AGRIECOEPIDEMIOLOGY OF TRYPANOSOMOSIS DUE TO *Trypanosoma vivax* IN RUMINANTS OF SOME FARMS LOCATED IN VENEZUELA: TECHNICAL NOTE

Agroecoepidemiología de la Trypanosomiasis por *Trypanosoma vivax* en Rumiantes en Algunas Fincas Localizadas en Venezuela: Nota Técnica

***Rita Tamasaukas*[1], *Héctor Ruiz*[2], *Aixa Aguirre*[1], *Noris Roa*[3], *Margarita Cobo*[4] & *Pedro María Aso*[5]**

[1]*LABIPRESAN, Universidad Rómulo Gallegos. San Juan de los Morros, Guárico, Venezuela. E-mail: ritamasa@net-uno.net.*
[2]*Facultad de Ciencias Veterinarias, Universidad Central de Venezuela. Maracay, Venezuela.*
[3]*Instituto de Investigaciones Zootécnicas-Ceniap/Fonaiap. Maracay, Venezuela.*
[4]*Facultad de Agronomía, Universidad Central de Venezuela. Maracay, Venezuela.*
[5]*Departamento de Biología Celular, Universidad Simón Bolívar. Caracas, Venezuela.*

ABSTRACT

Results obtained of seroprevalence of *T. vivax* in ovine and bovine farms located in two counties of Aragua State (Camatagua and San Casimiro) and one of Guárico State (Roscio), as well as the determination of trypanosomosis agriecoepidemiology. Concluding that the values of seroprevalence were smaller during the dry season in comparison with the rainy season, evidencing a marked relationship with the season and to the agroecological zone.

Key words: Trypanosomosis, *T. vivax*, agriecoepidemiology, cattle, ovine.

RESUMEN

Se presentan resultados sobre valores de seroprevalencia del *T. vivax* en fincas de ovinos y bovinos localizadas en dos Municipios del estado Aragua (Camatagua y San Casimiro) y uno del estado Guárico (Roscio), así como la determinación de la agriecoepidemiología de la trypanosomiasis. Concluyendo que los valores de la seroprevalencia fue menor durante la época seca en comparación con la época de lluvias, evidenciando una marcada relación con la estación y a la zona agroecológica.

Palabras clave: Trypanosomiasis, *T. vivax*, agroecoepidemiología, bovinos, ovinos.

Recibido: 13 / 11 / 1999. Aceptado: 07 / 09 / 2000.

INTRODUCTION

In Venezuela, livestock production has been limited by several factors: poor reproductive efficiency, high mortality rates in calves, lambs and adults, marginal nutrition due to low quality pastures and various diseases, among which, trypanosomosis is one of the higher relevance in bovine and ovine productions, as supported by researchers. Specifically, in the most important Venezuelan livestock production systems, namely Guárico, Apure, Zulia and southern Aragua States.

Trypanosomosis is a vector-borne inoculable infection, spread by haematophagous vectors including *Glossina spp.* in the African continent, tabanids and stomoxids in the American continent, among other arthropods. The causal agents of this disease in ruminants include a variety of species and subspecies of *Trypanosoma* genus in Africa and two species reported in America, i.e. *T. vivax* in cattle and sheep [5] and *T. evansi* in horses and other animals [1, 5, 12, 13, 16, 17].

Bovine trypanosomosis is of particular relevance because its economic impact due to mortality, chronic development (poor body condition, slow growth, decreased productivity). It is important to understand this infection as part of an etiologic complex (haemoparasitic diseases) in order to develop effective control and prevention strategies in Venezuela. In the present studies it were recorded significant results during epidemiological diagnosis (in a population groups sampled) of *T. vivax* and their agriecology patterns at the production system of ruminants in some farms located in two States of the Venezuelan central region.

The term "agriecoepidemiology" is a derivative from the conjuction of the agriecological and epidemiology words and we had introduced this term to their conjuction, and to show the relationship between both terms in the diagnosis of trypanosomosis.

The agriecological epidemiology of *T. vivax* in Venezuela has been studied by some researchers [4, 14, 17, 20] and it is a comprehensive view of the strong relationship that exists between the agricultural, ecological and epidemiological characteristics of livestock production in farms under *T. vivax* risk and the epidemiology of this parasite; i.e. **(a) The agricultural characteristics**: type of livestock system production (bovine, ovine, beef, dairy, dual purpose, only agricultural or pecuarian or both systems) and type of livestock breed. **(b) The ecological characteristics**: vegetation, topography, soil types, relief, altitude, climatic and seasonal conditions. Both, to classify in agriecological unities, the regions of the country, or, in one state, with similar conditions mentioned above. **(c) The epidemiological characteristics**: prevalence, incidence, spatial and timed distributions, age, sex and breed distribution; poblational field diagnosis of *T. vivax* using seroimmunological thecniques (IFAT, Ab-ELISA) with recognized applicances on herds.

MATERIALS AND METHODS

For the reasons cited above, it was suggested the application of the agriecoepidemiological terminology to involve all these aspects related to study of *T. vivax* in livestock, as much reported by Otte [12] and was development four studies during four distincts moments and in a variety of ruminant farms.

The agriecological zone term used is similar to the ecoregions reported by Gómez *et al.* [6] in Guárico State and by ICRAF [8] used to describe the characteristics of the humid tropics areas of West Africa and savannas of Latin America and main land-use systems and of the agriecological unities expresed by Tamasaukas & Roa [17] in their study of the basic epidemiology and agriecology of *T. vivax* in bovine farms of Guárico state.

About indirect fluorescent antibody test (IFAT) it was developed using the traditional method reported by Tamasaukas & Roa [17] with antigens prepared by experimental infection of *T. vivax* in one bovine, in the peak of parasitemia the animal was blooded and the parasites were concentrated and purified by Percoll´s gradient as described by Grab & Bwayo [7] and Lanham & Godfrey [9] with certain modifications.

The purified parasites were distributed in smears preparations in slides, air-dried, fixed with acetone/methanol (60:40), wrapped in tissue paper, freezing and stored at -20ºC. The serum samples were tested against known positive and negative control sera. The sera were expressed positive or negative according to their immunofluorescence or not.

The data for determination of seroprevalence were obtained from ovine and bovine animals, distributed for sex (males, females), crossbreeding (in ovine) and for age (ovine: adults, youngest and lambs; and bovine: 0-12; 13-24 and 25 or more months old).

RESULTS AND DISCUSS

Seroprevalence of *T. vivax* in ovine farms of Aragua State

The data were obtained from 82 animals distributed in three groups (adults, youngest and lambs), using a simple random method and the diagnosis by IFAT [17]. Blood samples were taken during the dry season (March-April 1995) in three farms from two counties (Camatagua and San Casimiro) in southern Aragua State, Venezuela, FIG. 1.

The seroprevalence of *T. vivax* was of 17.4% with a group distribution of 4.4% in adult animals, 37% in youngest and in lambs, 16.6%; a sex distribution of 14.9% in females and 20% in males; 16.6% in West Africa breed and 66.6% in mosaics crossbreed animals. No positive results were obtained with Barbados Black Belly and Persian Black Head crossbreed animals. The results showed a high *T. vivax* prevalence in ovine, even in dry season. This suggests a high susceptibility of sheep to this haemoparasite if we compared this data with the ones obtained in cattle in a similar agriecological zone and same season [19].

Seroprevalence of *T. vivax* in some farms of Aragua and Guárico States

It was studied using 102 ovine blood samples, distributed in groups according to age, sex and crossbreeding, using a simple random method and IFAT diagnosis technique. Samples were taken at the last of the dry season (March-April, 1995) in other four farms located in three counties (Camatagua and San Casimiro in southern Aragua State and Roscio, Guárico State, Venezuela). The seroprevalence of *T. vivax* was 12.7% with a group distribution of 7.3% in adults, 22.5% in youngest and in lambs, 33.3%; a sex distribution of 12.1% in females and 15% in males; 13.4% in crossbreed West Africa and 50% in mosaics animals. No positive results were observed with Barbados Black Belly, Persian Black Head, Bergamasca, Bergamasca x Puglia crossbreed and Dorset purebreed animals. The results showed a high *T. vivax* prevalence in ovine during the last of dry season, in these farms of Venezuela.

The basic agriecology distribution of *T. vivax*

The 102 ovine blood samples were distributed in agriecological zones, using a simple random method and the IFAT diagnosis technique. Samples were taken during the dry sea-

FIGURE 1. BOVINE FARM OF SAN CASIMIRO COUNTY, ARAGUA STATE, VENEZUELA.

FIGURE 2. VIEW OF AGRIECOLOGIC UNIT E2, SOUTHERN OF ARAGUA STATE, VENEZUELA.

son in another four farms in three counties (Camatagua and San Casimiro in southern Aragua state, and Roscio in Guárico State, Venezuela). The agriecological distribution of seroprevalence was 100% in Life Zone E (Dry Tropical Bush) with 100% in the Agriecological Unit E2 (mountains with semi-arid and sub-humid climatic conditions in three farms of Aragua State), FIG. 2. No parasite evidence was observated in the Agriecological Unit E1 (mountains with sub-humid-humid climatic conditions in one farm of Guárico State). Results showed a high *T. vivax* seroprevalence in ovine, even in dry season, in these farms of central States of Venezuela with a tipical agriecologic distribution.

Seroprevalence of *T. vivax* in bovines

It was done with 607 bovine blood samples distributed in groups according to age and sex using a simple random

method and diagnosis by IFAT technique. Samples were taken from January to May 1995 (during dry season and beginning of raining season), from eight farms in the following counties: Camatagua and San Casimiro (southern Aragua State), Ortiz and Monagas (Guárico State). The seroprevalence of *T. vivax* was 3.9% with a general group distribution of 3.8% in animals 0-12 months old, 13.5% in animals 13-24 months old and 2.9% in animals over 25 months old. In relation to sex distribution the results were 4.7% in females (6.1% from 0-12 months old, 15.6% from 13-24 months old and those 25 months old, 3.1%) and 1.4% in males (1.7% from 0-12 months old animals, and for animals 13-24 months old and more than 25 months of age, 0%). Analizing the data of the agriecological epidemiology of the infection in the area under study (Life Zone E = Dry Tropical Bush) with values of *T. vivax* seroprevalence of 75% in the Agriecological Unit E2 (mountains with semi-arid and sub-humid climatic conditions in the farms of Aragua State), and 25% in the Agriecological Unit E1 (mountains with sub-humid-humid climatic conditions in farms of Guárico State); it may be concluded that this haemoparasitism in cattle had a low seroprevalence in these farms of the two States studied located in the central region of Venezuela during the dry season, among the percentage of infection was increased at the beginning of the raining season. The factors, problems for flies and ticks presented a marked association with the seroprevalence rates in bovine and ovine farms of all counties, although Otte (1991) refered that these factors presented less association in his study in bovine farms of Colombia and only had significance when they were examined alone.

In TABLE I were summarised the results of the present studies.

The general mean seroprevalence of *T. vivax* was 11.3% distributed in 19 ruminant farms located in the two States studied and located in Venezuelan central region. In other studies the trypanosome seroprevalence rates were estimated as 33.8% in cattle during the raining season in the eastern region of Guárico State [17] and 3.6% in the dry season in Ortiz county at northwest of Guárico State [18]; Toro *et al.* [21] reported a 25% prevalence rate of *T. vivax* in bovine farms located in Carabobo, Falcón, Guárico, Zulia, Aragua, Barinas, Bolívar, Miranda and Portuguesa States.

Most recently, Toro [20] estimated the national prevalence at 21%, and 19% in bovine farms of the western plains. Duno [3] reported a prevalence rate of 57.8% in cattle in the northeastern of Falcón State.

Continuing with the description of the agriecologic studies of trypanosomosis, Tamasaukas & Roa [17] reported that according to data suministrated by Ministry of Agriculture (MAC) [10] in that year they were considered an inventory of 1,308,719 heads of bovine in Guárico State, being in the 19 sampled farms from a total of 9,495 animals for the moment of their study, while actually, the MAC [11] reported that in Guárico State were established 1,559,546 and 46,992 heads

TABLE I

SEROPREVALENCE OF *Trypanosoma vivax* IN RUMINANTS FARMS LOCATED IN TWO ECOREGIONS OF TWO STATES FROM VENEZUELAN CENTRAL REGION

Ecoregion	Animals	Seroprevalence (%)
E2	Ovine	100
E1	Ovine	0
E2	Bovine	75
E1	Bovine	25

General mean seroprevalence in ruminants on farms of two states of Venezuelan central region: 11.3%.

of bovine and ovine, respectively; and the area of the Roscio county was 115,692 ha, and in the present work aproximately an extension of 15,000 ha of the total farms were studied (12.9%). For Aragua State, the inventory was 128,806 and 13,537 heads of bovine and ovine, respectively; in 43,736.89 ha and 37,772.89 ha of Camatagua and San Casimiro counties, respectively [11], and in the present work aproximately an extension of 37,000 ha of the total farms were studied (45.4%). The values of these farms extensions were aproximadately calculated due to the absence of reliable registrations.

While Seidl *et al.* [15] reported that *T. vivax* was identified in 1995 in all ranches and 34.5% of the animals sampled tested on the Brazilian Pantanal and Bolivian lowlands, and these authors considered that 2,400 potentially affected adult cattle provided the boundaries of analysis for their estimates.

Serological evidence of *T. vivax* in ovine of American continent was determined by Vokaty *et al.* [22] and they found 64% seroprevalence in sheep in Coastal Guyana on indirect fluorescent antibody test (IFAT). In French Guiana, a temporal association has been found between dry season (November to January), high Tabanid density, and *T. vivax* clinical outbreaks [2].

CONCLUTION

It was showed in the present studies that the trypanosomosis seroprevalence was lower in dry season in ruminants farms than in raining season (with a closed relationship with the season) although the susceptibility to infection was higher in ovine than in bovine animals, and the agriecoepidemiology of this haemoparasitic disease was confirmed in special agriecologic units where some aspects of the production system and enviromental conditions (vegetation, climatology, soils, arthropods, etc.) shall be studied in each geographical zone.

ACKNOWLEDGEMENT

To the Parasitology & Parasite Diseases Cathedras, Facultad de Ciencias Veterinarias, Universidad Central de Venezuela, Maracay, Aragua State. To Fundacite Aragua

Grant DLAG0039, to International Foundation for Science (IFS) Grant B/2223-1 and Rómulo Gallegos University, San Juan de los Morros, Guárico State, for the cofinancial support of these researches.

BIBLIOGRAPHIC REFERENCES

[1] DESQUESNES, M. Epidémiologie de la trypanosomose bovine (*T. vivax*) en Guyane Francaise. **Mem. I Int. Seminar Non-Tsetse Transmitted Animal Trypanosomoses.** (October 14-16, 1992). Annecy, France: 168. 1992.

[2] DESQUESNES, M.; GARDINER, P. Epidémiologie de la trypanosomose bovine (*Trypanosoma vivax*) en Guyane française. **Rev. Elev. Med. vét. Pays trop.** 46(3): 463-470. 1993.

[3] DUNO, F. **Prevalencia de la tripanosomiasis bovina en la región Nor-oriental del estado Falcón**. Fac. Cienc. Veter. Univ. Central Vzla. (Tesis MSc.):152 pp.1992.

[4] ESPINOZA, E.; GONZÁLEZ, N.; ASO, P.; LÓPEZ, H. Tasa de incidencia serológica del *Trypanosoma vivax* en un sistema de producción bovina de doble propósito. **Mem. I Simposium Nacional Hemoparásitos y sus Vectores** (Octubre 01-02, 1998). Maracay, Venezuela:E8-6.1998.

[5] EUZÉBY, J. **Protozoologie Médicale Comparée. Les des Animaux et leurs Relations avec les Protozooses de l'Homme.** {Avec étude des arthopodes hématophages vecteurs de protozoaires, Vol. I: Généralités - Sarcomastigophores (Flagellés, Rhizopodes)} - Ciliés. France: 475. 1986.

[6] GÓMEZ, N.; RIERA, A.; SÁNCHEZ, A.; ARIAS, L. **Diagnóstico agroecológico del estado Guárico.** CIALLARCEN. Serie C. No. 1-07. Calabozo, Guárico:36. 1982.

[7] GRAB, D.J.; BWAYO, J.J. Isopycnic isolation of african trypanosomes on Percoll gradients formed in situ. **Acta Tropica.** 39:363-366. 1982.

[8] ICRAF. **ICRAF On Line, Web Homepage of the Internet** <http:www.cgiar.org/ICRAF/regional/region_6/region_6.htm> 1999.

[9] LANHAM, S.M.; GOODFREY, D.G. Isolation of salivarian trypanosomes from man and other mammals using DEAE-cellulose. **Exp. Parasitol.** 28: 521-534. 1970.

[10] MAC (MINISTERIO DE AGRICULTURA Y CRÍA). **Anuario estadístico.** MAC: Caracas, Venezuela. 1984.

[11] MAC (MINISTERIO DE AGRICULTURA Y CRÍA). **VI Censo Agrícola.** MAC. Caracas, Venezuela. 1998.

[12] OTTE, J. **La Importancia de la Tripanosomiasis en la Industria Ganadera de Córdoba, Colombia. Proyecto ICA/GTZ**. Colombia: 151. 1991.

[13] OTTE, J.; ABUABARA, J.Y.; WELLS, E.A. *Trypanosoma vivax* in Colombia: epidemiology and production losses. **Mem. I Int. Seminar Non-Tsetse Transmitted Animal Trypanosomoses**. (October 14-16, 1992). Annecy, France: 26. 1992.

[14] SANDOVAL, E.; ESPINOZA, E., GONZÁLEZ, N.; MORALES, G.; MONTILLA, W. JIMÉNEZ, D. Encuesta serohematológica en bovinos tripanosusceptibles de dos unidades agroecológicas del Valle de Aroa, estado Yaracuy. **Rev. Científica FCV- LUZ.** VIII (3): 253-268. 1998.

[15] SEIDL, A.; DÁVILA, A.M.R.; SILVA, R.A.M.S. Estimated financial impact of *Trypanosoma vivax* on the Brazilian Pantanal and Bolivian lowlands. **Mem. Inst. Osw. Cruz.** 94 (2): 269-272. 1999.

[16] SILVA, R.A.M., BARROS, A.T.M.; DÁVILA, A.M.R., RAMÍREZ, L.; SAHIB, C.A.; FERREIRA, M.S.J.; HERRERA, H.M. **Tripanosomose por *Trypanosoma evansi* ("Mal de Cadeiras"): una avaliação sobre fatores de risco no Pantanal**. EMBRAPA-CPAP. Boletim de Pesquisa, 6: 29 pp. 1996.

[17] TAMASAUKAS, R.; ROA, N. Epidemiología básica agroecológica de la tripanosomiasis bovina por *T. vivax* en el estado Guárico. **Rev. Fac. Cienc. Vet. Univ. Central Vzla.** 1-8: 143-165. 1991-1992.

[18] TAMASAUKAS, R.; GONZÁLEZ, A. Seroprevalencia de la trypanosomiasis bovina (*Triypanosoma vivax*) en fincas del Municipio Ortiz, estado Guárico, Venezuela. **Parasitol. al Día.** 19: 182. 1995.

[19] TAMASAUKAS, R.; RUÍZ, H.; BALDIZÁN, A.; GONZÁLEZ, A.; AGUIRRE, A, Seroprevalencia relativa general de la trypanosomiasis bovina debida al *Trypanosoma vivax* en fincas de la región central de Venezuela. **Parasitol. al Día.** 19: 180-182. 1995.

[20] TORO, M. Seroepidemiología de las hemoparasitosis en Venezuela. In: (Eds.) S. Giardina & F. García. **Hemoparásitos: biología y diagnóstico.** Manual de Laboratorio. Colección Cuadernos USB. Serie Biología/No. 1. Caracas, Venezuela: 35-49. 1990.

[21] TORO, M.; LEÓN, E.; GARCÍA, J.A.; RUÍZ, A. Resultados de un muestreo sobre tripanosomiasis bovina mediante técnicas serológicas. **Vet. Trop.** 5(1):43-50. 1980.

[22] VOKATY, S.; McPHERSON, V.O.M.; CAMUS, E.; APPELWHAITE, L. Ovine trypanosomosis: a seroepidemiological survey in Coastal Guyana. **Rev. Elev. Med. Vét. Pays trop**. 46(1-2):57-59. 1993.