Executive summary

- Tabanid biting flies in South America are capable of transmitting bovine trypanosomiasis (*Trypanosoma vivax*), a severely debilitating cattle disease that spread from Brazil to Bolivia in the 1990s, causing large numbers of cattle deaths.
- Scientists attempted to determine what role these flies play in disease transmission so that appropriate control measures can be identified and disseminated.
- Scientists found a high prevalence of bovine trypanosomiasis on one of two smallholder farms selected for study, with the tabanid fly population more than 20 times greater than that of the second farm. Some 33 species were identified, the most numerous being *Tabanus occidentalis*. *Trypanosoma vivax* was also identified in cattle on this farm and in the bloodmeals of a small proportion of collected flies.
- Cattle antibodies to *T. vivax* were also, for the first time, identified in the bloodmeals of flies, providing strong evidence that biting flies can and do transmit *T. vivax*.
- Studies of cattle defensive reactions to flies showed an increase in potential infection levels as flies interrupted in feeding moved to other animals. Separating infected from disease-free animals by 200 metres significantly reduced the transmission of trypanosomes.
- Treating animals with insecticides and prophylactically for trypanosomes dramatically reduced fly numbers (from 60% to 20%) and considerably reduced fly feeding times.
- This information will help smallholders decide if they can justify the cost of treatment against potential cattle and productivity losses to disease.

Project dates: April 1999 – March 2001

Background

Outbreaks of bovine trypanosomiasis in both Africa and South America, caused by *Trypanosoma vivax*, result in severe disease and death in cattle. In March 1996, infection in cattle spread from Brazil to Bolivia, resulting in disease outbreaks in Bolivia with up to 40% mortality.

This single-celled blood parasite now threatens the livelihoods of many poor smallholder farmers. Farmers and other cattle industry stakeholders are desperate for information and advice on appropriate control strategies. As the disease is new to the region, many factors in the epidemiological equation remain unknown, including *T. vivax*’s role in disease transmission. A number of biting flies (tabanid species) are thought to be involved, but the mechanism for transmission of is not well understood. This project aimed to provide some of the missing information.

Objectives

The project aimed to identify the bovine trypanosomiasis vectors in the recent Santa Cruz, Bolivia outbreak so that:

- Strategic timing and targeting of prophylactic treatments can be recommended
- Vector controls can be included into an integrated plan for disease control.

The project focused mainly on smallholder farmers whose livelihoods are most seriously affected by disease spread. The project concentrated on:
• Trapping flies and studying fly-cattle associations on two small-holder farms
• Examining the bloodmeals taken by flies to determine the prevalence of *T. vivax*
• Studying the effects of repellents on biting fly behaviour
• Training Bolivian researchers in entomological techniques.

**Highlights**

**Identifying flies that might carry bovine trypanosomiasis**

The project selected two farms in Santa Cruz for detailed study. Over 25,000 tabanid flies were trapped and identified, the vast majority at Chocolatal in the more humid northern Guaryos Province of Santa Cruz. Collaborators from the Laboratorio de Investigacion y Diagnostico Veterinario (LIDIVET) identified the greatest prevalence of bovine trypanosomiasis ever recorded in the Santa Cruz Department.

Trapping revealed a tabanid fly population more than 20 times greater than at the drier second farm in Sarah province. Researchers also found a much higher fly population at Chocolatal during the warm, wet summer months (November – March, see graph).

![Graph showing seasonality of tabanid flies at Chocolatal and Saavedra](image)

Seasonality of tabanid flies at Chocolatal (Guarayos Province – trap catches) and at Saavedra (Saniesteban Province – handnet catches from horse)

The Chocolatal study identified 33 species of tabanid flies, the most numerous species being *Tabanus occidentalis* (45–88%) which feeds aggressively on the cattle’s lower body and legs.

The disruptive effect of tabanid flies was measured by recording the defensive behaviour of cattle (hoof stamping and tail swiping). This behaviour intensified when the numbers of flies on the cattle’s body increased and encouraged an interruption of tabanid feeds. Once interrupted, flies moved to other animals, thereby increasing the potential for mechanical trypanosome transmission. When cattle were treated with a pyrethroid insecticide, Cypermethrin, the number of feeding flies in their body dropped from 60% to 20%. Feeding times were also significantly reduced.

In the vectors study, trypanosomes were found in approximately 7% of completed bloodmeals. *Tabanus occidentalis* was understandably the biggest culprit, though six other species had trypanosomes in their bloodmeals. Both *T. evansi* and *T. vivax* were identified.

Researchers, therefore, have strong reasons to suspect that a number of species transmit trypanosomes mechanically. The great number of flies and a longer fly season in humid areas also indicate that risk of transmission is greater on farms such as Chocolatal.

**Plans for strategic timing of prophylactic measures**

Disease risks can be reduced by applying prophylactics and insecticidal applications to cattle throughout the warm and wet high fly population months. However, year-to-year variations in climate and fly activity implies that tabanid populations need to be routinely monitored to provide a better guide to annual periods of high risk. Likewise, routine sampling of cattle would indicate areas of high infection prevalence and consequent high risk of disease spread.
Farmers find it difficult to decide whether or not to apply prophylactics for trypanosomes and insecticides for fly control. They must weigh the treatment cost against the value of livestock and potential losses as there are dangers that insecticides will knock out low level pests to which cattle have already developed resistance.

It is also important to separate infected from disease-free cattle. Separating stock by as little as 200 metres significantly reduces mechanical transmission between infected and uninfected cattle. Measures to reduce contacts will be of major importance in controlling the disease.

**Impact**

The project made good progress in helping to identify the fly species that are probable bovine trypanosomiasis vectors in the area. There now exists a strong case for strategic treatments against both trypanosomes and the flies themselves, especially during the humid summer months.

Findings can be applied in similar situations throughout South America and Africa. The integrated strategy for controlling bovine trypanosomiasis, including vector control and avoidance measures, was handed over to the animal health professionals for incorporation into regional plans.

Activities led to the production of information sheets on biting flies in both Spanish and English for use by animal health professionals and animal keepers. These will help them assess the disease threat and give guidance on steps to follow to protect animals. Oral presentations were also made to field workers convened by LIDIVET.

An integral part of this project was the training of counterpart Bolivian entomologists in vector studies. Together with the inputs from project R7162 which is developing diagnostics tests for bovine trypanosomiasis, the training aimed to build the capacity of Bolivian scientists to pursue similar future research unaided. Project outputs are likely to give a positive boost to small-holders within the Bolivian cattle industry, and also help veterinarians, animal health institutes, and entomology departments of local universities.

**Collaborators**

1. Laboratorio de Investigacion y Diagnostico Veterinario (LIDIVET) and Unidad Nacional de Vigilancia Epidemiologia Veterinario (UNIVEP), Santa Cruz, Bolivia
2. Institute for Tropical Medicine, Antwerp, Belgium
3. International Atomic Energy Agency, Vienna, Austria
4. CTVM, University of Edinburgh, UK

**Related projects**

R7162 - Improving the diagnosis of Trypanosoma vivax infection in cattle in Bolivia

Effect of Cypermethrin pour-on treatment of cattle on duration of feeding of *Tabanus occidentalis*
Selected publications

