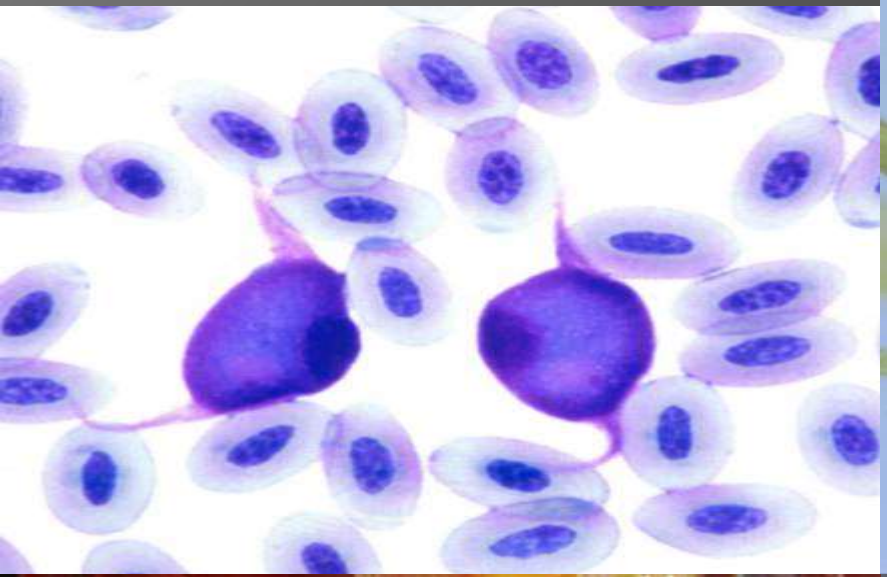
LEUCOCYTOZOON



Introduction

- A **PROTOZOAN PARASITE** of avian erythrocytes transmitted by the 'blackfly' Simulium spp.
- Infection causes the disease LEUCOCYTOZOONOSIS.
- The parasites were first seen by Danilewsky in 1884 in blood from an owl.
- There are over **100 species** in this genus.

Scientific Classification

Kingdom	Protista
Phylum	Apicomplexa
Class	Sporozoea
Order	Eucoccidiida
Family	Plasmodiidae
Genus	Leucocytozoon
Species	Smithi, Simondi, Caulleryi

Hosts & Vectors

Definitive host

- Ducks
- Turkey
- Geese
- Swans
- Similar waterfowl and Chickens

Vector

Black Fly(Simulium spp)

Major Species

- There are over 100 species in this genus, but the 3 most important species that’ve infected the most common domestic birds are;
- ***Leucocytozoon caulleryi*(**chickens)
- ***Leucocytozoon smithi(***turkeys)
- ***Leucocytozoon simondi(***ducks and geese)

Geographic Distribution

- Cases of *Leucocytozoon* have been reported all over, except Antarctica, due to the inability for the vector to survive

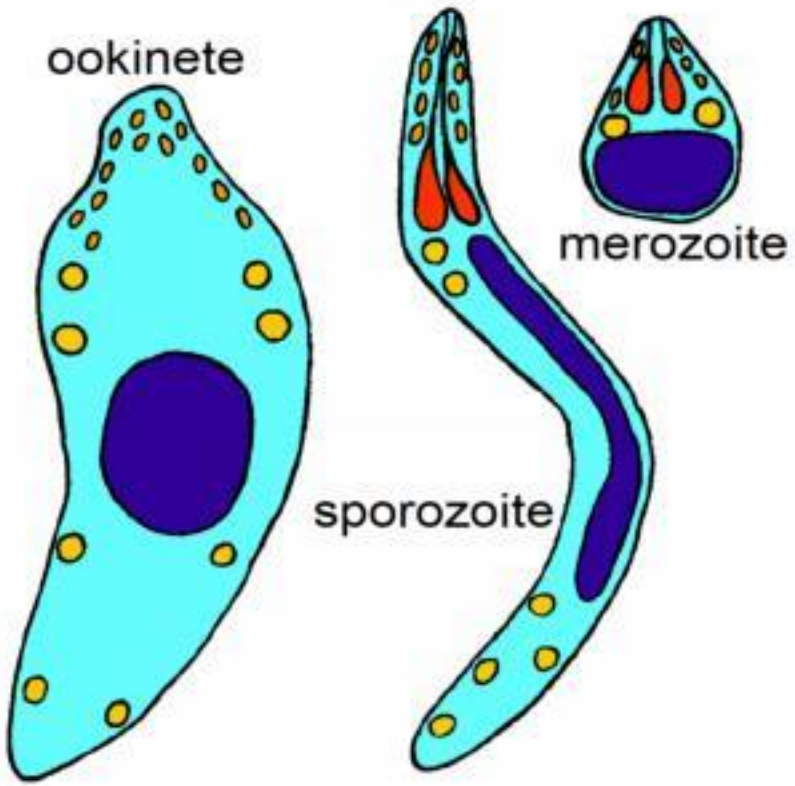
Geographical Distribution

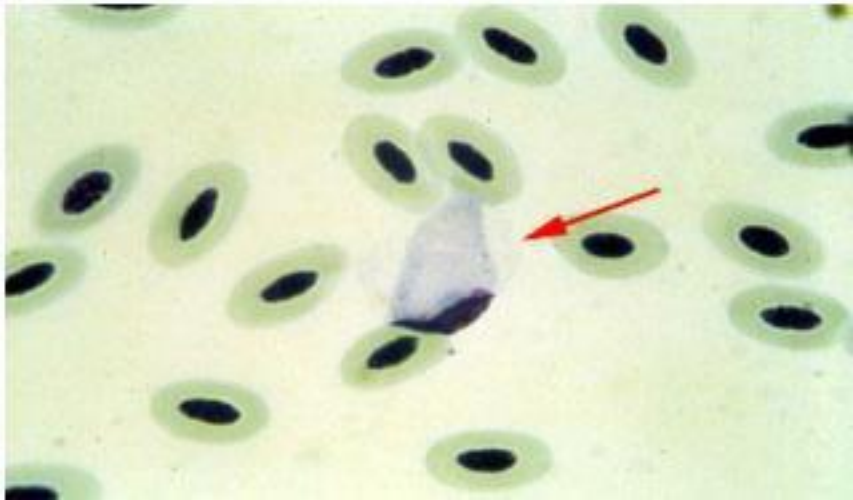
- In Thailand, India, Taiwan, Japan, Burma, Sri Lanka, the Philippines, Singapore, Malaysia, Indonesia, China, and Korea, USA, Canada and Africa most cases have been reported.

- Acute outbreaks of leucocytozoonosis have been reported in chickens, turkeys, waterfowl and wild birds worldwide.

Morphology

- Tissue cells are similar to most in apicomplexa
- Gametocytes: 12-14 microns
- Macrogametocytes: red -staining nucleus
- Microgametocytes: pale-staining nucleus





Leucocytozoonosis

- Caused by the blood parasite leucocytozoon, which is found in many water fowl.
- Most important blood parasite of birds and is pathogenic in both domestic and wild birds.
- This represents a serious economic risk.
- If not fatal, an immunity can develop after infection.

Epidemiology

- Can be found wherever both the black fly vector and a host are present.
- Highest rate of infection in the spring
- Very high mortality rate among juvenile birds

- Leucocytozoon use Black flies (Simulium species) as their vector and Birds as their **definitive host**.
- Over 100 species of birds have been recorded as hosts to these parasites.
- Leucocytozoon does not threaten human populations in terms of potential infection, infected poultry is not pathogenic in humans.
- Still, the parasite's economic impact could hurt poultry farmers' revenue as mortality rates are extremely high, especially among young birds

Transmission in Host

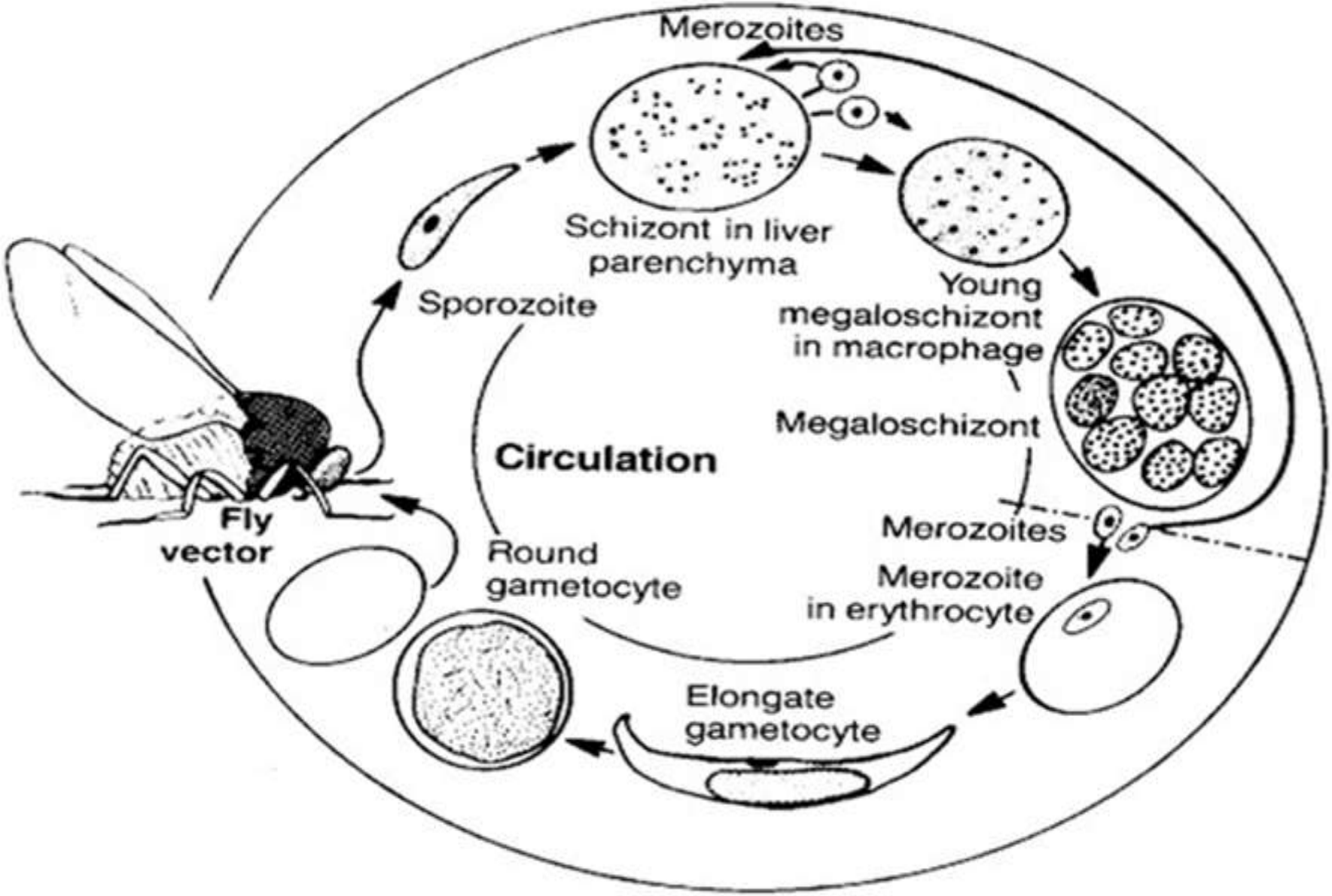
- Leucocytozoon's involves a fly vector (**the blackfly**) which carries the parasite from one avian host to another.
- When the blackfly vector bites a bird, perhaps around the unfeathered eye area, sporozoites are released in the vector's saliva and into the bird's **circulatory system.**


fieldcasestudy.com

Video :

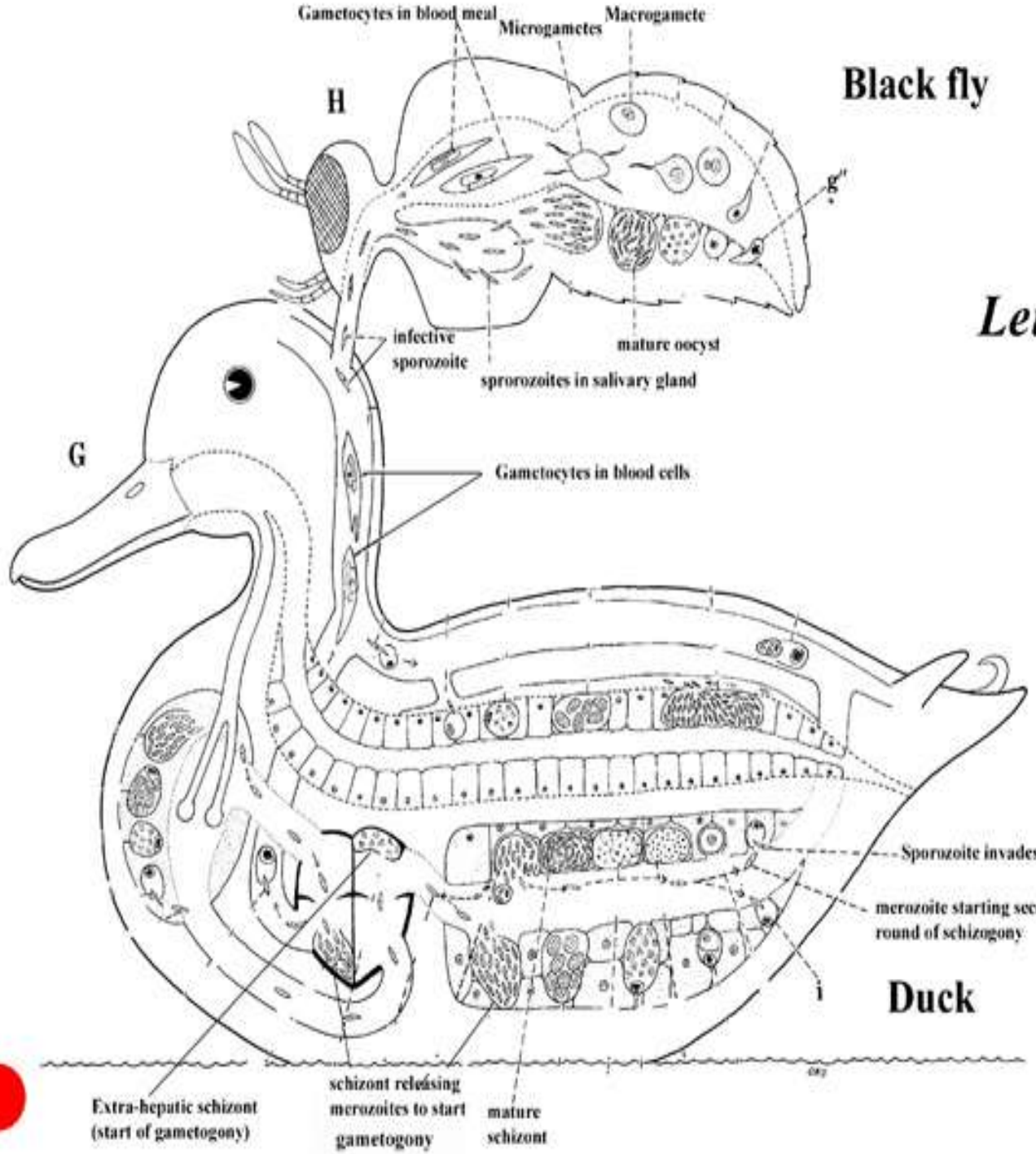
Life Cycle

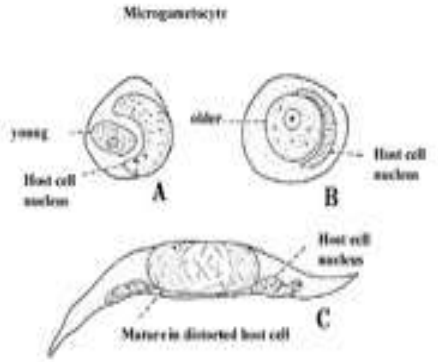
- -Sporozoites are injected into the bird when the fly feeds.
  -Sporozoites enter hepatocytes and develop into small schizonts.
  -Schizonts produce merozoites in 4-6 days.
  -Merozoites enter erythrocytes or macrophages.
  -In the erythrocyte the merozoites develop into round gametocytes.
  -In the macrophages the merozoites develop into megaloschizonts.
  -Megaloschizonts divide into primary cytomeres which multiply into smaller cytomeres and finally multiply by schizogony into merozoites.
  -Merozoites at this stage will penetrate leukocytes or developing erythrocytes to become elongated gametocytes.
  -At this point a non infected fly will feed on an infected bird and ingest the elongated gametocytes.
  -The elongated gametocytes become a macrogametocyte (female) and a microgametocyte (male).
  -The macrogametocyte and microgametocyte form an ookinete.
  -The ookinete penetrates an intestinal cell of the black fly and matures into an oocyst.
  -The oocyst produces sporozoites that leave and migrate to the salivary glands of the black fly, thus starting the life cycle over again.



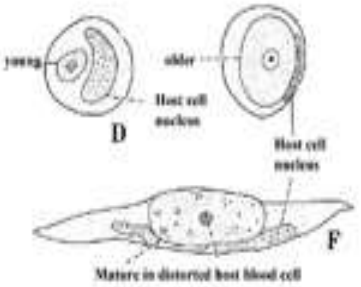
Leucocytozoon

Life cycle of *Leucocytozoon simondi*





Macrogametocyte



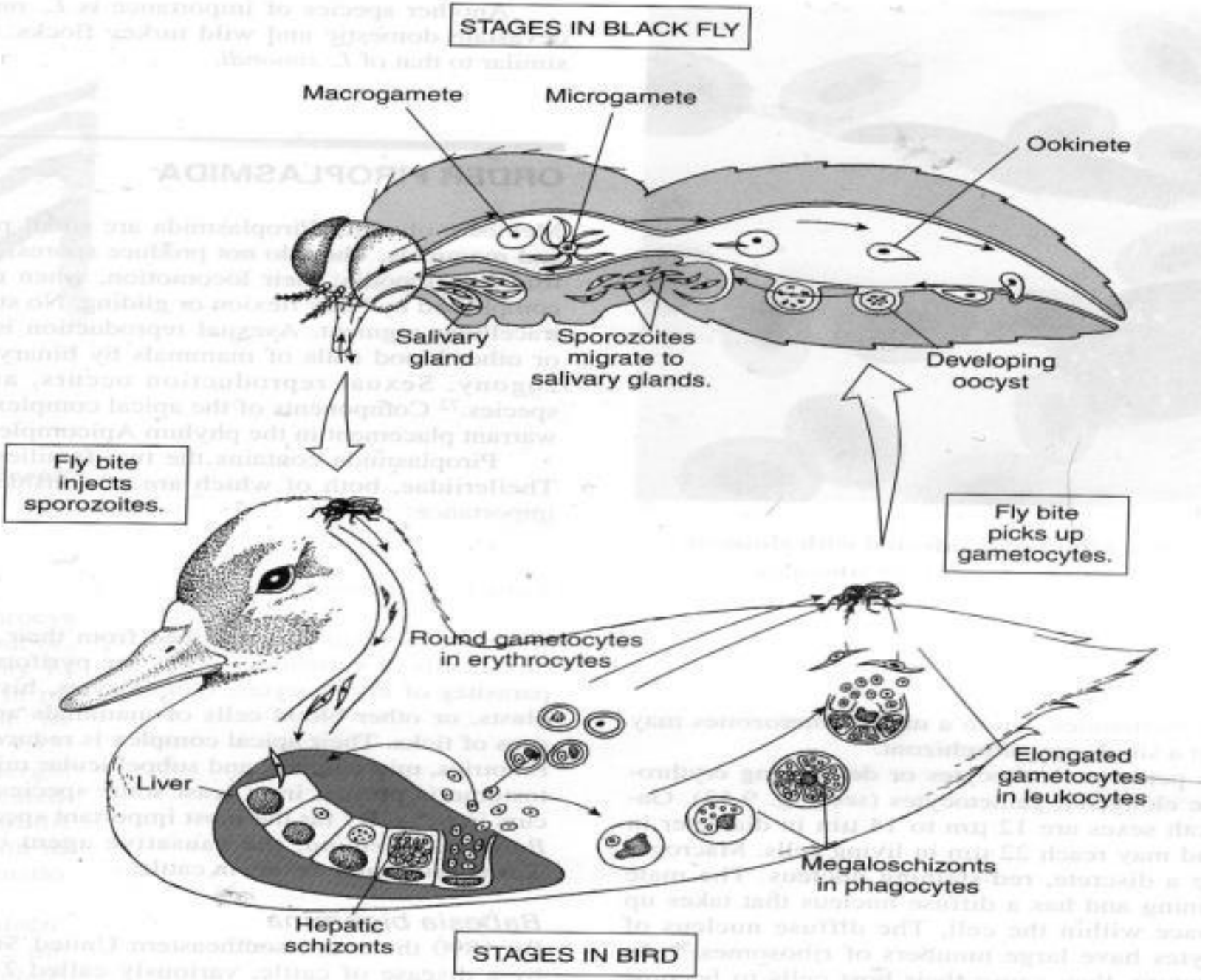


Figure 9.12 Life cycle of *Leucocytozoon simondi*.

by William Ober and Claire Garrison

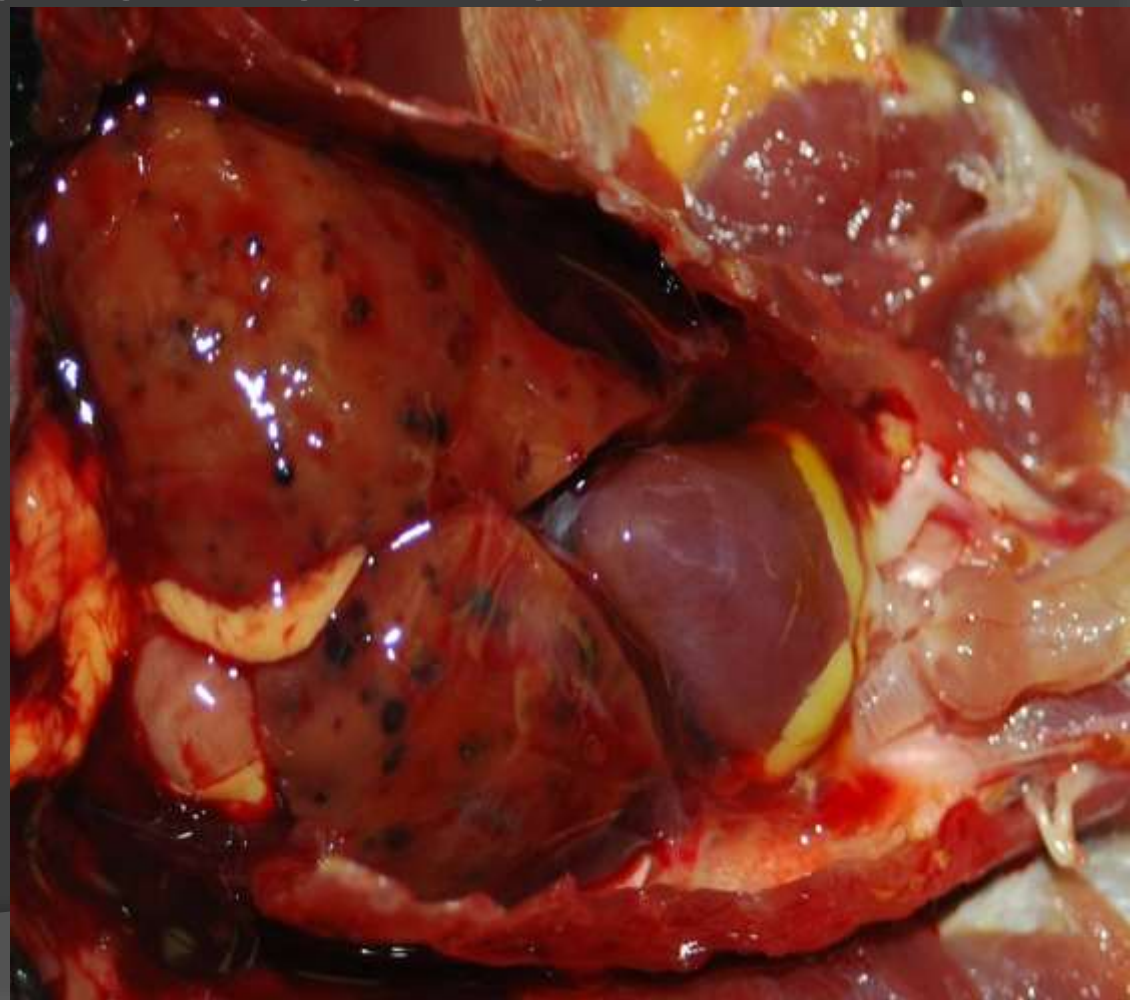
Pathogenesis

- Five days post infection:
  - Many schizonts develop in hepatocytes
  - Cells rupture
- Seven days post infection:
  - Megaloschizonts begin to appear in spleen
  - Also appear in Lymph and other tissues
  - Gametocytes accumulate in liver
- 12+ days post infection
  - Hemorrhagic scars from rupturing megaloschizonts

Area of Infection

- Leucocytozoon's infect the

- Heart
- Liver
- Lungs
- Spleen
- Brain



Clinical signs/symptoms

- The majority of birds affected with leucocytozoonosis exhibit no clinical signs.
- Visibly affected show mild to severe signs of **anorexia**, **luekocytosis**, **weakness**, **anemia**, **emaciation**, and have **difficult breathing**.
- Young birds manifest in **appetence**, **weakness**, **dyspnea**, and sometimes death within 24hrs.

- Signs in adults appear less abruptly and consist of listlessness and a low mortality rate.
- The mortality in adult birds occurs as a result of **debilitation** and increased susceptibility to **secondary infection**.
- Granulomatous and lymphocytic lesions are seen in the lungs, heart, brain and peripheral nerves. Large gametocytes can block capillaries of the lungs.

pathology

- Clinical signs
  - Anemia
  - Luekocytosis
  - non-pigmented gametocytes in the blood cells
- Physical signs
  - Thin blood causing tissues to appear pale
  - Both hepatomegaly and splenomegaly are present

Spleen

Lungs

Leucocytozoon in leucocytes

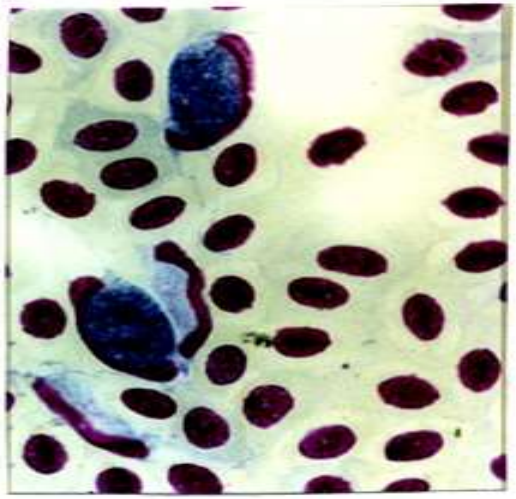
Diagnosis

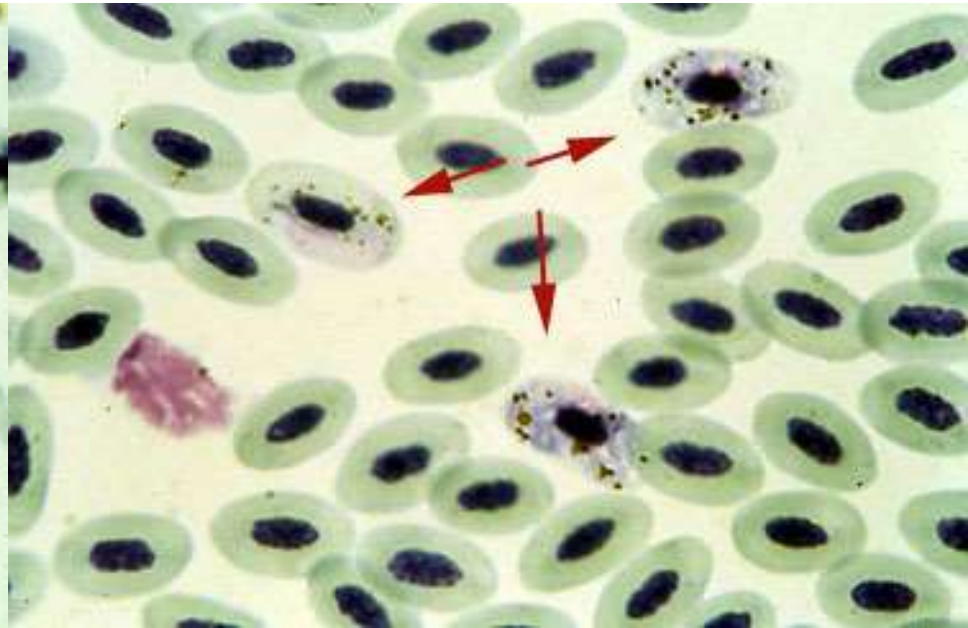
A diagnosis can be made by

- The demonstration of gametocytes in blood smears.
- **Histopathological** examination of the **liver**, **spleen** and **brain** can show developing **megaloschizonts**.
- **Necropsy** may reveal an enlarged spleen and liver.
- Since the majority of birds are sub clinically infected with Leucocytozoon, other causes of death must be ruled out even with the presence of Leucocytozoon gametocytes in peripheral blood smears.

Leucocytozoon smithi - gametocyte

This slide shows a typical gametocyte which has distorted the white blood cell into an elongate, elliptical body. Little evidence of the white blood cell morphology remains. Note that no schizonts appear in the blood.





Treatment and Control

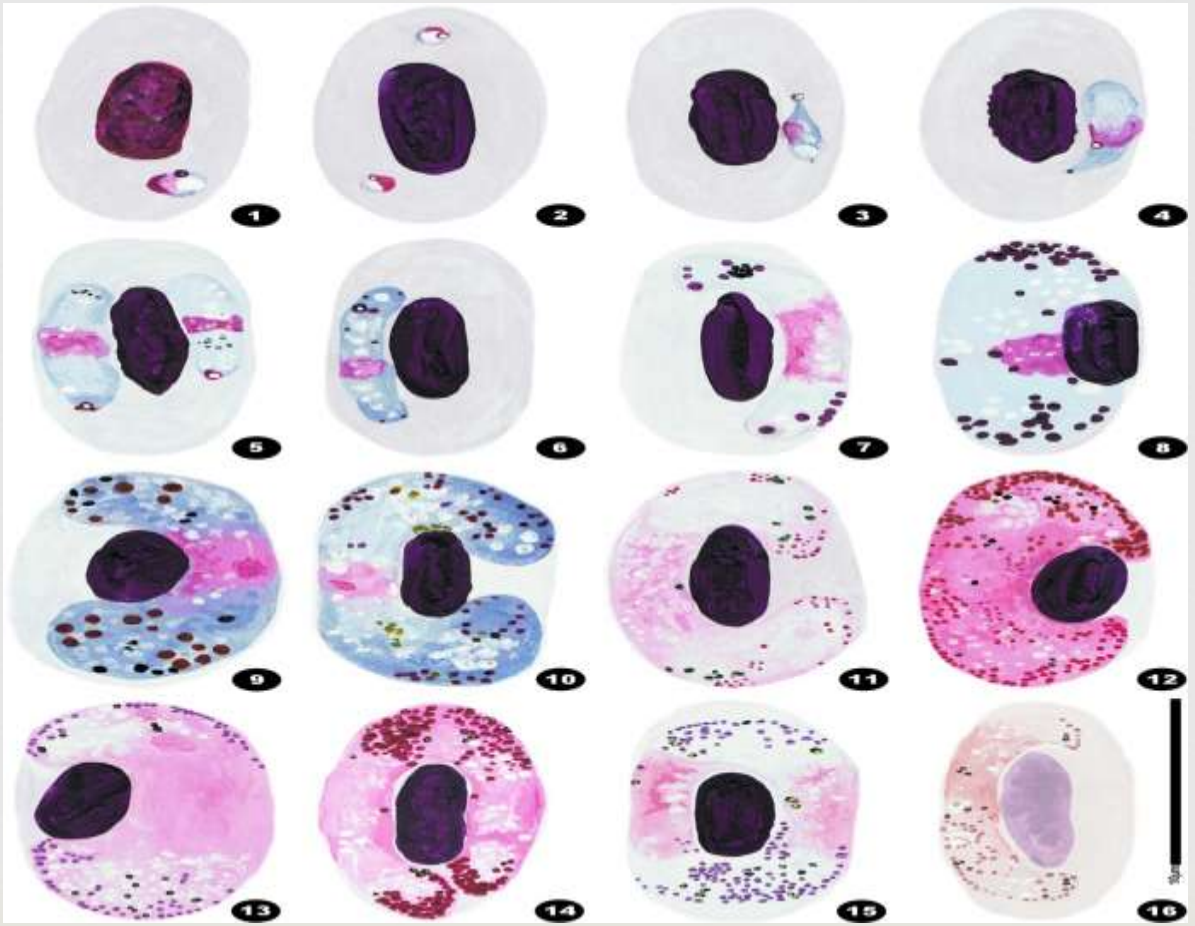
- Treatment usually is not effective, control of the Leucocytozoon in domestic avian species has, until recently, been limited to control of the **blackfly vector**.
- Preventive medication using **Pyrimethamine**(1 ppm) and **Sulfadimethoxine**(10 ppm) combined in the feed controls it.

* Quinine may be useful in early stage before gamatocyte appear

- **Clopidol (0.0125%–0.025%)** controls invertebrate vectors are helpful.
- **Quinacrine hydrochloride** or **Trimethoprim/Sulfamethoxazole** solution have been used i;e parasitemia is reduced, but the infection is not cleared.
- **Oral Anti-LEUCOCYTOZOONOSIS Vaccines** based on **TRANSGENIC** plants .

* Vector repellant and separation of infected bird is useful

Haemoproteus



Haemoproteus

- Parasites of birds and reptiles (snakes or lizards)
- Sexual phases in insects other than mosquitoes
- Exoerythrocytic schizogony is in endothelial cells
- Merozoites enter the RBC in circulating blood

Scientific Classification

- Kingdom: Protista

- Phylum: Apicomplexa
- Class: Sporozoea
- Order: Eucoccidiida
- Family: Plasmodiidae
- Genus: Haemoproteus

Species	columbae

GENUS INTRODUCTION

- Genus created was by Kruse in 1890
- Greek : *Haima* - blood
- *Proteus* - a sea god (who had the power of assuming different shapes)
- Synonyms of *Haemoproteus*:
  - *Halteridium*,
  - *Haemocystidium*
- Intracellular parasites - erythrocytes
- Pseudomalaria similarities with *Plasmodium* species

Haemoproteus columbae

- Host : Pigeon (*Columba livia*), doves.
- Vector : *Pseudolynchia canariensis* - louse flies (*Hippoboscidae*)

Heamoproteus Columbae

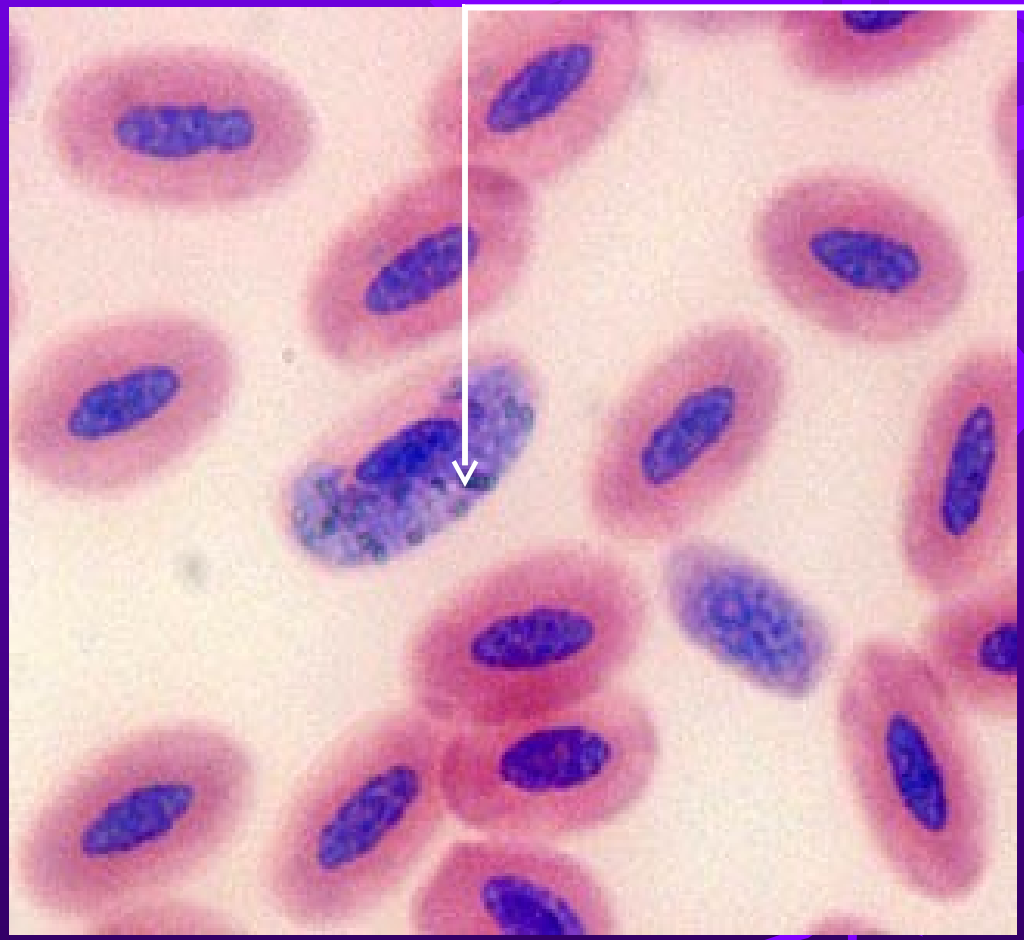
- Parasite of pigeons
- Host and vector are ectoparasitic flies that inject sporozoites with the bite
- Merozoites can develop from schizont or the schizont can break up into cytomeres
- At first resemble the ring stages of plasmodium but grow into macro- and microgametocytes in 5-6 days
  - Macrogametocytes have dark brown pigment granules, small nucleus and curves around RBC nucleus
  - Microgametocytes are less curved, less pigment granules and exflagellation results in 6-8 merozoites

H. Columbae

- In the stomach of the fly, oocyte makes many sporozoites that go to the salivary glands, remains infectious over the winter and can infect the young in the spring

- Usually no sign of disease in pigeons with occasional l ss of appetite, lungs congested, some anemia and spleen/liver enlargement

Morphology



- Gametocyte partially surrounds the cell's nucleus
- Multiple, refractile, golden-brown particles of hemozoin pigment.

Pseudolynchia canariensis - louse flies (Hippoboscidae)

Figure 1. Hippoboscidae fly detected in *Columba livia* pigeons in Lages, state of Santa Catarina, Brazil.

Life cycle

salivary glands of vector

sporozoite Infective stage bites a new host

Endothelial cells of blood vessels & lung, liver and spleen

asexual reproduction schizonts

Numerous merozoites penetration erythrocytes

Mature either macrogametocytes or microgametocytes

Another blood-sucking insect

Life cycle – cond.

ingested by another blood-sucking insect

sexual reproduction in the midgut of the insect

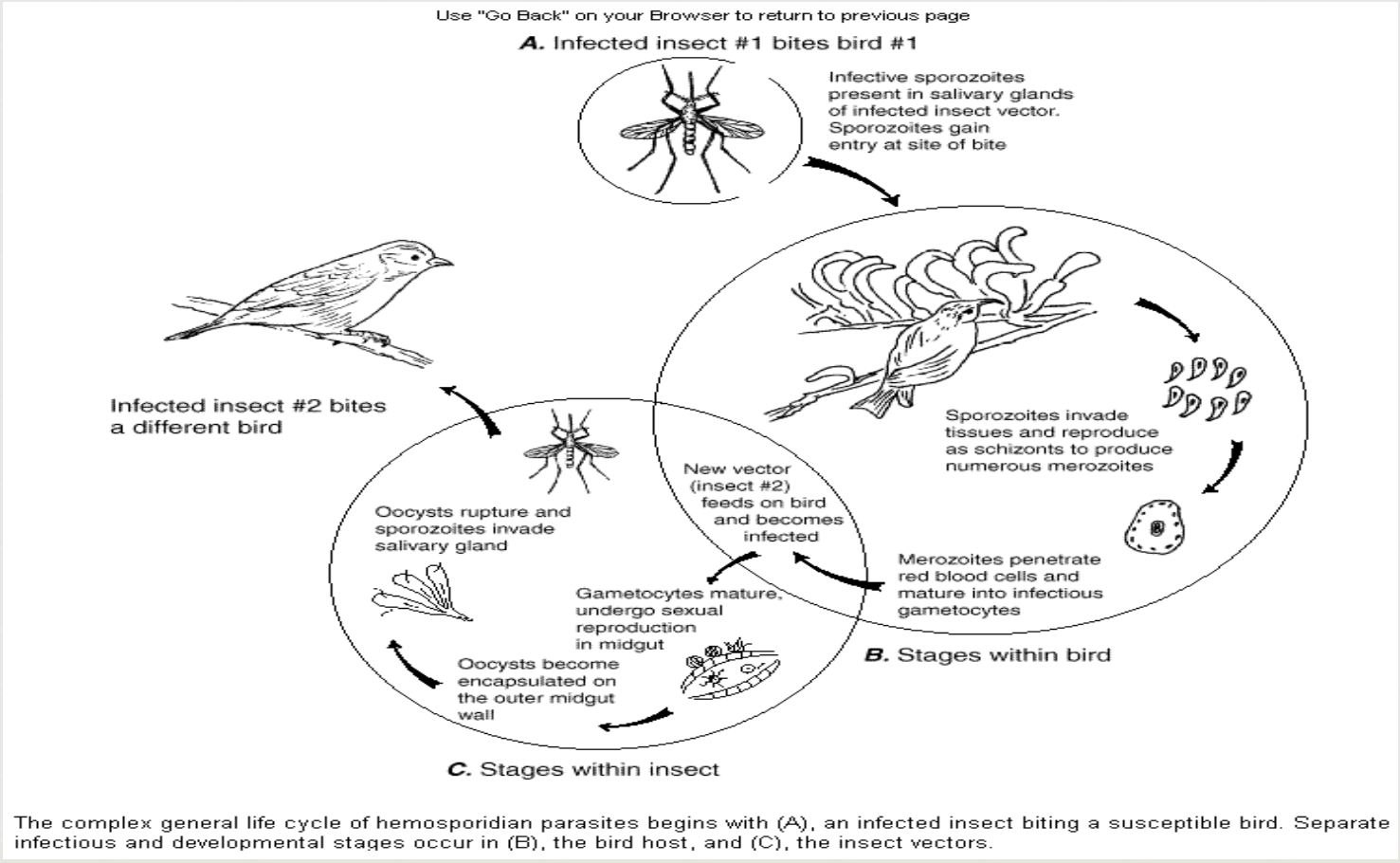
to produce oocysts

rupture and release numerous sporozoites

invade the salivary gland

subsequent infection for another host

Life cycle



The complex general life cycle of hemosporidian parasites begins with (A), an infected insect biting a susceptible bird. Separate infectious and developmental stages occur in (B), the bird host, and (C), the insect vectors.

PATHOGENESIS

- To produce subclinical infections
- Enlarged gizzards.
- Enlargement of the spleen, liver and kidneys
- May appear chocolate-brown due to hemozoin deposition
- Infected birds may suffer from reluctance to move,
- Ruffled appearance,
- Prostration And Death.
- Include Parasitemia And anemia.
- Large megaloschizonts may be present in skeletal muscles,
- Particularly those of the thighs and back.

Diagnosis

- Peripheral & Cardiac Blood smear examination.
- Liver & spleen impression smear were stained by Giemsa
- It shows a typical Halter shaped Gamonts in RBCs
- PM – Examination

Treatment and Control

- Antimalarial drugs - chloroquine may be useful
- Control
  - By eliminating the vector population
  - Habitat management
  - Application of insecticides
  - Use of ventilation fans

THANK YOU