Contagious Equine Metritis Within the United States: A Review of the 2008 Outbreak

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ABSTRACT

Contagious equine metritis (CEM) is a reportable foreign animal disease in the United States caused by the organism *Taylorella equigenitalis*. Import and export regulations regarding transport of horses into the United States from countries which either have a high prevalence of CEM or those that trade freely with countries having a high prevalence of CEM have failed to prevent the 2008 outbreak, which has not yet been traced to the original horse. It is important to recognize the clinical signs of acute CEM infections (endometritis, infertility, and abortion) to prevent further outbreak of disease. With early recognition, proper testing, and quarantine measures, the outbreaks and economic losses to the United States can be kept to a minimum. However, there are certain characteristics of the disease that are difficult to diagnose and control, such as the ability of the organism to infect an animal without creating clinical signs and the difficulty in culturing it. A review of the transmission, clinical signs, diagnostic methods, treatment, and prevention of CEM as well as a brief summary of the 2008 outbreak of CEM within the United States has been discussed in this article.

Keywords: Foreign animal disease; CEM; Contagious equine metritis; Endometritis; *Taylorella equigenitalis*

INTRODUCTION

In 1978, the U.S. multimillion dollar Thoroughbred industry was threatened by the appearance of a new venereal disease that could devastate the breeding industry, thereby affecting the racing industry. The disease that caused this problem was a highly contagious venereally transmitted bacterial disease, contagious equine metritis (CEM), caused by the *Taylorella equigenitalis* organism.

Despite import regulations on horses that are imported into the United States from countries which have a high prevalence of CEM, it was reintroduced into the U.S. equine population. The 2008 outbreak was likely because of poor farm sanitation procedures, inadequate testing protocol, and the difficulty in culturing the organism. Understanding the transmission of the organism and using current preventive measures may help prevent future outbreaks. Preventive measures include educating local veterinarians, improving import regulations, reinstating more routine testing procedures, and developing more sensitive and specific tests for identifying *T equigenitalis*. The objective of this review is to describe the CEM problem in the United States and the measures that need to be taken to solve it.

EPIDEMIOLOGY

*T equigenitalis* was first identified in 1977. Although mares from France are thought to have originally infected the equine population internationally, the devastating effects of *T equigenitalis* infections on the Thoroughbred industry were first seen in England when infected Thoroughbred mares were shipped from Ireland to breed with stallions in the Newmarket area of England.1-3 *T equigenitalis* immediately became a reportable disease in the United States and Canada. By the end of the 1977 breeding season in the Newmarket area, *T equigenitalis* was diagnosed in 29 Thoroughbred breeding farms, with 23 stallions and approximately 200 mares infected.1 This resulted in a decrease from 72% to 42% in the foaling rate, which in turn resulted in millions of dollars being lost in stud fees and foal sales.2

In 1978, just hours before a ban was placed on a shipment of horses from England, two French Thoroughbred stallions had been shipped into the United States. The Thoroughbreds had been tested on arrival to Kentucky and several times thereafter, one of them reportedly 11 times; all cultures were found to be negative.2 Despite the previous negative test results, on March 8, 1978, two mares which were bred by one of the French stallions tested positive for *T equigenitalis* infection.2 Efforts were quickly put in place to contain the outbreak through isolation of the horses, as well as culture examination of samples from all exposed horses.

In recent years, only a few cases have been reported in the United Kingdom, likely because of the voluntary
implementation of the United Kingdom’s Horserace Betting Levy Board’s Codes of Practice, which recommend endometrial swab testing for *T. equigenitalis* before and after breeding. France has not had any recent cases of CEM in Thoroughbreds, but *T. equigenitalis* remains endemic in other horse breeds.

There have been three or more outbreaks since the initial introduction of *T. equigenitalis* in the United States. In 1979, the organism was isolated in the Trakehner’s population in Missouri. The Missouri outbreak was speculated to be a strain of *T. equigenitalis* from Germany, and not Kentucky, because the strain was not resistant to streptomycin. Two biotypes have been identified, streptomycin-sensitive and streptomycin-resistant, which aid in the differentiation of infectious strains. In 2006, another outbreak occurred in the United States involving three Lipizzaner stallions. These stallions were imported to Wisconsin from Europe. The outbreak was quickly eradicated and no other horses were thought to have been infected with or exposed to *T. equigenitalis*.

On December 15, 2008, a Quarter Horse stallion standing in Kentucky, tested positive for *T. equigenitalis* when undergoing routine testing before the semen of the stallion was exported. The horse was bred in the United States, without any history of travel and having been bred naturally. Since then, of the 994 exposed horses, 23 stallions and five mares tested positive for CEM.

Molecular genotyping of the isolates of *T. equigenitalis* by pulsed-field gel electrophoresis demonstrated that each isolate was identical and unique to the current infection occurring in the United States. However, the source of the 2008 outbreak had not been identified. Although the 1978 outbreak affected the Thoroughbred breeding population, the current 2008 outbreak affected one Thoroughbred and others including American Hackney, Appaloosa, Arabian, Fjord, Fresian, Holsteiner, Lipizzaner, Quarter Horse, Paint, and Saddlebred horse breeds.

Of the 23 stallions confirmed positive, one was from Georgia, three from Illinois, three from Indiana, one from Iowa, four from Kentucky, one from Texas, and 10 from Wisconsin (Fig. 1). Every state other than Hawaii and Rhode Island have had exposed or suspected CEM-positive horses traced to them during this epidemiologic investigation. All four of the Kentucky stallions who tested positive for CEM (including the index stallion) were on the same Kentucky farm during the 2008 breeding season. The Texas stallion and the Indiana stallions were also on the Kentucky farm during the 2008 breeding season. Four of the 10 Wisconsin stallions were exposed to the CEM-positive stallions linked to the original Kentucky farm. One Wisconsin stallion was co-located with a Kentucky stallion in 2007 and another 2006, with one of the Indiana stallions which had spent time in Kentucky in 2008. The last six Wisconsin stallions, the Illinois stallions, the Iowa stallion, and the Georgia stallion were all linked to the first four Wisconsin stallions. The Iowa stallion was gelded before the 2008 breeding season, indicating that he had been infected earlier. Most of the stallions that were infected were only used for semen collection for artificial insemination. This would indicate that transmission was because of fomites or teaser mares rather than classical venereal transmission.

Of the five positive mares, two were from California, two from Illinois, and one was from Wisconsin. The Wisconsin mare was naturally bred by a positive Wisconsin stallion (Fig. 1). The Illinois mare was artificially inseminated with semen from one of the positive Indiana stallions. Both Kentucky & Wisconsin associated

![Figure 1. Epidemiology of the *T. equigenitalis* outbreak in the United States in 2008. Arrows indicate direction of transmission. Dates listed indicate the date horses were tested positive, not the date they were infected. Kentucky associated (Kentucky, Indiana, Texas): horses housed on same farm with all four *T. equigenitalis*-positive Kentucky stallions. Wisconsin associated (Wisconsin, Iowa, Georgia, Illinois): horses housed on a farm with one of the first four *T. equigenitalis*-positive Wisconsin stallions. AI: horses had no history of natural breeding.](image-url)
prove that *T. equigenitalis* is not endemic in the United States.

**TRANSMISSION**

*T. equigenitalis* is a Gram-negative nonmotile, bacillus or coccobacillus belonging to the family Pasteurellaceae, which is often pleomorphic and dumb-bell-shaped. *T. equigenitalis* can be transmitted during natural mating or artificial insemination. The organism is tropic to the clitoral fossa and sinus in mares. Occasionally, the organism will persist in the endometrium. In stallions, *T. equigenitalis* is tropic to the urethral fossa, urethral sinus, urethral and penile sheath, and has also been isolated from the epididymis and seminal vesicles. Stallions have fewer organisms on their genitals and do not form any immune response. *T. equigenitalis* is also transmitted indirectly through fomites (e.g., breeding phantom, artificial vagina) if these are not properly disinfected after use between stallions. Vertical transmission can occur, resulting in infection of foals born to positive mares. This was demonstrated by isolation of *T. equigenitalis* from placenta and the genital tract of foals.

**CLINICAL SIGNS**

Detecting infected mares and stallions is a significant problem as most appear clinically normal. Clinical signs are restricted to the reproductive tract and no systemic illness occurs. Acute clinical signs of *T. equigenitalis* develop in 30% to 40% of infected mares whereas they never develop in stallions. The acute symptoms of a *T. equigenitalis* include copious grayish white vaginal discharge, endometrial inflammation (what the disease was named for—contagious equine metritis), infertility, and abortion. Lesions (edema and hyperemia) are most severe in the endometrium, but salpingitis, cervicitis, and vaginitis also occur. The endometritis is characterized by an infiltration of neutrophils into the epithelium and lamina propria with destruction of the endometrial epithelial cells. *T. equigenitalis* adheres to the cilia of the epithelial cells and proliferates on the endometrium. Different strains of *T. equigenitalis* differ markedly in their ability to replicate in the endometrial cells. The organism’s ability to replicate in endometrial cells is related to the severity of clinical signs observed with infection. Mares will clear the endometritis, leaving no clinical signs of disease, and remain infected (carriers) with the organism lingering in the clitoral region or other tropic areas. Mares that do completely clear the organism may become reinfected as early as 2 weeks after recovering from their previous infection. Some immunity does develop as subsequent infections tend to display less severe acute clinical signs. Fertility of mares that have cleared the infection is not impaired permanently and returns to normal by the following breeding season.

**DIAGNOSTIC METHODS**

Isolation through culture is the gold standard for the detection of *T. equigenitalis*. Research has been done to determine the best method of culturing *T. equigenitalis* to yield the fewest false negative results. *T. equigenitalis* is difficult to culture because of specific and long incubation requirements that can lead to overgrowth of other bacteria. It can also be difficult to differentiate between *T. equigenitalis* and *Tasiniogena equi* (a phenotypically similar organism isolated from donkeys). To increase the sensitivity of *T. equigenitalis*, cultures can only be sent to special certified laboratories (Table 1). These laboratories undergo quality control testing before they are permitted to officially test for *T. equigenitalis* and issue certificates.

Tryptose chocolate blood agar under microaerophilic conditions is the most useful in distinguishing *T. equigenitalis* colonies, which are smooth, round, raised areas, 0.3 to 0.5 mm in size, and watery to opaque and yellowish to grey in color. It may be 3 to 14 days before the *T. equigenitalis* organism is visible on the growth medium. Selective inhibitors (amphotericin B, clindamycin, and trimethoprim) are additions required to the growth media to inhibit bacterial and fungal overgrowth and allow for both streptomycin sensitive and resistant strains of *T. equigenitalis* to grow.

The success of 10% chocolated horse blood agar may be because of the organism’s apparent necessity for growth factor X, which is for porphyrins or hemin. However, Taylor et al (1977) determined that *Taylorella sp.* was not dependent on factors V, X, or XV for growth. Factors V and X are substances that are released from erythrocytes during heating, as in the production of chocolated horse blood agar. The effectiveness by which *Taylorella sp.* grows on chocolated horse blood agar is likely because of the discovery that factor X did stimulate growth, but was not necessary for the growth of the organism. The actual factors that the organism does require for growth are unknown.

A major setback with using traditional culture methods for testing is that the organism may die before reaching the laboratory, resulting in false negative results. False negative results may also result from low numbers of bacteria present within the genitalia or after the overgrowth of other bacteria during transport or culture or inadequate nutrients within the culture media. To increase the number of positive culture results, the organism must be shipped at 4°C in Amies transport media with charcoal, and must arrive at the testing facility within 48 hours, or the samples are considered nondiagnostic. Amies medium with charcoal keeps *T. equigenitalis* viable much longer than other
transport media (e.g., Stuarts or Amies without charcoal) when stored at room temperature.\textsuperscript{22} The activated charcoal absorbs inhibitory by-products of bacterial metabolism that are produced by fast growing bacteria.\textsuperscript{23} Refrigeration is necessary because \textit{T. equigenitalis} numbers decline on swabs much quicker in hotter temperatures.\textsuperscript{12} The organism has been cultured from samples in Amies transport media after being stored for 18 years at \(20\)\(^\circ\)C.\textsuperscript{12}

Serological testing is only useful in acutely infected mares because stallions or mares that are carriers do not have antibodies against \textit{T. equigenitalis} and will not test positive on a serological test used for pre-export or import screening.\textsuperscript{24} Antibodies are detected around 7 days after exposure, and reach maximum titers at around 3 weeks. The antibody titers usually decline between 6 and 10 weeks after initial infection.\textsuperscript{5} Complement fixation is an approved serological test for identification of mares that test positive for \textit{T. equigenitalis} after negative bacterial cultures were collected.\textsuperscript{14} Serum for complement fixation is best collected at day 15 after potential \textit{T. equigenitalis} infection (breeding).

A polymerase chain reaction (PCR) for the detection of \textit{T. equigenitalis} was originally developed by Bleumink–Pluym in 1993.\textsuperscript{25} The original PCR has been modified to differentiate between \textit{T. equigenitalis} (CEM causative agent) and the similar organism \textit{T. asinigenitalis}.\textsuperscript{14,26} Although \textit{T. asinigenitalis} is phenotypically similar, its DNA is only 26\% homologous to \textit{T. equigenitalis}; whereas all of the \textit{T. equigenitalis} strains share 99.5\% or greater homology.\textsuperscript{12,27} PCR can be performed directly on swabs or taken from a culture plate after incubation to get a more sensitive result.\textsuperscript{11} PCR is generally considered to be more sensitive than culture, and results can be available within hours instead of days.\textsuperscript{26,28} Japan and Slovenia are using real-time PCR to eradicate \textit{T. equigenitalis} from their equine populations.\textsuperscript{29,30}

### Table 1

United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) approved \textit{Taylorella equigenitalis} laboratories as of January 2009

<table>
<thead>
<tr>
<th>Laboratory Name</th>
<th>City</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microbiology Laboratory, William R. Pritchard Veterinary Medical Teaching Hospital, University of California</td>
<td>Davis</td>
<td>CA</td>
</tr>
<tr>
<td>Colorado Veterinary Diagnostic Laboratory, Colorado State University</td>
<td>Fort Collins</td>
<td>CO</td>
</tr>
<tr>
<td>Florida Department of Agriculture and Consumer Services, Animal Disease Diagnostic Laboratory</td>
<td>Kissimmee</td>
<td>FL</td>
</tr>
<tr>
<td>University of Kentucky, Livestock Disease Diagnostic Center</td>
<td>Lexington</td>
<td>KY</td>
</tr>
<tr>
<td>New England Horse Laboratories</td>
<td>Worcester</td>
<td>MA</td>
</tr>
<tr>
<td>Maryland Department of Agriculture, Animal Health Laboratory</td>
<td>College Park</td>
<td>MD</td>
</tr>
<tr>
<td>Veterinary Medical Diagnostic Laboratory</td>
<td>Columbia</td>
<td>MO</td>
</tr>
<tr>
<td>New Jersey Department of Agriculture Division of Animal Health</td>
<td>Trenton</td>
<td>NJ</td>
</tr>
<tr>
<td>Cornell University Animal Health Diagnostic Laboratory</td>
<td>Ithaca</td>
<td>NY</td>
</tr>
<tr>
<td>Ohio Department of Agriculture, Animal Disease Diagnostic Laboratory</td>
<td>Reynoldsburg</td>
<td>OH</td>
</tr>
<tr>
<td>Oklahoma Animal Disease Diagnostic Laboratory, College of Veterinary</td>
<td>Stillwater</td>
<td>OK</td>
</tr>
<tr>
<td>Medicine, Oklahoma State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texas Veterinary Medical Diagnostic Laboratory—College Station</td>
<td>College Station</td>
<td>TX</td>
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<tr>
<td>Texas Veterinary Medical Diagnostic Laboratory—Amarillo</td>
<td>Amarillo</td>
<td>TX</td>
</tr>
<tr>
<td>VDACS Harrisonburg Regional Animal Health Laboratory</td>
<td>Harrisonburg</td>
<td>VA</td>
</tr>
<tr>
<td>Warrenton Regional Health Laboratory</td>
<td>Warrenton</td>
<td>VA</td>
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ceruminolytic agent into the clitoral sinuses. After infusing the agent, it is flushed from the sinuses with warm saline.\textsuperscript{4,19} For five consecutive days after the initial cleaning, the external genitalia and vaginal vestibules are thoroughly cleaned with 4% chlorhexidine solution. Then, these areas are packed with 0.2% nitrofurazone ointment, or another ointment effective against \textit{T. equigenitalis} (e.g., silver sulfadiazine).\textsuperscript{5,19,23} More than one treatment course may be necessary to completely eliminate the organism.\textsuperscript{5}

In stallions, one 5-day treatment course is usually adequate to eliminate the organism from their reproductive tract.\textsuperscript{5} When treating a stallion topically, the penis must be fully erect and extended. The smegma is removed, and then the urethral fossa, urethral sinus, and penis are rinsed with a 2% chlorhexidine solution. The penis is dried and a 0.2% nitrofurazone ointment is applied topically.\textsuperscript{5} All stallions that are imported from countries with a high prevalence of CEM are treated for \textit{T. equigenitalis}, irrespective of whether the culture test results were positive or negative.

**PREVENTION**

Before a horse enters the United States, it must have an import permit, health certificate, and a negative \textit{T. equigenitalis} culture within 30 days of import. This certifies that the horse had been fully examined before export and that no disease was recognized at that time. Horses have four ports of entry into the United States: Los Angeles, Newburg (New York), Miami, and Honolulu. On arrival to the United States, the horse is examined by a federal veterinarian and placed in federal quarantine. After federal quarantine, horses from countries with a high prevalence of \textit{T. equigenitalis} are transported to a state \textit{T. equigenitalis} quarantine facility. State \textit{T. equigenitalis} quarantine facilities are located in Alabama, California, Colorado, Florida, Georgia, Indiana, Kentucky, Louisiana, Maryland, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Tennessee, Virginia, and Wisconsin.\textsuperscript{19} Nondomesticated horses that have not had any contact with breeding horses, geldings, weanlings, or yearlings under the age of 731 days, and competitive and noncompetitive entertainment horses entering with a 90-day permit are exempted from these state quarantine facilities.\textsuperscript{19,32}

Any sample collection or test breeding that is performed for the testing of \textit{T. equigenitalis} must be performed by an accredited veterinarian and monitored by a United States Department of Agriculture APHIS official.\textsuperscript{23} It is important that no detergent or disinfectant is used to clean before collecting samples.\textsuperscript{23} If a horse is receiving systemic antibiotics, these should be discontinued at least 7 days before testing for \textit{T. equigenitalis}.\textsuperscript{12} Any topical antibiotics on the penis or clitoral area should be discontinued at least 21 days before testing.\textsuperscript{23}

When a mare arrives at the state quarantine facility, importation requirements state that swabs must be collected from the cervical canal, urethra, clitoral fossa, and sinus during estrus.\textsuperscript{19} Swabs are collected three times over a 7-day period, on days 1, 4, and 7. If these samples are negative for \textit{T. equigenitalis}, the mare is treated for 5 days and then released from quarantine. If any sample is positive, the mare must be treated and further testing is performed 21 days after the last day of treatment (Fig. 2A).

Timoney et al (1978) demonstrated variations in positive test results of carrier mares depending on the anatomical location where culture swabs were taken.\textsuperscript{32} Cervical or endometrial swabs were consistently positive, whereas
clitoral and urethral swabs often failed to demonstrate the organism.\textsuperscript{33} Acland et al (1983) determined that at 14 days after the infection, the organism is most frequently found in the lumen of the uterus and cervix, whereas at 21 to 116 days (more chronically) the organism is most frequently located in the clitoral sinus and fossa.\textsuperscript{31} There are no data as to which location yields a better diagnosis in stallions.

In stallions, swabs are collected from the prepuce, urethral sinus, and fossa glands.\textsuperscript{19} Often there are too few organisms present on the stallion’s external genitalia and hence the culture is not successful. To avoid missing infected stallions, after negative culture results they are naturally bred to two test mares and the test mares are then cultured for \textit{T equigenitalis}.\textsuperscript{19,23} The mares’ reproductive tract replicates the organism, leaving a larger population to identify on culture. Test mares are kept quarantined from exposure to other animals and are free from a \textit{T equigenitalis} infection before breeding.\textsuperscript{23} Both mares must test negative for \textit{T equigenitalis} in the test results for culture and serology before the stallion is diagnosed as negative for \textit{T equigenitalis}. Test mare cultures are obtained on days 3, 6, and 9 postbreeding.\textsuperscript{19,23} If negative, serologic testing occurs on day 15 and the stallion is treated topically for \textit{T equigenitalis} (Fig. 2B) for 5 days, after which he is released. If any sample during the testing process comes back positive, the stallion is treated, and starts the testing process over 21 days after treatment is completed.\textsuperscript{19,23}

The 2008 outbreak initiated this new testing protocol that outlined the testing and quarantine protocols for all horses involved in testing for \textit{T equigenitalis}. The new protocol supercedes all past protocols, but is based on the import requirements with increased culture and serum testing. To increase the chance of a test mare becoming infected after breeding, stallions must completely insert the penis shaft into each test mare at least twice, with ejaculation.\textsuperscript{23} This is an important distinction as \textit{T equigenitalis} is topical on stallions and is spread mainly through direct contact, not the semen. Complement fixation testing is required in all mares exposed during the 2008 outbreak along with the traditional cultures. Nonpregnant mares also require an additional swab of the distal cervix or endometrium. This is after the clitoral sinuses and clitoral fossa swabs are completed and the distal portion of the vaginal tract is cleaned and disinfected on day 7.\textsuperscript{23} For pregnant mares, complement fixation testing and culture of the sinuses and fossa may be performed pre-foaling, but swabbing the endometrium must be postponed until after foaling.\textsuperscript{23} A foal born from a positive mare may become infected \textit{in utero}. These foals must remain under quarantine until external genitalia cultures can be tested at 3 to 4 months of age.\textsuperscript{23} The consideration that foals may be born infected with \textit{T equigenitalis} is not part of the original import protocol, as horses under the breeding age are admitted into the United States without excess quarantine or \textit{T equigenitalis} testing procedures. Effective on December 15, 2008, Canada increased their import restrictions on horses, semen, and embryos in the United States. Horses will not require an import permit, but they will require special declarations on their health certificates, and quarantine during the 60 days before exportation to Canada.\textsuperscript{34} Horses may still be exported from Canada to the United States, but they must carry extra documentation for their return. Canadian restrictions on semen are only on semen collected after December 15, 2008 (the day the first stallion was diagnosed in the United States). Semen and embryos collected after the start of the outbreak must have an import certificate as well as a U.S. health certificate with certification that the semen was not from a stallion that had been in a \textit{T equigenitalis}-infected facility within 60 days of collection.\textsuperscript{34} The semen must be stored with an extender that contains antibiotics effective against \textit{T equigenitalis}.\textsuperscript{34} Semen that has entered the United States as unrestricted entry may be imported to Canada without extra restrictions. The flushing medium used to collect the embryos from the mare must contain antibiotics effective against \textit{T equigenitalis}.\textsuperscript{34}

**CONCLUSION**

\textit{T equigenitalis} outbreaks cause economic loss to breeding and equine export industries. Any outbreak of \textit{T equigenitalis} in the United States has the potential to cost the country millions of dollars based on shipments of semen and embryos as well as restrictions in travel outside of the United States. Since the introduction of \textit{T equigenitalis}, better techniques have been practiced that allow successful isolation of the organism in cultures. Research is continuously improving PCR so it may be both sensitive and specific enough to be used in screening and control of \textit{T equigenitalis}.\textsuperscript{26,28} PCR was performed on cultures from the last two positive stallions.

Although necessary improvements have been made in isolation procedures and import and export requirements, the United States is not protected from future \textit{T equigenitalis} outbreaks. Information from the latest outbreak indicates that many of the horses were infected through fomites rather than direct venereal transmission. If individual farms do not follow sanitary procedures and follow the regulations put in place, control of the \textit{T equigenitalis} infection is lost. Positive stallions have made it through the mandatory isolation facilities and have infected U.S. equine population in the past. This will continue if the quarantine facilities are not testing and quarantining the animals properly. Import regulations exempting colts from quarantine and testing should be revisited with the knowledge that \textit{T equigenitalis} may be
cultured from placentas. Routine testing of native horses may help as a second defense against foreign disease outbreaks. The 16-year-old Quarter Horse stallion first diagnosed with *T. equigenitalis* had never been tested before this positive result. The re-entry of *T. equigenitalis* into the U.S. breeding population is a reminder that foreign animal diseases do not always remain foreign. The eradication of this disease will be more difficult to accomplish now (especially because the horse that started the 2008 outbreak has not yet been identified). It is logical to consider more routine testing, as is done in the United Kingdom, may help eradicate the disease from the United States.

**REFERENCES**


