

RESEARCH NOTE

Bovine Trypanosomiasis in Bolivian and Brazilian Lowlands

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The Bolivian and Brazilian lowlands are located in the center of South America (Fig.1). The principal Bolivian lowlands are located in the Santa Cruz Department and the Brazilian lowlands in the Pantanal region.

The Santa Cruz Department is the largest and most important in Bolivia regarding economic production. With a population of 1,598,957 bovines, it is the most important livestock region of Bolivia. The greatest number of cattle is found in extensive lowland provinces of Nuflo de Chavez, Guayaros, Velasco, Chiquitos, Angel Sandoval and Cordillera (M Hall et al. 1993 *Tabanidae of Santa Cruz Department, Bolivia, and their Role as Pests of Livestock. October 1992 to March 1993*, Final Report on ODA Animal Health Programme Project R5407, 66 pp.).

The Pantanal is a seasonal floodplain of about 140,000 km² and is divided into 11 subregions. It is populated by 3,996,000 cattle and 4,966 buffalo (EA Cadavid Garcia 1986 EMBRAPA/CPAP, documento 4: p. 126-127) and it is among the most important livestock regions of Brazil. Extensive cattle ranches occupy most of these wetlands. These regions present a rich fauna of mammals, reptiles, birds and insects. ATM Barros (1992 Proc. 12th Congresso Latino Americano de Zoologia, Belém, Brazil, p. 198) identified 25 species of Tabanidae, belonging to 15 genera and three subfamilies in the Pantanal and Hall et al. (*loc. cit.*) identified 35 species of Tabanidae belonging to 16 genera in the Santa Cruz Department. Here, we discuss the origin of bovine trypanosomiasis due to *Trypanosoma vivax* in Brazil and its relationship with outbreaks in Bolivia.

The study in the Pantanal, Brazil - In June 1995, 30 bovines were bled from their jugular veins using a vacuum system (Vacuum II, Labnew, Campinas, Brazil). The sampled animals were from the Poconé subregion of the Pantanal. All sampled animals were zebu purebred (*Bos taurus taurus* x *B. t. indicus*) and crossbreeds between 1 and 9 years old with a mean of 7 years and standard deviation (SD) of 2.18 years. The diagnosis was made using the microhematocrit centrifuge test. Blood from each sample and the concentrated parasites in the buffy coat of microhematocrit tubes were also used to prepare thin smears.

The study in Santa Cruz Department, Bolivia - Between January and May 1996, thin blood smears stained with May-Gruenwald-Giemsa were submitted by veterinarians to the Laboratorio de Diagnostico e Investigaciones Veterinarias in Santa Cruz de La Sierra. In September, blood samples were collected from the caudal vein of 29 bovines in the Laguna Concepción (Province of Chiquitos). Samples were taken using the vacuum system. The sampled animals originated from Bolivian lowlands, all Bolivian criollo-zebu crossbreeds, were between 1 and 10 years old with a mean of 4 years and SD of 2.73. The diagnosis was made using the microhematocrit centrifuge test. The trypanosomes in both countries were identified based on morphological (Fig. 3) and biometrical data as described by CA Hoare (1972 *The Trypanosomes of Mammals. A Zoological Monograph*, Blackwell Scientific Publication, Oxford, 749 pp.).

In July 1995, the first recorded cases of bovine trypanosomiasis, due to *T. vivax*, were discovered near the city of Poconé in the Pantanal region of Brazil. The clinical signs observed were fever, lethargy, loss of appetite, weakness, dysentery, abortion and loss of condition. Some animals had substantial loss of weight in relatively short time.

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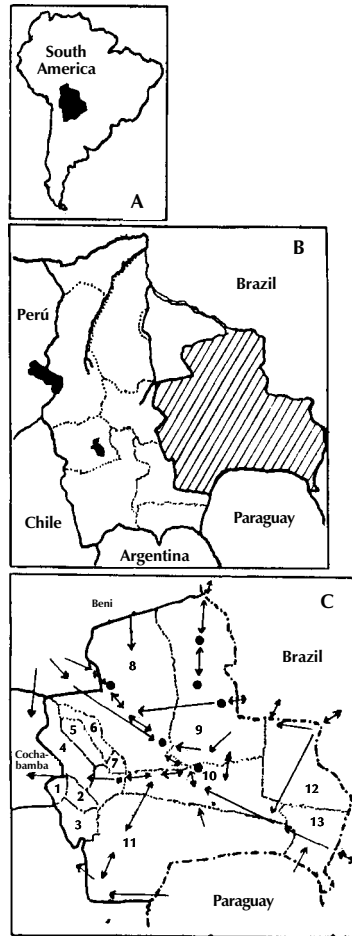


Fig. 1. A: Bolivia in South America; B: Santa Cruz Department; C: Provinces of Santa Cruz Department: 1: Caballero, 2: Florida, 3: Vallegrande, 4: Ichilo, 5: Sarah, 6: Santiesteban, 7: Warnes, 8: Nuflo de Chavez and Guarayos, 9: Velasco, 10: Chiquitos, 11: Cordillera, 12: Angel Sandoval, 13: German Bush; routes of traffic of cattle in the Department of Santa Cruz and between Bolivia and Brazil, location of bovine trypanosomiasis outbreaks in Bolivia. ● location of outbreaks; → one way route, ⇄ two way routes.

Emaciation and severe cachexia were present. Ten of the 29 bovines examined by microhematocrit test were infected by *T. vivax* (34.5%). Five months later the most recent cases of *T. vivax* infections were recorded in the Paraguayan subregion of the Pantanal in the vicinity of the Velasco Province (Bolivia) where the first cases were reported in the beginning of 1996.

In 1996, *T. vivax* was diagnosed in thin blood smears of 159 bovines from the Provinces of Velasco (57), Nuflo de Chavez (20), Guarayos (30) and Chiquitos (52) and in 86.2% of the 29 cattle from Laguna Concepción examined by microhematocrit tests. The clinical signs observed were fever, anemia, abortion, progressive weakness, lethargy, substantial weight loss in a relatively short time period, loss of condition and appetite, progressive emaciation, and death. Some animals registered a hematocrit as low as 17%.

T. vivax was reported in the New World for the first time in French Guyana (M Leger & M Vienne 1919 *Bull Soc Pathol Exotique* 12: 258-266), and later in others parts of South and Central America, and some Caribbean islands (RD Meléndez et al. 1995 *Trypanews* 2: 4). In Brazil, JJ Shaw and R Lainson (1972 *Ann Trop Med Parasitol* 66: 25-32) reported the first occurrence of *T. vivax* when the parasite was observed in a water buffalo (*Bubalis bubalis*) from the vicinity of the city of Belém, State of Pará. EA Wells et al. (1977 *Trans R Soc Trop Med Hyg* 71: 448) found antibodies to *T. vivax* in 54% of 666 bovine sera from the State of Mato Grosso. Other reports were made by LJ Pereira and ACVV Almeida (1978 *Pesq Agrop Bras* 3: 17-21), NM Serra Freire (1981 *Rev Bras Med Vet* 4: 30-31), NM Serra Freire et al. (1981 *Atas Soc Biol Rio de Janeiro* 22: 35-36), NM Serra Freire (1982 *Rev Fac Med Vet UFF* 1: 41-45) in cattle, sheep and buffalo from the State of Amapá, and S Lanhham et al. (1981 *Trans R Soc Trop Med Hyg* 75: 471-472) in buffalo from the State of Pará. Twenty-three years later, RAMS Silva et al. (1995 *Mem Inst Oswaldo Cruz* 5: 561-562) reported the occurrence of *T. vivax* in the north of Pantanal and in the following year they reported outbreaks of *T. vivax* in the lowlands of Bolivia.

The extended period between the Shaw and Lainson (*loc. cit.*) report of *T. vivax* in the north of Brazil, and the record of Silva et al. (*loc. cit.*) in the Pantanal, suggests that the Amazonian forest constituted a physical barrier impeding the traffic of cattle between these regions. However, in the 1970's, road construction accelerated in the interior of the country, linking the north and the central regions. The roads, BR 163 and BR 230, linking Cuiabá (capital of the State of Mato Grosso, located 100 km east of Poconé) to Belém, have

contributed to an increase in the flow of cattle through the region. This may have been a contributing factor to the spreading of *T. vivax* in the Pantanal (Fig. 2).

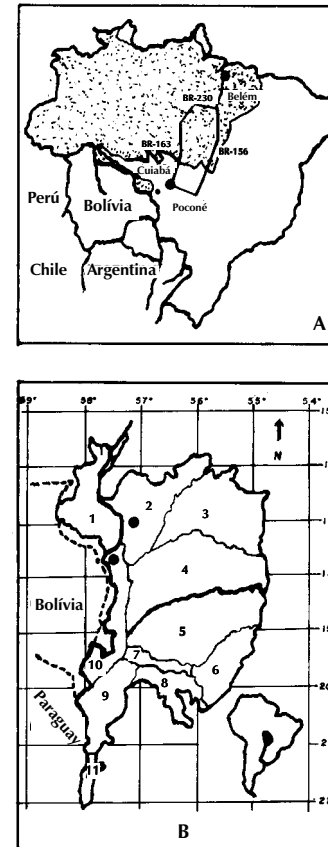


Fig. 2. A: location of the roads BR 158 and BR 163, linking Cuiabá to Belém. The marked region represents the Amazonian forest. B: Location of the Pantanal and the bovine trypanosomiasis outbreaks in Brazil. 1. Pantanal of Caceres; 2. Pantanal of Poconé; 3. Pantanal of Barão de Melgaço; 4. Pantanal of Paiguaguás; 5. Pantanal of Nhecolândia; 6. Pantanal of Aquidauana; 7. Pantanal of Abobral; 8. Pantanal of Miranda; 9. Pantanal of Nabileque; 10. Pantanal of Paraguay; 11. Pantanal of Porto Murtinho. ● location of outbreaks.

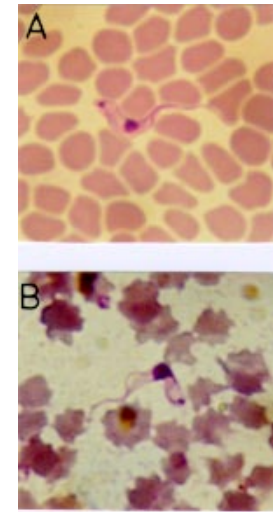


Fig. 3: photomicrographs of *Trypanosoma vivax*. A: from bovines of the Pantanal of Poconé, State of Mato Grosso, Brazil; B: from bovines of Santa Cruz Department, Bolivia.

The increase in cattle trading between Brazil and Bolivia between 1995 and 1996, due to depressed prices for Brazilian cattle, has caused an increase in the movement of horses and cattle through the properties of both countries. Around 180,000 head of Brazilian bovines, particularly from the northern parts of Pantanal, were sold to Bolivia during this period. The traditional cattle-raising system in the Pantanal is based on calf and yearling production. Its marketing involves animal transportation to market-places, river ports and railway stations, principally during the rainy season when the region is flooded. The most common method of transportation is on foot, with herds averaging 906 animals, and taking on average of 11 days to cover 230 km (EA Cadavid Garcia 1985 EMBRAPA/CPAP, Circular técnica 16, 45 pp.). Similar cattle-raising systems are used in the lowlands of Santa Cruz Department. Conditions for the acquisition or transmission of *T. vivax* are greatest at the numerous resting places along the route, mainly near the market places. The interaction among animals from different properties and host proximity provide an excellent opportunity for disease transmission by the vectors. This could have contributed to the spread of the disease.

In Kenya a temporal association exists between the rainy season when biting flies, particularly Tabanidae, are abundant, and an increased prevalence of *T. vivax* infections in cattle (PR Gardiner 1989 *Adv Parasitol* 28: 229-317). In the Santa Cruz Department, studies on zoning the province into three regions of estimated tabanid fly challenge by Hall et al. (*loc. cit.*) showed that the Provinces of Velaco, Nuflo de Chavez, Guayaros and Chiquitos are in an area of high fly challenge. In the Pantanal, studies showed that the high vector season occurs in the first half of the rainy season, from September/October to December/January. However, the tabanids remain abundant until the end of the rainy season. The rainy season represents the period of greatest risk of trypanosome transmission by these insects due to their abundance and the population

peak of species with high vector potential, notably *Tabanus importunus* (RAMS Silva et al. 1995 *Revue Élev Méd vét Pays trop* 4: 315-319). Similar to Pantanal, in the lowlands of Santa Cruz Department, the rainy season could represent the period of greatest risk of trypanosome transmission by these insects.

The results of this study suggest that accelerated construction of roads in the interior of Brazil, linking the north and central-west regions contributed to *T. vivax* introduction in the Pantanal. Moreover, the increase in cattle trading from Brazil to Bolivia was responsible for the introduction of the parasite in Bolivia. The infected animals were from less than one year to ten years old suggesting that the disease was recently introduced in both Brazilian and Bolivian lowlands.