Foot and Mouth Disease

Foot and Mouth Disease (FMD) is caused by the Foot and Mouth Disease virus. This virus commonly infects cloven-hoofed animals; the disease does not easily pass to humans.[1] However, people who have been near infected animals can carry and spread the virus via their clothing, shoes, and vehicles.[2] Fodder can become contaminated after contact by infected animals and, although horses, dogs, cats, and birds are not affected by FMD, they can act as mechanical vectors. Avian species can carry the virus on their feet and feathers and will excrete the virus after ingesting infected material.[3] FMD is characterized by lesions of the mouth and feet. These blisters can lead to fever, weight loss, lameness, and salivating or drooling.[4] FMD can also cause mastitis, loss of milk flow, and spontaneous abortions. FMD is spread through aerosol transmission or animal-to-animal transmission.[5] APHIS's current FMD protocol includes herd eradication to prevent the spread of the disease.[6]

It is important to note the numbers of animals reported in this section generally refer to total livestock. Data specific to cattle are addressed in the data section of this document. The first recorded incidence of FMD in the United States occurred in 1870 when the disease was transferred to the New England states and New York via infected cattle from Canada where FMD had arrived from Scotland.[7] Subsequent outbreaks of FMD occurred in 1880, 1884, 1902, 1908, 1914, 1924 (two separate outbreaks), and 1929, making a total of nine U.S. outbreaks.[8] In all but two outbreaks (1914 and 1924), relatively small numbers of animals were involved and FMD was eradicated and quarantines were lifted within a few months.[9] The 1880 outbreak was limited to "two or three lots of animals." The 1884 outbreak was contained in the vicinity of Portland, Maine and affected only a few animals.[10] The 1902 outbreak involved a total of 12 counties in Massachusetts, Vermont, New Hampshire, and Rhode Island.

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1 Knipe, et al., *Field's Virology, 5th Ed.*, (Hagerstown, MD: Lippincott Williams & Wilkins, 2007).

2 "Foot-and-Mouth Disease," United States Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), January, 2002; accessed May 10, 2007, http://www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_foot_mouth_disease07.pdf.

3 *Merck Veterinary Manual, 9th Edition*, ed. C. Kahn (Whitehouse Station, NJ: Merck & Co., 2008), accessed April, 2010, http://www.merckvetmanual.com/mvm/index.jsp.

4 "Foot-and-Mouth Disease," United States Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), January, 2002; accessed May 10, 2007,

5 J.M. Musser, "A Practitioner's Primer on Foot-And-Mouth Disease," *Journal of American Veterinarian Medicine Association* 224 (2004):1261-8.

6 "Foot-and-Mouth Disease," United States Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), January, 2002; accessed May 10, 2007,

7 United States Department of Agriculture, *Yearbook of the United States Department of Agriculture 1915*, (Washington, D.C.: United States Government Printing Office, 1916).

8 Osei-Agyeman Yeboah, Victor Ofori-Boadu and Samaila Salifou, "A Foot and Mouth Disease Induced Model of US Excess Supply of Beef" (paper presented at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia, January 31-February 3, 2009), accessed April, 2010, http://ageconsearch.umn.edu/bitstream/46053/2/Yeboah_SAEA_09_FMD.pdf.

9 United States Department of Agriculture, *Yearbook of the United States Department of Agriculture 1915*, (Washington, D.C.: United States Government Printing Office, 1916).

10 Ibid

The 1908 outbreak involved a total of 23 counties in Pennsylvania, New York, Michigan, and Maryland. Within 5 months of the outbreak all diseased and exposed animals were slaughtered and buried.[11] This outbreak started near Detroit, Michigan, where calves had been vaccinated against cowpox. Dr. John R. Mohler, chief of the Pathological Division of the Bureau of Animal Industry, along with Dr. Milton J. Rosenau, director of the Hygienic Laboratory of Public Health, discovered the vaccine used to fight cowpox in this instance had been contaminated with the FMD virus. This vaccine had been imported from Japan in 1902, which led to suspicions that the 1902 outbreak also originated with this vaccine. Researchers concluded that both the 1902 and 1908 outbreaks originated from the vaccination serum and that it was the vector which carried the disease out of the laboratory into the general herd population.[12] This discovery led to the requirement by the Public Health and Marine Hospital Service that manufacturers of vaccine test their vaccines for the FMD virus and other infections communicable to man.[13]

In both the1902 and 1908 events, the U.S government shared the cost of eradication with the states involved. In 1902, the USDA paid producers of destroyed livestock 70 percent of the appraised value and the state paid the remaining 30 percent. In 1908, the USDA paid producers of destroyed livestock 67 percent of the appraised value and the state paid the remaining 33 percent.[14]

The most devastating outbreak of FMD in the United States began in 1914 and ended in late 1915. It originated in a cattle herd from Michigan, but its entry into the stockyards in Chicago, Illinois turned the outbreak into an epizootic episode. More than 165,000 animals were depopulated during this event and the subsequent quarantine as a result of destruction orders. The "Yearbook of the United States Department of Agriculture 1915," printed in 1916 (Yearbook),[15] reported the states quarantined during the 1914-1915 epidemic included Connecticut, Delaware, District of Columbia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, Washington, West Virginia, and Wisconsin.[16, 17]

[11] Ibid

[12] "John Mohler and Milton Rosenau, *The Origin of the 1908 Outbreak of Foot-and-Mouth Disease in the United States*, (Washington D.C.: Government Printing Office, 1915), accessed May, 2010, http://www.archive.org/details/originof1908outb00mohl.

[13] A.D. Melvin, "The 1908 Outbreak of Foot-and-Mouth Disease in the United States," in *The 25th Annual Report of the Bureau of Animals Industry for the Year 1908*, (Washington, D.C.: Government Printing Office, 1910), accessed April, 2010, http://books.google.com/books?id=Z0xJAAAAMAAJ&pg=PA379&lpg=PA379&dq=The+1908+Outbreak+Of+Foot-And-Mouth+Disease+In+The+United+States&source=bl&ots=EvHTto-Th1&sig=2F2PPM2CofVQ-Cp4KyNtX8EwLVI&hl=en&ei=d8DYS9q5AoWkswPH8OmdBg&sa=X&oi=book_result&ct=result&resnum=3&ved=0CAoQ6AEwAg#v=onepage&q=The%201908%20Outbreak%20Of%20Foot-And-Mouth%20Disease%20In%20The%20United%20States&f=false.

[14] United States Department of Agriculture, *Yearbook of the United States Department of Agriculture 1915*, (Washington, D.C.: United States Government Printing Office, 1916).

[15] Ibid

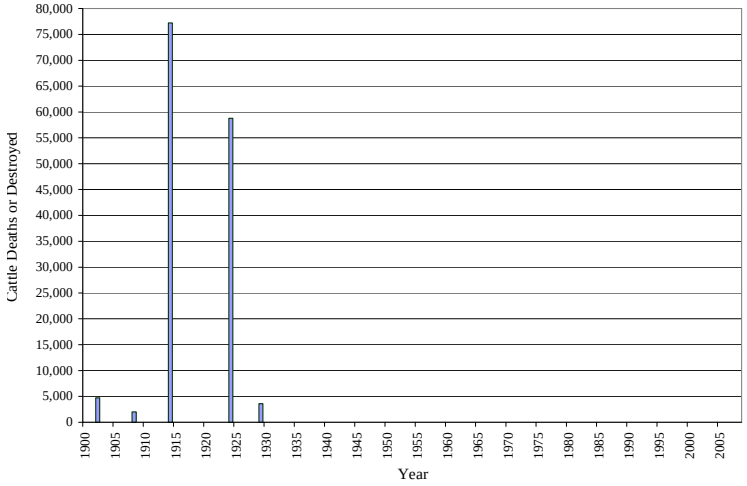
[16] Ibid

[17] J.G. Ferneyhough, *Special Report of the State Veterinarian on Foot and Mouth Disease in Virginia*, Richmond: Clyde W. Saunders, 1916; accessed May, 2010, http://books.google.com/books?id=ZeQOAQAAIAAJ&printsec=frontcover&dq=foot+and+mouth&lr=&cd=31#v=onepage&q&f=false.

The 1924 outbreak in California also reached epidemic proportions with the disease spreading to 16 counties including Los Angeles and San Francisco. The "1956 The Yearbook of Agriculture: Animal Diseases" authored by the USDA, also indicated the state of Texas experienced an outbreak of FMD in 1924. The eradication of the outbreak in California involved the destruction of wildlife as well as domesticated animals and the wildlife destruction numbers were reported for the first time during this outbreak. Deer in the Stanislaus National Forest became infected after they came in contact with infected livestock herds which were using the forest for summer pasture.

The United States suffered its most recent FMD outbreak in 1929 when a drove of swine in Montebello, California, became infected after consuming infected meat scraps from a tourist steamship that had stocked meat in Argentina. Five droves were slaughtered and the disease was contained within one month.[18] The following chart illustrates the number of cattle destroyed due to FMD in the United States.

Cattle Deaths or Destroyed Due to FMD (U.S. Since 1900)



Source: Various Yearbooks of the United States Department of Agriculture

Currently, if an outbreak of FMD were to occur, state veterinarians and APHIS would participate in a cooperative effort of early control and eradication. Each state, in conjunction with APHIS, has an emergency response plan. Both the Department of Homeland Security and the Department of Justice also are involved should an FMD outbreak occur in the United States. All outbreaks of FMD will be responded to in a cooperative partnership involving both state and federal agencies inclusive of USDA, the Department of Homeland Security, the Environmental Protection Agency, and the Department of Defense.[19] The Emergency Response Foot-and-Mouth Disease and Other Foreign Animal Diseases Factsheet published by the APHIS Veterinary Services describes the U.S. FMD outbreak procedure and is presented at:

[18] Alejandro E. Segarra and Jean M. Rawson, "Foot and Mouth Disease: A Threat to U.S. Agriculture", Congressional Research Service Report for Congress, April 16, 2001, Accessed May, 2010, http://www.nationalaglawcenter.org/assets/crs/RS20890.pdf.

[19] "The Emergency Response Foot-and-Mouth Disease and Other Foreign Animal Diseases Factsheet," United States Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), April, 2007; accessed May, 2010, http://www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_emer_response_fmd_07.pdf.

http://www.aphis.usda.gov/publications/animal_health/content/printable_version/fs_emer_response_fmd_07.pdf.

FMD is not currently present in the United States, Canada, Mexico, Central America, Australia, and New Zealand. FMD occurs sporadically or persistently in other areas of the world. Currently there are active quarantines for FMD in Japan and South Korea, which have resulted in substantial destruction of livestock and bans on importation of uncooked meat product from these countries into the United States. In addition to the response protocols in the United States, the animal health industry has also incorporated a series of intense training modules for all levels of animal health practitioners. The animal health industry also conducts simulation exercises wherein different scenarios and response protocols are practiced and coordination efforts between and among federal and state agencies, both civilian and law enforcement, are practiced, assessed and modified. A recent exercise, named Operation Palo Duro, was conducted from February 21 to 23, 2007. This exercise involved more than 26 federal, state, and local agencies and private sector organizations. Issues, observations, and recommendations from this exercise were disseminated to public animal health officials nationwide. Public animal health officials and others, during their ongoing disease identification and containment training, continue to reference the results and recommendations from this exercise. Producers and stakeholders are also invited to attend and participate in those training modules relevant to their particular area of interest.

The recent United Kingdom (U.K.) experiences with FMD have demonstrated the importance of rapid diagnosis and containment of infected animals. The demography of U.K. farms may have contributed to FMD issues there. Sheep and swine are more widely raised in the U.K. than in the United States with substantial commerce in these species among farms. Therefore there may be a greater risk for rapid spread before detection in the U.K. Another high risk factor in the U.K. is the presence of many farms in a very small area whereas the U.S. herds are separated by relatively greater distances. In addition, the climate in the Western and Southwestern United States is not as conducive to virus survival outside a host as is the cooler and damper climate of the U.K.