Equine Piroplasmosis and the 2010 World Equestrian Games

Veterinary Services
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The consultations with these experts enabled Veterinary Services to provide background and the latest scientific information on equine piroplasmosis and the 2010 World Equestrian Games. Veterinary Services sincerely appreciates the time, expertise, and significant contributions provided by these individuals.

Introduction

In the fall of 2010, the United States will host the World Equestrian Games (WEG) at the Kentucky Horse Park in Lexington, Kentucky. Because horses that are positive to equine piroplasmosis (EP) will be able to participate in all disciplines including endurance, we expect an increased interest in the disease. We have prepared this document to answer questions about EP and the measures the United States will take to allow EP-positive horses to participate in the WEG. If you have additional questions, we have provided references and contact information for obtaining information below. Finally, we expect to update this document as additional information becomes available before the WEG.

What is equine piroplasmosis (EP)?

EP is a tick-borne disease caused by two parasites, *Babesia caballi* and *B. equi*. Certain ticks are biological vectors in which the parasite amplifies and then is transmitted to horses under certain conditions. If horses become affected, fever, anemia, jaundice, hemoglobinuria, central nervous system disturbances, and sometimes death may result. In the acute phase, some infected horses are less severely affected and may show little or no symptoms with no decrease in performance. Those that survive infection in the acute phase may carry the parasites for prolonged periods during which they are potential sources of infection to other horses via tick-borne transmission or mechanical transfer by biting ticks, needles, or surgical instruments.

What ticks spread EP?

Dermacentor nitens, the tropical horse tick, is currently the only known natural vector of EP in the United States. *B. caballi* and *B. equi* have been shown to be experimentally transmitted by three additional U.S. tick species, *D. albipictus*, the winter tick; *D. variabilis*, the American dog tick; and *Boophilus microplus,* the southern or tropical cattle tick. For more information about the ticks that may spread EP, please see appendix 1.

What countries are affected?

EP occurs in South and Central America, the Caribbean (including Puerto Rico), Africa, the Middle East, and Eastern and Southern Europe. The United States, Canada, Australia, Japan, England, Iceland, and Ireland are not considered to be endemic areas.

Has the United States been affected before?

The United States eradicated EP from south Florida in 1988. It took more than 25 years and $12 million to eradicate EP from south Florida. In 1960, many backyard horses in south Florida sickened with a progressive anemia, jaundice, and fever. Twenty percent of the affected horses died. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS), and Florida investigated. The tropical horse tick was the apparent vector because when horses sickened, tropical horse ticks were found on the premises.

USDA's Agricultural Research Service (ARS) studied the tropical horse ticks collected during the investigation in south Florida. In Beltsville, Maryland, scientists put the ticks on unaffected horses, and the ticks spread EP of the *B. caballi* type. ARS characterized *B. caballi* by observing the parasites reproduction. Moreover, ARS observed the process of anemia through time-lapse photography; as *B. caballi* penetrated the horse's red blood cell, *B. caballi* disrupted red blood cells, usually fracturing them. ARS also determined that the incubation period was 14 to 18 days.

In fiscal year 1962, a State-Federal EP control program was initiated in south Florida. The State quarantined the affected animals. Infected and exposed animals were sprayed every 3 weeks, and ears and false nostrils were treated. To eliminate the carrier state in *B. caballi*-affected animals, the horses were treated with drugs to help eliminate the parasites.

In addition, movement controls were employed to prevent the spread of disease. Animals from Florida entering racetracks in south Florida were inspected and sprayed for ticks. When horses were absent from the racetracks, the premises were sprayed for ticks annually in March or April.

What are the risks of the United States becoming affected?

The greatest risk for introduction of this disease is through international movement of infected horses into the United States. Many disease free countries, including the United States, have the climate suitable for a foreign tick vector or have ticks that could act as vectors. The U.S. horse population is presumed to be entirely susceptible to infection. Certain tick vectors within the United States have been shown experimentally to transmit *B. equi* and *B. caballi*.

Many other factors influence whether infection and clinical disease caused by these parasites could become endemic in the United States. Genetics of the horse, the virulence of the infecting strain, the tick burden, the tick infection rate, and the challenge dose are factors influencing disease expression and possibly transmission. However, knowledge of these factors is lacking.

Another risk factor is the increased infestations of the southern cattle tick within and outside our quarantine zone in Texas. The cattle fever tick (*Boophilus annulatus*) and the southern cattle tick (*Boophilus microplus*) are vectors of the causal agent of piroplasmosis in cattle. In cattle, the causative agents are *B. bigeminia* and *B. bovis*, and the disease is usually referred to as bovine babesiosis, rather than piroplasmosis.

Bovine babesiosis, or piroplasmosis, and the *Boophilus* ticks were officially eradicated from the continental United States in 1943, except for a permanent quarantine zone that was established in 1983 along the Rio Grande river in south Texas. Although the southern cattle tick feeds mainly on cattle, it is often found on horses. With the increased infestations of the southern cattle tick within the quarantine zone in Texas and the potential movement of free ranging cattle, horses, deer, and exotics across the Texas border, the risk of its introduction and reestablishment within the United States increases. *Boophilus microplus* is an experimental vector of EP in the United States.

What are we doing to prevent the introduction of EP?

We have safeguards in place to prevent importing affected horses.
The United States has safeguards in place to prevent the entry and spread of EP from imported horses. These safeguards include health certification, permits, testing at the port of entry, and quarantine at animal import centers. USDA recently developed the competitive enzyme-linked immunosorbent assay (cELISA) to improve detection of piroplasmosis-affected animals. Currently, to import horses into the United States, USDA requires that horses be tested for piroplasmosis with the cELISA. If testing for EP during quarantine finds anti-*B. caballi*, anti-*B. equi*, or both antibodies in horses, horses will not be allowed entry into the United States.

We have a National Tick Surveillance Program.
Within the USDA's National Tick Surveillance Program, we use geospatial methods to determine the U.S. distribution of ticks and other arthropods affecting humans and livestock. Because ticks spread certain diseases, knowledge of the distribution of ticks and tick-borne diseases is important in identifying areas of risk and developing targeted surveillance and control strategies.

APHIS established a database using records from the Smithsonian's U.S. National Tick Collection and the APHIS National Veterinary Services Laboratories tick identification program to determine the distribution of 34 harmful ticks. Of these 34 ticks, 16 are associated with disease transmission in horses. In addition to containing updated information on tick distributions, the database includes information on environmental factors (climate, vegetation, soil, elevation, and land use) that may indicate current and future tick distributions**.**

Spatial analysis tools are being used to study the ecological factors that influence the distribution in the United States of the American dog tick, *D. variabilis*, one of three U.S. tick species that has been shown experimentally to transmit *B. caballi* and *B. equi*. Moreover, we are investigating the use of satellite imagery to generate models to predict areas where suitable habitat might exist for *D. nitens*, the tropical horse tick, the only known natural vector of EP in the United States. In addition, we are developing an interactive Web site to update and disseminate information on the distribution of ticks. The Web site will include distribution maps, life cycle information, host associations, and methods of collecting and preserving ticks. (When this Web site is developed, we will update this document to include the Web site address.)

What are EP-related issues for hosting equine events?

The United States has previously granted waivers to horses found positive for EP to enter the United States for competitions such as the 1984 and 1996Summer Olympic Games. However, for previous events in the United States, risk analyses examined issues associated with the cross-country or marathon phase of 3-day events and excluded EP-positive horses from participating in events with prolonged exposure to vegetation and opportunity for tick attachment. (See appendix 2 for previous approaches used in both the United States and Australia to manage EP at equine events.)

The United States has won the bid to hold the 2010 World Equestrian Games (WEG) in Kentucky, making 2010 the first time the WEG will be held in the United States or outside of Europe. The resulting challenge will be to monitor the positive horses to ensure EP is not transmitted to negative horses. The USDA's approving the participation of horses positive for piroplasmosis in field events, after evaluating the risk, contributed to the event being awarded to the United States.

What did the risk evaluation of EP-positive horses participating in the WEG in 2010 show?

USDA assembled a group of experts in piroplasmosis, tick and wildlife biology, risk analysis, international equestrian competitions, and U.S. import requirements to carefully assess the risk of ticks infected with piroplasmosis transmitting the disease to susceptible horses at the 2010 WEG. The group's findings are presented in the "Risk Assessment and Recommendations for Participation of Piroplasmosis-Positive Horses in Field Equestrian Events for the 2010 World Equestrian Games at the Kentucky Horse Park." This document is available by request from the APHIS National Center for Import and Export by calling (301) 734-8364.

Tick survey shows low prevalence of American dog ticks.
The group examined the occurrence of ticks in Kentucky and the results of a 2002 survey of the Kentucky Horse Park conducted in the summer months. The survey indicated a low prevalence of American dog ticks, which are competent vectors, or those capable of transmitting EP, leading the Kentucky State Veterinarian, the American Horse Council, the American Association of Equine Practitioners, and the Kentucky Thoroughbred Association to support the participation of piropositive horses in the field events under adequate tick surveillance and monitoring protocols. Overall, the group agreed that the study indicated low tick prevalence but recommended

additional surveys during the fall in the years before the WEG, which will occur in the fall of 2010.

Site visit finds highly managed grounds.
In addition, the group conducted a site visit to the Kentucky Horse Park, a large park area with grounds that have been highly managed for decades, making it a unique venue for such an event. The short grass in the fields and pastures is not characteristic for most areas where horse events would typically occur, thus offering an advantage for tick control. The adjacent farms and pastures follow the same type of landscaping, making the vegetation management for tick mitigation strategies much easier to fulfill.

Effective mitigations will lower the risk.
The conclusion of the risk analysis was that the possibility of one or more susceptible horses becoming positive for piroplasmosis resulting from the 2010 WEG could be as low as 0.00014 percent (1 in 1 million horses) or as high as 0.0088 percent (9 in 100,000 horses) but is most likely 0.00065 percent (7 in 1 million horses). This broad range is attributable to many variables and tells us that the more effective the tick mitigations and controls, the lower the risk of susceptible horses becoming infected.

To effectively address the potential risk factors for tick incursions onto the grounds and competition courses of the Kentucky Horse Park, the group recommended requirements for tick control, including general long-term strategies, preparation of the venue for the games, tick control for horses, and security. Tick experts will work with the Kentucky Horse Park to develop a site plan for the field events. Tick surveys will then be conducted along the proposed event courses to determine the need for additional control measures. These strategies were recommended to minimize the risk of introduction of piroplasmosis infection into the local tick population of Kentucky and decrease the risk of infection from EP-infected horses to susceptible horses.

Based on the data and information presented in the risk assessment and recommendations document, the USDA recommended that EP-positive horses be allowed to participate in the field events of the 2010 WEG if tick control measures are fully implemented.

Currently, the organizations involved in the planning and execution of the WEG in Kentucky are cooperating to form an action and tick control plan. The World Games 2010 Foundation, USDA, State of Kentucky, and Fédération Equestre Internationale are working to establish the private quarantine facilities and develop a tick control program that will promote the competition at the games and prevent the introduction of piroplasmosis into the United States. In addition, tick surveys are ongoing on the grounds of the Kentucky Horse Park and surrounding areas. These yearly surveys comprise various methods of tick collection strategies, including drag sampling, mammal trapping, and $C0_2$ trapping. Mitigation measures will be put in place each year and evaluated by the tick surveys the following year.

Where can I find out more about the WEG?

- Request a copy of the following document from the APHIS National Center for Import and Export by calling (301) 734-8364:

  Risk Assessment and Recommendations for Participation of Piroplasmosis-Positive Horses in Field Equestrian Events for the 2010 World Equestrian Games at the Kentucky Horse Park, October 2005.

- Visit the Fédération Equestre Internationale's Web site for the WEG at www.feigames2010.org/.

Where can I find out more about EP?

- The following references are recommended:

Battsetseg B, Xuan X, Ikadai H, Bautista JL, Byambaa B, Boldbaatar D, Battur B, Battsetseg G, Batsukh Z, Igarashi I, Nagasawa H, Mikami T, Fujisaki K. 2001. Detection of *Babesia caballi* and *Babesia equi* in *Dermacentor nuttalli* adult ticks. Int J Parasitol. 3 1:384-6.

Battsetseg B, Lucero S., Xuan X, Claveria FG, Inoue N, Alhassan A, Kanno T, Igarashi I, Nagasawa H, Mikami T, Fujisaki K. 2002. Detection of natural infection of *Boophilus microplus* with *Babesia equi* and *Babesia caballi* in Brazilian horses using nested polymerase chain reaction. Vet Parasitol. 107: 351-357.

Brooks *et al.* 1996. Piroplasmosis of horses: What is known concerning transmission and disease risk. Georgia Department of Agriculture and USDA.

Bryant JE, Anderson JB, Willers KH. 1969. Control of equine piroplasmosis in Florida. J AmVet Med Assoc. 154:1034-6.

DeWaal DT. 1992. Equine piroplasmosis: a review. Br Vet J. 148:6-14.

Enigk K. 1943. Die Ubertrager der Pferdepiroplasmose, ihre Verbreitung und Biologie. Arch. Wiss. Prakt. Tierheilk 78:209-240.

Enigk K. 1944. Weitere Untersuchungen zur Ubertragerfrage der Pferdepiroplasmose. Arch. Wiss. Prakt. Tierheilk 79:58-60.

Friedhoff KT, Tenter AM, Muller I. 1990. Haemoparasites of equines: impact on international trade of horses. Revue Scientifque et Technique OIE 9: 1187-1194.

George JE, Davey RB, Pound JM. 2002. Introduced ticks and tick-borne diseases: the threat and approaches to eradication. Vet Clin Food Anim 18: 401-416.

Guimaraes AM, Lima JD, Ribeiro MFB. 1998. Sprogony and experimental transmission of *Babesia equi* by *Boophilus microplus*. Parasitol Res. 84:323-327.

Heuchert CMS Giulli V, Athaide DF, Bose R, Friedhoff KT. 1999. Seroepidemiologic studies on *Babesia equi* and *Babesia caballi* infections in Brazil. Vet Parasitol 85: 1-11.

Kappmeyer LS, Perryman LE, Hines SA, Baszler TV, Katz JB, Hennager SG, and Knowles DP 1999. Detection of equine antibodies to Babesia caballi by recombinant B. caballi rhoptry-associated protein 1 in competitive-inhibition enzyme-linked immunosorbent assay. Journal of Clinical Microbiology. 37:2285-2290.

Knowles DP, Perryman LE, Kappmeyer LS, and Hennager SG. 1991. Detection of equine antibody to Babesia equi merozoite proteins by a monoclonal antibody based competitive inhibition ELISA. Journal of Clinical Microbiology, 29:2056-2058.

Knowles DP. 1996. Equine Babesiosis (Piroplasmosis): A problem in the international movement of horses. Guest Editorial. Br. vet. J. 152:123-126.

Knowles RC, Mathis RM, Bryant JE, Willers KH. 1966. Equine piroplasmosis. J Am Vet Med Assoc. 148(4):407-10.

Murrell A, Barker SC. 2003. Synonymy of *Boophilus* Curtice, 1891 with *Rhipicephalus* Koch, 1844 (Acari: Ixodidae). Syst Parasitol 56: 169-172.

Neitz WO. 1956. Classification, Transmission, and Biology of Piroplasms of Domestic Animals. Ann. NY Acad Sci. 64: 56-111.

Potgieter FT, de Waal DT, Posnett ES. 1992. Transmission and diagnosis of equine babesiosis in South Africa. Mem Inst Oswaldo Cruz. 87 Suppl 3:139-42.

Roby TO, Anthony DW. 1963. Transmission of equine piroplasmosis by *Dermacentor nitens* Neumann. J Am Vet Med Assoc. 142: 768-769.

Rodriguez Bautista JL, Ikadai H, You M, Battsetseg B, Igarashi I, Nagasawa H, Fujisaki K. 2001. Molecular evidence of *Babesia caballi* (Nuttall and Strickland, 1910) parasite transmission from experimentally-infected SCID mice to the ixodid tick, *Haemaphysalis longicornis* (Neuman, 1901). Vet Parasitol. 102:185-91.

Stiller D, Coan ME. 1995. Recent developments in elucidating tick vector relationships for anaplasmosis and equine piroplasmosis. Vet Parasitol. 57:97-108.

Stiller D, Goff WL, Johnson LW, Knowles DP. 2002. *Dermacentor variabilis* and *Boophilus microplus* (Acari: Ixodidae): experimental vectors of *Babesia equi* to equids. J Med Entomol. 39:667-70.

Strickland RK, Gerrish RR. 1964. Distribution of the Tropical Horse Tick in the United States, with Notes on associated cases of Equine Piroplasmosis. J Am Vet Med Assoc. 144:875-8.

Taylor WM, Bryant JE, Anderson JB, Willers KH. 1969. Equine piroplasmosis in the United States--a review. J Am Vet Med Assoc. 155:915-9.

Thompson PH. 1969. Ticks as vectors of equine piroplasmosis. J Am Vet Med Assoc. 155(2):454-7.

USDA/APHIS: Ticks of Veterinary Importance. Animal and Plant Health Inspection Service, Agriculture Handbook No. 485. US Government Printing Office, Washington, DC, May 1976.

Walker JB, Keirans JE, Horak IG. 2000. Accounts of individual species occurring outside the Afrotropical region. pp. 523-583. In The Genus *Rhipicephalus* (Acari, Ixodidae): A Guide to the Brown ticks of the World. Cambridge University Press, New York, New York.

- Contact Dr. Tim Cordes, Senior Staff Veterinarian and National Manager for Equine Programs, National Center for Animal Health Programs, VS, APHIS, USDA, by calling (301) 734-3279.

Appendix 1: Tick Vectors

Table 1 lists the tick vectors of EP and their distribution by country.

Table 1. Tick Vectors of Equine Piroplasmosis

Tick Vector	Country	No. of Hosts	Pathogen	Transmission
Boophilus microplus	Caribbean, Central, and South America, Africa, Australia, Asia	1	*B. equi*	Transstadial
D. albipictus (experimental)	United States	1	*B. caballi*	Transovarial
D. marginatus	Russia, Germany	3	*B. caballi* *B. equi* (transstadial only)	Transovarial Transstadial
D. nitens	North, Central, and South America	1	*B. caballi*	Transovarial
D. nuttalli	Mongolia, China	3	*B. caballi*, *B. equi*	Transstadial Transovarial
D. pictus	Russia	3	*B. caballi*, *B. equi*	Transstadial
D. silvarum	Russia, Ukraine	3	*B. caballi*	Transstadial Transovarial
D. variabilis (experimental)	United States	3	*B. caballi* *B. equi* (intrastadial only)	Transovarial
D. reticulates	Europe	3	*B. caballi*	Transovarial
Hyalomma anatolicum	Greece	3	*B. caballi* *B. equi* (transovarial only)	Transstadial
H. dromedarii	Africa	3	*B. caballi* *B. equi* (transstadial only)	Transstadial Transovarial
H. longicornis (experimental)	Asia, Australia	3	*B. caballi* (experimental)	Transovarial Transstadial
H. marginatum	Greece	2 or 3	*B. caballi* *B. equi* (transstadial only)	Transstadial Transovarial
H. truncatum	Africa, Asia, Saudi Arabia, Yemen	3	*B. caballi*	Transovarial
H. uralense	Asia	1 or 2	*B. equi*	Transstadial
H. volgense	Ukraine	1 or 2	*B. caballi*	Transovarial
Rhipicephalus bursa	Bulgaria	2	*B. caballi*, *B. equi*	Transstadial
R. evertsi evertsi	Africa	2	*B. caballi*, *B. equi*	Transstadial
R. evertsi mimeticus	Africa	2	*B. equi*	Transstadial
R. pulchellus	Africa	3	*B. equi*	Transstadial
R. sanguineus or turanicus	Greece, Asia, Africa	3	*B. caballi* *B. equi* (transstadial only)	Transstadial Transovarial

Sources: Neitz, 1956; deWaal, 1992; Potgieter et al., 1992; Walker et al., 2000; Rodriguez et al., 2001; Battsetseg et al., 2001; and Jongejan and Uilenburg, 2004.

Appendix 2: Previous Approaches to Managing EP at Equine Events

Various approaches have been taken to prevent the spread of EP at major world equestrian competitions. At both the 2000 Sydney Olympic Games and 1996 Atlanta Olympic Games, seropositive horses participated with no apparent transmission of disease. However, different approaches were employed at these two events for treating the core areas. In addition, at the Sydney Olympic Games, horses were able to participate in a wider range of events under stringent risk mitigation measures.

At the 1996 Atlanta Olympics at the Georgia International Horse Park, a primary tick control method was to treat the core area with a pesticide on four occasions. The core area contained the competition area for dressage and jumping, stable areas, training arenas, and veterinary and farrier facilities. Moreover, stable areas were treated immediately before the horses arrived on July 1, 1996. The piroplasmosis restricted area, the warmup and holding areas, and the competition arena received additional treatments in late July.

However, at the 2000 Sydney Olympic Games, the Australian Quarantine and Inspection Service (AQIS) considered the extensive use of pesticides on sites where seropositive horses were located unnecessary because other measures are as effective. AQIS recommended vegetation management for pastured exercise areas. A computer simulation demonstrated that vegetation management was as effective in reducing tick populations as several applications of a pesticide.

At the Atlanta Olympic Games, seropositive horses were permitted to compete in the dressage and show jumping. To reduce the probability of exposure to the potential tick vector *D. variabilis* outside the core area of the Georgia International Horse Park, horses were not permitted to compete in 3-day eventing. U.S. authorities had estimated that 1,302-3,302 ticks per hectare would be present at the Olympic site in Atlanta during the competition.

In contrast, for the Sydney 2000 Olympics, AQIS determined that risk mitigations, such as thorough daily inspection of all horses and weekly pesticide treatments of seropositive horses, would minimize the risk of tick attachments, without the need to prohibit the entry of horses for 3-day eventing. Further, tick surveys found no tick species implicated as vectors of EP on the site. Consequently, AQIS did not propose to restrict the use of seropositive horses for the Sydney 2000 Olympics or for other international show jumping, dressage, and eventing competitions or races in Australia. Following are among the risk management strategies employed in the 2000 Sydney Olympic Games to ensure the risk of the establishment of EP in Australia was negligible:

- Tick surveys were conducted for quarantine and competition sites.
- AQIS approved postarrival quarantine and competition sites to hold seropositive horses.
- Interior walls of stables housing seropositive horses had to be smooth without crevices.

- The number of seropositive horses imported were restricted only if there were inadequate facilities and resources for their management.
- All horses, wild equidae, and perissodactyls for export to Australia were treated with a pesticide effective against ticks before export.
- Horses, saddlery, and tack were inspected for ticks before export. For animals, a systematic approach was taken with examination of ears, false nostrils, underbody areas, perineum, mane, and tail.
- If unprocessed feed was imported, the introduction of exotic ticks by this means had to be prevented.
- On arrival in Australia, all horses were thoroughly inspected for ticks.
- Seropositive horses were clearly identified and supervised while in Australia.
- Seropositive horses remained on postarrival quarantine and competition sites. Movement between the sites was controlled.
- Postarrival quarantine was conducted in areas free of ticks; that is, stables.
- Seropositive horses were inspected daily for ticks and washed weekly with a pesticide.
- Seropositive horses were maintained separately from other horses in a clearly demarcated area, and access was restricted.
- Entry of dogs to postarrival quarantine and competition areas where seropositive horses were located was actively discouraged.
- Bedding for seropositive horses had to be rubber, wood shavings, or shredded paper. If straw was used for stable bedding for seronegative horses located on the same site as seropositive horses, it had to be from tick-free areas.
- Hay, chaff, and other feedstuffs not heat treated were from tick-free areas, if possible.
- Hard landscaping was used around the stable area of seropositive horses.
- Seropositive horses could compete in areas where ticks were present for a maximum of 7 days.
- Exercise areas were mowed and vegetation understory was controlled for postarrival quarantine and competition sites holding seropositive horses.
- Seropositive horses were exported as soon as possible or within 10 days of fulfilling the function for which they were imported.

Finally, during both events, instrument usage especially needles, syringes, and other skin penetrating instruments was controlled to reduce the risk of spreading EP through contaminated needles and instruments. In addition, needle exchanges and decontamination containers were provided. Needles, syringes, and scalpel blades used for seropositive horses remained in the stabling area until disposal.