



THE PROGRAMME AGAINST AFRICAN TRYPANOSOMIASIS

**REPORT OF THE SECOND
PAAT ADVISORY GROUP CO-ORDINATORS MEETING**

NAIROBI, KENYA

15-17 OCTOBER 1996

Food and Agriculture Organization of the United Nations
Inter-African Bureau for Animal Resources of the African Union
International Atomic Energy Agency
World Health Organization of the United Nations

FOREWORD

The Programme Against African Trypanosomosis (PAAT) has been established to provide overall direction and focus to the activities of all those concerned with and affected by this disease. The formation, and international acceptance, of the Programme being based on the recognised need for improved collaboration and coordination between International Organisations, research institutes, donors, development agencies, governments and affected rural communities. Established in 1995, by consultation facilitated by the appropriate FAO Statutory Bodies, programme management is delegated to a joint secretariat composed of FAO, OAU/IBAR, IAEA and WHO, all of whom have delegated responsibility in the field of African Trypanosomosis control, mandated by their governing bodies.

The overall goal of the programme is the solution of the problem of tsetse and Trypanosomosis, both human and animal, in the broader context of food security, health, rural development and sustainable agriculture. In pursuance of this objective, the role of advisory group coordinators is to identify co-workers in specific technical and scientific fields and to encourage and facilitate their inter-action within the topical advisory groups thus established.

The inaugural meeting of the coordinators of the combined Research and Development and the Policy, Planning and Implementation modules met in OAU/IBAR, Nairobi, Kenya from 15 to 17 October 1996. Dr. W. Masiga, Director, OAU/IBAR, welcomed participants on behalf of the Joint Secretariat and outlined the purpose of the meeting which was to clarify the functions of the coordinators, identify main areas of operational constraint and to make recommendations to the Committee for the future direction of the programme. Moderators, Drs. D. Rogers, B. Bauer, I. Maudlin, K. Katondo and P. Holmes, were elected to chair individual sessions. The rapporteurs were Drs. R. Dwinger, K. Katondo and J. Slingenbergh with Mr. B. Hursey as the meeting Secretary. The list of participants is attached as Annex 1.

The meeting was held with the financial and technical support of the Joint Secretariat with a contribution from ODA, UK, to facilitate the attendance of the Chairman of the Programme Committee, Professor P. Holmes.

Introduction

The events leading to the establishing of the International Programme against African Trypanosomosis are recorded in the reports of the following meetings: "The Coordination of Research and Development within an International Programme to Clarify and Solve the problem of African Animal Trypanosomosis", Vienna, 1994; "Inaugural meeting of the Programme Steering Committee", Nairobi, 1995; "Meeting of the Panels of Experts on Ecological, Technical, and Development Aspects of the Programme for the Control of African Animal Trypanosomosis and Related Development", Rome, 1995; and "The Programme Against Trypanosomosis, Committee Meeting Report", Brussels, 1996.

The justification for the Programme is the considerable impact of the disease over large areas of otherwise potentially fertile and productive regions in sub-Saharan Africa and the recognised need to implement control strategies in the broader context of rural development and sustainable agriculture. The programme has a facilitatory function and aims to coordinate the actions of the many and diverse workers in this field and, through the structures established, give guidance on the focus and direction to the investment of funds for the clarification and solving of the problem. The aims, structures and logical framework of the programme is described in the Programme Memorandum published in January 1996.

The present meeting brought together, for the first time, the Advisory Group Coordinators of both the Research and Development as well as the Policy, Planning and Implementation modules. The objectives of the meeting being to clarify the role of the Coordinators and, through technical discussion, provide advice and recommendations to the Programme Committee on the immediate issues to be addressed.

The meeting Agenda is attached as Annex 2. and the summary of the proceedings, conclusions and recommendations are recorded below.

Reports from advisory groups

Socio/economics

Potential and actual co-workers have been identified in national systems in Africa, in regional and international organisations and in European universities and research centres. Current networking and/or collaborative arrangements have been established between i) CIRDES/ITC/ILRI for research and control in West Africa; ii) ILRI/ICIPE/CIRDES/RTTCP on integrated strategies for control iii) CIRDES/ITC/ILRI/ICIPE for the formation of a confederation of research efforts. In addition, contacts have been made with the RTTCP initiative in southern Africa and the Social Science and Medicine Africa Network (SOMA-Net).

The objective of these activities may be classified under the heading of " Livestock production under Trypanosomosis risk-Socio-economic assessment of the adoption, sustainability and impacts of Trypanosomosis and its control". The three main areas of investigation being; the

characterisation of problem settings and control techniques; analysis of adoption and sustainability of control strategies; and, analysis of the socio-economic impacts of control strategies.

Vector Management and Control

Bait Techniques - Research and Development:

The formation of the advisory group has been slow mainly due to inadequacy of communications with potential participants. With regard to technical issues problem areas are identified as lack of planning skills and therefore ill defined objectives in the activities undertaken; inadequate consideration of the need for sustainability of the techniques developed; and poor judgement in the selection and application of such techniques.

Bait Techniques - Implementation:

The formation of advisory groups in both east and west Africa is hampered by difficulties in communication and funding. The basic information required from co-workers should be identified in the form of a standard questionnaire for widespread distribution and possible inclusion in TTIQ. Practical problems are experienced in the application of control techniques whilst the logistical demands of implementing large scale control with bait techniques are often difficult to meet. Improved coordination and collaboration would help to solve these problems.

To overcome this lack of communication it was requested that the secretariat assist through the following actions: inform African Ministers responsible for livestock of the programmes aims and structures, through OAU and FAO statutory structures; define more specifically the potential contributory role of the FAO liaison officers network; and improve and simplify data collection through the use of standardised questionnaires.

Other Techniques - Research and Development:

The potential alternative techniques for tsetse control may be classified under the broad headings of either biological or genetic control. Due to the longer-term commitment required to investigate and develop this potential, research is largely restricted to universities and institutes in developed countries and therefore the advisory group is rather small. However, due to the limitations of the current conventional techniques this investment may be justified particularly if the ultimate objective is the eradication of the tsetse fly and the associated Trypanosomosis.

Of the two lines of investigation, that relating to biological control has not as yet indicated anything very positive. Genetics based investigations are, on the other hand, being pursued in the fields of SIT development, where efforts are mainly directed at affecting economies and increasing the potential for large scale application, hybrid sterility, chemosterilisation, sex-ratio distortion and the production of transgenic insects. Although long term, all investigations have potential for eventual practical application. The potential of other approaches such as vector competence, refractoriness and the transformation of symbionts have not been assessed.

Entomology

Coordination amongst workers in West Africa has been identified and emphasis is placed on the elucidation of odours attractive to various species of tsetse. Particular attention is being paid to the responses of tsetse to reptiles and their odours.

In east/southern Africa similar efforts are being made on clarifying the responses of tsetse to attractive baits.

Behavioural studies have the practical objectives of improving the effectiveness of attractive baits through optimal positioning in the field, improvements to their design, the potential of alternative approaches such as refuges and the identification of more efficient odour attractants.

Regional and/or national workshops are suggested as a means to improve east/west collaboration. These could be at least partially met by modification to the meetings of the FAO National Liaison Officers Network.

Diagnosis and Epidemiology

Animal Trypanosomosis:

Advisory group formation is underway with information letters being sent to two groups; that concerned with field application of the techniques available and the other with developing and testing new techniques. A major problem with interpretation of results is the absence of guidelines on standardised protocols. Discussion points for clarification within the advisory group include the validation of existing techniques, the search for new techniques and biologicals, an inventory of reagents available, the development of epidemiological tools for monitoring control programmes and the evaluation of "pen-side" tests. An immediate action identified is to undertake an overview of the poly and monoclonal antibodies and the antigens available for incorporation into the ELISA diagnostic techniques.

Human Trypanosomosis:

The initial action towards advisory group formation will take advantage of the TDR/WHO structures. Letters have been despatched to potential participants and replies are awaited.

Host Management

With emphasis on the exploitation of the trypan-tolerant trait in cattle, programmes are on-going in Senegal, Guinea and Gambia to promote and evaluate breed productivity. To assist with data collection from the field level, the use of a standardised questionnaire is suggested.

Parasite Management

Animal Trypanosomosis:

Initial contacts with co-workers has been made and a good response received from those based in Europe. On-going research activities are directed towards: i) the development of controlled release drugs; ii) the search for new drugs, where an initiative to co-ordinate this work has been set up by the Tropical Institute in Belgium and a workshop scheduled to be held in 1997/98; and iii) investigations into the impact and significance of drug resistance in parasites.

Further studies on drug usage and availability at the farm level, and on the development of guidelines to minimise the effects of drug resistance are recommended.

Human Trypanosomosis:

The incidence of sleeping sickness is increasing throughout Africa and epidemics are reported from Zaire, Sudan, Uganda and Angola. The situation may soon be back to that experienced in the 1930s. Although some 55 million people are considered at risk, only 3.5 million are under active surveillance. Reported levels of infection stand at some 25 000 cases per year whilst it is estimated that a more accurate figure would be in the range of 300 000 to 500 000.

Urgent problems that need to be addressed include improving communications at all levels, co-ordination, staff training, the collection, analysis and dissemination of information, as well as the identification of effective strategies for surveillance and control. The very limited amount of research being undertaken in these areas was noted with concern.

Planning and Strategy Development

The basis for strategic planning depends on answers to the basic questions: why?- which involves a problem analysis, where?- in order to identify priority control areas, how?- to define appropriate methods; and when? - to determine the phasing of implementation.

The constraints to proper planning and strategy development, as outlined in the presentations of various coordinators, are summarised as difficulties in communication, the need to improve participation through highlighting benefits, the need for closer co-ordination and donor involvement, the limited availability of resources, difficulties in determining the demands and needs of beneficiaries, the lack of response to questionnaires and in poor programming. Within the RTTCP these problems are largely avoided by a set of principal and logical steps which were presented in outline to the meeting.

Environmental and Land-use Issues

It was suggested that the titles of the two Advisory Groups be amended to read "impact of disease on land use and environment" and "the environmental impact of control" respectively.

A schematic plan for data flow to ensure more effective data exploitation was presented. This provoked discussion on the need for data storage and management with the suggestion that compatibility be ensured with other relevant software systems such as that of OIE.

The role of coordinators

The role of the technical and scientific advisory groups, as defined in outline by the Vienna meeting, was accepted by the meeting. " To take responsibility for, and collect data on, various technical and scientific topics..... To provide and strengthen links between international institutes and NARs. To establish a catalogue of expertise on these issues and to serve the modules accordingly".

In accepting this definition the discussion focused on the mechanisms of and the constraints to the formation of active advisory group inter-action, the collection of information and the outputs expected from the groups.

The main constraints to advisory group formation were identified as the need for the programme to achieve a higher global profile and credibility with improved communications. The latter through e-mail links and travel funds.

Regarding the collection of information it was agreed that a standardised basic questionnaire be devised based on the simple queries of how?, what?, why? when?, who? and how much?. Coordinators requiring more specific information could attach a supplementary and more detailed questionnaire to reflect their interest and needs.

The outputs required were agreed to be contributions to the international resource inventory, the identification of technical and scientific priorities and position and review papers on state of the art topics as enumerated in the programme's logical framework.

The secretariat will facilitate the work of coordinators through highlighting the programme to member nations and statutory bodies, the distribution of the basic questionnaire and by involving the FAO Liaison Officers Network.

Policy, planning and implementation

Strategies for Regional Programmes

The over-riding concern of the meeting was with the need to devise strategies that would ensure the sustainability of control programmes. Here, there was unanimous agreement that eventual and long term success could only be expected if costs were transferred to beneficiaries such as the producers and consumers. The forms of privatisation may vary and this topic should become the subject of a position paper to be drafted by the relevant co-ordinator, in consultation within the advisory group. Issues to be considered should include: the choice of control method, the implications of land tenure, the responsibilities of public services, the economic and social incentives and demands, and the variation of the influence of these in differing situations. The consensus of the meeting was that the indications from farmers so far demonstrated that the choice

of technique was significant. They are willing to pay for drugs as for other farming essentials such as seed, fertilizer etc., but seem more reluctant to be involved with artificial, attractive devices. More recently greater enthusiasm has been expressed for the use of live baits, particularly in some areas of West Africa.

The meeting stressed the support needed from the secretariat as a source of information, its dissemination and in data management.

Approaches to Sustainable Control Strategies

Human Trypanosomosis

To sustain actions against sleeping sickness is problematic. The privatisation of human health services being dependent on the cash economy of communities and individuals affected. The incidence of the disease is increasing, such that it is ranked third in the list of diseases of greatest economic impact in Africa. Paradoxically, investment in control has considerably decreased from a peak in the 1960s to negligible amounts today.

To improve the opportunities for the sustainability of control, strategies should be developed that link vector control activities to the common objectives of improved human and animal health. However, this is not always feasible as the two diseases do not always coincide with equal priority. Exceptions to this occur in Côte d'Ivoire and Uganda.

WHO has initiated a surveillance system which facilitates the collection of geo-referenced data at the village level. The prospects for merging this data with that on animal Trypanosomosis should be investigated. This will facilitate greater collaboration between the medical and veterinary disciplines. Particular concern being expressed by the meeting for the potential of domestic animals as carrier reservoirs of the human disease.

Integrated Disease Management

Field trials in West Africa showed, through recording herd infection rate and PCV levels in cattle, that treating all suspected infections with 7mg. of berenil every two months failed to achieve overall herd productivity. However, once the regular treatment of animals with insecticide was introduced into this scenario, tsetse became undetectable, Trypanosomosis decreased to negligible levels and productivity was restored. These results indicate the clear potential of the strategies developed, which in the opinion of the meeting should be further investigated and subjected to a review and assessment by the advisory group concerned. This review should take into account the biological variables presented by different farming systems.

Considering the environmental implications, the use of both artificial and live baits are recommended as the vector control methods of choice. However, further information is required

to elucidate the consequences of the dermal intake of the insecticide, the effects on insectivorous birds and the method of application, i.e. dipping; spraying or pour-on.

Drug Management and Resistance

The practical significance of resistance to drugs remains largely unknown and needs to be monitored. Standardised protocols for drug resistance testing should be developed, backed up by quality assurance. In these respects a data base is urgently required in order to facilitate decision making. The programme should commission a position paper on these issues within the next two years.

Millions of drug doses are used without veterinary control. New brands of existing chemicals are being launched by pharmaceutical companies indicating that Trypanosomosis is still regarded as an important commercial market. Alternative drugs are needed and companies should be urged to screen all potential candidates for trypanosomicidal activity.

Socio/economic Aspects

The meeting recognised the need for a position paper on the socio-economic and cultural implications of Trypanosomosis and its control. It being appreciated that unless the influence of traditional laws and cultures were understood and taken into account attempts to actively involve rural communities in these activities may fail.

At this point the meeting agreed that consideration be given to presenting the main position papers identified as invited keynote position papers at the next meeting of the ISCTRC, Maputo, 1997.

Research and development

Disease and Disease Mapping

In view of the importance afforded to the mapping of the data required to facilitate activities in research, planning, strategy development and implementation, the meeting afforded some time to discuss the item in more detail. Needs were expressed for tsetse distribution, drug resistance, Trypanosomosis and disease risk maps. Multivariate analysis could also be applied to rationalise the mapping of fly challenge, disease risk and disease incidence. Other areas requiring more accurate detail include cattle prevalence, human population distribution, farming/production systems and the incorporation of sleeping sickness information.

The meeting stressed that this exercise would require the collaboration of all advisory groups to assist in the data collection and further recommended that FAO act as a central receiving station for the reception and processing of the information gathered.

To overcome the need for this extensive data base the EU funded East African Project - farming in tsetse areas (FITA) will focus on distinct focal areas where the disease is recognised as a significant problem.

Trypanotolerance

The exploitation of trypanotolerance in livestock should be set in an economic framework. The trait has developed, through natural selection over 500 generations and 5000 to 7000 years of exposure. This has also worked towards resistance against other adverse effects such as tick borne diseases and helminths, driven by the necessity for survival and not for productivity. The need now is to enhance productivity whilst retaining trypanotolerance. To determine this requires an inventory of how different livestock breeds cope in different scenarios of disease challenge. Studies in Togo have shown that the degree of genetic tolerance is positively correlated with the ability to cope with Trypanosomosis, the genes being distributed according to the degree of disease risk.

The factors that influence breed selections made by farmers depend primarily on disease challenge. More information is needed to gain an understanding of the value placed at this level on breed attributes. Priority areas for further investigation include improving the productivity of tolerant breeds and evaluating the variation in toleration exhibited by the various breeds and strains.

Prediction and Prevention of Sleeping Sickness

Sleeping sickness continues to occur in the same historical foci, such as in Zaire where the current outbreaks mirror those of 60 years ago. The development of GIS and analytical modelling may lead to a better understanding of the factors involved although it is suspected that fly density, man/fly contact and the involvement of animal reservoirs may be critical for the development of epidemics. It is important to ascertain the host animals of tsetse which may then contribute to an indication of the disease risk, hence a need for more extensive information on blood meal analyses.

The discussion concluded with an agreement on the need for a standardised and comprehensive surveillance system that could also be applicable to other diseases and form the basis for a common data base.

Protocols for Detection of Drug Resistance

The need for standardised appropriate tests was recognised and endorsed by the meeting. Three approaches were available through testing in i) the host, ii) mice or iii) in-vitro. All have advantages and disadvantages and overall it was considered that the most practical and appropriate would be to undertake screening in mice and to back-up the results using cattle. Care should be taken to distinguish between drug failure in general and drug resistance. It was concluded that the issue be addressed through a specific workshop to identify and agree on the appropriate tests and technologies.

Conclusions and recommendations

Summary Conclusions

Coordinators should prepare an inventory of on-going research and field based activities for submission to the Programme Committee through the Secretariat.

In consultation with their advisory groups, coordinators should rank the priorities within each subject for the information of the secretariat. This list should be submitted by April 1997.

There is need for closer collaboration at all levels between the medical and veterinary professions in aspects of Trypanosomosis control. This is particularly so in the areas of data management and vector control.

Strategic planning for Trypanosomosis control, in the broader context of rural development, is dependent on an analysis of the constraint and the definition of its socio-economic impact. The definition of these across the wide range of agro-ecological zones and farming systems affected demands the methodical development, production and analysis of geo-referenced data layers on the many and varied influencing natural, human and disease factors involved.

The sustainability of tsetse and Trypanosomosis activities will ultimately depend on the sharing of costs proportionally between the beneficiaries, both producers and consumers. However, in some situations the nature and the magnitude of the problem is such that it may be in the broader national interest to subsidise control efforts.

Farmers have shown their willingness to invest in farm inputs of demonstrated economic benefit but continue to be reluctant in their acceptance of tsetse control techniques. This indicates the need to develop new approaches; uppermost among which is the realisation of the potential demonstrated by the treatment of livestock with insecticides applied in "pour-on" formulations or by the use of electro-dyne sprayers.

The following technical review and position papers will be produced by the concertive action of the concerned advisory groups for presentation and debate at the ISCTRC meeting to be held in Maputo, September, 1997.

- i)** Disease impact on farming (Coordinator: B. Swallow)
- ii)** Drug management and parasite resistance (Coordinators: S.Geerts and M. Ekwanzala)
- iii)** The socio-economic and cultural implications of Trypanosomosis, both human and animal, and its control (Coordinators: B. Swallow and M. Kamuanga)
- iv)** A review and assessment of various tsetse control bait techniques for practical application, with particular emphasis on the insecticide treatment of livestock (Coordinators: R. Allsopp and A. Douati)

Recommendations

It is recommended that the secretariat, together with the Programme Committee, consider ways to establish an e-mail network to improve communications between coordinators, the secretariat and advisory groups to enhance the functioning of the programme.

The Programme's logical framework should include a system for monitoring and evaluation, with well defined OVI's. This should be drafted by the secretariat for the acceptance of the Programme Committee.

In specific cases funds should be made available to enable regional coordinators to attend meetings and to gather the required information in their areas of responsibility.

The programme information, collation, analysis and dissemination functions as provided by FAO require major strengthening in the form of human resources for data management.

The factors which determine and influence the sustainability of tsetse control in various scenarios of cost-recovery, land tenure, farming systems, ecological and socio-cultural conditions should be further investigated and clarified. This should be initiated through the secretariat

Effective surveillance systems should be initiated to clarify the worsening sleeping sickness situation in a number of foci, and to facilitate the prediction of further epidemics.

It is recommended that the development of strategies for tsetse control programmes take into account all available technical options and thus enhance approaches to Integrated Disease Management (IDM).

The meeting recommends that funding for the World Acaricide Resistance Reference Centre be assured to address concerns over the possible development of insecticide resistant ticks and tsetse and to facilitate the integration of tsetse with tick and tick borne diseases control.

The Programme should utilise its resources to investigate the feasibility, and pursue the progressive privatisation, of tsetse and Trypanosomosis operations.

Priorities in research and development

Although not listed as an agenda item the advisory group coordinators were requested to indicate a priority list of research topics in their specific areas. These are recorded as follows:

1. Impact of Disease and Control on Land-use and Environment

- Database development.
- Analysis of farming production systems in various eco-zones and the disease situation in these systems.

- Selection of bio-indicators for i) the impact of humans and ii) the impact of control; on the environment.
- Application of remote sensing to these studies to record habitat changes over time and to identify good indicators of the bio-diversity.
- the regional application of these studies.

2. Bait Techniques Implementation - South and East Africa

- Improvements to odour bait technology, particularly the dispensing of odours.
- Authoritative advice on the privatisation of tsetse control services.
- The use of GIS and RS to study tsetse and their control.
- Environmental effects of targets - how they are perceived by those affected, by beneficiaries and by those paying for them.

3. Bait Techniques Implementation - West and Central Africa

- Improved sensitivity of survey techniques.
- Better understanding of the role of lesser known species of tsetse
- Clarification of the economic benefits of tsetse control.
- Refinement of the treatment of cattle with insecticides as a means of control.
- Improved understanding of the role of livestock as reservoirs for sleeping sickness.

4. Bait Techniques; Research and Development

- Improvements to target technology.
- Improvements in insecticide formulations.
- Insecticide application techniques, e.g. electro-dyne sprayers.
- Clarification of the inter-action between fly and host.
- Guidelines on the organisation of control at the village and extension levels.
- Clarification of tsetse feeding habits by species - specifically, do they feed on cattle.

5. Vector Management; Tsetse Behaviour and Ecology

- Modification of bait techniques for a wider range of species
- Elucidation of the responsiveness of tsetse to various hosts.
- Pursuing community participation for sustainability of control.
- Development of tools for behavioural studies, i.e. radar tracking, GIS and RS.
- Development of effective barriers through modelling.

6. Vector Management; Techniques other than Bait Attractants

- The identification of candidate nematodes for biological control through genetic engineering.
- Development of large scale rearing for tsetse parasitoides.
- Artificial diets for tsetse rearing to facilitate SIT.
- The genetic manipulation of flies to facilitate refractoriness and new approaches to

chemotherapy.

- Genome sequencing of *G.morsitans* and/or *G. pallidipes*

7. Diagnosis and Epidemiology of Animal Trypanosomosis

- Improvement of existing diagnostics.
- Development of epidemiological tools.
- An inventory of diagnostic reagents.
- Standardisation and quality assurance as applicable to diagnostics, protocols, interpretation and analysis.
- An understanding of the role of mechanical transmission.

8. Diagnosis and Epidemiology of Sleeping Sickness

- Need to introduce effective diagnostics at the field level.
- Development of new, more effective diagnostics.
- Strengthening monitoring and improving information flow.
- Identification of sustainable approaches, including considerations of privatisation and community participation.
- A better understanding of the disease impact on humans.

9. Parasite Management for Animal Trypanosomosis

- A coordinated search for new drugs.
- Vaccine development.
- Alternative formulations of existing drugs (some promising progress is being made).
- Drug resistance and the genetics thereof.
- Standardised test for detection of drug resistance.
- Development of integrated vector/parasite management.

10. Parasite Management for Sleeping Sickness

- Protocols for drug treatment taking into account side effects, existing drugs and economics.
- A better understanding of the different stages of the disease and the development of appropriate diagnostics.
- Guidelines for community participation and an understanding of social consequences.
- Epidemiological tools, programme management tools and indicators.
- The factors affecting the emergence of disease, in epidemic proportions, in the main foci.

The concluding discussion on this item highlighted that the most common factor affecting the majority of priorities identified was the need for the collection and analysis of data. This, when combined with benefit:cost analyses would facilitate the identification of an amenable environment for privatisation, the improved targeting of public resources, the preparation for new land pressures that may result from control and the more effective empowerment of local communities.

Enabling investigations that would contribute to these aims include:

- the impacts of the micro-economics of public reform;
- the evaluation of the relationships between improved disease control, livestock and farming systems;
- clarification of the financial aspects for the delivery of animal treatment regimes;
- the spatial and economic factors relating to the exploitation of trypanotolerance and drug use;
- the social and cultural issues and the perception of the disease by local people