**Unit I: Protista : Babesiosis in Cattle (Red water, Tick Fever)**

**Introduction:**

The disease is named for the genus of the causative organism, which was named after the [Romanian](https://en.wikipedia.org/wiki/Romanian_people) [bacteriologist](https://en.wikipedia.org/wiki/Bacteriology) [Victor Babeş](https://en.wikipedia.org/wiki/Victor_Babe%C5%9F). In 1888, Victor Babeş identified the microorganisms in red blood cells as the cause of febrile [hemoglobinuria](https://en.wikipedia.org/wiki/Hemoglobinuria) in cattle. In 1893, [Theobald Smith](https://en.wikipedia.org/wiki/Theobald_Smith) and Frederick Kilborne discovered that a tick was the vector for transmission in Texas cattle. The agent was B. bigemina. This was the first demonstration that an [arthropod](https://en.wikipedia.org/wiki/Arthropod) could act as a [disease vector](https://en.wikipedia.org/wiki/Disease_vector) to transmit an infectious agent to a vertebrate host.

In 1957, the first human case was documented in a [splenectomized](https://en.wikipedia.org/wiki/Splenectomy) Croatian herdsman.[[3]](https://en.wikipedia.org/wiki/Babesiosis#cite_note-NEJM_Babesiosis_Review-3) The agent was B. divergens. In 1969, the first case was reported in an [immunocompetent](https://en.wikipedia.org/wiki/Immunocompetent) individual on Nantucket Island. The agent was B. microti, and the vector was the tick [I. scapularis](https://en.wikipedia.org/wiki/Ixodes_scapularis).][Equine](https://en.wikipedia.org/wiki/Horse) babesiosis is also known as piroplasmosis (from the [Latin](https://en.wikipedia.org/wiki/Latin_language) piro, meaning [pear](https://en.wikipedia.org/wiki/Pear) + [Greek](https://en.wikipedia.org/wiki/Greek_language) plasma, a thing formed).

**Bovine Babesiosis**

Bovine Babesiosis (BB) is a tick-borne disease of cattle. The principal strains are *babesia bovis* and *babesia bigemina*, with Rhipicephalus ticks being the major vector. *Babesia divergens* is also found, with the major vector being *Ixodes ricinus.*

BB is found in areas where its arthropod vector is distributed, especially tropical and subtropical climates. Babesia bovis and B. bigemina are more widely distributed and of major importance in Africa, Asia, Australia, and Central and South America. Babesia divergens is economically important in some parts of Europe and possibly northern Africa.

**Transmission of Infection**

Transmission of B bovis takes place when engorging adult female ticks pick up the infection. They pass it on to their progeny via their eggs. Larvae (or seed ticks) then pass it on in turn when feeding on another animal. B bigemina is also passed from one generation of ticks to the next. Engorging adult ticks pick up the infection and nymphal and adult stages (not larval stages) of the next generation pass it on to other cattle.

Morbidity and mortality vary greatly and are influenced by prevailing treatments employed in an area, previous exposure to a species/strain of parasite, and vaccination status. In endemic areas, cattle become infected at a young age and develop a long-term immunity. However, outbreaks can occur in these endemic areas if exposure to ticks by young animals is interrupted or immuno-naïve cattle are introduced. The introduction of Babesia infected ticks into previously tick-free areas may also lead to outbreaks of disease.

**Pathophysiology**

Babesia parasites reproduce in [red blood cells](https://en.wikipedia.org/wiki/Red_blood_cell), where they can be seen as cross-shaped inclusions (four [merozoites](https://en.wikipedia.org/wiki/Merozoite) asexually budding, but attached together forming a structure looking like a "[Maltese cross](https://en.wikipedia.org/wiki/Maltese_cross)") and cause hemolytic anemia, quite similar to malaria.

Unlike the Plasmodium parasites that cause malaria, Babesia species lack an exoerythrocytic phase, so the liver is usually not affected.

In nonhuman animals, [Babesia canis](https://en.wikipedia.org/wiki/Babesia_canis) rossi, [Babesia bigemina](https://en.wikipedia.org/wiki/Babesia_bigemina), and [Babesia bovis](https://en.wikipedia.org/wiki/Babesia_bovis) cause particularly severe forms of the disease, including a severe haemolytic anaemia, with positive erythrocyte-in-saline-agglutination test indicating an immune-mediated component to the haemolysis. Common sequelae include haemoglobinuria "red-water", disseminated intravascular coagulation, and "cerebral babesiosis" caused by sludging of erythrocytes in cerebral capillaries.[[citation needed](https://en.wikipedia.org/wiki/Wikipedia%3ACitation_needed%22%20%5Co%20%22Wikipedia%3ACitation%20needed)]

In bovine species, the organism causes hemolytic anemia, so an infected animal shows pale mucous membranes initially. As the levels of [bilirubin](https://en.wikipedia.org/wiki/Bilirubin) (a byproduct of red blood cell lysis) continue to increase, the visible mucous membranes become yellow in color (icterus) due to the failure of the liver to metabolize the excess bilirubin. Hemoglobinuria is seen due to excretion of red-blood-cell lysis byproducts via the kidneys. Fever of 40.5°C (105°F) develops due to release of inflammatory byproducts.[[citation needed](https://en.wikipedia.org/wiki/Wikipedia%3ACitation_needed)]

**Symptoms**

BB is predominantly observed in adult cattle. Infected animals develop a life-long immunity against re-infection with the same species and some cross-protection is evident in B. bigemina-immune animals against subsequent B. bovis infections.

***B. bovis***
Conditions are often more severe than other strains.

* High fever
* Parasitaemia (percentage of infected erythrocytes) - maximum parasitaemia is often less than one per cent.
* Neurologic signs such as incoordination, teeth grinding and mania. Some cattle may be found on the ground with the involuntary movements of the legs. When the nervous symptoms of cerebral babesiosis develop, the outcome is almost always fatal.
* Dark coloured urine
* Anorexia

***B. bigemina***

* Fever
* Anorexia
* Animals likely to separate from herd, be weak, depressed and reluctant to move
* Haemoglobinuria and anaemiaDark coloured urine
* Central nervous system (CNS) signs are uncommon
* Lesions
* In *b. bigemina* parasitaemia often exceeds 10 per cent and may be as high as 30 per cent.

Clinical symptoms for ***Babesia divergens*** are similar to *B. bigemina* infections.

The survivors may be weak and in reduced condition, although they usually recover fully. Subacute infections, with less apparent clinical signs, are also seen.

**Treatment**

Mild cases may recover without treatment. Sick animals can be treated with an antiparasitic drug. Treatment is most likely to be successful if the disease is diagnosed early; it may fail if the animal has been weakened by anemia. Imidocarb has been reported to protect animals from disease but immunity can develop. There are also concerns with regard to residues in milk and meat.In some cases blood transfusions and other supportive therapy should be considered.

**Prevention**

Effective control of tick fevers has been achieved by a combination of measures directed at both the disease and the tick vector. Tick control by acaracide dipping is widely used in endemic areas. Dipping may be done as frequently as every 4-6 weeks in heavily infested areas. The occurrence of resistance of ticks, chemical residues in cattle and environmental concerns over the continued use of insecticides has led to use of integrated strategies for tick control.

Babesiosis vaccines are readily available and are highly effective. Anti-tick vaccines are also available in some countries and can be used as part of an integrated program for the control of ticks.
Babesiosis can be eradicated by eliminating the host tick(s). In the US, this was accomplished by treating all cattle every two to three weeks with acaricides. In countries where eradication is not feasible, tick control can reduce the incidence of disease.