January 1996 and July 1997, were to be followed up at 3, 6, 9 and 12 months after the initial diagnosis. A total of 302 records were studied but only 168 were included in the analysis, the remaining 134 having been lost to follow-up. Of the 168 analysed, 40 (23.8 percent) were confirmed as HAT patients, while 57 (33.9 percent) seroconverted (became CATT-negative). There was no significant association between the interva1 of follow-up and the development of HAT nor its stage ($P > 0.05$ in both cases). Seroconversion was not associated with any of the factors analysed (age, sex, follow-up interval). It is concluded that serosuspects are an important epidemiological factor in the control of *T. b. gambiense* HAT, and their management should be more than just following them up for 12 months.

12328 **Meda, H.A., Bosompem, K.M., Doua, F., Enyaru, J.C., Kibona, S., Masake, R., Ngaira, J.R., Kuzoe, F. and Moncayo, A., 2001.** Multicentre evaluation of the specificity of CIATT in field diagnosis of *T. b. gambiense* and *T. b. rhodesiense* sleeping sickness in non endemic areas: preliminary results. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 49-54.

Meda: Centre Muraz - OCCGE, 01 B.P. 153, Bobo-Dioulasso, Burkina Faso.

The card indirect agglutination test for trypanosomiasis (CIATT) is a trypanosome antigen detection assay that has been found to be highly sensitive in both *Trypanosoma brucei gambiense* and *T. b. rhodesiense* sleeping sickness endemic areas. In order to determine its suitability as a tool for the control of human African trypanosomiasis, a multi-centre evaluation of its specificity was carried out in non-endemic areas in four countries (for *T. b. gambiense* in Côte d'Ivoire and Ghana; for *T. b. rhodesiense* in Tanzania and Uganda). The aims of the study were (a) to determine the reproducibility of the test when performed by different laboratories, (b) to determine its specificity in field diagnosis of *T. b. gambiense* and *T. b. rhodesiense* trypanosomiasis in non-endemic areas, and (c) to compare its specificity with that of other serological antibody detection and parasitological methods. The study showed that CIATT has good reproducibility, with a concordance (of results from the different centres versus the reference laboratory) ranging

from 67 percent to 100 percent; this gives a kappa index ranging from 0.35 to 1. The specificity of CIATT was high, ranging from 61 percent in Côte d'Ivoire to 98 percent in Tanzania. The specificity was higher in *T. b. rhodesiense* areas than in *T. b. gambiense* areas. Higher specificity was observed in areas far away from old endemic foci than in areas closer to old foci. The concordances between CIATT and CATT were 60.1 percent and 74.7 percent in Côte d'Ivoire and Ghana respectively (70 percent for both countries). In both countries there was a statistically significant difference ($P < 0.05$) between the performances of the two tests. The other serological tests (IFAT and ELISA), the haematocrit centrifugation technique and the miniature anion-exchange centrifugation technique failed to confirm the CIATT-positive samples in the study areas. There was a good agreement (61 percent to 92 percent concordance) between the results obtained with CIATT and PCR. Based on these results, recommendations are made for further evaluation of CIATT in screening and treatment follow-up programmes.

12329 **Moore, D.A.J., Edwards, M., Escombe, R., Agranoff, D., Bailey, W., Squire, S.B. and Chiodini, P.L., 2002.** African trypanosomiasis in travelers returning to the United Kingdom. *Emerging Infectious Diseases*, **8** (1): 74-76.

Chiodini: Department of Clinical Parasitology, Hospital for Tropical Diseases, Mortimer Market, Capper Street, London WC1E 6AU, UK.

Two returning safari tourists with African trypanosomiasis were admitted to the Hospital for Tropical Diseases, London, in a 3-day period, compared with six cases in the previous 14 years. We describe the clinical features, diagnosis, and problems encountered in accessing appropriate therapy, and discuss the potential for emergence of this disease in increasingly adventurous international travellers.

12330 **Omadwa, C.W., Matete, G.O., Wamwiri, F., Njenga, J., Masinde, A. and Jakait, C., 2001.** Human African trypanosomiasis (HAT) outbreak in Okame location of Teso district and Musokoto location Busia district: the current situation. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 105-106.

Omadwa: KETRI, P.O. Box 399, Busia, Kenya.

The greater Busia district (Teso district and Busia district) of western Kenya has been a sleeping sickness focus since the 1940s. From the late 1970s KETRI has been involved in carrying out both passive and active surveillance in an effort to diagnose, treat and control the disease. Following the diagnosis of two cases of sleeping sickness in Amase village of Okame location in May 1998, all patients in Alupe hospital that came from this area and the nearby villages in the old sleeping sickness foci were examined for the disease. A total of 33 cases (including seven diagnosed and treated in LIRI, Uganda) were diagnosed in the 12 months to May 1999, four by active and 22 by passive surveillance. In July/August, 16 patients were diagnosed. In August, the first case of sleeping sickness was diagnosed in Igara village of Musokoto location, followed by two

more cases after two months. The high number of late-stage cases of the disease (11) could be due to misdiagnosis or poor knowledge of the disease in the areas concerned.

12331 **Penchenier, L., Simo, G., Grébaut, P., Nkinin, S. and Herder, S., 2001.** Diagnostic par PCR de la trypanosomose humaine à *Trypanosoma brucei gambiense* dans des foyers d'Afrique centrale. [The diagnosis of human trypanosomiasis due to *T. b. gambiense* by PCR in the foci within Central Africa.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 101-104.

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

We have tested PCR performed on blood, adapted for the diagnosis of HAT, in four foci within Central Africa on 155 sleeping sickness patients (T^+), 1432 serological suspects (SS), 222 negative controls (by CATT 1.3 and parasitological examination) exposed to trypanosomiasis risk (R^+), and 49 negative control individuals not exposed to trypanosomiasis risk (R^-). All but one of the 155 T^+ and 50 of the 1432 SS individuals were positive by PCR. Three of the 222 R^+ controls were positive by PCR whereas none was found among the 49 R^- controls. We tested the reproducibility of the PCR findings on 22 T^+ patients whose treatment was delayed for 1-3 months and also on 33 healthy individuals negative by PCR (PCR^-) who were followed for 6 months. The results were identical to those obtained earlier. We followed up 39 of the PCR^+ SS and also 111 SS highly positive by CATT but PCR^-. We found no new patients among PCR^- SS but five new cases among PCR^+ SS. The three R^+ negative controls which had been PCR^+ all later became PCR^-. The 49 negative controls (R^-) all remained PCR^-. At the end of the study, PCR was positive in 99.4 percent (159/160) of patients and negative in all exposed (222/222) and non-exposed (49/49) controls. It was negative in 96.9 percent (1383/1427) of the serological suspects and brought a gain of 12.8 percent (5/39) in the number of patients diagnosed.

12332 **Ruiz, J.A., Simarro, P.P. and Josenando, T., 2001.** Epidémiologie de la trypanosomiase humaine africaine dans le foyer historique de Quiçama (Angola). [Epidemiology of human African trypanosomiasis at Quiçama focus (Angola).] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 61-62.

Ruiz: C/ELISA, 14, 08023 Barcelona, Spain. [Medicus@pangea.org]

Sleeping sickness in Angola was first described at Quiçama historic focus situated near the Kwanza river. During the colonial period, prevalence was reduced to 0.01 percent, but social troubles in the 1970s resulted in decreased efficiency of the trypanosomiasis control programme. As a result, patients in Quiçama were forced to go to the Viana Centre in Luanda to be treated. When control activities restarted in Quiçama in 1997, the epidemiological situation was unknown and only limited data from Viana were available. A seroparasitological survey was carried out in Quiçama in July 1997 to evaluate the situation and to establish control measures. Thirty-one villages were chosen and 8 796 persons were examined, representing coverage of 85.5 percent of the population. The infected zone was delimited to 18 villages situated along the river Kwanza where 5042 persons were declared at risk. The prevalence was 2 percent. In 1998 and 1999, surveys

were performed in villages where sleeping sickness cases had been reported in 1997. A total of 3 086 persons were examined in 1998, representing coverage of 75.4 percent, and prevalence was down to 0.5 percent. In 1999, it fell to 0.3 percent. Adults were found to be more affected than children due to the cumulative factor. There was no significant difference between genders: the risk of contracting sleeping sickness is thus the same during fishing activities done by men as during agricultural activities normally performed by women. In 1996, the treatment of patients from Quiçama represented 20 percent of the activities of the Viana Centre. In 1997, this proportion fell to 9.4 percent, in 1998 it was 2.9 percent and in the first half of 1999 only 0.7 percent, showing the impact of control activities undertaken in Quiçama.

(b) PATHOLOGY AND IMMUNOLOGY

12333 **Enanga, B., Mezui Me Ndong, J., Boudra, H., Debrauwer, L., Bouteille, B., Chauvière, G., Deloron, P., Labat, C., Dubreuil, G., Dumas, M., Périé, J., and Houin, G., 2001.** Pharmacocinétique, métabolisme et excrétion du mégazol chez un modèle primate de trypanosomose humaine africaine à *Trypanosoma gambiense*: étude préliminaire. [Pharmacokinetics, metabolism and excretion of megazol in a *T. gambiense* vervet model of human African trypanosomiasis: preliminary study.] (Abstract only.) *In*: OAU/STRC, 2001 (see **25**: no. 12291), p. 448.

Enanga: Laboratoire de Cinétique des Xénobiotiques, Faculté des Sciences Pharmaceutiques, F-31062 Toulouse, France.

The pharmacokinetics of megazol were investigated after single oral administration of the drug (100 mg/kg) to six vervet monkeys infected with *T. b. gambiense.* The plasma levels of megazol ranged between 0.2 μg/ml and 46 μg/ml 24 h after administration. In prolonged infections of animals, megazol absorption was accelerated (8 h as compared with 4 h for T_{max}) but the amount absorbed was not significantly modified. The megazol concentrations in cerebrospinal fluid represented between 5.5 percent and 10.6 percent of the plasma levels at the same times, regardless of whether the animals had been treated with suramin. Unchanged megazol was eliminated predominantly via the urinary route (46-96 percent of the dose administered compared with 0-5 percent in the faeces). Furthermore, this urinary elimination of megazol was altered in animals having prolonged infections. In the urine, unchanged megazol, as well as four unidentified metabolites, was characterised by LC-MS/MS. This study indicates that megazol crosses the blood-brain barrier when it is administered orally, whether or not in combination with suramin. Prolonged infections affect both the absorption of megazol and its urinary elimination.

12334 **Wood, L., Miller, D., Jacobs, P. and Mansvelt, E., 2002.** Trypanosomiasis - An unusual cause of reversible multiple organ dysfunction in South Africa. *South African Medical Journal*, **92** (7): 527-528.

Wood: Department of Haematology and Bone Marrow Transplantation Unit, Constantiaberg Medi-Clinic, Cape Town, South Africa.

Symptoms are described in a 56-year-old woman who had been bitten on the lower leg in Tanzania, and later showed trypanosomes in the peripheral blood. Recovery after treatment is described.

(c) TREATMENT

[See also **25**: nos. 12320, 12333, 12368,

12335 **Lejon, V., Lardon, J., Kenis, G., Bisser, S., Büscher, P., Bosmans, E. and N'Siesi, X., 2001.** Cytokine concentrations in serum and cerebrospinal fluid of sleeping sickness patients. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 71-77.

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

Although cytokines are considered to play an important role in the pathogenesis of trypanosomiasis, most information comes from animal models and only a few data are available for the human disease. In order to investigate the alterations in cytokine profile in human trypanosomiasis caused by *Trypanosoma brucei gambiense*, we quantified different cytokines/chemokines in infected patients before and after treatment. The concentrations of IFN-γ, TNF-α, IL-6, IL-8, IL-10, gp-130, sIL-6R and CC-16 were determined by ELISA in serum and CSF samples. IFN-γ was detectable in only a few serum samples and was completely absent in the CSF samples of the patients. Only in a few patients were abnormal TNF-α concentrations detected in serum and CSF. Increased concentrations of IL-6 and IL-8 were detected, particularly in serum of early-stage patients and in CSF of late-stage patients. In the late-stage patients, CSF concentrations of both cytokines dropped after treatment. Abnormal IL-10 levels were detected in all serum samples, with increasing concentrations in later-stage infections. Levels dropped after treatment but still remained in the abnormal range. IL-10 levels in CSF of late-stage patients were strongly increased, reaching levels comparable to serum levels, and dropped to early-stage levels after treatment. Serum and CSF levels of gp-130, CC-16 and sIL-6R were all normal both before and after treatment. From our data, we cannot conclude that pro-inflammatory cytokines IFN-γ and TNF-α play a pivotal role in human trypanosomiasis infection. However, pro-inflammatory cytokines IL-6 and IL-8 seem to play a role in the blood compartment in early infections and contribute to neuropathogenesis in late infections. Both might function as neurotrophic factors and modulators of the blood brain barrier. IL-10 also seems to play a major role in the pathogenesis of human trypanosomiasis in the later stages in the blood as well as in the CNS. Because of its abnormally elevated levels in CSF of late-stage patients compared to early-stage patients, CSF IL-10 could be a candidate for stage determination and might also be used to monitor successful treatment since its concentrations drop to near normal levels very soon after treatment.

12336 **Matovu, E., Enyaru, J.C.K., Legros, D., Schmid, C. and Kaminsky, R., 2001.** The drug susceptibilities of *T. b. gambiense* isolates from north western Uganda. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 85-88.

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

Since the 1980s, increasing numbers of new cases of *Trypanosoma brucei gambiense* sleeping sickness have been diagnosed in north-western Uganda and recently there have been reports of alarming rates of relapse. A study was therefore carried out to determine the sensitivities of *T. b. gambiense* isolates from Omugo, north-western Uganda, to melarsoprol and DFMO. Culture-adapted *T. b. gambiense* were exposed to 0.001-0.14 μg/ml melarsoprol or 1.56-100 μg/ml DFMO. Minimum inhibitory concentrations (MICs) of each drug were scored for each isolate after a period of 10 days' drug exposure. The results indicate that for DFMO the MIC values for all stocks analysed ranged from 1.13-6.3 μg/ml, indicating that they were generally sensitive to the drug. For melarsoprol, however, the MIC values were elevated, ranging from 0.009-0.072 μg/ml, compared to two *T. b. gambiense* isolates from Côte d'Ivoire whose MICs ranged from 0.001-0.018 μg/ml. Furthermore, the range contrasted with that of *T. b. rhodesiense* from south-east Uganda which had MIC values of 0.001-0.004 μg/ml. All the MIC values obtained in our study fell below expected peak melarsoprol concentrations in serum of treated patients. It should be noted, however, that due to constant fluctuations caused by pharmacokinetic complications, it may not be possible to maintain constant drug concentrations in serum as was the case in our *in vitro* experiments. Nevertheless, the MIC of 0.072 μg/ml exhibited by one of our isolates is beyond levels attainable in CSF so that this isolate would probably not be eliminated from CSF of treated patients. From our study, it appears that reduced drug susceptibility may be a contributing factor to observed relapses in north-western Uganda.

12337 **Schmid, C., Kaminsky, R., Bebronne, N. and Legros, D., 2001.** Melarsoprol and DFMO levels in plasma and cerebrospinal fluids of late stage sleeping sickness patients in Omugo, NW Uganda. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 89-92.

Schmid: Swiss Tropical Institute, Socinstrasse 57, 4002 Basel, Switzerland.

In order to investigate a major problem of melarsoprol treatment failures among late-stage *Trypanosoma brucei gambiense* sleeping sickness patients in Omugo, Arua District, north-western Uganda, a study was undertaken to compare melarsoprol concentrations in serum and CSF of relapse and non-relapse patients. Three different groups of patients were examined: (a) patients who were treated for the first time with melarsoprol (n = 53), (b) patients treated for a second time with melarsoprol after an earlier relapse (n = 15), and (c) patients treated with DFMO after multiple relapses from melarsoprol treatment (n = 50). Plasma and CSF samples were collected 14-38 h after the last treatment. Drug concentrations were determined by bioassay, based on the overall antitrypanosomal effects of the biological fluids. A comparison between average melarsoprol concentrations of first treatment and relapse treatment patients showed no significant difference. This held true

for plasma and CSF levels. However, the CSF levels of both groups, 0.000-0.066 µg/ml for first treatment patients and 0.004-0.063 µg/ml for relapse treatment patients, were often near or below the concentration necessary to eliminate trypanosomes *in vitro*. It is concluded that the cause for the high number of relapses after melarsoprol treatment is probably not due to reduced drug concentrations in the CSF but rather due to differences in drug sensitivities in the trypanosome isolates. For DFMO, the plasma levels were sufficient to eliminate *T. b. gambiense* in all patients, but the levels in CSF were rather low.

12338 **Stich, A., Abel, P.M. and Krishna, S., 2002.** Human African trypanosomiasis. [Review]. *British Medical Journal*, **325** (7357): 203-206.

Stich: Medical Mission Institute, Department of Tropical Medicine and Epidemic Control, D-97074, Würzburg, Germany. [august.stich@mail.uni-wuerzburg.de]

6. ANIMAL TRYPANOSOMIASIS

(a) SURVEY AND DISTRIBUTION

[See also **25**: nos. 12303, 12315, 12357]

12339 **Catley, A., Osman J., Mawien C., Jones B.A. and Leyland T.J., 2002.** Participatory analysis of seasonal incidences of disease of cattle, disease vectors and rainfall in southern Sudan. *Preventive Veterinary Medicine*, **53**: 275-284.

Organization of African Unity/Interafrican Bureau for Animal Reseources, P.O. Box 30786, Nairobi, Kenya.

During an investigation into a chronic wasting disease in Southern Sudanese cattle, a participatory appraisal method called a ‘seasonal calendar’ was used to understand local perceptions of seasonal variations in cattle diseases, disease vectors, intermediate hosts and rainfall. Repetition of a standardised seasonal calendar with Dinka informants demonstrated good reproducibility of the method. Comparison of rainfall data produced by seasonal calendars and objective measures of rainfall demonstrated good validity of the seasonal calendar method. Subjective assessment of seasonal calendar scoring patterns by veterinarians indicated that herders’ perceptions of seasonal populations of biting flies, ticks and snails were similar to modern veterinary knowledge. The uses of seasonal calendars in veterinary epidemiology are discussed.

12340 **Doran, M. and Bossche, P. van den, 2001.** An assessment of the socio-economic impact of bovine trypanosomosis and its control in the southern African region. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 307-315.

Doran: RTTCP, P.O. Box A560, Harare, Zimbabwe.

To determine the socio-economic impact of bovine trypanosomosis, rapid rural appraisal surveys were conducted in an area of medium/high tsetse challenge (Petauke/Nyimba/Msanzara) and in a tsetse-free area (Mvuvye/Katete South) of eastern Zambia during July-October 1997. Approximately 550 households were interviewed in each area using a standard questionnaire covering issues such as household characteristics, off-farm employment and income generation, crop and livestock practices and asset ownership. Cattle herd sizes and structures differed between the two areas, while ownership of other livestock was similar. Calving rate was found to be lower in the tsetse-infested area but calf mortalities were within normal ranges and due mostly to other diseases. There was no difference in cropping practices between the two areas but the performance was better in the tsetse-free area. Comparison of these survey results with those obtained in other areas of the southern African region indicated that it is dangerous to make generalisations on the impact of bovine trypanosomosis and its control on cattle production and offtake. With the exception of the impact on calving rates, all other direct and indirect impacts are affected by non-trypanosomosis related factors such as the cattle owners' disease management practices, the potential for herd and arable land expansion and cash requirements. Use of manure on crops was no greater in tsetse-free areas, despite higher levels of cattle ownership, but the greater use of draught power in these areas facilitates expansion of the area cropped. All these factors and their linkages have to be considered when planning for the localised control of bovine trypanosomosis. Failure to do so may result in an overestimate of the benefits accruing from control and is likely to affect the sustainability of an intervention.

12341 **Magona, J.W., Mayende, J.S.P. and Walubengo, J., 2001.** Field evaluation of *Trypanosoma congolense* and *Trypanosoma vivax* denatured antigen-based antibody ELISA tests in Uganda. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 422-426.

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

Indirect enzyme-linked immunosorbent assays (ELISA) for detection of trypanosomal antibodies using denatured *Trypanosoma congolense* and *T. vivax* antigens were evaluated in Uganda. A total of 400 bovine sera were analysed, consisting of 120 parasitologically negative samples from a tsetse-free area, 120 parasitologically positive samples, 80 samples from an area of low tsetse challenge (Kiboga) and 80 samples from an area of medium to high tsetse challenge (Arua) of unknown disease status. Using the modified ROC analysis, cut-off points of 30 percent and 25 percent positivity were determined for the *T. congolense* and *T. vivax* assay, respectively. The *T. congolense* assay had a diagnostic specificity of 62.5 percent, sensitivity of 62.5 percent for infections due to all trypanosome species, 81 percent for homogeneous infections and 48 percent for heterogeneous infections. The *T. vivax* assay had a diagnostic specificity of 81.3 percent, sensitivity of 81.3 percent for infections due to all trypanosome species, 76.5 percent for homogeneous infections and 81.3 percent for heterogeneous infections. The buffy coat

technique revealed trypanosomes in none of the samples from Kiboga and in 15 percent of those from Arua. In contrast, the *T. congolense* assay revealed a sero-prevalence of 52.5 percent in Kiboga and 30 percent in Arua, while the *T. vivax* assay revealed 21.3 percent in Kiboga and 46.3 percent in Arua. The *T. vivax* assay had a higher negative predictive value (78 percent) than the *T. congolense* assay (47 percent) in the area of low tsetse challenge (Kiboga) and a higher positive predictive value (75 percent) than the *T. congolense* assay (66 percent) in the area of medium to high tsetse challenge (Arua). The *T. vivax* assay appears to be more efficient than the *T. congolense* assay and it is potentially useful in determining the distribution of bovine trypanosomosis and targeting appropriate control measures in different areas of Uganda.

12342 **Rebeski, D.E., Winger, E.M., Robinson, M.M., Gabler, C., Crowther, J.R. and Dwinger, R.H., 2001.** Improved ELISA technique for bovine trypanosomosis. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 437-447.

Rebeski: Animal Production Unit, FAO/IAEA Agriculture and Biotechnology Laboratory, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

The use of the enzyme linked immunosorbent assay (ELISA) technique has been improved and standardised for reliable detection of trypanosomal antibodies. Antigens of *Trypanosoma congolense* and *T. vivax* were derived from *in vitro* cultured trypanosomes. Microplates were precoated with heat-detergent denatured antigens in standardised conditions before transport to the end-user. Comprehensive evaluation studies demonstrated that these plates can be stored at 20°C to 50°C for more than 1 year without affecting the assay precision. Moreover, these plates provided improved assay robustness at acceptable diagnostic proficiency as shown by the use of defined serum samples originating from cattle experimentally infected with *T. congolense.* Similar findings were reported from field evaluation in 16 laboratories in different countries in Africa. The application of a set of four control charts, reporting the untreated and normalised assay absorbance, the assay precision and proficiency, was presented to assure test quality on a daily basis and as a means to address assay problems at an early stage. The introduction of quality control, including the routine use of internal quality control charts, represents an important improvement in assuring the generation of reliable test results.

12343 **Solano, P., Michel, J.F., La Rocque, S. de, Lefrançois, T., Sidibé, I., Cuny, G., Duvallet, G. and Cuisance, D., 2001.** Polymerase chain reaction as a diagnostic tool for detecting trypanosomes in naturally infected cattle in Burkina Faso. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 181-182.

Solano: CIRAD-EMVT, B.P. 5035, 34032 Montpellier Cedex 1, France.

A survey aimed at estimating the prevalence of bovine trypanosomosis was undertaken in the Sidéradougou area of Burkina Faso in November 1997. A representative stratified random sample of 1036 cattle was selected and their buffy-coats examined microscopically for trypanosomes. PCR was used on a randomly selected subset of 260

animals using primers specific for *Trypanosoma congolense* savanna and riverine forest types, *T. vivax* and *T. brucei.* The parasitological prevalence in the total sample of 1036 individuals was 5.3 percent (± 1.3 percent) and in the 260 selected individuals it was 4.2 percent (± 2.4 percent). PCR made possible the detection of a significantly higher proportion of infected animals (11.5 ± 3.9 percent). The trypanosome species most frequently encountered was *T. congolense* savanna type (80 percent of positive cases), followed by *T. vivax* and *T. brucei. Trypanosoma congolense* forest type was never seen. PCR identified 10 of the 11 animals positive by microscopical examination. Of the 30 individuals positive by PCR, two-thirds (most of which had a PCV below 25 percent) were negative using the parasitological technique. Such differences in prevalence obtained by the two techniques could have a significant impact on the strategy selected for the control of the disease in affected areas. It was shown that the PCR technique could be applied in a rapid, simple and economic way and thus seems a promising tool for estimating trypanosomosis prevalence.

(b) PATHOLOGY AND IMMUNOLOGY

[See also **25**: no. 12312]

12344 **Mbwambo, H., Ndung'u, J.M., Murilla, G.A., Munga, L., Sinyangwe, L., Machila, N., Holmes, P.H. and Eisler, M.C., 2001.** Trypanocidal drug resistance in Tanzania. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 168-174.

Mbwambo: Animal Disease Research Institute, P.O. Box 9254, Dar-es-Salaam, Tanzania.

Although the use of prophylactic and therapeutic trypanocidal drugs has been well documented at some sites in Tanzania, there is little detailed information on the extent of the problem on an area-wide basis. A survey was conducted between May 1997 and December 1998 in 30 sampling sites in Tanga, Coast and Dar es Salaam Provinces of Tanzania. Blood samples (n = 2 761) from cattle were collected and examined for presence/absence of trypanosomes using the buffy-coat technique and Giemsa-stained blood films. Sera were collected for trypanocidal drug determination, and trypanosome stabilates were prepared for drug sensitivity testing. Trypanosomes were found in 359 (13.0 percent) of the samples (73.0 percent *Trypanosoma congolense*, 23.1 percent *T. vivax* and 3.9 percent *T. brucei*). Prevalence at individual sampling sites varied between 0 and 43.0 percent. Pangani District in Tanga Province and Bagamoyo District in Coast Province had the highest prevalences (21.4 percent and 10.9 percent, respectively). Drug sensitivity testing in mice using seventeen pooled stabilates of *T. congolense* from areas with high trypanosomosis prevalence indicated the presence of resistance to isometamidium chloride at two locations (Mivumoni and Tanga Dairy) and resistance to both isometamidium and diminazene aceturate at four locations (Mkwaja, Sakura and Mivumoni (Pangani) and Bunju (Bagamoyo)). Drug sensitivity testing in cattle showed resistance to both diminazene and isometamidium at three sites. Analysis of sera using isometamidium-

ELISA showed wide variation in usage rates, and further evidence of isometamidium resistance: 18.4 percent of 359 trypanosome-infected cattle showed evidence of recent isometamidium treatment.

12345 **Sinyangwe, L.N., Machila, N., Mubanga, J., Delespaux, V., Brandt, J., Geerts, S., Holmes, P.H. and Eisler, M.C., 2001.** Trypanocidal drug resistance in the Eastern Province of Zambia. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 165-167.

Sinyangwe: Central Veterinary Research Institute, P.O. Box 33980, Lusaka, Zambia.

The use of trypanocides has been intensive in the Eastern Province of Zambia and resistance to trypanocides has already been reported. A cross-sectional study was carried out in 34 randomly selected villages in the Lundazi, Petauke and Katete Districts between October 1996 and July 1997. One thousand five hundred and seventy nine cattle over 6 months of age were sampled using Giemsa-stained thick and thin blood smears and HCT. Sera were collected to determine chemoresistance and trypanosome stabilates were collected for drug sensitivity testing. Trypanosome infections were observed in 25 (74 percent) of the villages studied. Prevalence in individual villages varied between 0 and 64 percent. Overall mean prevalence was 14.4 percent (96 percent *Trypanosoma congolense*, 2 percent *T. vivax* and 2 percent *T. brucei*). No infection was found in certain villages where a high prevalence had previously been reported. To investigate whether this was a seasonal effect, which might influence the apparent occurrence of drug resistance, a one-year longitudinal study was conducted in eight selected villages in the same districts commencing in November 1997. Every 2 months, 50 randomly selected animals were sampled in each village. Prevalence varied widely between villages and between visits. Three villages all had a maximum prevalence of 20-30 percent and minimum prevalence of < 5 percent. Others varied between 0 and 6 percent on different visits. *Trypanosoma. congolense* stabilates (n = 71) collected during these studies were tested in mice for sensitivity to isometamidium chloride (1.0 mg/kg) and diminazene aceturate (20 mg/kg): 38 were sensitive to both drugs, 24 resistant only to isometamidium, eight resistant only to diminazene and one resistant to both drugs. In spite of a relatively high proportion of isometamidium-resistant stabilates, ELISA testing showed evidence of recent administration of the drug in only 4 percent of the cattle. Socio-economic studies in the area indicated that administration of this drug is becoming less common, farmers preferring diminazene on account of lower cost per dose. Fortunately, the use of both drugs as a sanative pair can still be expected to be effective in this area.

12346 **Taylor, K., Mertens, B., Rocchi, M. and Elson, L., 2001.** Immune suppression during bovine trypanosomosis. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 179-180.

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

Immune suppression is a nearly universal feature of infection and may represent an essential element of the host-parasite relationship. Because the pro-inflammatory molecule TNF-α has been shown to be an important mediator of T cell suppression in the murine model of trypanosomosis, we monitored its regulation during bovine trypanosomosis in *Trypanosoma congolense* infection of trypanosusceptible Boran and trypanotolerant N'Dama cattle. During the acute stage of infection, transcription of TNF-α (11 days p.i.), IFN-γ-induced TNF-α secretion (14 days p.i.) and the number of TNF-α and IL-1β positive monocytes following overnight adhesion to plastic (21 days p.i.) were all transiently elevated in Boran cattle. Conversely, the numbers of TNF-α and IL-1β positive monocytes after overnight culture with IFN-γ were depressed. These data suggest that, at least in trypanosusceptible cattle, monocytes might be activated transiently and at a relatively early stage of infection but, between the second and third week of infection, their phenotype changes so that fewer are able to respond to specific activation. In N'Dama cattle the lowest expression of TNF-α coincided with the highest expression of IL-10 mRNA. In Boran cattle TNF-α mRNA was elevated early in infection, before the observed increase in IL-10. Coincident with increased IL-10, TNF-α returned to basal transcription levels in these cattle. Both observations suggest that IL-10 may be involved in the regulation of TNF-α.

(c) TRYPANOTOLERANCE

[See also **25**: nos. 12312]

12347 **d'Ieteren, G., 2001.** The exploitation of trypanotolerance: a dream of academics or a reality for sustainable livestock development in tsetse affected areas. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 265-270.

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

Trypanotolerance is one of the best recognised examples of innate resistance to disease and one of the most thoroughly investigated. Experimental and field studies reported in this paper are providing the basic tools with which the trypanotolerance trait can be identified and exploited. Evaluation of the degree of genetic determination of the different disease resistance traits, their heritability and their genetic correlations with each other and with animal performance traits should now be possible; this knowledge will allow progress to be made in the development of breeding programmes and policies. There is increasing recognition that Africa possesses animal genetic resources probably unparalleled in any other continent. Evidence that these resources can provide sustainable and environmentally sound solutions for some of the vast disease problems currently confronting Africa is now being found. Thus, the natural innate resistance possessed by breeds of cattle such as the N'Dama and the West African shorthorn to trypanosomosis and to several other important infectious diseases is now accepted as an important component of national and regional disease control programmes. The fact that these breeds also possess considerable production potential, and that their disease resistance traits could be exploited in crossbreeding, offers an unparalleled opportunity to improve livestock

production in the vast areas of Africa dominated by the tsetse fly, ticks and helminths, particularly as production systems evolve into more market-orientated production.

12348 **Gbodjo Zakpa, L., d'Ieteren, G., Diedhou, M., Leak, S.G.A. and Coulibaly, L., 2001.** Breed choice and trypanosomosis risk. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 299-300.

Gbodjo Zakpa: ILRI, B.P. 32, Korhogo, Côte d'Ivoire.

Decreasing efficacy of trypanocidal drugs and difficulties in sustaining tsetse control strengthen the importance of trypanotolerant livestock and the enhancement of disease resistance as options for livestock production. At the same time, continued increase in urban demand for milk and meat in West Africa and increased demand for draught oxen are influencing breed choices towards increased size and milk production. In order to assess the influence of these conflicting trends on farmers' decisions, studies of changes in herd composition and farmers' priority traits for breeding decisions were undertaken. Thirty traditionally managed cattle herds were monitored in northern Côte d'Ivoire between 1984 and 1992. Breed of calves at birth, tsetse challenge, trypanosome prevalence in post-weaners and trypanocidal drug requirements were recorded monthly. Three genotypes were considered: tolerant (N'Dama or Baoulé), Zebu and crosses between them. The percentage of tolerant animals varied with trypanosomosis risk, being greatest when risk was high. There has been a slow progressive trend towards more crossbreeding which accelerated in 1988 following the start of tsetse control operations in 1987. It is concluded that farmers' breeding strategies respond to external influences such as disease risk. Breed types must be taken into consideration in any impact evaluation of tsetse control interventions in order to understand the changes in trypanosome prevalence and trypanocidal drug consumption which are used as indicators of successful control.

12349 **Iraqi, F., Kemp, S. and Teale, A., 2001.** Towards identification and cloning of the trypanotolerance genes in mouse. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 296-298.

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

Recently, three quantitative trait loci (QTLs), *Tir1*, *Tir2* and *Tir3*, controlling resistance/susceptibility to *Trypanosoma congolense* infection in mice, have been mapped to mouse chromosomes 17, 5 and 1, respectively. In this study we used advanced intercross lines (AILs) to fine map these QTLs in an F6 C57BL/6 (resistant) × A/J (susceptible) mouse population. Data from 1611 mice which developed infections after inoculation with *T. congolense* were used for the analysis. 67 microsatellites located within the three QTLs at intervals of 0.5-3 cM were genotyped on mice representing phenotypic extremes (200 first and 200 last to succumb). The resistance/susceptibility status of the C57BL/6 and A/J parental strains was confirmed. Genetic and phenotypic data analysis revealed that each of the three QTLs was fine mapped within different intervals. Preliminary results indicated that *Tir1* comprises a single locus within an interval of less than 1.5 cM with LOD score of 16.5. *Tir2* comprises a single locus within an interval of 2 cM with LOD score of 6.5. *Tir3*

comprises two loci separated by 20 cM, each mapped within an interval of less than 4 cM, with LOD scores of 8.5 and 4.5. A combined model including the effects of all the QTLs on chromosomes 1, 5 and 17 account for about 20 percent of the total variance in the F6 generation.

12350 **Kamuanga, M., Tano, K. and d'Ieteren, G., 2001.** Farmers' preferences of cattle breeds, their market values and prospects for improvement in West Africa: a summary review. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 271-289.

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

There is a broad band of territory comprising the subhumid zone and the non-forested areas of the humid zone of West Africa in which a mixture of trypanotolerant, trypano-susceptible and crossbred cattle are found. Availability of a variety of breeds allows farmers to choose the breeds they judge most appropriate for their circumstances. From the perspective of the national and international community, however, there is a risk that valuable strains or breeds of cattle may be interbred out of existence, as indicated by the current downward trend in the population of some indigenous trypanotolerant breeds, following the continued incursion of disease-prone Zebu cattle into the subhumid, tsetse-infested zones in the region. The case studies reviewed in this paper were conducted between 1994 and 1997 by ILRI research teams in Burkina Faso, Côte d'Ivoire and Nigeria in order to evaluate farmer preferences for cattle traits. The objectives were to obtain information necessary for a possible reorientation of cattle improvement programmes and to determine factors affecting adoption and conservation of trypanotolerant cattle at risk of extinction. In Burkina Faso and Côte d'Ivoire, farmers' preferences for cattle traits were evaluated using the technique of conjoint analysis. Fitness to traction, disease resistance and fertility were found to be the most preferred traits of bulls. Most preferred traits for cows were fecundity, disease resistance and feeding ease. Analysis of the relationships between breed preferences and breeding practices confirmed a strong trend away from Muturu (south-west Nigeria) and Baoulé (southern Burkina Faso) – two West African shorthorn cattle known to be trypanotolerant – and identified the traits farmers find less desirable and traits more desirable relative to other breeds. Importantly, high preferences for disease resistance and relatively low preferences for standard off-take traits (milk and beef) suggest that indigenous breed preservation *in situ* and planned programmes for cattle breed improvement are both possible. In all three countries, analysis of cattle market prices found small, but significant, price differences by breed.

12351 **Maichomo, M.W., Olubai, W., Mwendia, C.M.T. and Mapenay, I.M., 2001.** Farmer responses on acceptability of the Orma Boran, a trypanotolerant breed of cattle introduced into Nguruman, Kajiado District in Kenya. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 293-295.

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

Animal trypanosomosis is endemic in Nguruman. Chemoprophylaxis is still the major method of control practised, besides tsetse fly trapping and strategic animal movement. Trypanotolerance has been identified as a more sustainable approach to controlling trypanosomosis. The focus of this study is on technology transfer of trypanotolerance through crossbreeding of Orma Borans with the local Maasai zebu cattle and the implications on the pastoral economy. Responses of Maasai pastoralists regarding the performance and adaptability of the Orma bulls were analysed. Seven and eight farmers were interviewed in Shompole and Olkiramatian group ranches, respectively. Their ages ranged from 28 to 58 years. Out of a total of 15 farmers, 11 were uneducated while four had some formal education. Generally, the responses were positive regarding bull size, colour and trypanotolerance, and 67 percent of the pastoralists interviewed were willing to purchase the bulls for breeding purposes. However, 33 percent were non-committal, citing either inability of the bulls to withstand harsh environmental conditions during dry weather and/or inability to preserve endemic stability. There was no significant difference ($P > 0.05$) in farmers' responses regarding acceptance of the Orma bulls between high and low tsetse challenge areas and between respondents with or without prior experience of the bulls. Issues of economic costs, apathy and lack of education partly contributed to the ambivalence felt by the Maasai farmers regarding the trypanotolerant Orma bulls.

12352 **Wissocq, N., Monsengo, B., d'Ieteren, G. and Mommens, G., 2001.** A N'Dama cattle resource population for research on trypanotolerance. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 301-302.

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

Studies are needed on the genetics of the multiple components of trypanotolerance, and their relationships with other resistance and adaptation traits and productivity, in well controlled ongoing production systems where it is possible to identify and quantify the environmental and genetic effects. A resource population of N'Dama cattle, selected from an original group imported into the Democratic Republic of Congo 75 years ago, has been established in the Mushie district, Bandundu Province, Congo D.R., within a commercial ranch situated in one of the highest available tsetse/trypanosomosis challenge areas. Breeding cows are maintained in multi-sire herds. Parentage (sire) is determined using molecular genetic markers. In order to evaluate the genetic diversity within the experimental population, 50 unrelated bulls were genotyped for 33 bovine microsatellites on 19 chromosomes. It was concluded that variability, and polymorphism, of the markers in the resource population is substantial and will thus allow accurate parentage determination. More importantly for research on within-breed genetic variation of trypanotolerance measurements, it was also concluded that the population is one of the purest available N'Dama cattle populations exposed to high levels of natural trypanosomosis risk, as indicated by the likely absence of introgression of zebu type genes.

12353 **Wissocq, N., Ngamuna, S. and d'Ieteren, G., 2001.** A resource environment for research on multi-disease resistance. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 303-304.

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

Other animal health constraints as well as trypanosomosis limit agriculture and livestock production in the humid and subhumid zones of Africa, and understanding their interactions and their combined effects on productivity is crucial. An eco-system in which research on interactions among diseases and on the exploitation of multi-disease resistance traits can be optimally carried out is reported. The resource environment is situated in the non-forested part of the humid zone and is exposed to a very high tsetse challenge as well as being a high-risk area for dermatophilosis. Only trypanotolerant N'Dama cattle are able to survive there and their success is equally attributable to dermatophilosis resistance. It is concluded that the specific climate, vegetation, land use, prevalence and risk of endemic tropical diseases, animal husbandry and methods for animal health management practised in this N'Dama population provide an excellent environment for individual animals to express their respective levels of disease resistance to the most economically important animal parasites/diseases.

(d) TREATMENT

[See also **25**: nos. 12288, 12308, 12319, 12344, 12345]

12354 **Bossche, P. van den, Doran, M. and Connor, R.J., 2001.** An analysis of trypanocidal drug use in the Eastern Province of Zambia. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 131-136.

Bossche: RTTCP, P.O. Box A560, Harare, Zimbabwe.

As part of the development of a strategy for the control of bovine trypanosomosis in Zambia, a survey was conducted to quantify and qualify the current use of trypanocidal drugs (diminazene aceturate and isometamidium chloride) in a tsetse-controlled and a tsetse-infested area of the Eastern Province. A total of 207 trypanocide users were interviewed. Questions were posed on herd structure, trypanocidal drug preference, treatment strategy, reason for treatment, method of treatment and treatment frequency. The majority of the cattle owners preferred to use diminazene aceturate rather than isometamidium chloride. Both trypanocides were used mainly to treat clinically sick animals (not necessarily infected with trypanosomes) and preference was given to the treatment of oxen and cows. The proportion of animals treated and the frequency of drug application did not differ between the two areas. Hence, in the tsetse-controlled area, a high proportion of the trypanocide treatments was inappropriate. In the tsetse-infested area, on the other hand, the treatment of clinically sick animals significantly reduced the trypanosomosis-related mortality but was insufficient to boost reproduction in cows. Despite the fact that the cattle owners administered most trypanocides themselves, evidence from the survey suggests that most of the farmers did not under-dose with either diminazene aceturate or isometamidium chloride. Moreover, other factors enhancing the

development of trypanosome resistance to trypanocides were not present in the areas surveyed. Conclusions are drawn on the usefulness of this type of survey in determining appropriate methods to control bovine trypanosomosis.

12355 **Bourdichon, A.J., Maina, N., Mwinuka, N.I., Akbar, S.J. and Fazil, M.A., 2001.** Report on the use of the trypanocidal drug combination 'Trypan' in chemotherapy for trypanosomosis in domestic livestock and sleeping sickness in humans and efficacy in experimental *in vitro* tests against *Plasmodium falciparum*. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 449-450.

Bourdichon: Department of Research and Development of Pharmaceutical Drugs, ATAROST Allgemeine Tierarzneimittelfabrik GmbH&Co., Postfach 1154, 27233 Twistringen, Germany.

Trypan, a combination of diminazene-di-aceturate, phenazone and procaine, has been used effectively against *Trypanosoma evansi* infections in camels for many years and has recently been shown to be effective against *T. congolense*, *T. vivax* and *T. brucei* infections. When administered to people, the compound is generally given as a deep i.m. injection at a dose of 2 mg/kg b.w. daily for 7 days or in three doses of 5 mg/kg b.w. at intervals of one or more days. *In vitro* testing of Trypan against two chloroquine-resistant strains of the malaria parasite *P. falciparum* showed that a concentration of 60 ng/ml was extremely effective in killing the parasites or inhibiting their growth. Further *in vivo* experiments should be done to evaluate the effectiveness of the drug against sleeping sickness and malaria.

12356 **Bourdichon, A.J. and Zhang Zichen, 2001.** Trypanosomal value of diminazene-di-aceturate and liposomal diminazene in experimental *Trypanosoma brucei evansi* infection in mice. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 435-436.

Bourdichon: Department of Research and Development of Pharmaceutical Drugs, ATAROST Allgemeine Tierarzneimittelfabrik GmbH&Co., Postfach 1154, 27233 Twistringen, Germany.

The failure of the classical trypanocidal drugs to control animal and human trypanosomiasis during the last decades has resulted in significant efforts to identify new compounds or drug combinations that could be used to overcome the obstacles imposed by parasite resistance. We have recently developed a new drug combination of diminazene and liposomes which we have tested against *T. b. evansi* infection in mice. Three different doses of diminazene liposomes, 79.5, 68.2 and 56.8 mg/kg b.w., were compared with unencapsulated diminazene at 159, 95 and 31 mg/kg b.w. All injections were given intraperitoneally. The results showed that only mice treated with diminazene liposomes at 68.2 mg/kg were still alive 2 weeks after administration. Those treated with diminazene liposomes at the other two doses and all untreated control mice died 2 weeks after administration, while all treated with unencapsulated diminazene died in 5 days.

12357 **Catley, A. and Leyland, T., 2001.** Participatory paradigms: towards a common understanding in animal health services. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 144-154.

Catley: Sustainable Agriculture and Rural Livelihoods Programme, International Institute for Environment and Development, 3 Endsleigh Street, London WC1H 0DD, UK.

In general, livestock development projects have a poor record of demonstrating long-term positive impacts on poor livestock keepers in Africa. This situation has been attributed to institutions and policies which are not client-focused, particularly with respect to less wealthy communities in marginalised areas. Although, at the present time, a range of veterinary activities claim to use community participation, understanding and expectations of the concept vary considerably between projects and the professionals concerned, and can lead to false hopes concerning the outcomes. Detailed analysis of different projects shows that usually one of two distinct approaches is taken, either a *target-orientated* and *top-down* approach viewed by professionals as a means to an end, or an *empowering* and *bottom-up* approach where local people set priorities and seek advice from professionals. This article discusses the experiences of community participation by reference to two interventions: rinderpest eradication using a heat-stable vaccine and community-based animal health workers, and tsetse control using targets and traps. In comparison to the rinderpest intervention, a top-down approach still appears dominant in tsetse control, with a tendency to focus on technical rather than social issues. While this approach has produced short-term reductions in tsetse populations, it is evident that communities have not really bought into tsetse control initiatives. A number of issues seem not to be well documented. It is often unclear how communities perceive trypanosomosis in comparison with other problems, and local leadership in tsetse control seems to revolve around government-appointed chiefs or administrators. Determining local willingness to contribute can be a participatory process if community-level analysis is encouraged. A negative impact of an influential stakeholder group (veterinarians and pharmacists selling trypanocidal drugs and pour-ons) may lead to attempts to undermine the participatory process. Community-level methodologies often seem researcher driven. Attention to these issues together with a more detailed understanding of different levels of community participation might assist tsetse control programmes to become more sustainable at community level.

12358 **Clausen, P.-H., Schares, G., Patzelt, R.J., Poetzsch, C.J., Scheer, A., Kakaire, D., Olila, D., Peregrine, A.S., McDermott, J. and Mehlitz, D., 2001.** PCR and DNA-probe hybridization to assess the efficacy of therapeutic and prophylactic isometamidium treatment in *Trypanosoma* spp.-infected dairy cattle in peri-urban Kampala, Uganda. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 429-434.

Clausen: Institute for Parasitology and Tropical Medicine, Freie Universität Berlin, Königsweg 67, D-14163 Berlin, Germany.

In a cross-sectional study carried out in June 1994, 486 cattle from 50 randomly selected dairy farms in the vicinity of Kampala, Uganda, were examined for trypanosome infections. The trypanosome prevalence, determined by the haematocrit centrifugation technique (HCT) and/or the mini-anion-exchange centrifugation technique (m-AECT), was 18.9 percent, comprising 78.2 percent *Trypanosoma brucei*, 10.9 percent *T. vivax* and 10.9 percent mixed *T. brucei/T. vivax*. PCR gave positive results in 34.8 percent of the blood samples tested, with 76.2 percent positive for *T. brucei*, 20.6 percent positive for *T. vivax* and 3.2 percent positive for mixed *T. brucei/T. vivax* infections. Using primers specific for savanna-type *T. congolense*, no specific products could be amplified. When the PCR-generated products were hybridised with species-specific DNA probes, the overall detection rate increased further to 43.1 percent. All cattle were treated with a prophylactic dose of isometamidium chloride (1 mg/kg body weight) and thereafter monitored on a monthly basis for the presence of parasitaemia and trypanosome DNA. The trypanosome prevalence (HCT and m-AECT) declined, being 0.4 percent, 0.7 percent and 3.2 percent at 1, 2 and 3 months after treatment, respectively. The parasitological results were confirmed by PCR. Neither PCR products nor hybridisation signals could be detected when testing aparasitaemic blood samples collected from cattle at the first and second month after prophylactic treatment. Parasitaemic samples collected after treatment were DNA-positive. The parasitological and DNA-based findings of this study, and additional results from *in vivo* and *in vitro* drug sensitivity studies on trypanosome field isolates collected from the study area, confirm the presence of a high level of isometamidium sensitivity amongst the trypanosome populations present in Mukono County in 1994.

12359 **Tettey, J.N.A., Skellern, G.G., Midgley, J.M. and Grant, M.H., 2001.** The composition of preparations containing isometamidium in clinical use: implications for variations in therapeutic effect. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 192-194.

Tettey: Department of Pharmaceutical Sciences, Strathclyde Institute for Biomedical Sciences, 27 Taylor Street, Glasgow G4 0NW, UK.

Preparations containing isometamidium chloride (ISM) have been used successfully in the chemotherapy and chemoprophylaxis of veterinary trypanosomiasis. They are mixtures of isomeric phenanthridines and ethidium chloride and the ratio of the components in the mixture is inherently dependent on the manufacturing process. The increasing incidence of resistance to ISM has stimulated research into the chemical equivalence of commercially available preparations. Sachets of preparations containing ISM from two manufacturers (four from each) were obtained on the open market and analysed using HPLC and the indophenol reaction. Significant qualitative and quantitative differences were found in products from the two manufacturers, and significant differences occurred in the content of ISM and of the impurity ammonium chloride in different batches from one of the manufacturers. Such differences between products may result in different therapeutic profiles and therefore may have direct clinical implications with respect to their interchangeability.

7. EXPERIMENTAL TRYPANOSOMIASIS

(a) DIAGNOSTICS

[See also **25**: nos. 12326, 12328]

(b) PATHOLOGY AND IMMUNOLOGY

12360 **Iraqi, F., Sileghem, M. and Teale, A., 2001.** TNF-α expression in trypanosomiasis resistant and susceptible mouse strains during infection with *Trypanosoma congolense*. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 290-292.

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

TNF-α is a candidate for trypanosomiasis resistance quantitative trait locus (QTL) *Tir1*. We therefore determined TNF-α expression at the protein and mRNA levels in two resistant (C57BL/6 and C57BL/10) and two susceptible (A/J and BALB/c) mouse strains challenged by the bites of tsetse infected with *T. congolense* IL1180. Cells from four sources (peripheral lymph nodes, mesenteric lymph nodes, spleen, peritoneal cells) were sampled 4 days pre-infection and at days 4, 7, 14, 21 and 28 post-infection. TNF-α mRNA in the different tissues was measured by PCR amplification. No TNF-α induction was seen in cells from uninfected control mice whereas a strong induction was seen in some of the cell populations from infected mice. At day 7 p.i., a strong induction of TNF-α was seen in peripheral lymph node cells in both resistant mouse strains but not in BALB/c or A/J mice. At day 14 p.i., the intermediate BALB/c strain had acquired a marked TNF-α induction whereas the susceptible A/J strain remained negative. At day 21 p.i., a modest induction was seen in A/J. In the mesenteric lymph node cell populations, a similar pattern of response was seen but it was transient and much lower. The same response was also apparent, although to a lesser extent, in the spleen. An increase in TNF-α mRNA in the early stages of infection (4-7 days p.i.) was observed in the resistant strains, followed by a large decrease. In the susceptible strains, increasing amounts of mRNA were observed up to day 14 p.i., followed by a decrease at day 21 p.i. Levels of mRNA in the resistant strains at day 7 p.i. were 10^2-10^4 fold lower than levels in uninfected control mice. These results are consistent with increased mRNA turnover and degradation and increased protein translation. We propose that TNF-α responses are a positive factor in determining the degree of host resistance to murine *T. congolense* trypanosomiasis in the early stages of infection.

12361 **Nyakundi, J.N., Crawley, B. and Pentreath, V.W., 2002.** The relationships between endotoxins, nitric oxide and inflammatory cytokines in blood and intestinal tissues in experimental *Trypanosoma brucei brucei* infections. [rats] *Parasitology*, **124** (Pt 6): 597-604.

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Increased levels of circulating endotoxins are a feature of both human and experimental African trypanosomiasis. Studies with rats and mice have shown that these may originate from intestinal damage with altered permeability of the gut epithelium. Endotoxins are potent immunomodulatory substances which can initiate the production of a range of cytokines and mediators from different cell types. In rats infected with *T. b. brucei* we have examined possible associations of the endotoxin increases with increases in levels of TNF-alpha, IL-1beta, IL-6, IFN- gamma and nitric oxide (NO). Significant increases in each substance occurred at days 21 and 33 post-infection (p.i.). The increases in cytokines were highly correlated with the endotoxin levels (e.g. at day 21 p.i. the correlation-regression values were as follows: TNF-alpha, $r = 0.9$, $P < 0.01$; IL-1beta, $r = 0.83$, $P < 0.01$; IL-6, $r = 0.9$, $P < 0.01$; IFN- gamma, $r = 0.7$, $P < 0.01$). There were also strong correlations between the increased levels of several individual cytokines. Biopsies of chopped sections of small intestine tissues of rats showed a parallel production of cytokines, again with significant correlations with the circulating endotoxins. The production of NO and cytokines by the intestine may be associated with the increased transepithelial permeability which occurs during the infection.

12362 **Nyakundi, J.N., Crawley, B., Smith, R.A. and Pentreath, V.W., 2002.** The relationships between intestinal damage and circulating endotoxins in experimental *Trypanosoma brucei brucei* infections. [rats] *Parasitology*, **124** (Pt 6): 589-595.

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The involvement of intestinal damage in experimental African trypanosomiasis was investigated in rats infected with *Trypanosoma brucei brucei* by measuring the urinary excretion of the previously administered non-metabolizable sugar probes, D-mannitol and lactulose, and the flux of FITC-dextran across isolated, everted gut segments. There was increased urinary recovery and flux of the sugar probes across the intestine which were significant ($P < 0.05$) and maximum at day 21 of the infection, but subsequently reduced, in the terminal stages of infection (dav 33 p.i.). In the case of the everted sac studies the reductions were to less than 25 percent of control values ($P < 0.001$). Levels of circulating endotoxin were increased approximately 3-fold at day 21 p.i., 4-fold at day 33 p.i., compared to controls. At day 21 there was a significant correlation ($r = 0.63$, $P < 0.01$) between the log endotoxin levels and the increased sugar excretion expressed as the lactulose/mannitol ratios. Histological studies showed damage to the villi, wall thinning and marked cellular infiltrations, which were very prominent in the proximal jejunum and duodenum. These results demonstrate that during trypanosome infections in rats, increased intestinal leakage and increased circulating endotoxins are significant pathological features.

(c) CHEMOTHERAPEUTICS

12363 **Geerts, S., Ndung'u, J.M., Murilla, G.A., Mbwambo, H., Sinyangwe, L., Machila, N., Delespaux, V., Brandt, J., Peregrine, A.S., McDermott, J.J., Holmes, P.H. and Eisler, M.C., 2001.** A simplified cost-effective method for area-wide testing of trypanocidal drug sensitivity of *T. congolense* in mice. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 175-178.

Geerts: Institute of Tropical Medicine, Nationalestraat 155, B-2000 Antwerp, Belgium.

Testing of trypanocidal drug sensitivity in stabilates of pathogenic trypanosomes derived from cattle continues to be problematic, in spite of development of *in vitro* techniques, since these are generally complicated and costly for the resources available in developing country laboratories. Furthermore, such assays are unable to characterise rapidly large numbers of trypanosome populations. Many populations of *Trypanosoma congolense* and *T. brucei* may be isolated directly by inoculation of mice with blood of infected cattle, without the need for carrying liquid nitrogen to the field. Mice may then be used for testing trypanocidal drug sensitivity. Classically this involves using multiple drug doses to determine the dose required to cure 50 percent of animals (CD_{50}), requiring at least 30 mice per drug. However, many laboratories lack the resources required to maintain a mouse colony large enough to test significant numbers of isolates by this method. A simplified protocol for trypanocidal drug sensitivity testing using just 3 doses for either isometamidium (0.1, 1.0 and 10 mg/kg b.w.) or diminazene (1, 20 and 40 mg/kg b.w.) was evaluated. This method requires at least 15 mice per drug and represents a significant reduction over full CD_{50} testing. The method showed clear differences in the level of drug sensitivity of *T. congolense* populations from different areas of Kenya, Tanzania and Zambia. Finally, an even more simplified protocol was developed on the basis of results obtained with the three-dose protocol, using just a single dose of each drug: 1.0 mg/kg b.w for isometamidium, and 20 mg/kg b.w. for diminazene. This method requires just 6 mice per drug, plus controls. While this method is not able to provide definitive information on the level of drug sensitivity of individual stabilates, it provides a cost-effective means of characterising the resistance phenotype of large numbers of trypanosome populations in a given area. The method is not, however, applicable to *T. vivax* infections, which are rarely infective for mice.

12364 **Gichuki, C.W., Burri, C., Kamau, D.M., Ndung'u, J.M. and Brun, R., 2001.** Investigations on the clinical efficacy against *T. rhodesiense* infections and pharmacokinetics of the novel compound SIPI 1029 in African green (vervet) monkeys. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 93-97.

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

It has been shown that SIPI 1029 (Trybizine HCl), an inhibitor of adenosylmethionine decarboxylase, is curative against *Trypanosoma evansi* infections in

buffaloes and cattle after single i.m. injections at 1.5 mg/kg and 0.5 mg/kg respectively. It is also active against *T. b. rhodesiense* and *T. b. gambiense* infections in mice. Following these observations, a study on the pharmacokinetics and efficacy of the drug against early-stage *T. b. rhodesiense* infections in vervet monkeys was carried out. Three infected monkeys were treated with one i.m. dose of 1 mg/kg on each of 5 consecutive days starting on the 14th day post-infection. Parasites disappeared from their blood on the 2nd or 3rd day but reappeared after 22-44 days. Parasites in the cerebrospinal fluid either appeared or re-appeared 22-45 days after treatment, coinciding with relapse of parasitaemia. Pharmacokinetic studies showed a maximum drug concentration in serum samples 5 min after administration, followed by rapid elimination in the next 3 h. Thereafter, elimination was much slower and therapeutic values remained more or less constant for 48 h. None was detected in the CSF, which might explain the relapses. In another study, weak transient drug activity was seen in the CSF in 1-3 h samples following i.v. administration. This low activity in the CSF suggests that the drug does not cross the blood-brain barrier in sufficient amounts to kill the parasites. It is recommended that lipophilic analogues of SIPI 1029 be investigated for anti-trypanosome activity as well as for their ability to cross the blood-brain barrier.

12365 **Gichuki, C.W., Kamau, D.M., Ngotho, J.M., Ndung'u, J.M., Burri, C. and Brun, R., 2001.** The effect of the novel compound, CGP 40215, against early-stage *T. rhodesiense* infections: pharmacokinetics in blood and CSF levels in vervet monkeys. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 111-113.

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

CGP 40215 is a diamidine synthesised by Novatis, which inhibits the synthesis of polyamines by preventing the hydroxylation of the ornithine step catalysed by *S*-adenosylmethionine decarboxylase. This compound has been shown to be active against several trypanosome species *in vitro* and *in vivo* in mice. It is hypotensive in rats but not in mice or marmosets at concentrations of up to 10 mg/kg slow i.v. infusion. On the basis of these observations, a study has been undertaken in vervet monkeys to evaluate the effect of this compound on blood pressure and blood clotting time, its therapeutic efficacy against early-stage *Trypanosoma brucei rhodesiense* infections and its pharmacokinetics. The compound was found not to be hypotensive at dosages of up to 8 mg/kg i.v. injection, and higher doses caused only transient hypotension. There was no observable effect on blood clotting time. Between 14 and 16 days post-infection with *T. b. rhodesiense*, four groups of monkeys were treated with CGP 40215 at different dosage regimes. At 2 mg/kg i.m. daily, 2 mg/kg i.v. twice a day and 4 mg/kg i.v. daily, all for 5 days, the compound caused temporary remission of parasitaemia, CSF parasites and clinical signs. One monkey died within 14 days of treatment and two developed relapse parasitaemia and were sacrificed. Eight monkeys given 4 mg/kg i.m. twice a day for 8 days became aparasitaemic after 6 days. One died 12 days after treatment started and one developed relapse parasitaemia 232 days after treatment but the rest remained parasite free throughout the 300 days of post-treatment follow-up. No drug was detected in the CSF even at the highest dosage regime although the trough drug levels increased with the dosage. The half-life of the drug in

serum was short (3-4 h) but the twice-daily regime maintained therapeutic serum levels for 24 h.

12366 **Nok, A.J., 2002.** Azaanthraquinone inhibits respiration and *in vitro* growth of long slender bloodstream forms of *Trypanosoma congolense*. *Cell Biochemistry and Function*, **20** (3): 205-212.

Nok: Department of Biochemistry, Ahmadu Bello University, Zaria, Nigeria.

An ethanolic extract of *Mitracarpus scaber* was found to possess *in vitro* and *in vivo* trypanocidal activity against *Trypanosoma congolense*. At a dosage of 50 mg kg^{-1} day^{-1} in normal saline for 5 days, the extract cured Balbc mice infected with *T. congolense* without any relapse. The isolated active component benz(g)isoquinoline 5,10 dione (Azaanthraquinone) (AQ) purified from the extract was found to inhibit glucose-dependent cellular respiration and glycerol-3-phosphate-dependent mitochondrial O_2 assimilation of the long bloodstream forms of *Trypanosoma congolense*. On account of the pattern of inhibition, the target could be the mitochondrial electron transport system composed of glyceraldehyde 3-phosphate dehydrogenase (G3PDH). The azaanthraquinone specifically inhibited the reduced coenzyme Q_1-dependent O_2 uptake of the mitochondria with respect to ubiquinone. The susceptible site could be due to ubiquinone redox system which links the two enzyme activities.

12367 **Nok, A.J., Njoku, G.C. and Balogun, E., 2002.** A 45-kDa midgut glycoprotein from *Anopheles albimanus* mosquito mediates the killing of trypanosomes. *Cell Biochemistry and Function*, **20** (3): 257-262.

Nok: Department of Biochemistry, Ahmadu Bello University, Zaria, Nigeria.

Trypanosomes do not inhabit or grow in anopheles mosquitoes, the vector for the transmission of *Plasmodium* parasites the causative agent for malaria. The possession of lytic factors by the anopheline mosquito was thus considered. Head and midgut sections prepared in phosphate buffered saline were tested for trypanocidal action against *T. congolense*. While the head section was inactive towards the trypanosomes, the midgut extract at 0.2 mg ml^{-1} diminished the motility of the parasites within 2 min of incubation; killing 50 percent of the population after 5 min. At 0.5 mg ml^{-1} of the extract, about 90 percent of the parasites were killed within 2 min of incubation. The midgut fraction was subjected to a purification protocol involving successive chromatography on: octyl-sepharose, reactive brown agarose and fetuin-agarose columns. A final trypanocidal active fraction (gp45), which moved homogeneously during electrophoresis as a 45-kDa protein, was recovered from the fetuin-agarose column. The protein reacted positively with thiobarbituric acid, which suggests it is a sialoglycoprotein. Desialylation of the glycoprotein nullified its trypanocidal activity on *T. congolense*. Similarly, when the saccharides, lactose, methyl-β-galactoside, lactulose, methyl-umbelliferyl-β-galactoside (MU-Gal), were included in the culture medium, they inhibited the gp45 trypanocidal activity. Asialo-fetuin and asialo-RBC also inhibited the gp45-induced killing of *T.*

congolense cells. The potential use of anopheline 45 kDa protein in the production of transgenic tsetse flies (*Glossina* spp.) in the control of trypanosomiasis is discussed.

8. TRYPANOSOME RESEARCH

(a) CULTIVATION OF TRYPANOSOMES

(b) TAXONOMY, CHARACTERISATION OF ISOLATES

12368 **Penchenier, L., Nkinin, S., Herder, S., Grébaut, P., Gastellu Etchegorry, M., Kaminsky, R. and Legros, D., 2001.** Résistance au mélarsoprol: résultats préliminaires de l'analyse isoenzymatique des souches de *Trypanosoma brucei gambiense* isolées du foyer de trypanosomose humaine d'Omugo (Ouganda). [Resistance to melarsoprol: preliminary results of isoenzyme analysis of *T. b. gambiense* stocks isolated from the human trypanosomiasis focus of Omugo, Uganda.] *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 98-100.

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

Between December 1998 and February 1999, as part of an ongoing study on resistance to melarsoprol, OCEAC received 125 strains of trypanosomes from the Omugo sleeping sickness focus in Uganda where relapse to treatment is stated to be more than 20 percent. Of these strains, 23 (18 percent) were taken from relapse patients and 102 (82 percent) from patients receiving their first treatment. All the strains were isolated by KIVI, either from venous blood or from CSF. Because of contamination and delays between sampling and arrival, only 28 strains could be cultured, of which three were from relapse patients. These 28 strains were analysed by isoenzyme electrophoresis on cellulose acetate gel and could be grouped into seven zymodemes. The three strains isolated from relapse patients all belonged to the zymodeme most often encountered in Central Africa: *T. b. gambiense* group 1. Resistance, if it exists, is therefore not due to a strain genetically different from those which respond to melarsoprol treatment.

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

[See also **25**: nos. 12293, 12335, 12362]

12369 **Alexander, D.L., Schwartz, K.J., Balber, A.E. and Bangs, J.D., 2002.** Developmentally regulated trafficking of the lysosomal membrane protein p67 in *Trypanosoma brucei*. *Journal of Cell Science*, **115** (16): 3253-3263.

Bangs: Department of Medical Microbiology and Immunology, University of Wisconsin - Madison School, Madison, WI 53706, USA. [jdbangs@facstaff.wisc.edu]

12370 **Andrews, N.W., 2002.** Lysosomes and the plasma membrane: trypanosomes reveal a secret relationship. *Journal of Cell Biology*, **158** (3): 389-394.

Andrews: Section of Microbial Pathogenesis and Department of Cell Biology, Yale University School of Medicine, New Haven, CT 06536 USA.

Studies of the cell invasion mechanism of the parasite *Trypanosoma cruzi* led to a series of novel findings, which revealed a previously unsuspected ability of conventional lysosomes to fuse with the plasma membrane. This regulated exocytic process, previously regarded mostly as a specialization of certain cell types, was recently shown to play an important role in the mechanism by which cells reseal their plasma membrane after injury.

12371 **Claustre, S., Denier, C., Lakhdar-Ghazal, F., Lougare, A., Lopez, C., Chevalier, N., Michels, P.A.M., Périé, J. and Willson, M., 2002.** Exploring the active site of *Trypanosoma brucei* phosphofructokinase by inhibition studies: Specific irreversible inhibition. *Biochemistry*, **41** (32): 10183-10193.

Willson: Laboratoire de Synthèse et de Physico-Chemie de Molécules d'Intérêt Biologique UMR-CNRS 5068, Université Paul Sabatier, 118 route de Narbonne Cedex, France. [willson@chimie.ups-tlse.fr]

12372 **Clerici, F., Gelmi, M.L., Yokoyama, K., Pocar, D., Van Voorhis, W.C., Buckner, F.S. and Gelb, M.H., 2002.** Isothiazole dioxides: Synthesis and inhibition of *Trypanosoma brucei* protein farnesyltransferase. *Bioorganic and Medicinal Chemistry Letters*, **12** (16): 2217-2220.

Clerici: Istituto di Chimica Organica, Facoltà di Farmacia, Università di Milano, Via Venezian 21, 20133 Milan, Italy. [francesca.clerici@unimi.it]

12373 **Grünfelder, C.G., Engstler, M., Weise, F., Schwarz, H., Stierhof, Y.D., Boshart, M. and Overath, P., 2002.** Accumulation of a GPI-anchored protein at the cell surface requires sorting at multiple intracellular levels. [*T. brucei*] *Traffic*, **3** (8): 547-559.

Overath: Max-Plank-Institut für Biologie, Abteilung Membranbiochemie, Correnstrasse 38, D-72076 Tübingen, Germany.

12374 **Guerra-Giraidez, C., Quijada, L. and Clayton, C.E., 2002.** Compartmentation of enzymes in a microbody, the glycosome, is essential in *Trypanosoma brucei.* *Journal of Cell Science*, **115** (13): 2651-2658.

Clayton: Zentrum für Molekulare Biologie der Universität Heidelberg, Im Neuenheimer Feld 282, D-69120 Heidelberg, Germany. [cclayton@zmbh.uni-heidelberg.de]

12375 **Kaminsky, R., Maeser, P., Kralli, A., Matovu, E. and Enyaru, J., 2001.** The potential of molecular markers for the diagnosis of arsenical-resistant *T. b. gambiense*. *In*: OAU/STRC, 2001 (see **25**: no. 12291), pp. 427-428.

Kaminsky: Swiss Tropical Institute, Socinstrasse 4002, Basel, Switzerland.

Arsenic-resistant trypanosomes are known to be deficient in a P2 transporter by which adenosine and related compounds traverse the trypanosome membrane. We have identified a P2 type adenosine transporter TbAT1 by functional cloning in the yeast *S. cerevisiae.* Functional characterisation of adenosine transporters from drug-sensitive and drug-resistant isolates was carried out. Sequence data of the TbAT1 gene revealed six point mutations in the transporter gene from resistant isolates. Two point mutations within the central fragment of this gene could be used to distinguish between $TbAT1^s$ and $TbAT1^r$. One of the mutations abrogates a recognition site for *Sfa*N1 which is otherwise present in $TbAT1^s$, while the other introduces a new recognition site. *Sfa*N1 digestion of a PCR fragment from $TbAT1^s$ resulted in two bands, but of different sizes as compared to the digestion product from $TbAT1^r$. The different sizes can be visualised on a gel. *Sfa*N1 digestion of PCR products of the central section of TbAT1 was carried out on 11 field isolates of *T. b. gambiense* and *T. b. rhodesiense*. Preliminary results included some sensitive patterns from relapse patients and some sensitive/resistant mixtures from new cases which are being followed up.

12376 **Kang, X.D., Szallies, A., Rawer, M., Echner, H. and Duszenko, M., 2002.** GPI anchor transamidase of *Trypanosoma brucei*: in vitro assay of the recombinant protein and VSG anchor exchange. *Journal of Cell Science*, **115** (12): 2529-2539.

Duszenko: Physiologisch-chemisches Institut, University of Tübingen, 72076 Tübingen, Germany. [michael.duszenko@uni-tuebingen.de]

12377 **Mookherjee, N. and Pearson, T.W., 2002.** *Trypanosoma simiae* and *Trypanosoma congolense*: surface glycoconjugates of procyclic forms - the same coats on different hangers? *Experimental Parasitology*, **100** (4): 257-268.

Pearson: Department of Biochemistry and Microbiology, Petch Building, University of Victoria, PO Box 3055, Victoria BC, Canada V8W 3P6. [parasite@uvvm.uvic.ca]

12378 **Moreno, B., Rodrigues, C.O., Bailey, B.N., Urbina, J.A., Moreno, S.N.J., Docampo, R. and Oldfield, E., 2002.** Magic-angle spinning ^{31}P NMR spectroscopy of condensed phosphates in parasitic protozoa: visualizing the invisible. *FEBS Letters*, **523** (1-3): 207-212.

Oldfield: Department of Chemistry and Biophysics, University of Illinois at

Urbana-Champaign, 600 South Mathews Avenue, Urbana, IL 61801, USA. [eo@chad.scs.uiuc.edu]

12379 **Morris, J.C., Wang, Z.-F., Drew, M.E., Paul, K.S. and Englund, P.T., 2002.** Inhibition of bloodstream form *Trypanosoma brucei* gene expression by RNA interference using the pZJM dual T7 vector. (vol **117**, pg 111, 2002) (Correction). *Molecular and Biochemical Parasitology*, **120** (2): 325.

Englund: Department of Biological Chemistry, John Hopkins School of Medicine, 725 North Wolfe Street, Baltimore, MD 21205, USA. [penglund@jhmi.edu]

12380 **Morris, J.C., Wang, Z.-F., Drew, M.E. and Englund, P.T., 2002.** Glycolysis modulates trypanosome glycoprotein expression as revealed by an RNAi library. *EMBO Journal*, **21** (17): 4429-4438.

Englund: Department of Biological Chemistry, John Hopkins Medical School, 725 N. Wolfe Street, Baltimore, MD 21205, USA. [penglund@jhmi.edu]

12381 **Ochola, D.O.K., Prichard, R.K. and Lubega, G.W., 2002.** Classical ligands bind tubulin of trypanosomes and inhibit their growth in vitro. *Journal of Parasitology*, **88** (3): 600-604.

Lubega: Molecular Biology Laboratory, Faculty of Veterinary Medicine, Makerere University, Kampala, Uganda. [glubega@imul.com]

12382 **Robinson, N.P., McCulloch, R., Conway, C., Browitt, A., and Barry, J.D., 2002.** Inactivation of Mre11 does not affect *VSG* gene duplication mediated by homologous recombination in *Trypanosoma brucei*. *Journal of Biological Chemistry*, **277** (29): 26185-26193.

Barry: Wellcome Centre for Molecular Parasitology, University of Glasgow, Anderson College, 56 Dumbarton Road, Glasgow G11 6NU, UK.

12383 **Schnaufer, A., Domingo, G.J. and Stuart, K., 2002.** Natural and induced dyskinetoplastic trypanosomatids: how to live without mitochondrial DNA. [Review: African trypanosomes] *International Journal for Parasitology*, **32** (9): 1071-1084.

Schnaufer: Seattle Biomedical Research Institute, 4 Nickerson Street, Suite 200, Seattle, WA 98109, USA. [achim@sbri.org]

Salivarian trypanosomes are the causative agents of several diseases of major social and economic impact. The most infamous parasites of this group are the African subspecies of the *Trypanosoma brucei* group, which cause sleeping sickness in humans

and nagana in cattle. In terms of geographical distribution, however, *Trypanosoma equiperdum* and *Trypanosoma evansi* have been far more successful, causing disease in livestock in Africa, Asia, and South America. In these latter forms the mitochondrial DNA network, the kinetoplast, is altered or even completely lost. These natural dyskinetoplastic forms can be mimicked in bloodstream form *T. brucei* by inducing the loss of kinetoplast DNA (kDNA) with intercalating dyes. Dyskinetoplastic *T. brucei* are incapable of completing their usual developmental cycle in the insect vector, due to their inability to perform oxidative phosphorylation. Nevertheless, they are usually as virulent for their mammalian hosts as parasites with intact kDNA, thus questioning the therapeutic value of attempts to target mitochondrial gene expression with specific drugs. Recent experiments, however, have challenged this view. This review summarises the data available on dyskinetoplasty in trypanosomes and revisits the roles the mitochondrion and its genome play during the life cycle of *T. brucei*.

12384 **Wallace, L.J.M., Candlish, D. and De Koning, H.P., 2002.** Different substrate recognition motifs of human and trypanosome nucleobase transporters - Selective uptake of purine antimetabolites. *Journal of Biological Chemistry*, **277** (29): 26149-26156.

De Koning: Institute of Biomedical and Life Sciences, Division of Infection and Immunity, Joseph Black Building, University of Glasgow, Glasgow G12 8QQ, UK. [H.de-koning@bio.gla.ac.uk]

12385 **Willson, M., Sanejouand, Y.-H., Perie, J., Hannaert, V. and Opperdoes, F., 2002.** Sequencing, modeling, and selective inhibition of *Trypanosoma brucei* hexokinase. *Chemistry and Biology*, **9** (7): 839-847.

Willson: Laboratoire de Synthèse et de Physico-Chemie de Molécules d'Intérêt Biologique UMR-CNRS 5068, Université Paul Sabatier, 118 route de Narbonne Cedex, France. [willson@chimie.ups-tlse.fr]

12386 **Wilson, M.E., Lewis, T.S., Miller, M.A., McCormick, M.L. and Britigan, B.E., 2002.** *Leishmania chagasi*: uptake of iron bound to lactoferrin or transferrin requires an iron reductase. [*T. brucei*] *Experimental Parasitology*, **100** (3): 196-207.

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