

Equine viral diseases in the Pantanal, Brazil. Studies carried out from 1990 to 1995

R.A.M.S. Silva ^{1*} A.M.R. Dávila ²
L.B. Iversson ³ U.G.P. Abreu ⁴

Key words

Equidae - Horse - Virosis - Equine infectious anemia - Respiratory disease - Equine encephalomyelitis - Disease transmission - Pantanal - Brazil.

Summary

A survey on equine viral diseases was carried out in the Pantanal, Brazil, from 1990 to 1995, and the authors report for the first time the occurrence of respiratory viral diseases in horses from the Pantanal. Seropositivity for the equine adenovirus was 42%, primarily among animals under 3 years of age (61.9%). It was 36% for the equine herpesvirus 1 (EHV-1) (50 and 22.2% of seropositive foals and mares, respectively). The observed seropositivity for EHV-1/respiratory was 58%. Among the equine rhinoviruses only equine rhinovirus 1 (ERV-1) was studied in this survey. Seropositivity for ERV-1 was 18%. Foals aged 1 to 2 years (22.2%) presented a titer of 1/5. Titers of 1/10 and 1/20 were only observed in animals over 5 years old. Seropositivity for influenza A/Equine/2/Miami was 30%. Foals represented 40% and mares 28.6% of all seropositive animals. Seropositivity for influenza A/Equine/2/Fontainebleau was 42%. Foals and mares represented 86% (43% in each group) of all seropositive animals. In the study on equine infectious anemia, the observed prevalence was 24.8%. Seropositivity among males was 14.3% and among females 10.6%. In the survey on arboviroses, neutralizing antibodies to the eastern equine encephalomyelitis (6.7%), western equine encephalomyelitis (1.2%) viruses, Ilheus flavivirus (26.6%), Maguari (28.2%) and Tacaiuma (15.7%) bunyaviruses were observed. The equine viral arteritis was not found in the region. In the Pantanal, except for arboviroses, apparently all equine viruses are acquired when young horses mix with older ones or through local management practices.

■ INTRODUCTION

The Pantanal is a large wetland with an area of 140,000 km², located in the center of South America, between 16 and 21°S, and 55 and 58°W. It is divided into 11 subregions differing in terms of watercourses, soil types and historical occupation (9, 12) (figure 1). Extensive cattle ranches occupy most of this wetland. It is populated by 3,996,000 cattle, 4966 buffaloes and 49,000 horses (2, 4). The Pantanal is considered one of most important livestock regions of Brazil.

1. EMBRAPA/CNPSA, BR 153, Km 110, Vila Tamandua, Concordia, SC, Brazil
E-mail: rsilva@cnpsa.embrapa.br; Fax: 55 49 442 8559

2. Lab. de Biologia Molecular de Tripanosomatídeos, DBBM - Oswaldo Cruz Institute, FIOCRUZ, CEP: 21045-900, Av. Brasil 4365, Rio de Janeiro, RJ, Brazil

3. Departamento de Epidemiologia, Escola de Saúde Pública, Universidade de São Paulo, Av. Dr. Amaldo 715, 01255-000, São Paulo, SP, Brazil

4. EMBRAPA/CPAP, Rua 21 de Setembro, 1880, 79320-900, Corumbá, MS, Brazil

■ MATERIALS AND METHODS

Equine respiratory diseases

In 1993, 50 serum samples of sick horses from three outbreaks of respiratory diseases involving approximately 300 equines were collected. Several diagnostic methods were applied at the Animal Health Trust, Newmarket, England, as follows: the hemagglutination inhibition (HI) test and virus neutralization were used as diagnostic tests for adenovirus; the hemagglutination inhibition test was used for influenza; serum neutralization was used as a diagnostic test for herpesvirus.

Equine infectious anemia

The study on equine infectious anemia (EIA) in domestic horses was conducted in the Nhecolândia (24,762 km²), Paraguay (7,373 km²) and Nabileque (13,076 km²) subregions of the Pantanal, involving 28 ranches and 3285 Equidae from 1990 to 1995. The animals were divided into four classes. In class 1 horses

were used for work, in class 2 there were non-domesticated horses, in class 3 horses were used for reproduction, and in class 4 horses were learning to work. The horses were bled from the jugular vein using a vacuum system (Vacuum II, Labnew, Campinas, SP, Brazil). The diagnosis was made at the EMBRAPA/CPAP, Corumbá, Brazil, using the agar gel immunodiffusion test (D-Tec AIE, Pitman Moore, Inc., M. Cassab Comercio e Industria Ltda, SP, Brazil). A binary analysis (0 or 1) testing the occurrence of the disease in each animal was performed with the following factors: coat color, age, sex and class.

Equine arboviruses

In 1992 sera of 432 horses were tested in the laboratory of arboviruses of the Evandro Chagas Institute, Belem, Brazil, by the HI test according to the procedure described by Shope (8), using antigens of the eastern equine encephalitis (EEE), western equine encephalitis (WEE), Mucambo (MUC) and Mayaro alphaviruses, of the Ilheus (ILH), St Louis encephalitis, Cacicapore and Rocio flaviviruses, and of Caraparu, Catu, Guaroa, Maguari (MAG), Oropuche and Tacaiuma (TCM) bunyaviruses. Sera positive in the HI test were tested for neutralizing antibody by the technique described by Casals (3).

■ RESULTS AND DISCUSSION

Equine adenovirus

In the Pantanal seropositivity for EAdv was 42%, mainly among animals under 3 years of age (61.90%). According to Mohanty and Dutta the EAdv causes a disease of the upper respiratory tract in foals under 3 months of age (5). According to Mumford (pers. comm., 1993) adenovirus infections seem to be common in the Pantanal, but are probably subclinical.

Equine rhinovirus

In this survey only ERV-1 was studied. Seropositivity for ERV-1 was 18%. Foals between 1 and 2 years old (22.20%) presented a titer of 1/5. The titers 1/10 and 1/20 were only observed in animals over 5 years old. Antibodies to ERV-1 were observed in 88.88% of mares. In the present survey, the authors found in agreement with Powell (7) that the majority of horses become infected at a young age. ERV-1 infection was common in the entire equine population and was acquired when young horses mixed with older ones.

Equine influenza

A/Equine/2/Miami

The overall seropositivity observed was 30%. Foals represented 40% and mares 28.57% of all seropositive animals.

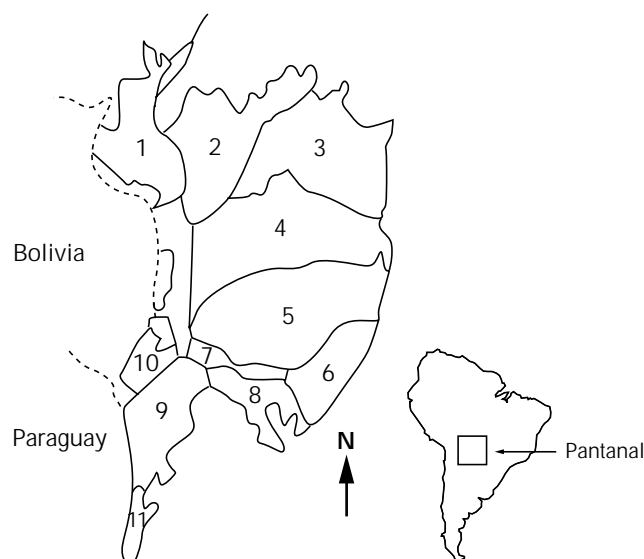
A/Equine/2/Fontainebleau

Seropositivity observed in horses was 42%. Foals and mares represented 86% (43% in each group) of all seropositive animals.

According to Mumford (pers. comm., 1993) the results of the Pantanal survey revealed that many horses had antibodies to influenza A/equine/2 and the reaction was stronger against the recent field strain (1989) than the prototype Miami/63.

Equine herpesviruses 1 and 4

Seropositivity for EH-1 observed in the horses was 36%. Foals represented 50% and mares 22.22% of seropositive horses.



Pantanal subregions

1. Pantanal of Cáceres
2. Pantanal of Poconé
3. Pantanal of Barão de Melgaco
4. Pantanal of Paiaguás
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

Figure 1: Location of the Pantanal and its subregions.

Seropositivity for EH-4 was 58% (foals 55.17% and mares 24.13%). EHV-1, known as the equine abortion virus, is a major equine pathogen, responsible for a triad of clinical signs: abortion, neurological and respiratory diseases. The high percentage of seropositive foals and mares suggested that the provision of adequate control measures was desirable.

Equine infectious anemia in the Pantanal

The prevalence of EIA in domestic horses was 24.84%. Seropositivity among males was 14.25% and among females 10.59%. The prevalence observed in each class was: 18.17% in class 1, 1.04% in class 2, 3.99% in class 3, and 0.21% in class 4 (Silva *et al.*, 1997, unpubl. data).

In the Pantanal, studies showed that the season of blood sucking vectors occurs in the first half of the rainy season, from September/October to December/January. However, the tabanids still remain in high numbers until the end of the rainy season. Due to their abundance, particularly that of *Tabanus importunus*, this season represents the period of major risk for equine infectious anemia transmission (10). According to Pearson and Knowles the larger percentage of positive tests in the Southern and Eastern United States may be due to prevalence of insect vectors (6).

According to Silva *et al.* (11) the main factors influencing the occurrence of EIA in Equidae of Pantanal were age, sex and class

($P > 0.05$). The age influence was due to the length of exposure to tabanid vectors and local husbandry practices. The sex influence probably existed because only males are usually used for work. The class influence occurred primarily because adults and males were included in class 1. Man has undoubtedly played an important role in the EIA virus transmission to equines used to work in the region. On the other hand, in wild populations, the insect vectors could have a fundamental importance in EIA transmission in Pantanal.

Equine arboviruses

Neutralizing antibodies to the eastern equine encephalomyelitis (6.70%), western equine encephalomyelitis (1.20%) viruses, Ilheus (26.60%) flavivirus, Maguari (28.20%) and Tacaiuma (15.70%) bunyaviruses were observed.

According to Iversson *et al.* (4) there is serological evidence implicating the EEE virus as a recent cause of equine encephalitis in the Brazilian Pantanal. Moreover, past infections linked with fresh water swamps resembled those of the swamp areas of North America near the Great Lakes and the Atlantic coast where the EEE virus is prevalent.

The geographic proximity of Northern Argentina, affected since 1908 by periodic EEE and WEE epizootics, suggest that the Pantanal may be an important focus of virus maintenance and possibly the source of introduction of the virus into other epizootic areas. According to Monath (pers. comm., 1991) the Pantanal region may be the central area from where arboviruses spread to Argentina, Paraguay and Bolivia.

An antibody to the Mucambo virus, a subtype of the Venezuelan equine encephalitis (VEE) complex, was detected in horses with encephalomyelitis.

The significance of antibodies to MAG, ILH and TCM viruses in horses is unknown. The MAG virus is closely related to the Cache Valley virus, which was isolated from a horse with encephalomyelitis in the United States. Horses from Argentina showed an 80% prevalence of neutralizing antibodies to the MAG virus, without implicating this agent in epidemics of encephalitis.

The Tacaiuma virus was isolated from mosquitoes and a febrile person in Northern Brazil. Antibodies were detected in people and horses in Brazil and Argentina.

The Ilheus virus was recovered from mosquitoes, birds, sentinel monkeys and men in Brazil and other countries of South and Central America. HI antibodies were previously detected in horses in Brazil. Neither TCM nor ILH viruses are known to cause equine encephalitis.

CONCLUSION

The Pantanal is vast and heterogeneous. Its unique combination of vegetation, soil, relief, flood cycles, climate and food variety creates perfect conditions for viral animal diseases. In the Pantanal, except for arboviral diseases all equine viruses are apparently acquired when young horses mix with older ones. The most common method of transportation is on foot. Conditions for the acquisition or transmission of equine viral diseases are greatest at the numerous resting-places along the roads, mainly near market places. Interactions among animals from different properties and host proximity provide an excellent opportunity for disease transmission. Research on EIA in the Pantanal is well established, although respiratory viruses and arboviruses need to be investigated in more intensive epizootiological studies.

REFERENCES

- CADAVID GARCIA E.A., 1985. Comercialização do gado bovino do Pantanal Mato-Grossense. Corumbá, MS, Brasil, EMBRAPA/CPAP, 45 p. (Circular técnica 16)
- CADAVID GARCIA E.A., 1986. Estudo técnico econômico da pecuária bovina de corte do Pantanal Mato-Grossense. Corumbá, MS, Brasil, EMBRAPA/CPAP, p. 126-127. (Documento 4)
- CASALS J., 1967. Immunological techniques for animal viruses. In: Maramoros K., Koprowski H. Eds., *Methods in virology*, vol. 3. New York, USA, Academic Press, p. 146-181.
- IVERSSON L.B., SILVA R.A.M.S., TRAVASSOS DA ROSA A.P.A., BARROS V.L.R.S., 1993. Circulation of eastern equine encephalitis, western equine encephalitis, Ilheus, Maguari and Tacaiuma viruses in equines of the Brazilian Pantanal, South America. *Rev. Inst. Med. trop. S. Paulo*, **35**: 355-359.
- MOHANTY S.B., DUTTA S.K., 1981. *Veterinary virology*. Philadelphia, PA, USA, Lea and Febiger, 372 p.
- PEARSON J.E., KNOWLES R.C., 1984. Standardization of the equine infectious anemia immunodiffusion test and its application to the control of the disease in the United States. *J. Am. vet. Med. Assoc.*, **184**: 298-301.
- POWELL D.G., 1991. Viral respiratory disease of the horse. *Vet. Clin. North Am.: Equine Pract.*, **7**: 27-61.
- SHOPE R.E., 1963. The use of micro-hemagglutination inhibition test to follow antibody response after arthropodborne virus infection in a community of forest animals. *An. Microbiol. Rio de Janeiro*, **11**: 167-171.
- SILVA J.S.V. DA, ABDON M.M., SILVA M.P. DA., 1995. Delimitação do Pantanal brasileiro e sua sub-regiões. In: Encontro sobre sensoriamento remoto aplicado a estudos no Pantanal, Corumbá, MS, Brasil, 9-12 outubro 1995, p. 9.
- SILVA R.A.M.S., BARROS A.T.M., HERRERA H.M., 1995. Trypanosomiasis outbreaks due to *Trypanosoma evansi* in the Pantanal, Brazil. A preliminary approach on risk factors. *Revue Elev. Méd. vét. Pays trop.*, **48**: 315-319.
- SILVA R.A.M.S., HERRERA H.M., PEREIRA, J.E., 1995. Five years of study on Swamp Fever in the Pantanal, Brazil: A preliminary evaluation on prevalence and influence of sex, age, coat color, and animal function. In: XVIII Congresso Brasileiro de Microbiologia, Santos, SP, Brasil, Sociedade Brasileira de Microbiologia, 2-5 setembro 1995, p. 51.
- WILCOX R., 1992. Cattle and environment in the Pantanal of Mato-Grosso, Brazil, 1870-1970. *Agric. Hist.*, **66**: 232-256.

Reçu le 23.11.98, accepté le 8.4.99

Résumé

Silva R.A.M.S., Dávila A.M.R., Iversson L.B., Abreu U.G.P. Maladies virales du cheval au Pantanal, Brésil. Etudes réalisées entre 1990 et 1995

Les auteurs ont étudié de 1990 à 1995 des maladies virales du cheval au Pantanal, Brésil, et rapportent pour la première fois la présence de maladies virales respiratoires. La séropositivité pour l'adénovirus équin était de 42 p. 100 et concernait principalement les animaux âgés de moins de 3 ans (61,9 p. 100). Vis-à-vis de l'herpèsvirus équin de type 1 (EHV-1), elle était de 36 p. 100 (parmi les animaux séropositifs, 50 p. 100 étaient des poulains et 22,2 p. 100 des juments). La séropositivité observée pour EHV-1/respiratoire était de 58 p. 100. Parmi les rhinovirus équins, seul le rhinovirus équin de type 1 (ERV-1) a été étudié lors de l'enquête. La séropositivité pour ERV-1 était de 18 p. 100. Les poulains âgés de 1 à deux ans (22,2 p. 100) ont présenté un titre de 1/5. Des titres de 1/10 à 1/20 n'ont été observés que chez des animaux âgés de plus de cinq ans. Les réactions positives vis-à-vis du virus influenza A/Equine/2/Miami était de 30 p. 100. Les poulains représentaient 40 p. 100 et les juments 28,6 p. 100 de tous les animaux séropositifs. La séropositivité pour l'influenza virus A/Equine/2/Fontainebleau était de 42 p. 100. Les poulains et les juments totalisaient 86 p. 100 (43 p. 100 dans chaque groupe) des animaux séropositifs. Dans l'étude concernant l'anémie infectieuse du cheval, la prévalence observée était de 24,8 p. 100. La séropositivité était de 14,3 p. 100 chez les mâles et de 10,6 p. 100 chez les femelles. Dans l'enquête sur les arboviroses, des anticorps neutralisants ont été observés pour les virus de l'encéphalite équine de l'est (6,7 p. 100), de l'encéphalite équine de l'ouest (1,2 p. 100), le flavivirus Ilheus (26,6 p. 100), et les bunyavirus de Maguari (28,2 p. 100) et de Tacaiuma (15,7 p. 100). Aucun cas d'artérite virale équine n'a été détecté dans la région. Au Pantanal, à l'exception des arboviroses, tous les virus équins sont apparemment contractés quand de jeunes chevaux sont mis en contact avec des chevaux plus âgés, ou suite aux pratiques d'élevage locales.

Mots-clés : Equidae - Cheval - Virose - Anémie infectieuse du cheval - Maladie respiratoire - Encéphalomyélite équine - Transmission des maladies - Pantanal - Brésil.

Resumen

Silva R.A.M.S., Dávila A.M.R., Iversson L.B., Abreu U.G.P. Enfermedades virales equinas en Pantanal, Brasil. Estudios desarrollados de 1990 a 1995

Los autores estudian las enfermedades virales equinas en Pantanal, Brasil, de 1990 a 1995 y reportan por primera vez la incidencia de enfermedades respiratorias virales en caballos en Pantanal. La seropositividad para el adenovirus equino fue de 42%, principalmente entre los animales de menos de 3 años de edad (61.9%). Para herpesvirus equino 1 (EHV-1) fue de 36% (50 y 22.2% de seropositividad en potrancos y yeguas respectivamente). La seropositividad observada para EHV-1/respiratorio fue de 58%. Entre los rinovirus equinos, en este trabajo solo rinovirus equino 1 (ERV-1) fue estudiado. La seropositividad para ERV-1 fue de 18%. Potros de 1 a 2 años (22.2%) presentaron títulos de 1/5. Títulos de 1/10 y 1/20 fueron observados únicamente en animales de más de 5 años de edad. La seropositividad para influenza A/Equina/2/Miami fue de 30%. Los potrancos representaron 40% y las yeguas 28.6% de todos los animales seropositivos. La seropositividad para influenza A/Equina/2/Fontainebleau fue de 42%. Potrancos y yeguas representaron 86% (43% en cada grupo) de todos los animales seropositivos. En el estudio de anemia infecciosa equina, se observó una prevalencia de 24.8%. La seropositividad entre machos fue de 14.3% y entre hembras fue de 10.6%. En la encuesta de los arbovirus, se observaron anticuerpos neutralizantes contra virus de la encefalomyelitis equina del este (6.7%), encefalomyelitis equina del oeste (1.2%), flavivirus Ilheus (26.6%), Bunyavirus Maguari (28.2%) y Tacaiuma (15.7%). La arteritis viral equina no se observó en la región. En Pantanal, con excepción de las arbovirosis, aparentemente todas las virosis equinas se adquieren cuando jóvenes caballos se mezclan con viejos o a través de prácticas de manejo locales.

Palabras clave: Equidae - Caballo - Virosis - Anemia infecciosa equina - Enfermedad respiratoria - Encefalomyelitis equina - Transmisión de enfermedades - Pantanal - Brasil.