Phylum : Protozoa

Class : Sporozoa

Genus : ***Plasmodium***

Disease : Malaria (Italian, mal aria – foul air, 1880) .

There are (4) species of plasmodia that infect humans are :

Species	Length of sexual cycle (in mosquito 27 °c) .	Prepatent period (in humans) pre-erythrocytic cycle	Length of a sexual cycle (in humans) .
P. vivax (benign tertian) malaria(m.)	8-9 days	8 days	48 hours
P. malariae (quartan m.)	15-20 days	15-16 days	72 hours
P. falciparum (malignant tertian m.)	9-10 days	5-7 days	36-48 hours
P. ovale (tertian m.)	9 days	9 days	48 hours

Habitat : RBC_S and tissues .

Vector and final host : Anopheles .

Infective stage : Sporozoites .

Mode of infection :Human infection occurs by bite of an Anopheles mosquito which introduces sporozoites into circulatory system .

The merozoites of different plasmodia species invade different stages of RBC_S :

P. vivax : invades only young immature stage of RBC_S .

P. ovale : invades young and pliable RBC_S .

P. falciparum : invades any stages of RBC_S .

P. malariae : invades mature stages of RBC_S .

Diagnosis :

The greatest numbers of parasites are present in the blood in between paroxysms .

We used Leishman's or Giemsa's stain for :

1) Thick film : it is useful for detection of light infection (RBC were completely lysed) .
2) Thin film : is useful for species diagnosis (morphology is maintained and species are identified) .

Serological test : Dipstick test for malaria antigen using a sandwich ELISA .

Clinical aspects :

1. Cold stage : lasting for 30 - 60 minutes .
2. Hot stage : lasting for 1 – 4 hours .
3. Sweating stage : lasting for 1 – 2 hours .

The paroxysms occur due to sudden libration of merozoites into the blood stream and varies according to each *Plasmodium* species .

Additional symptoms :

- Headache .
- Lethargy .
- Anorexia .
- Nausea .
- Vomiting .
- Anemia .
- Diarrhea .
- CNS involvement .
- Nephrortic syndrome (high loss of protein in the urine).

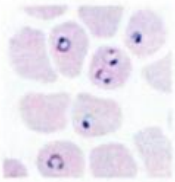
Malaria relapse : Some persons who have been treated with antimalarial drugs relapse back into disease due to reinfect of merozoites to hepatocytes .

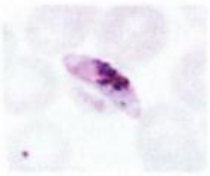
Ex : *P . vivax* .
P . ovale .

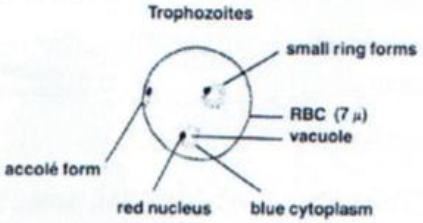
Diagnostic Stages

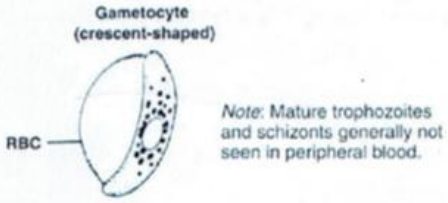
Plasmodium falciparum

P. falciparum





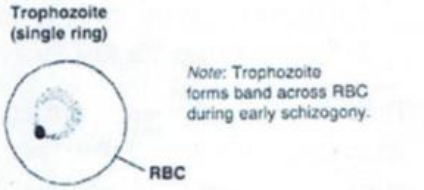




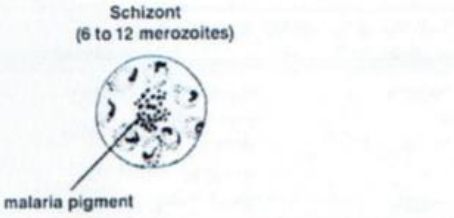
Note: Mature trophozoites and schizonts generally not seen in peripheral blood.

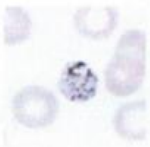
Plasmodium malariae

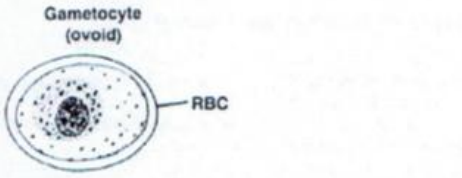
P. malariae



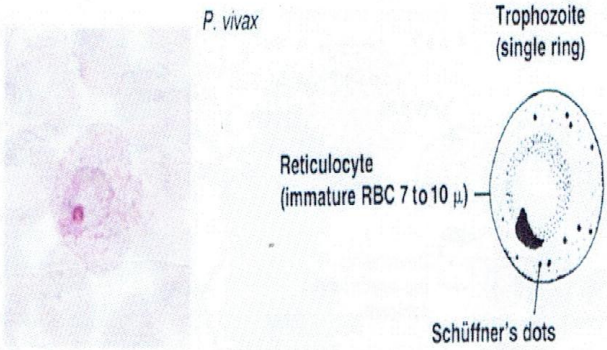
Note: Trophozoite forms band across RBC during early schizogony.



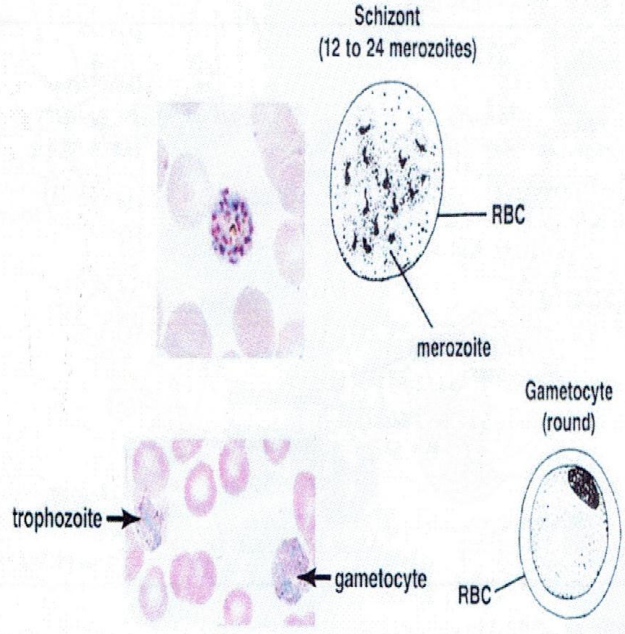




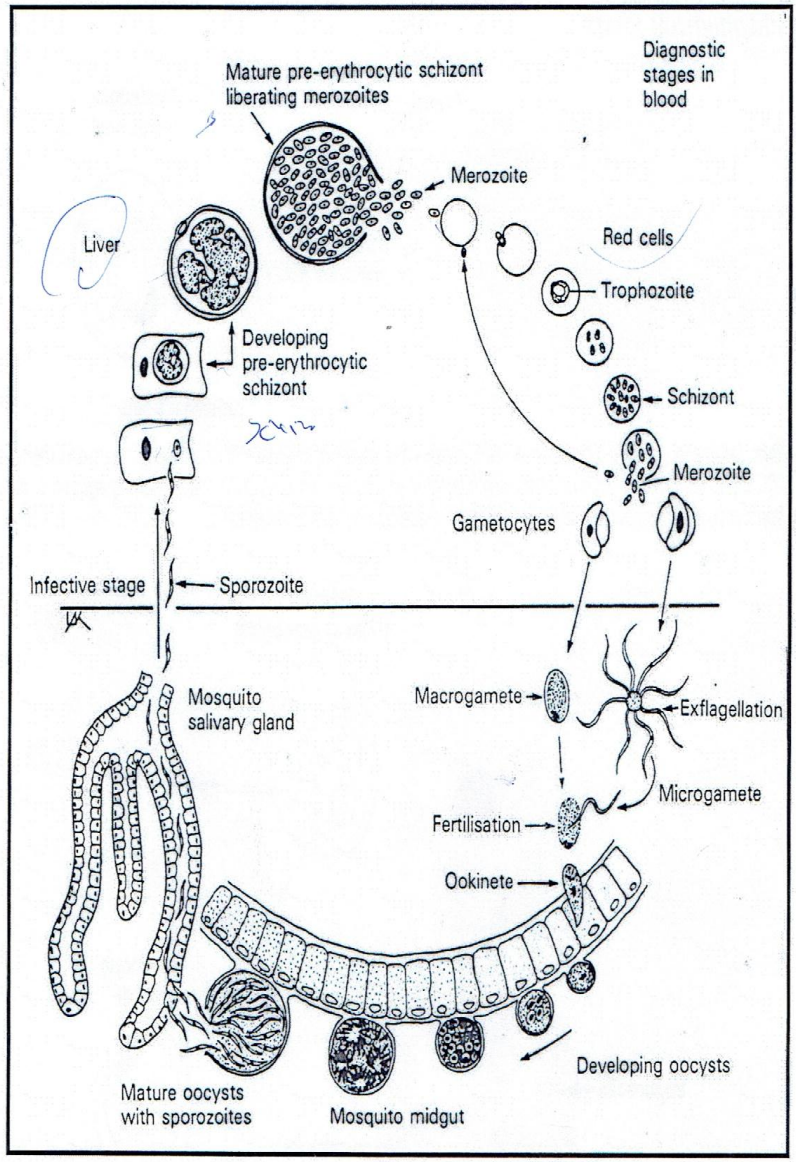
Plasmodium vivax



Note: *Single ring, one-third diameter of an RBC; invades only immature RBCs so that large bluish-staining cells are parasitized. RBC shows red-stained Schüffner's dots, which become visible between 15 and 20 hours following invasion of the cell. Trophozoite is very ameboid and assumes bizarre shapes during early schizogony.*



P. ovale **(rare)** ***Note:*** *Single ring, one-third diameter of RBC. RBC is oval, shows Schüffner's dots.*

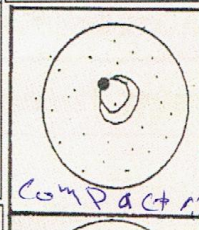
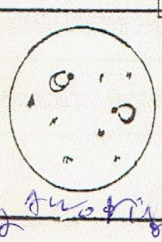
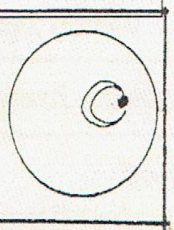
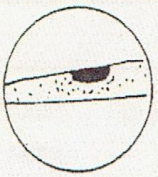
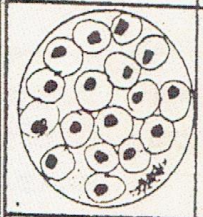
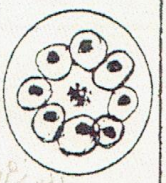
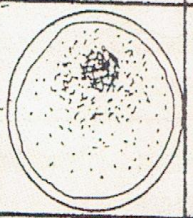
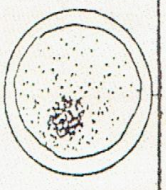
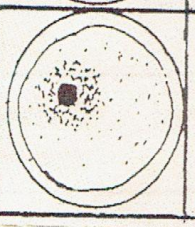
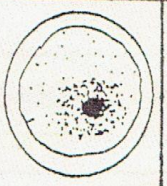


Life Cycle of Malaria.

Table : Differential diagnosis of malarial parasites in Giemsa stained thin blood films

Stage of parasite	*Plasmodium vivax*	*Plasmodium malariae*	*Plasmodium falciparum*	*Plasmodium ovale*
Duration of asexual cycle in blood	48 hours	72 hours	36–48 hours	48 hours
Infected red cells	Enlarged and pale, contain Schüffner's dots	Not enlarged. In rare instances minute dots are seen	Not enlarged. Various size of Maurer's dots	Not much enlarged and oval in shape. Often fimbriated, contain Schüffner's dots
Rings	About ⅓ to ¼ diameter of red cell	Smaller than *vivax*. Abundant cytoplasm	Smallest, about 1.5 μm in diameter, doubly infected corpuscles common	Similar to *vivax*
Early schizont	Irregular and amoeboid	Round, not amoeboid, with band forms	*Oval or round	Round, compact
Late schizont	12 to 18 merozoites	6 to 12 merozoites arranged like daisy head	*18 to 24 merozoites	6 to 12 merozoites
Pigment	Yellow-brown, fine particles	Dark brown and coarse	Dark brown and coarse	Darkish brown, not so coarse
Gametocytes	Round or oval, larger than red cell	Round, smaller than *vivax*	Crescent or banana shape	Rather smaller than *vivax*. Red cell enlarged

*Usually absent from circulatory blood.

Stages	*P. vivax*	*P. falciparum*	*P. malariae*
Ring			
Amoeboid (Early schizont)		Not seen	
Mature Schizont (Late schizont)		Not seen	
Male Gametocyte			
Female Gametocyte			

Morphological forms of Malaria