

Avian Spirochetosis

Spirochete infection of birds

- Spirochete infection caused by helical-shaped bacteria. Two distinct forms exist because of difference in colonization, pathogenesis and lesion production.
 1. Acute septicaemic borreliosis (**blood spirochetosis**) caused by tick borne ***Borrelia anserine*** (*B. anserina*).
 2. Subacute-to-chronic **intestinal** disorders of varying severity caused by different groups of spirochetes (***Serpulina species***).

Synonyms

- Avian Spirochetosis (AS)
- *Borrelia anserina* infection,
- Avian Borreliosis,
- Fowl Tick fever, Chicken Tick Fever,
- Fowl Tick Paralysis, Chicken Tick paralysis,
- Spirochetosis, Fowl Spirochetosis.

Definition

- It is an acute, insect born, septicemic disease of many species of birds, characterized by:
 - High fever, anorexia, depression, cyanosis of the head, diarrhea, leg weakness progressing to paralysis and death.
- The highest incidence of avian Spirochaetosis is recorded during **summer months** where the insect vectors are common, but may be observed at any time through the year.

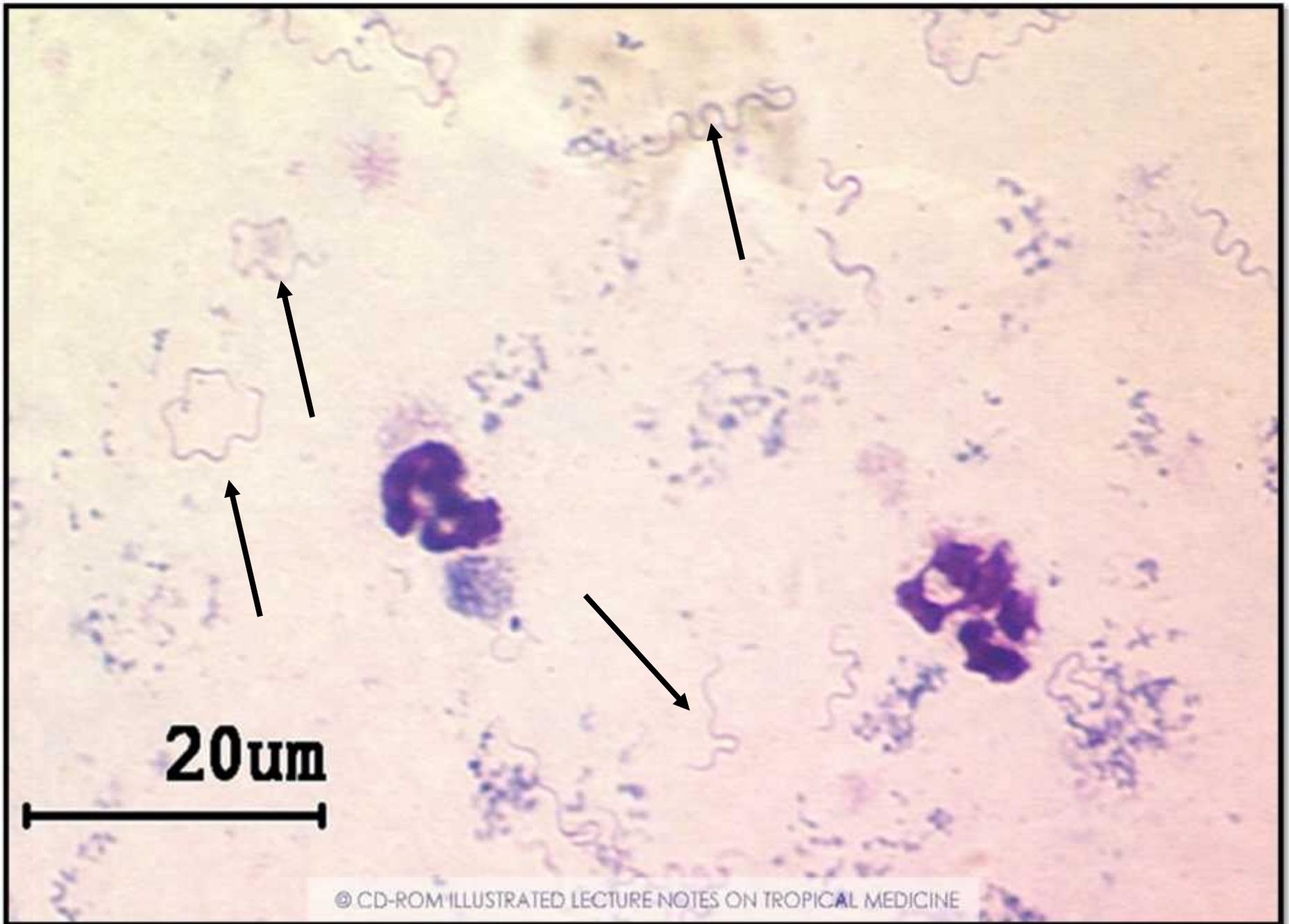
□ Etiology

- ***Borrelia anserina***

- ***Cellular morphology:***

- ***On stained smears:***

- It is a long, helical bacterium, usually with 5-8 loosely arranged coils (spirals).
- It is stained blue to purple with routine Hematological dyes (Geimsa, Leishman, dilute carbol fuchsin, and methylene blue stains).



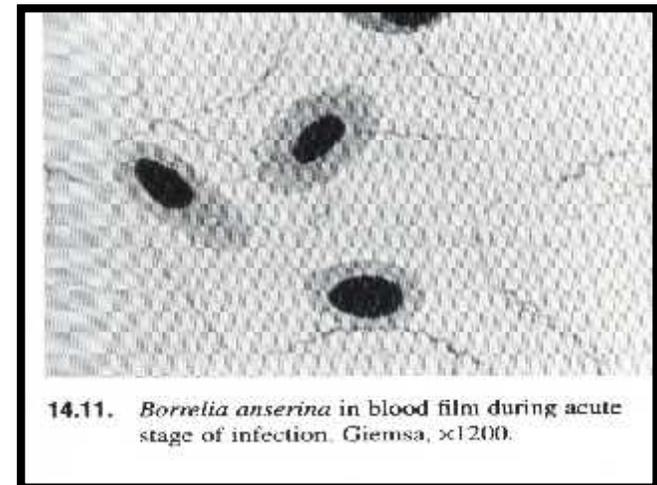
20 μm

• *In the early stage of the disease at the 3rd – 5th day of infection (febrile or pyrexial stage):*

- Stained blood or tissue smears show the organism **intercellular in the blood, liver, and spleen.**

In the late stage of the disease (terminal or apyrexial stage):

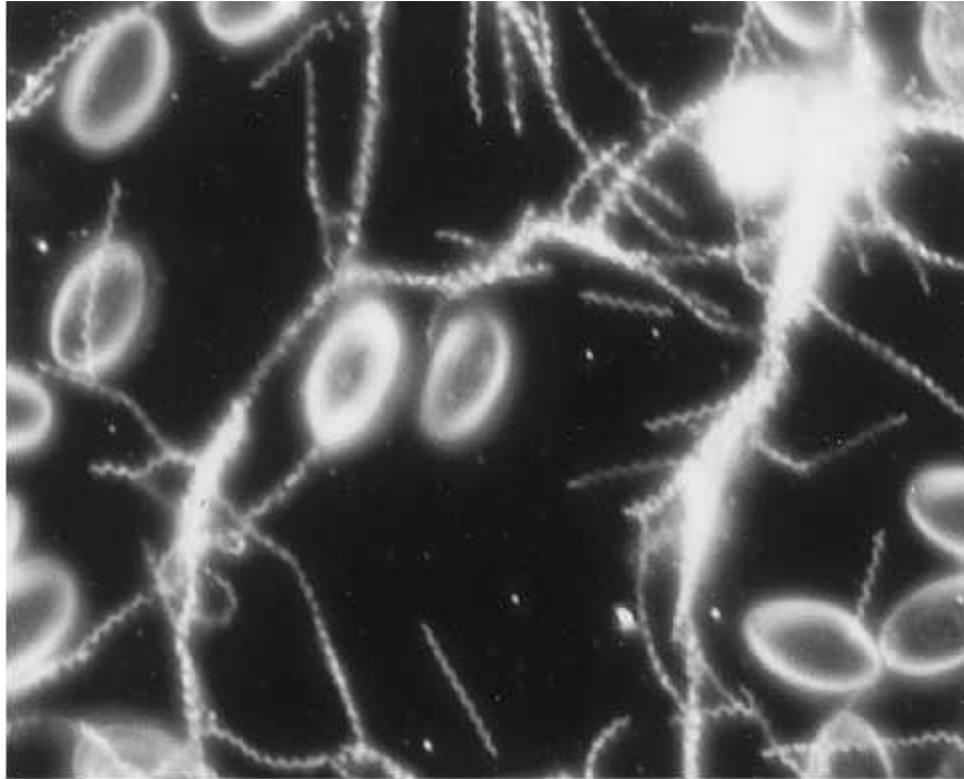
Stained smear may show spirochetes in clumps. Also spirochetes may not be observed in stained smear.



14.11. *Borrelia anserina* in blood film during acute stage of infection. Giemsa, $\times 1200$.

- *In wet smear using dark-field phase contrast microscopy:*
- Spirochetes have a definite, uniform, wavy appearance, are actively motile by a single, short, delicate flagellum at each end and may or may not adhere to blood cells.
- This method is used at **early or late stages** of the disease, when infections are due to low-virulent strains, and for demonstrating spirochetes in decomposed tissues or tick.





Chicken during terminal stages of spirochetosis. Note the agglomeration of organisms. Dark-field, x480.

- Spirochetes in blood can be concentrated in the Buffy coat by microhematocrite centrifugation of heparinized blood.
- *On electron microscopy*, spirochetes have several periplasmic subterminal flagella.

Propagation and culturing:

- *Borrelia anserina* cannot be cultured using routine bacteriologic media.
- **N.B.**
- *Borrelia* will grow on Barbour-Stoenner-Kelly medium, but loses virulence after 12 passages.

❑ *Serologic detection in the host:*

- to detect spirochetes in the serum, by agglutination, immobilization precipitin and fluorescent antibody tests.

❑ *Biochemical reactions:*

- Nothing is known about the biochemical reactions, except it produces acid from glucose.

❑ *Strain classification:*

- Many serotypes may be found, but there is no formal serotypes classification. Strains differ in their virulence.

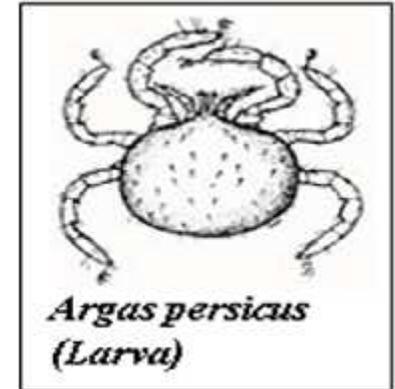
❑ *Resistance:*

- The organism is not very resistant outside the host and must be maintained in some vector between hosts.

Susceptibility

- chickens, turkeys, geese, ducks, pheasants and canaries.
- Pigeons are refractory to natural infection.
- All ages are susceptible but Young birds are affected more severely than older ones. Older birds tend to be more resistant.
- Usually seen in tropical or subtropical countries. Wherever the biologic vectors are found. The most common vector is *Argas persicus*

Mode of infection and transmission



- **Sources of infection are:**

1. Blood sucking insects (ticks, mite, mosquitoes.....).
2. Dropping, blood, tissues from infected live or recently dead birds.

- **Transmission:**

- The organism is transmitted from one bird to another by:** the bites of the avian ticks, red mites and mosquitoes of the genus *Culex*.

- **Transovarian transmission (biological transmission):**

occur in soft ticks (*Argas persicus*) i.e. Infected ticks lay infected eggs → Hatch infected larvae → pass the spirochetes to the nymphs → Pass the spirochetes to the ticks.





- N.B.

- *Agras persicus* remain infective for up to 430 days after feeding on infected host.
- Ticks remain infected despite feeding on chicks hyperimmune to *B. anserina* or on chicks with high blood levels of chemotherapeutic agents effective against *Borrelia*.

Mechanical transmission:

- The fowl tick is infective by all stages (adult, eggs, larvae, nymphs); other vectors (lice, mosquitoes, some species of ticks, inanimate objects) and Ingestion of infected ticks or their eggs.
- Ingestion of food contaminated with fecal matter from infected ticks
- Ingestion of droppings (bile-stained dropping) of infected birds containing the spirochete either directly or indirectly by contaminated food and water.
- Cannibalism of infected moribund birds or scavenging of recently dead infected carcasses.

Clinical signs

- There is abrupt **fever** (43C – 46C) and increased water consumption.
- Affected birds appear
 - listless, depressed, inactive, weak, droopy, with cyanotic head, ruffled feathers and rapid loss of body weight.
 - stop eating and pass fluid to mucoid green fecal droppings containing excess bile and white to pale yellow urates and they tend to set on their hocks, with their eyes closed.



The birds are depressed, cyanotic;
greenish diarrhea with considerable
amounts of urates



Late in the disease:

- birds develop **paresis or paralysis** and become **anemic** (Non-hemolytic anemia in affected birds results from erythrophagocytosis causing decreased total erythrocytes, hemoglobin and packed cell volumes), emaciated, and drowsy to comatose.
- **nervous signs**, and **subnormal body temperature just prior to death**.
- Recovered birds have weakness or paralysis of one or both wings and/or legs.



At a later stage, paresis and paralysis are developing, the birds become somnolent and comatose.

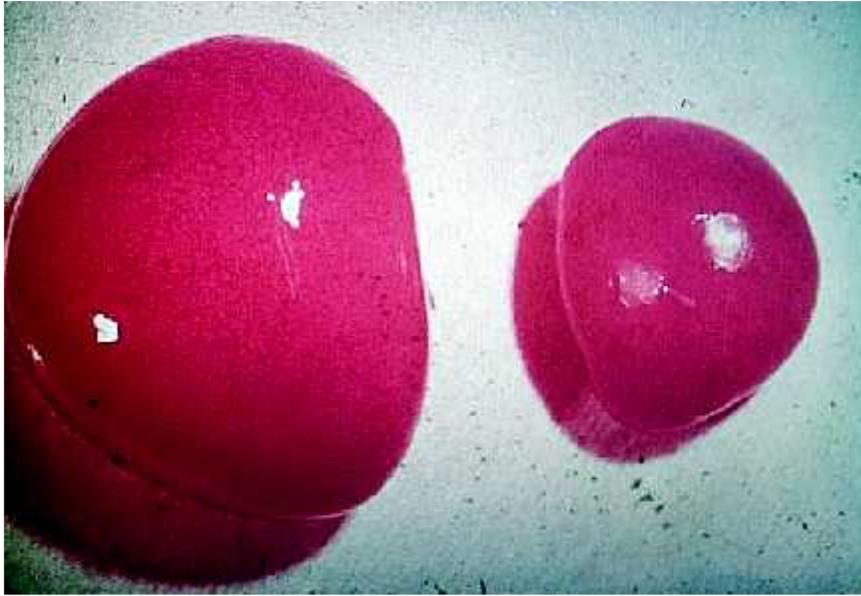
- Egg production in layers or breeders may be reduced by 5-10%, with a higher number of small eggs.
- The course of the disease is about 4-6 days.

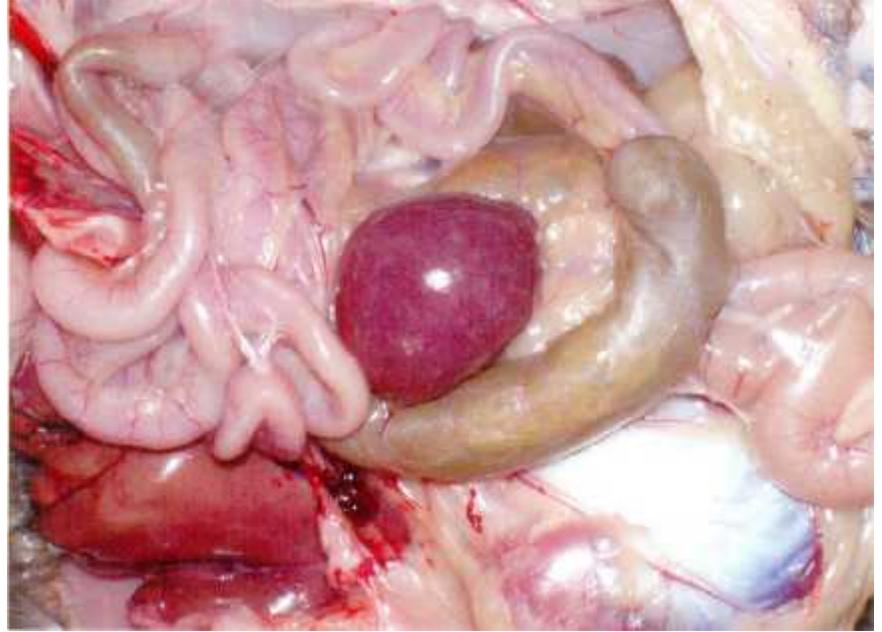
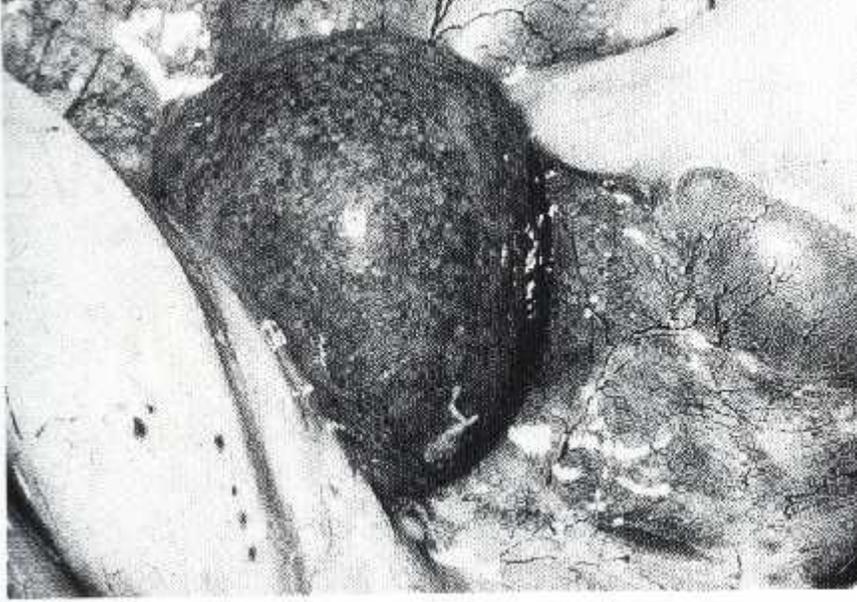
✳ **Morbidity and mortality rate:**

- ✌ Vary greatly depending on the number of infectious vectors in the area, may approach 100% in highly susceptible flocks

Postmortem Lesions

- Marked enlargement of the spleen, mottled by ecchymotic hemorrhages, is the most characteristic lesion
- N.B. Splenic lesions result from macrophage and lymphoid hyperplasia, erythrophagocytosis, and hemosiderin deposition. Multifocal necrosis and hyalinization of white pulp and/or extensive hemorrhage may be present in some birds.

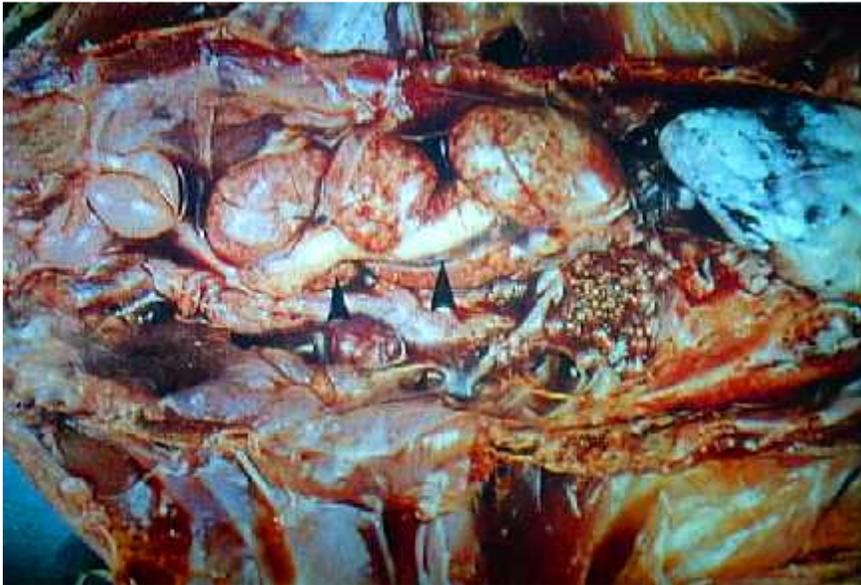




- **Liver** is enlarged, congested and may contain small hemorrhages or pin point foci of necrosis or marginal infarcts.



- ***Kidneys*** are swollen and pale with excess urates distending the ureters.
- ***Proventriculus***: linear hemorrhage is seen between the proventricular glands and at proventricular – ventricular junction).



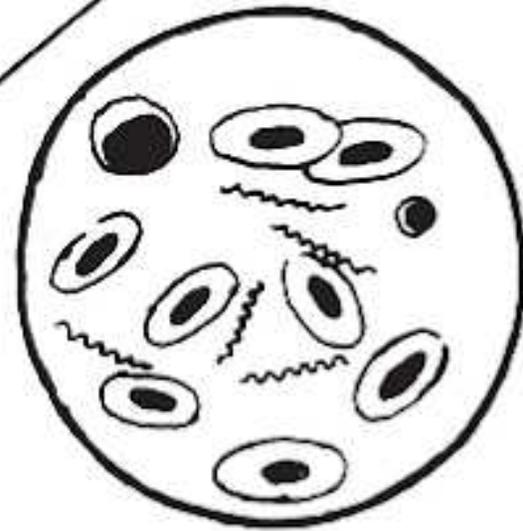
Dark blue comb



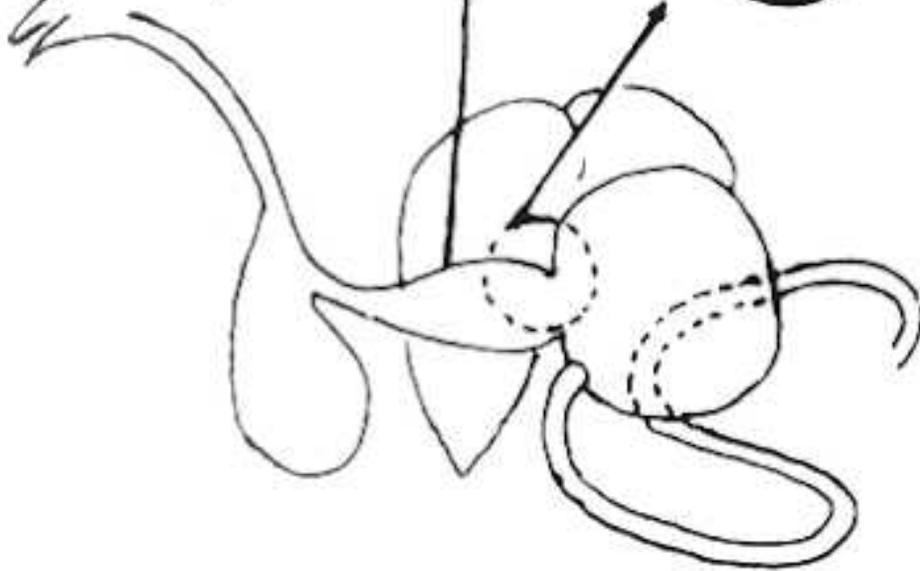
Linear haemorrhages between proventricular gland



Enlarged, haemorrhagic spleen ± white necrotic spots



Spirochaetes in blood smear



Intestine: Catarrhal inflammation of the Intestine (green, mucoid intestinal contents are present)

Mild Fibrinous **pericarditis** and **myocarditis** occurs infrequently.

Ovary may be inflamed and congested. Peritonitis.

Extensive **muscle** necrosis and hemorrhage occurred in infected pheasants



Diagnosis

- 1. Case history, clinical signs, gross lesions,**
- 2. presence of larval ticks on the underneath side of wing webs of** sick birds and punctuate of hemorrhage from tick bites on the shank and finding nymph and adult ticks in bird environment and feed mostly at night.
- 3. Detection of spirochetes in Geimsa stained blood** smear during the febrile stage is diagnostic.
- 4. In freshly dead bird the organism can be detected in smears made from** the pericardial fluids or heart blood or in section from the liver or spleen (**tissue impression smear**).



4) *The spirochetes may not be detected in the blood or in tissue during the late stage of the disease (apyrexial stage), so they may be diagnosed by* the following:

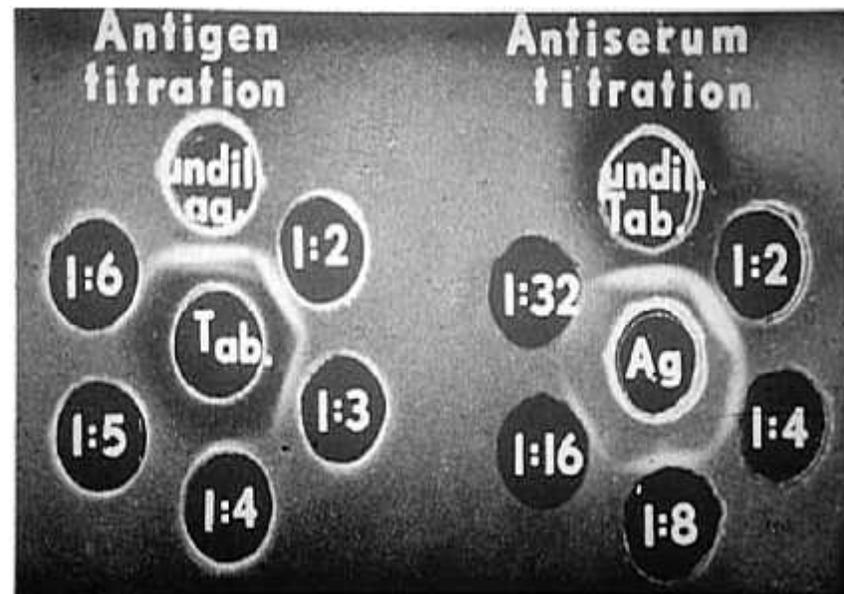
a) Identification of the spirochetal antigen in infected blood, liver or spleen by agar gel test or fluorescent antibody test.

b) Inoculation of the infective defibrinated blood, serum or tissue suspension in saline into yolk sac of 6 day old embryonated chicken or turkey eggs. Spirochetes may be demonstrated 2-3 up to 6 days later by examining of allantoic fluid.

c) Inoculation of 0.5 to 1 ml blood, serum or tissue suspension I/M in young chicks or poults (3-7 days old up to 10 -15 weeks old) and finding spirochetes at at 3rd -5th day up to 10th day post infection in the blood

5) Serology

Several serological tests have been used to detect *Borrelia anserina* antibodies in the bird including serum plate agglutination test, tube agglutination test, Fluorescent antibody test, agar-gel precipitin test by using known antigen.



6) Differential diagnosis:

Avian spirochetosis can resemble other poultry diseases characterized by septicemia including fowl cholera, fowl typhoid, colisepticemia, ND, AI and MD.

Differential diagnosis depends on:

- The characteristic lesions of AS, positive blood film.
- Inability to culture salmonella, *P.multocida*, or *E.coli*.
- Absence of respiratory signs and absence of extensive hemorrhages in G.I.T, and other tissues typical of N.D, AI., inability to isolate NDV, or AIV.
- Absence of ocular, neural and visceral tumors lesions of MD.

Prevention

1. Sanitation and sound management:

- Clean and hygienic poultry pens should be used for housing.
- The poultry house should be free from insects.
- Spirochetosis is best prevented by not introducing tick infested birds into clean flocks.
- Do not introduce susceptible birds into infected flocks or housing where the infected birds were once kept.

2. Eradication: of ectoparasites by disinfection using insecticides (malathione)

3. Vaccination:

- A wide variety of bacterins have been prepared.
- ***Avian spirochete vaccine (killed vaccine)*** is used for vaccination of chicken, turkeys, duck, geese. An autogenous or polyvalent vaccine containing multiple serotypes may be necessary to provide full protection.
- ***Age of vaccination:*** 4- 6 months.
- ***Dose:*** 1ml for chickens, 2ml for turkeys, ducks, geese by I/M or S/C injection.
- ***Period of immunity:*** 4- 6 months.

Control

1) Sanitation and sound management:

- Hygienic disposal of dead birds and destroying all the birds in severely affected flocks.
- Eradication of the ectoparasites (ticks, mites, other biting insects) by using of insecticides:
 - On the host birds by wet dipping in malathione 0.5%.
 - In the houses and the surroundings by malathione 3%.
- It may be difficult to eradicate the fowl tick without destroying the infested wooden building and destroying all the birds in severely affected flocks.

- **Treatment**

- The most widely used are ***penicillin derivatives*** (drug of choice) single dose 20,000 IU/bird I/M inj. given 3 times in 24 hours.

- ***Oxytetracycline:***

- A single dose 40mg/kg B.W., I/M inj.
- Or water medication at a dose 1gm/gallon water for 3 days.

- ***Streptomycin:*** 100mg/bird injection.

- ***Other antibiotics (kanamycin, chloramphenicol, ampicilline, Tylosin, Tiamulin).***

- ***Arsenical preparation as:***

- Atoxyle (sodium arsanilate): 20-50 mg/kg I/M.
- Spirocid: 0.2 mg/kg per os.
- Myosalversan, Novarsenobenzal, Neoarsphenamine.

