



Potomac Horse Fever

by **HEATHER SMITH THOMAS**

Potomac Horse Fever (PHF) is a sporadic and seasonal (late summer) disease. This disease is technically known as equine monocytic ehrlichiosis, but because it was first noticed in the Potomac River Valley of Maryland in 1979, most horsemen know it as Potomac Horse Fever. Since then it has been diagnosed in nearly every state, in every Canadian province, as well as in France and other European countries.

This disease probably existed in a subclinical form long before 1979, and in other areas—"river valley fever" and "Shasta River Crud" have been a problem in Northern California for a long time. Affected horses developed diarrhea, fever and usually died unless treated with tetracycline—the same drug now used to treat horses with PHF. It just happened that a virulent strain emerged in 1979 in Maryland and gained attention and a name.

The causative agent is a Rickettsial organism called *Ehrlichia risticii* (named for Miodrag Ristic, one of the researchers who identified it in 1984 at the University of Illinois at Urbana). It belongs to the same family as organisms that cause Rocky Mountain Spotted Fever, anaplasmosis and typhus (all spread by insects, fleas or ticks). It was assumed for nearly 20 years that Potomac Horse Fever, like those diseases, was transmitted by some kind of insect—one that is active from June through September (since these are the months in which most horses get the disease) but, until recently, no one was able to identify the actual culprit.

The disease appears most frequently in areas with running water. The Ohio River Valley has been another PHF "hot spot" for nearly two decades. Once it appears, the disease tends to stay in an area. Most cases occur in river bottoms or areas with streams. This clue led a team of researchers at University of California, Davis, to finally establish a link between freshwater snails and the organism that causes Potomac Horse Fever, in 1998.

Ehrlichia organisms are usually transmitted by arthropods, but no one had ever been able to transmit PHF from horse to horse with ticks or flies. In 1994, scientists first suspected that PHF had a link with water, when an Ohio State University molecular biologist established a genetic relationship between *E. risticii* and another type of bacteria which infects salmon and causes illness in dogs that eat the infected fish. This theory was reinforced in 1997 when the University of California research team discovered that PHF is the same disease as the aforesaid Shasta River Crud, which has affected horses for an even longer time near California's Shasta and Klamath rivers.

In 1998, the research team collected and tested snails in the Potomac River watershed in Maryland. At first they found only four snails, out of 1000 collected, that tested positive. Then, when the other gathered snails were sent to California and put into tanks to grow in warm water, they

released a secretion containing tiny tadpole-shaped fluke larvae which harbored bacteria genetically identical to some of the strains of *E. risticii* found in horses with Potomac Horse Fever. The flukes are parasitic flatworms that spend part of their life cycle in snails.

Researchers then tried to discover how the tiny fluke larvae get into the horse—whether the horse drinks them, picks them up directly through the skin, or if an intermediate insect host is eaten by them. A recent study shows that horses can acquire *E. risticii* by ingesting tiny fluke larvae in infected intermediate hosts such as aquatic insects. The immature flukes have now been found in caddisflies. These are small, mothlike insects with two pairs of wings, a soft body and long legs. The wormlike larva of this fly lives in fresh water, encased in a protective covering made of twigs, grains of sand and other debris cemented together.

The free-swimming larval stage of the fluke can penetrate the skin of an animal or the tissues of an aquatic insect such as the caddisfly larvae. The researchers theorized that horses could pick up the infection via skin penetration by fluke larvae, by drinking water containing these larvae, or by eating or drinking an aquatic insect infected with the larvae. To determine the route of infection in horses, a number of test horses were challenged with infectious snail secretions and aquatic insects collected from a region in northern California where PHF commonly occurs.

Two horses stood with their front feet in water harboring infected fluke larvae, two horses drank water containing the larvae, and six horses were fed various aquatic insects harboring *E. risticii* infected larvae. The only horse in the study who was successfully infected was one that was fed mature caddisflies. The clinical signs and changes in the blood were consistent with PHF. The horse developed laminitis as well, which occurs in 40 percent of horses with PHF. The fact that laminitis has only been reported

in naturally occurring cases (it has never occurred in experimentally induced cases) reinforces the researchers' conclusion that natural transmission probably occurs by the oral route, through ingestion of immature fluke larvae in the insect intermediate hosts.

E. risticii exists in nature in a complex aquatic ecosystem, and is probably transferred to horses when they accidentally eat insects, such as caddisflies, that contain the infected fluke larvae. One type of caddisfly, *Dicosmoecus-gilvipes*, is widespread in the western mountain regions of North America and very abundant in the Shasta River. Mature caddisflies are present there from July to November—the same time of year that horses get PHF. Horses often eat insects along with the grass they consume when grazing near water, or drink mature insects trapped on the water surface, or even ingest recently dead insects who've fallen into feed and water after being attracted to stable lights. Other types of insects may also be potential sources of infection.

The researchers feel that providing alternative water sources for horses near rivers and streams (and even keeping horses out of wet pastures) might help prevent PHF cases, since in every instance in which they confirmed this disease, the horses had been in an irrigated pasture. Keeping horses away from streams, ponds, springs and other watery habitats, where snails, flukes and aquatic insects thrive, may be the best way to prevent PHF.

Symptoms and Treatment

The first sign that a horse might have PHF is that the animal goes off feed, is a bit lethargic and doesn't drink. He may be mildly colicky. There is usually fever, and it may be very slight or soon shoot up to 106 degrees. A veterinary exam at that time would show low blood pressure and low blood cell count. Two to three days later, the usual sign is severe, explosive diarrhea. The horse is in extreme pain with diarrhea and/or colic, and becomes severely dehydrated, requiring intravenous fluids. In 20 to 40 percent of cases, the horses founder and some are euthanized to relieve their

misery. It may take only two or three days for the disease to run its course, or it may be as long as two or three weeks.

PHF is associated with warm weather, but in areas with mild winters it can occur any time of year. In extreme heat (more than 100 degrees, as in the Southwest) there are not as many cases as when weather is between 80 and 100 degrees. Early diagnosis and treatment can ease the severity of the disease and speed recovery.

The disease is more common than once thought. Researchers have screened numerous blood samples for evidence of previous exposure. The fact that many horses test positive, with no history of illness, indicates that the disease may sometimes be very mild. There seems to be a subclinical form, as well as a mild form that merely seems to cause infection of the fetus, and abortion.

However, if not treated quickly, acute cases have a high mortality rate. And many owners do not recognize that the horse has foundered until too late. The foundering can cause more damage to the horse than the fever and diarrhea. Most horses respond to treatment with fluids and tetracyclines given intravenously but often require constant care for a couple weeks. In other cases there may be subclinical infections with no sign of illness, and some horses have a mild, short course of the disease.

Abortion In Mares

During the past 12 years, several studies have confirmed that PHF can cause abortion. Researchers isolated the bacteria in tissues cultured from the fetus of an experimentally infected mare and found antibodies in aborted fetuses, showing that the PHF bacteria could cross the placental barrier and infect the fetus. Many mares abort two to three months after the infection occurs. These mares all had inflammation of the placenta—aborted fetuses had infection in their livers and intestines. Sick mares treated with trimethoprim-sulfadiazine aborted, but those treated with oxytetracycline did not abort.

It's hard to know how many PHF abortions occur—sometimes the disease is mild and goes unnoticed in the

mare, and there is a long time between the dam's illness and the actual abortion. Owners of mares aborting at seven months' gestation should consider PHF as a possible cause, though abortions from EHV-1 (equine herpesvirus type 1—rhinopneumonitis) can also occur then. Tissue samples from the fetus' intestines can be sent to a diagnostic laboratory along with other routinely submitted samples. Since *E. risticii* bacteria often localize in intestinal cells, finding lesions in the gut would make it highly suspicious that PHF was the cause of the abortion.

Vaccination

A vaccine became available in 1987. It requires two doses the first year and a yearly booster. Some veterinarians recommend a biannual vaccination in areas where PHF is common, since this vaccine does not give strong protection. The vaccine can sometimes be obtained in combination with Eastern-Western encephalomyelitis and tetanus. The disease may still occur in horses that have been vaccinated, but is generally milder if they have some immunity from vaccination.

With the discovery that fluke larvae in snails and aquatic insects are the source of infection, rather than biting insects, a better vaccine may be designed. Present vaccines are only marginal in protection because they were developed thinking that horses were bitten by a tick or some other arthropod, introducing the bacteria into the bloodstream. These vaccines produce circulating antigens in the blood. If infection is coming in orally, though, a vaccine needs to produce immunity in the gut lining. Another reason current vaccines may not be working as well as is hoped, is that there are many different strains of the bacteria—the vaccine does not provide immunity against them all. A research team at Ohio State University reported in 1995 that there are at least 28 separate strains of *E. risticii*—some cause mild disease, while some cause abortion. Whether or not you vaccinate will depend upon where you live (whether PHF is common in the area or not) as well as your own assessment of risk.