WORLD ORGANISATION FOR ANIMAL HEALTH
Protecting animals, preserving our future

Original: English
March 2018

REPORT OF THE MEETING OF THE OIE *AD HOC* GROUP ON ANIMAL AFRICAN TRYPANOSOMOSES[1]

Paris, 6–8 March 2018

———

The first meeting of the OIE *ad hoc* Group on Animal African Trypanosomoses (hereafter referred to as the Group) was held at the OIE Headquarters in Paris from 6 to 8 March 2018.

1. Opening of the meeting

Dr Matthew Stone, Deputy Director General of the OIE for International Standards and Science, welcomed the Group members and the representatives from the Scientific Commission for Animal Diseases (Scientific Commission) and the Terrestrial Animal Health Standards Commission (Code Commission).

Dr Stone informed the Group that their Terms of Reference were based on a request of the African Union to include a chapter in the *Terrestrial Animal Health Code* (*Terrestrial Code*) on animal African trypanosomoses. He emphasised that the purpose of the *Terrestrial Code* is to support disease control, to provide recommendations for surveillance, and to promote safe international trade avoiding unjustified trade barriers. He pointed out the importance of providing scientific rationale for all the proposed provisions in the draft chapter. Finally, he stressed the need for all the members of the Group to consider *Terrestrial Code* Chapter 1.2. *Criteria for the inclusion of diseases, infections and infestations in the OIE list* when considering the hosts and pathogenic agents to be included in the case definition. He also reminded the experts of the ongoing work to draft chapters on equine trypanozoon and non-equine surra.

Dr Stone emphasised that the members of the Group were nominated by the Director General of the OIE according to their internationally recognised expertise and geographically balanced representation, but they were not representing their own countries or institutions in the meeting. He noted that all members of the Group were asked to declare any actual or potential conflict of interest and respect the confidentiality of the process.

2. Appointment of the chairperson and rapporteur, and adoption of the agenda

The meeting was chaired by Dr Rob Bagnall, and Dr Vincent Delespaux was appointed as rapporteur with the support of the OIE Secretariat. The draft agenda was adopted by the Group.

The Terms of Reference and adopted agenda, and List of Participants are presented as Appendices I and II, respectively of this report.

3. Update on the current knowledge of the epidemiology, diagnostic and control strategies of animal African trypanosomoses (excluding both non-equine surra and equine *Trypanozoon*)

Presentations entitled *The Epidemiology and Impact of Animal African Trypanosomoses, Animal African Trypanosomoses, Taxonomy and Diagnostic Methods, and Animal African Trypanosomoses Control Measures* were given by Dr Marc Desquesnes, Dr Vincent Delespaux and Dr Issa Sidibe, respectively.

---

1 Note: This ad hoc Group report reflects the views of its members and may not necessarily reflect the views of the OIE. This report should be read in conjunction with the September 2018 report of the Scientific Commission for Animal Diseases because this report provides its considerations and comments. It is available at: http://www.oie.int/en/international-standard-setting/specialists-commissions-groups/scientific-commission-reports/meetings-reports/

Reference was also made by Dr Giuliano Cecchi to the recently developed concept of the Progressive Control Pathway (PCP) for animal African trypanosomoses (Diall *et al.*, 2017).

4 Draft *Terrestrial Animal Health Code* Chapter 8.Y. *Animal African trypanosomoses*

The Group extensively discussed the scope of the new *Terrestrial Code* chapter and took into consideration the existing *Terrestrial Code* draft chapters 8.X. Infection with *Trypanosoma evansi* (non-equine surra) and Chapter 12.3. *Infection with Trypanozoon in equids* (*dourine, equine surra*), which had already been circulated twice for Member Country comments.

The Group considered the comments of some Members Countries received on the draft *Terrestrial Code* chapter 8.X. and 12.3. and also extensively discussed the trypanosomes taxonomy and current diagnostic limitations.

The Group acknowledged that, in the majority of endemic countries, the diagnosis of the disease is mainly based on the identification of the parasite by direct examination techniques. However, the Group agreed that serology for antibody detection would be the most sensitive diagnostic method to determine the disease status of a country or zone.

It was highlighted that co-infection with several trypanosome species in the same animal could exist. Therefore, once IgG is detected by a species-specific ELISA[2] (*T. vivax* ELISA, *T. congolense* ELISA, *T. brucei* ELISA, or *T. evansi* ELISA), an animal should be considered as infected with animal African trypanosome(s), regardless of the species identified because other species may also exist.

On the other hand, it was also noted, that with appropriate surveillance and using molecular laboratory techniques in an appropriate number of samples, a country or zone could be able to gather sufficient epidemiological evidence to substantiate claims regarding the absence of certain species of trypanosomes.

Although some members of the Group felt that only one chapter that took account of all the different species of Trypanosoma was necessary, the Group noted that the main purpose of the draft *Terrestrial Code* chapter should be to support Members Countries in their efforts to control the disease while ensuring safe international trade. The Group proposed to limit the scope of the chapter to infection with animal trypanosomes of African origin in multiple host species, which would exclude infection with *T. evansi* (surra) and *T. equiperdum* (dourine).

Article 8.Y.1. General Provisions

The Group pointed out the range of trypanosome species that were considered of African origin by the scientific literature and also the diversity of potential hosts. The Group agreed that the chapter should focus on those species and domestic and wildlife hosts of epidemiological importance.

The Group assessed the different trypanosomes of African origin against the listing criteria defined in the *Terrestrial Code* chapter 1.2. It was decided, that for the purpose of this chapter, animal trypanosomes of African origin should be restricted to *T. congolense*, *T. simiae*, *T. godfreyi*, *T. vivax*, and *T. brucei*. The Group also agreed that the "susceptible animals" should be domestic and wild animals belonging to the following families: bovidae, suidae, equidae, camelidae, canidae and felidae as well as non-human primates.

The Group discussed the challenge of differentiating a species of Trypanosome within the three subgenera of the Salivaria section, namely Trypanozoon, Duttonella and Nannomonas; the Group suggested that a case of animal trypanosomes of African origin should be defined as either:

i) a susceptible animal where a pathogenic agent of the Duttonella (*T. vivax*), Nannomonas (*T. congolense*, *T. simiae*, *T. godfreyi*) or Trypanozoon (*T. brucei*) subgenera has been identified; or

ii) the presence of antibodies has been detected in a sample from a susceptible animal showing clinical signs consistent with animal trypanosomoses of African origin or which had an epidemiological link to a confirmed case in any of the susceptible animal species.

2 ELISA: enzyme-linked immunosorbent assay

The Group considered peer-reviewed publications (Eisler *et al.,* 2001) and discussed the length of incubation periods of the disease. It was noted that the incubation period depends on different factors, including the host and the trypanosome species. The Group suggested that for the purpose of this chapter the incubation period should be 90 days.

The Group was of the opinion that Member Countries should not impose bans on the trade in commodities of domestic and captive wild susceptible animals in response to a notification of infection with animal trypanosomes of African origin in wild susceptible animals if they were traded in accordance with the relevant Articles of the chapter.

Article 8.Y.2 Safe commodities

The Group considered *Terrestrial Code* Chapter 2.2. *Criteria applied by the OIE for assessing the safety of commodities.*

The Group agreed that pasteurised milk and milk products, hair, wool and fibre, gelatine, horns, hooves and claws, meat products, and hides and skins that have undergone standard processing procedures should be considered safe commodities.

The Group took note of the risk posed by fresh meat (Mandal *et al.,* 2017; Van Vinh Chau *et al.,* 2016). It was agreed that non-processed meat may pose a very low but not negligible risk and therefore meat should not be considered a safe commodity.

Article 8.Y. 3. Country or zone free from infection with animal trypanosomes of African origin

The Group considered several epidemiological scenarios for a country or zone to be declared free from the infection. The Group considered several scientific publications (Maudlin *et al.,* 2004a; Van den Bossche & De Deken, 2004; Warnes *et al.,* 1999), and agreed on the possibility and feasibility of implementing effective vector protection measures and physical separation between domestic and wildlife population.

It was suggested that a country or zone could be declared free from the infection only in susceptible domestic animals, regardless of the status of susceptible wildlife, even in the presence of competent vectors.

The Group took note of the scientific rationale of Article 15.1.3 on country or zone free from African swine fever virus and decided to follow a similar approach. The Group drafted provisions for historical freedom, freedom in all susceptible animals and freedom only in susceptible domestic and captive wild animals.

With regards to the time elapsed since the last detected case, the Group noted that, in field conditions, the persistence of antibodies (IgG) would range from 4 to 6 months (Desquesnes *et al.,* 2003). The Group also considered the challenge of conducting an epidemiological investigation, which should include serological surveys, to rule out the presence of the infection by antibody detection. Therefore, the Group agreed that 2 years would be the minimum time that should elapse for a country to be able to gather sufficient scientific evidence to substantiate freedom, providing that (i) the disease was notifiable in the entire country, (ii) an appropriate surveillance was in place and (iii) commodities from susceptible animals were imported following the recommendations of this chapter.

The Group took into consideration the role of vectors in the epidemiology of the disease and agreed to add a paragraph on the need to conduct specific entomological surveillance, as well as surveillance in zones neighbouring an infected country or zone.

Article 8.Y.4 Recovery of free status

The Group discussed the possibility of providing a 'fast-track' recovery procedure and took note of the Articles on recovery of free status of different existing disease-specific chapters of the *Terrestrial Code*.

The Group pointed out that appropriate treatment of infected animals would reduce the parasitaemia and would therefore reduce the risk of transmission.

The Group proposed that, if appropriate biosecurity measures are in place, the free status could be recovered earlier than 2 years provided that surveillance has been carried out during at least 180 days (2 maximum incubation periods) after the infected animals have been killed or slaughtered.

The Group also proposed that a country or zone could recover the free status 6 months after an appropriate treatment (Maudlin *et al.*, 2004b) was administered to the infected animals.

The Group discussed whether or not a test (ELISA) to detect either antigens or antibodies following treatment should be recommended for the recovery of the status. The Group took into consideration that antibodies could be present up to 6 months after treatment and that the presence of antibodies should not always be considered as an indication of infectivity. The Group decided to postpone this discussion to the next meeting. The Group agreed to draft provisions for the international trade of commodities that were not considered 'safe commodities'. It took note of the commodity-based trade articles of already existing disease-specific chapters of the *Terrestrial Code.*

Article 8.Y.5. Recommendations for importation from countries or zones free from infection with animal trypanosomes of African origin

Susceptible animals

The Group proposed that for the importation of susceptible animals from free countries or zones, the Veterinary Authorities should require the presentation of an international veterinary certificate attesting that: (1) the animals showed no clinical sign of animal trypanosomoses of African origin on the day of shipment; (2) the animals were kept in a country or zone free from animal trypanosomes of African origin since birth or was introduced in accordance with the provisions of the chapter Article 8.Y.6.

Article 8.Y.6 Recommendations for importation from countries or zones infected with animal trypanosomes of African origin

Susceptible animals

The Group proposed that for the importation of susceptible animals from infected countries or zones, the Veterinary Authorities should require the presentation of an international veterinary certificate attesting that the animals: (1) were kept in a fly-proof quarantine station isolated for at least 30 days prior to the shipment; (2) were subjected to a pathogenic agent identification test and an antibody detection ELISA adapted to the epidemiological situation with negative results on samples collected at the entrance of the quarantine station and at least 30 days after the first test; (3) were transported in a fly-proof vessel/vehicle to the place of shipment; (4) showed no clinical sign of animal trypanosomoses of African origin during the quarantine period and on the day of shipment.

The Group pointed out the significance of reactivation of parasitaemia after a period of stress such as transport (Desquesnes, 2004). Therefore, while acknowledging that recommending risk mitigation measures in the country of destination was not the normal practice of the *Terrestrial Code*, it was considered justified to recommend further risk mitigation measures (30 days of isolation period in a quarantine station and laboratory testing) in the importing country. The Group added an extra 30 days to the quarantine period in case a positive animal was detected during the isolation period, providing the positive animal was killed and the carcass properly disposed of. Consequently, a total quarantine of 90 days was suggested.

Article 8.Y.7. Recommendations for importation of semen from countries or zones free from animal trypanosomes of African origin

The Group proposed that for the importation of semen from free countries or zones, the Veterinary Authorities of the importing countries should require the presentation of an international veterinary certificate attesting that the semen came from a donor free from the pathogens and was collected, processed and stored in accordance with Chapters 4.5. and 4.6.

Article 8.Y.8. Recommendations for importation of semen from countries or zones infected with animal trypanosomes of African origin

The Group proposed that for the importation of semen from infected countries or zones, the Veterinary Authorities of the importing countries should require the presentation of an international veterinary certificate attesting that the semen came from a donor free from the pathogens and will remain free based on the fact that the semen were collected in a fly-proof artificial insemination centre.

The Group noted the 90-day isolation period and test scheme recommended in Article 8.Y.6. It was suggested that the donor should be kept in isolation at least 90 days prior to semen collection and that an identification test and an antibody detection ELISA should be carried out at the entrance in the artificial insemination centre and

at least 90 days after the first tests. The Group emphasised that the serological test should be adapted to the epidemiological situation of the country to ensure an appropriate sensitivity of the results.

The Group recommended that semen should also be collected, processed and stored in accordance with Chapters 4.5. and 4.6.

Article 8.Y.9. Recommendations for importation from countries or zones free from animal trypanosomes of African origin

For *in-vivo* derived embryos and for *in-vitro* produced embryos

The Group proposed that for the importation of embryos from free countries or zones, the Veterinary Authorities of the importing countries should require the presentation of an international veterinary certificate attesting that (1) the donor female was proven to be non-infected with the pathogens; (2) the semen used complied with the relevant articles of the chapter; and (3) the embryos were collected, processed and stored in accordance with Chapters 4.7. or 4.9, as relevant.

Article 8.Y.10. Recommendations for importation from countries or zones infected with animal trypanosomes of African origin

For *in-vivo* derived embryos and for *in-vitro* produced embryos

The Group proposed that for the importation of embryos from infected countries or zones, the Veterinary Authorities of the importing countries should require the presentation of an international veterinary certificate attesting that the embryos came from a donor female free from the pathogens and not at risk of infection based on the fact that the collection were carried out in a fly-proof collection centre.

Based on the recommendation for trade of semen from an infected country or zone, the Group recommended that the female donor should be kept in isolation for at least 90 days prior to the collection and that an identification test and an antibody detection ELISA should be carried out at the time of entry to the collection centre and at least 90 days after the first tests. The embryos should also be collected, processed and stored in accordance with Chapters 4.7. and 4.9., as relevant.

Article 8.Y.11. Recommendations for importation of fresh meat from countries or zones free from animal trypanosomes of African origin

The Group proposed that for the importation of fresh meat from free countries or zones, the Veterinary Authorities of the importing countries should require the presentation of an international veterinary certificate attesting that the fresh meat of susceptible animals came from animals free from the pathogens, slaughtered in an approved slaughterhouse/abattoir and subjected to ante- and post-mortem inspections with favourable results.

Article 8.Y.12. Recommendations for importation of fresh meat from countries or zones infected with animal trypanosomes of African origin

The Group proposed that for the importation of fresh meat from infected countries or zones, the Veterinary Authorities of the importing countries should require the presentation of an international veterinary certificate attesting that the fresh meat of susceptible animals came from animals that had been slaughtered in an approved slaughterhouse/abattoir and had been subjected to ante- and post-mortem inspections with favourable results.

The Group pointed out that the risk of cross-contamination after slaughter was negligible. It also noted that based on the experience of the members of the Group, the parasites are not expected to survive in meat that is kept at 4°C for more than 5 days. The Group also agreed that other effective inactivation procedures may exist and be used and therefore included this possibility in the Article.

Article 8.Y.13 General Principles of surveillance and Article 8.Y.14 General conditions and methods for surveillance

The Group took into consideration the Articles on surveillance of *Terrestrial Code* Chapter 8.3. *Infection with bluetongue virus* to develop the articles on surveillance for animal trypanosomes of African origin.

The Group highlighted the importance of considering wildlife and feral susceptible animals, as well as domestic and captive wild animals, when designing a surveillance system of animal trypanosomoses of African origin. The Group also agreed that the specific surveillance recommendations should aim at supporting Member

Countries in their efforts to control the disease as well as those Member Countries aiming at demonstrating absence of infection.

The Group considered different surveillance strategies and diagnostic methods available. It was agreed that according to the purpose of the surveillance, clinical, parasitological, serological and molecular surveillance should be taken in consideration.

The Group stressed that serological surveillance for the detection of antibodies against animal trypanosomoses is key to demonstrating absence of infection. It was suggested that the presence of maternal antibodies should be considered as they could be detected in the offspring up to 6 months of age (Dwinger *et al.*, 2011). The Group stressed that any positive diagnostic result should be followed-up to rule out the presence of infection.

5. Other matters

Based on the Group's draft *Terrestrial Code* chapter proposal, it was recommended to amend the *Terrestrial Code* Chapter 1.3. *Diseases, infections and infestations listed by the OIE* to remove Trypanosomosis (tsetse-transmitted) from the List and to include infection with animal trypanosomes of African origin.

The Group took note of the request made by the Specialist Commissions after their February 2018 meetings to provide its expert opinion on the merit of merging infection with *T. evansi* (surra) in a single multispecies *Terrestrial Code* chapter. The Group acknowledged that surra is globally accepted as a single disease. In addition, the Group stressed that the risk mitigation measures would be very similar regardless of the host.

The Group also acknowledged the diagnostic challenge of differentiating horses infected with *T. evansi* (surra) from those infected with *T. equiperdum*, but also noted the epidemiological differences of the two diseases.

Based on the above, the Group was of the opinion that three *Terrestrial Code* chapters could be drafted:

1. Infection with animal trypanosomoses of African origin – several host and pathogen species
2. Infection with *T. evansi* – several host species
3. Infection with *T. equiperdum* –equine.

The Group could not finalise the draft chapter during the 3-day meeting and listed the pending issues that would need to be addressed before finalising the draft chapter:

1. Vector surveillance;
2. Sentinel surveillance;
3. Surveillance for demonstration of freedom;
4. Surveillance for recovery of freedom;
5. Whether or not compartmentalisation should be considered.

Another meeting could be convened by the Director General to finalise the drafting of the chapter and to consider the feedback from Specialist Commissions after their September 2018 meetings.

6. Adoption of the report

The *ad hoc* Group reviewed the draft report provided by the rapporteur and agreed to circulate it electronically for comments before the final adoption

_____

…/Appendices

Appendix I

MEETING OF THE OIE *AD HOC* GROUP ON ANIMAL AFRICAN TRYPANOSOMOSES

Paris, 6–8 March 2018

_____

Terms of Reference

1. Excluding both non-equine surra (infection with *T. evansi*) and equine *Trypanozoon* (infection with *T. evansi*, *T. b. equiperdum and T. brucei*), consider the latest scientific evidence regarding the epidemiology and control strategies for animal African trypanosomoses with a focus on the tsetse-transmitted trypanosomes. The draft chapter may include, but not be limited to:

    a. The case definition for animal African trypanosomoses considering the listing criteria of the *Terrestrial Code* Chapter 1.2.

    b. The elements for a national control programme for animal African trypanosomoses

    c. The requirements for a country or zone to declare freedom from animal African trypanosomoses

    d. The recommendations for the safe international trade of animals susceptible to animal African trypanosomoses

    e. Specific recommendations for the surveillance of animal African trypanosomoses taking into consideration the *Terrestrial Code* Chapter 1.4 on animal health surveillance and Chapter 1.5 on surveillance for arthropod vectors of animal diseases

_____

Agenda

1. Opening of the meeting
2. Appointment of chairperson and rapporteur, and adoption of the agenda
3. Update on the current knowledge of the epidemiology, diagnostic and control strategies of animal African trypanosomoses (excluding both non-equine surra and equine *Trypanozoon*)
4. Draft *Terrestrial Animal Health Code* Chapter 8.Y *Animal African trypanosomoses*
5. Other matters
6. Adoption of the report

_____

Appendix II

MEETING OF THE OIE *AD HOC* GROUP ON ANIMAL AFRICAN TRYPANOSOMOSES

Paris, 6–8 March 2018

———

List of Participants

MEMBERS

Marc Desquesnes
UMR177-Intertryp (CIRAD-IRD)
CIRAD-bios
Campus international de Baillarguet
TA A-17 / G
34398 Montpellier Cedex 5
FRANCE
marc.desquesnes@cirad.fr

Mary Isabel Gonzatti
Simon Bolivar University Department of Cellular Biology Miranda
VENEZUELA
mgonzat@usb.ve

William Shereni
Tsetse Control Division
Department of Livestock and Veterinary Services
Ministry of Lands, Agriculture and Rural Resettlement,
ZIMBABWE
shereni2005@yahoo.com

Rob Bagnall
Former Deputy Director Veterinary Services KwaZulu Natal
Hemel en Aarde Estate
Hermanus, 7200
SOUTH AFRICA
robbagnall@telkomsa.net

Issa Sidibe
Insectary and Tsetse and Trypanosomiasis Programme
IBD-CETT 01 BP 1087
Bobo-Dioulasso 01
BURKINA FASO
sambo@fasonet.bf

Vincent Delespaux
Scientific coordinator
Vrije Universiteit Brussel (VUB), Brussels
BELGIUM
vincent.delespaux@vub.be

OTHER PARTICIPANTS

Giuliano Cecchi
Subregional Office for Eastern Africa
Food and Agriculture Organization of the United Nations (FAO)
CMC Road, Bole Sub City, Kebele 12/13
P O Box 5536, Addis Ababa
ETHIOPIA
Giuliano.Cecchi@fao.org

Jose Ramón Franco Miguell
(*Invited but could not attend*)
Medical Officer
Human African Trypanosomiasis Programme
Innovative & Intensified Disease Management
World Health Organization (WHO)
Geneva, SWITZERLAND
francoj@who.int

SPECIALIST COMMISSION REPRESENTATIVES

Baptiste Dungu
Member of the Scientific Commission for Animal diseases
MCI-Santé Animale
26 Dalrymple Crescent
Edinburgh EH9 2NX
UNITED KINGDOM
b.dungu@mci-santeanimale.com

Emmanuel Couacy-Hyman
Member of the Terrestrial Animal Health Standards Commission
Virologist – Epidemiologist
Laboratoire Centrale de Pathologie Animale
BP 206 - Bingerville
COTE D'IVOIRE
chymann@hotmail.com

OIE HEADQUARTERS

Matthew Stone
Deputy Director General
12 rue de Prony, 75017 Paris
FRANCE
Tel: 33 - (0)1 44 15 18 88
Fax: 33 - (0)1 42 67 09 87
m.stone@oie.int

Gregorio Torres
Chargé de mission
Science and New Technologies Department
g.torres@oie.int

François Diaz
Chargé de mission
Science and New Technologies Department
f.diaz@oie.int

———

REFERENCES

Desquesnes M. (2004). Livestock trypanosomes and their vectors in Latin America. OIE (World Organisation for Animal Health, Paris, France, p. 27. ISBN: 92-9044-634-X.

Desquesnes M., Bengaly Z. & Dia M.L., (2003). Evaluation de la persistance des anticorps détectés par Elisa-indirect *Trypanosoma vivax* après traitement trypanocide chez des bovins naturellement infectés. *Rev. Elev. Med. vet. Pays trop*., **56**, 141–144.

Diall O., Cecchi G., Wanda G., Argilés-Herrero R., Vreysen M.J.B., Cattoli G., Viljoen G.J., Mattioli R. & Bouyer J. (2017). Developing a Progressive Control Pathway for African Animal Trypanosomosis. *Trends Parasitol.*, **33**, 499–509.

Dwinger R.H., Grieve A.S., Jeannin P., Agyemang K. & Faye J. (2011). Anti-trypanosomal antibodies in sequentially collected sera of N'Dama cattle under natural trypanosomiasis risk in The Gambia. *In:* The African trypanotolerant livestock network - Livestock production in Tsetse Affected Areas of Africa. FAO Corporate Document Repository. Produced by ILRI.

Eisler M.C., Brandt J., Bauer B., Clausen P.-H., Delespaux V., Holmes P.H., Ilemobade A., Machila N., Mbwambo H., McDermott J.J., Mehlitz D., Murilla G., Ndung'u J.M., Peregrine A.S., Sidibé I., Sinyangwe L. & Geerts S. (2001). Standardised tests in mice and cattle for the detection of drug resistance in tsetse-transmitted trypanosomes of African domestic cattle. *Vet. Parasitol*., **97**, 171–182.

Mandal M., Laha R., Pandit S. & Sasmal N.K. (2017). Oral route of transmission: *Trypanosoma evansi* in a mice model experiment. *J. Parasit. Dis.*, **41**, 880–882. doi:10.1007/s12639-017-0910-x

Maudlin I., Holmes P.H. & Miles M.A. (Eds), (2004a). Vector control. *In:* The Trypanosomiases. CABI Publishing, Cambridge, USA, pp. 491–533.

Maudlin I., Holmes P.H. & Miles M.A. (Eds), (2004b). Chemotherapy and Disease control. *In:* The Trypanosomiases. CABI Publishing, Cambridge, USA, pp. 403–445.

Van den Bossche P. & De Deken, R. (2004). The application of bait technology to control tsetse. *In:* The Trypanosomiases, Maudlin I., Holmes P. & Miles M.A., Eds. CABI Publishing, Cambridge, USA, pp. 515–522.

Van Vinh Chau N., Buu Chau L., Desquesnes M., Herder S., Phu Huong Lan N., Campbell J.I., Van Cuong N., Yimming B., Chalermwong P., Jittapalapong S., Franco J.R., Tue N.T., Rabaa M.A., Carrique-Mas J., Thanh T.P.T., Tran Vu Thieu N., Berto A., Thi Hoa N., Van Minh Hoang N., Canh Tu N., Khac Chuyen N., Wills B., Tinh Hien T., Thwaites G.E., Yacoub S. & Baker S., (2016). A clinical and epidemiological investigation of the first reported human infection with the zoonotic parasite *Trypanosoma evansi* in Southeast Asia. *Clin. Infect. Dis*., **62**, 1002–1008. doi:10.1093/cid/ciw052

Warnes M.L., Van den Bossche P., Chihiya J., Mudenge D., Robinson T.P., Shereni W. & Chadenga V. (1999). Evaluation of insecticide-treated cattle as a barrier to re-invasion of tsetse to cleared areas in northeastern Zimbabwe. *Med. Vet. Entomol.*, **13**, 177–184. doi:10.1046/j.1365-2915.1999.00148.x

———