

# Theileriosis in Commercial Holstein Calves and Heifers

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## ABSTRACT

In this article, we report a series of theileriosis cases in Holstein calves and heifers without any ticks on body surface in a commercial dairy farm in Tehran, Iran. Depressed feed intake and poor growth are common consequences of heat stress during summer. Increased insects and flies' populations in calf barns induce further stresses and can spread infectious diseases among calves. Theileriosis is a well-known parasitic disease infecting dairy cows and heifers during hot seasons. Several calves with high body temperature (>40°C) and hyperpnea were diagnosed initially for pneumonia. However, they did not respond to treatment effectively, as calves died after 2 or 3 days after disease identification. On-farm necropsy findings revealed yellowish or pale peripheral tissues that led us to make a diagnosis for theileriosis. Notably, no tick was found on body surface of the calves. The laboratory examinations confirmed existence of theileria in blood samples of the infected calves. It seems that theileriosis could occur in young calves in a different way than a routine transmission via ticks. Since the incidence of theileriosis coincided with increased farm flies' population, it may be assumed that flies could be an intermediary host for transmitting theileria among calves.

**Keywords:** Holstein Calf; Theileriosis; Flies; Prevention; Tick, Health

## Introduction

During hot seasons, dairy heifers encounter several metabolic issues such as reduced feed intake and likely weakened immune systems [1], predisposing them to poor growth and infectious diseases. In addition to heat stress, the increasing number of insects and flies in the surroundings environment imposes further stress. Insects such as ticks and flies, especially biting flies, may carry infectious agents as vector. Pink eye, anaplasmosis, theileriosis, and bovine leukemia virus [2] are the known diseases transmitted by ticks and biting flies. It is notable that ticks are the main vector of theileria parasite in both sheep and cow [3]. However, unfortunately, it seems that this deadly disease can be transmitted by biting flies. Theileriosis is a parasitic disease caused mainly by protozoa called theileria. Despite many theileria species, only a few of them cause severe symptoms. Theileria parva, theileria annulata,

[3] and theileria orientalis [4] are the most prevalent species infecting cattle. Each theileria spp. has its own vector, as T. parva is transmitted by Rhipicephalus appendiculatus while T. annulata can be transmitted by various Hyalomma species [3]. Symptoms begin with high fever and lethargy and then lead to anorexia. The affected calves develop anemia, as pallor are seen in the mucosal membranes of the eye, gums, and vagina [5]. Depending on diseases severity, theileriosis cases are placed into mild to severe categories. Animals showing mild symptoms are categorized as resistant, whereas those exhibiting severe symptoms are categorized as susceptible [6]. Mortality rate is closely related to host susceptibility, strain and dose of infecting agent [6]. As noted, the routine way to spread theileriosis is via ticks, but it should be noted that there are other routes such as blood transmission by arthropods and even infected

colostrum [7]. During hot seasons, it seems that flies could move the theileria and spread the disease by transfusing blood from susceptible animals to healthy ones. In the current case series report, the decreasing age of animals (2-6 month-old heifers vs. 8-14 months-old heifers) may indicate new disease patterns in dairy farms. On the other hand, lack of any ticks on the body surface of the infected heifers suggests a different transmission way in young heifers. As the disease spreads concurrent with flies overload; therefore, it can be hypothesized that the biting flies may be the main cause of theileriosis outbreak.

### Case Presentation and Discussion

In a large dairy farm (Tehran, Iran), a series of theileriosis were observed with the onset of hot season during the last two years. Beforehand, it is necessary to pay attention to the history of theileriosis in this dairy farm. For the past decade, with onset of hot seasons, theileriosis has been observed once every few years in older heifers, as large numbers of ticks were found attached to body surfaces including ear, strunt, and udder. Treatment with routine drugs such as buparvaquon and tetracycline injections has not been successful. Therefore, mortality rate has been high (over 50% of infected animals). As a result, to decrease outbreak, preventive protocols were designed. Spraying heifers and dairy cows against ticks at the beginning of hot seasons was the primary protocol to control tick overload and breaking parasite life cycle within the farm. Regular spraying was an effective management tool in preventing theileriosis up to the last two years. New cases of theileriosis were, however, detected most recently in which no tick was found on heifers' body surface.

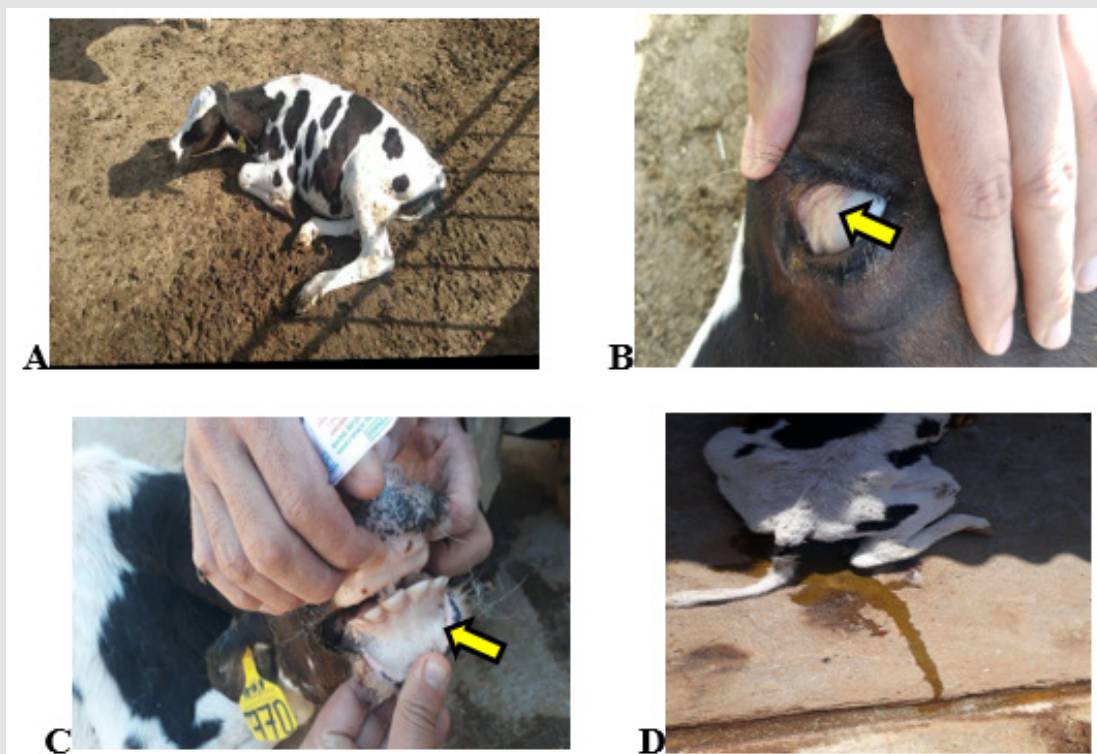
Two six months-old Holstein heifers with elevated rectal temperature ( $>40^{\circ}\text{C}$ ) and hyperpnea were initially diagnosed for respiratory diseases. The sick animals were treated by injecting dexamethasone, tetracycline, and florfenicol. However, the expected result was not favorable, as calves' general health became worst day by day and they finally crippled. Additional examination of downer calf led us to discover vagina pale or even yellowish. Notable, all of mucosal membranes such as gum and eyeball were also pale or yellowish. The calves died 3-4 hours after crippling. Peripheral blood samples from ear vein were taken and blood smears were prepared. The samples were immediately sent to a veterinary laboratory (Dampavar Laboratory, Shahriar, Tehran, Iran) to examine the cause of anaemia and death. In the laboratory report, theileria were seen, so theileriosis was diagnosed as a cause of calf death.

The next case was a male pre-weaned calf. Similar to the previous ones, symptoms were initiated with severe fever and hyperpnea and continued with severe anaemia and crippling. The calf was culled 3-4 hours after he was found crippled and anaemic. Other cases (about 10 male and female calves) with similar symptoms

and disease progress were recognized for theileriosis. Diarrhea was also observed before death. In general, disease progress can be divided into 3 distinct phases:

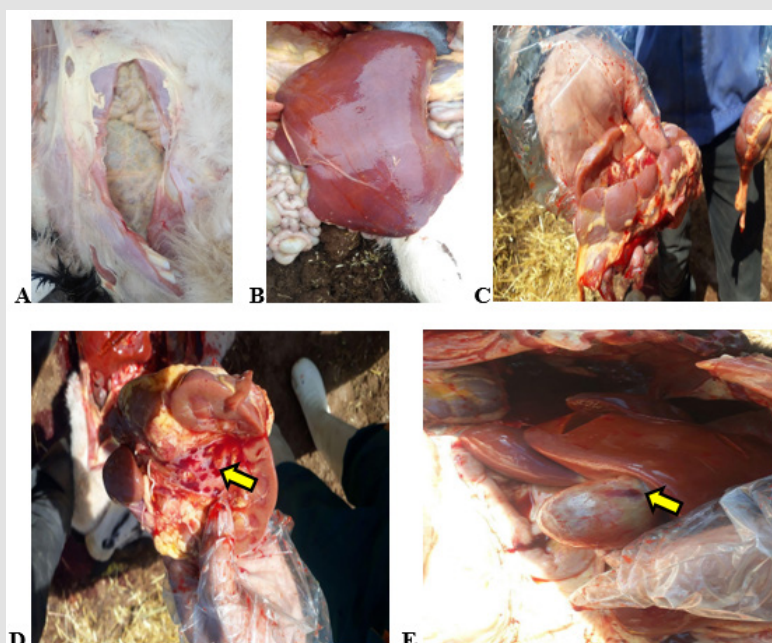
- 1) Severe fever,
- 2) Anaemia and crippling, and
- 3) Death.

It is important to note that treatment with buparvaquon and tetracycline was performed immediately after diagnosing the diseases, but the treatment was ineffective, as all 10 calves died or culled because of severe anaemia. It has been reported that drugs or vaccines are not fully effective against theileria infections which further confirms our reports [4]. Pre-mortem signs of calves identified for theileriosis are presented in (Figure 1). In line with our findings, others also reported pyrexia and anaemia as clinical manifestation of bovine theileriosis [8]. Even though the treatment protocol was relatively similar to the current study, the salvage of infected calves was different. It is believed that theileriosis can be manifested from pre-acute to acute or from sub-acute to chronic states, depending on pathogen's invasive capacity and host susceptibility [8]. As the mortality rate was high in our study, it seems that young calves are more susceptible than older ones. Necropsy was performed on-farm for all culled or death calves for further investigation of theileriosis occurrence. Watery blood and yellowish peripheral tissues and related organs were the first post-mortem observations observed following the necropsy. It has been demonstrated that theileria parasite induce dramatically haematologic and biochemical changes to infected animals [9]. Therefore, inconsistency in blood shape and appearance observed in our study could be attributed to destroyed erythrocytes as a result of parasite multiplication inside erythrocytes. The yellowish color of eyeball, skin or mucosal membrane found in our study may indicate higher bilirubin concentrations which may further suggest red blood cells breakdown and liver damages [10]. Observing interior organs revealed enlarged liver, kidney, and damaged lung. In addition, mucosal lesions or petechiae were found on organs such as kidneys and heart. It is important to note that liver enlargement or hepatomegaly was the most prominent finding in all cases. These symptoms were in agreement with other observations [3]. The post-mortem necropsy findings are shown in (Figure 2). All pre- and post-mortem observations confirmed that theileriosis was the cause of calf mortality, although no tick was found. As a result, theileriosis could be transmitted in ways beyond ticks. In the current study, incidence of theileriosis coincided with increased fly populations while disease outbreak was controlled by applying preventive protocols such as regular spraying against flies. It seems that biting flies can act as a vector to transmit theileria among calves.



**Figure 1:** Clinical signs of theileriosis in Holstein calves.

- A) Crippled calf,
- B) B and C) mucosal pallor, and
- C) D) diarrhea before death.



**Figure 2:** The necropsy findings of the infected calves.

- A) Yellowish color of skin and peripheral tissues,
- B) Enlarged liver,
- C) Enlarged kidney,
- D) Petechiae inside kidney, and
- E) Petechiae on the gallbladder.

## Conclusion

Dairy calves are susceptible to many infectious diseases at young ages, especially during stressful conditions such as hot environments. Theileriosis is one of the most important and deadly diseases that can occur during summer seasons. A series of theileriosis cases were diagnosed and reported in this study in a large commercial dairy farm (Tehran, Iran), although without ticks. Generally, ticks are the main cause of theileria transmission; however, it seems that it can be transmitted by biting flies as well. Thus, preventing fly overload on farms would be an effective strategy to break parasite life cycle and control disease outbreak. Regular spraying against flies is recommended for all commercial farms globally.

## Acknowledgment

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