

*Theileria*

# THEILERIOSIS

- Theileriosis caused by the species of *Theileria* genus is an important protozoan disease in ruminants such as cattle, sheep and goats.
- Vectors are ticks belonging to Ixodidae family and the pathogens are transmitted by ticks as transstadial.
- The disease is common in tropical and subtropical countries including Turkey.

# Biology

- Vectors: Ixodid ticks
  - Gametogony (occurs in tick intestinal epithelial cells)
  - Sporogony (occurs in tick salivary gland)
- Hosts: Cattle, sheep, goat, other domestic and wild ruminants
  - Schizogony (micro- and macroschizonts occur in lymphocytes, monocytes and hystiocytes (mainly in lymph nodules and spleen).
  - Piroplasmic form (in erythrocytes)
- These protozoan species are obligatory intracellular parasites.

# Morphology

- Piroplasms are seen as small, round, oval, ring, anaplasmod inside of erythrocytes in the peripheral blood.
- Schizonts are seen inside of lymphocytes, monocytes and hystiocytes in lymph nodes and spleen (macro and microschantzonts).

# Development

- The vector ticks that feed blood from infective animal get the infective erythrocytes during blood feeding.
- From these, especially ring forms develop and turn into micro and macrogamonts and then yarn-shaped microgametes and round-shaped macrogametes.
- Zygote is formed by mating of macro- and microgamete in the intestine of tick.
- The zygote pass to the hemolymph of ticks piercing the stomach wall and turns into ookinete.

Micro and macrogamonts in tick intestine.

Kinets in the epithelial cells of tick intestine

# Development

- Active ookinets pass to the salivary glands of tick and multiply by sporogony in there.
- The infective sprozoites form in the acini cells of the tick salivary glands.
- *Theileria* species transmitted by ticks as transstadial.
  - Nymph stage from larva stage or adult stage from nymph stage.

Uninfected salivary glands  
of tick

Infected salivary glands of tick

Sporozoite in the tick salivary gland.

# Development

- The infective ticks give the sporozoites that are found in the salivary glands of ticks to the susceptible definitive hosts (mammals).
- Schizonts are seen inside of lymphocytes in regional lymph nodes within 5 to 8 days at the earliest.
- As a result of schizogony, macro and microschorizonts and than merozoites are formed.
- Piroplasmic forms are formed by merozoites entering to the erythrocytes.

Macro and microsclerites in the lymphocytes      Piroplasmic forms in the erythrocytes

# Theileriosis in Cattle

- *T. annulata* (Vectors: *H. anatolicum*, *H. excavatum*, *H. detritum*, *H. marginatum*)
- Cattle, zebu and water buffalo.
- 80% of piroplasmic forms are rounded, ovoid, while the rest are comma, basil and anaplasmaid-shaped.
- Disease is called as tropical theileriosis, Mediterranean coast fever, Egyptian fever
- It is common in north Africa, south Europe, Middle East, India, China, south Russia and Turkey.

*Theileria annulata*  
(0,6-1,9 $\mu$ m)

# Theileriosis in Cattle

- *T. parva* (Vector: *Rhipicephalus appendiculatus*)
- Cattle, zebu and water buffalo.
- 80% of piroplasms are basil-shaped, the rest are oval and round-shaped.
- The proliferation site is lymphocyte cells.
- It is called as East Coast fever and Corridor disease.
- The disease and its vector ticks do not exist in Turkey, but is common in Africa.

*Theileria parva*  
(1,5-2x0,5-1 $\mu$ )

# Theileriosis in Cattle

- *T. mutans* (Vector: *Amblyomma variegatum*)
- It is accepted as a parasite of water buffaloes,
- It causes mild infection.
- 45-60% of piroplams are parachute form.
- Benign theileriosis
- It is seen in a narrow region of Africa.
- The vector tick and *T. mutans* do not exist in Turkey.

*Theileria mutans*

# Theileriosis in Cattle

- *T. taurotragi* (Vector: *Rhipicephalus appendiculatus*)
- It causes disease in deer, antelope and cattle.
- It is seen in south Africa.
- *T. velifera* (Vectors: *Amblyomma* spp.)
- It causes disease in water buffalo and is not pathogenic for cattle.
- It is seen in Africa.

# Theileriosis in Cattle

- *T. sergenti* / *buffeli* / *orientalis* (Vectors: *Haemaphysalis longicornis*, *Ha. punctata*)
- The piroplasmic forms are larger than *T. annulata*.
- It has been reported from Mediterranean basin, Middle East, Far East, America, Asia, Australia, Europe, Africa and Turkey.
- The pathogenicity is low.

*Theileria orientalis*

# Theileriosis in Sheep and Goats

- *T. lestoquardi* (Vectors: *Hyalomma* spp.)
- The piroplasmic forms are mostly round-shaped.
- Malignant theileriosis
- It is seen in north and east Africa, south Europe, Middle East, central and south Asia.

*Theileria*  
*lestoquardi*  
(0,6-2 $\mu$ )

# Theileriosis in Sheep and Goats

- *Theileria* sp. China (Vector: *Haemaphysalis* spp.)
- It is a pathogenic species.
- It causes deaths especially in youngers.
- It is common in China.

# Theileriosis in Sheep and Goats

- *T. ovis* (Vectors: *Rhipicephalus* spp.)
- The piroplasms are polymorphic.
- It is considered as nonpathogenic or low pathogenic.
- It is seen in north and east Africa, south Europe, Middle East, central and south Asia.
- It has also been reported from Turkey.

*Theileria ovis*  
0.5-2  $\mu$  m

- *T. separata*
- Nonpathogenic

# *Theileria* species in other ruminants

- *Theileria camelensis* (Vector: *Hyalomma dromedarii*)
  - Camel
  - It has been reported from Egypt, Somali and Turkestan.
- *Theileria cervi*
  - Deer
- *Theileria tarandi* (Vector: *Ixodes persulcatus*)
  - Deer
  - It has been reported from Russia.

# Pathogenicity

- The disease causes with severe findings in some cattle strains and can cause death in that animals.
- Age (cattle older than 1-2 ages are susceptible)
- The schizogony stage is pathogenic.
  - Seconder infections may emerge depending on the destruction that occurs in immune system.
- Strain resistance
- Virulence of the species.

# Symptoms

- The incubation period of the disease is about 9-5 days.
- There is initially asymmetric, then symmetrical bloating in the lymph nodes (on the 5<sup>th</sup> day following the infection)
- High fever (41-42°C)
- Anemia due to suppression in blood-forming organs (aplastic anemia)
- In addition to these, hemoglobinemia, bilirubinemia and icterus can be seen in sick animals.
- Bloody, mucous diarrhea
- Respiratory failure due to pulmonary edema
- Death

# The course of infection

- mild
  - In immune cattle
- peracute
  - Death within 3-4 days
- acute
- subacute
  - Low pathogenic species
- chronic

Swollen prescapular lymph node

Tear and nasal discharge

Hemorrhage in intestine

Hemorrhage in kidney

Hemorrhage in heart

Ulcers in abomasum

# Diagnosis

- Epidemiological information
- Season
- Clinical findings
- Microscopic examination
  - Thin smear from lymph nodes
  - Thin and thick blood smear
- Serological methods
  - IFA, IHA, DFA, ELISA, CF
- Molecular methods
  - PCR

# Prevention and Control

- Vaccination
  - *T. annulata*
- Control of animal movements
- Vector tick control
  - In the stables
  - On the host

# Treatment

- Buparvaquone (Butalex) 2,5-5 mg/kg im single dose or 2,5 mg/kg two times with 48 hour intervals
- Parvaquone (Clexon) 10 mg/kg im two times with 48 hour intervals
- Halofuginon (Terit) 1,2 mg/kg 500 ml peros mixed with water