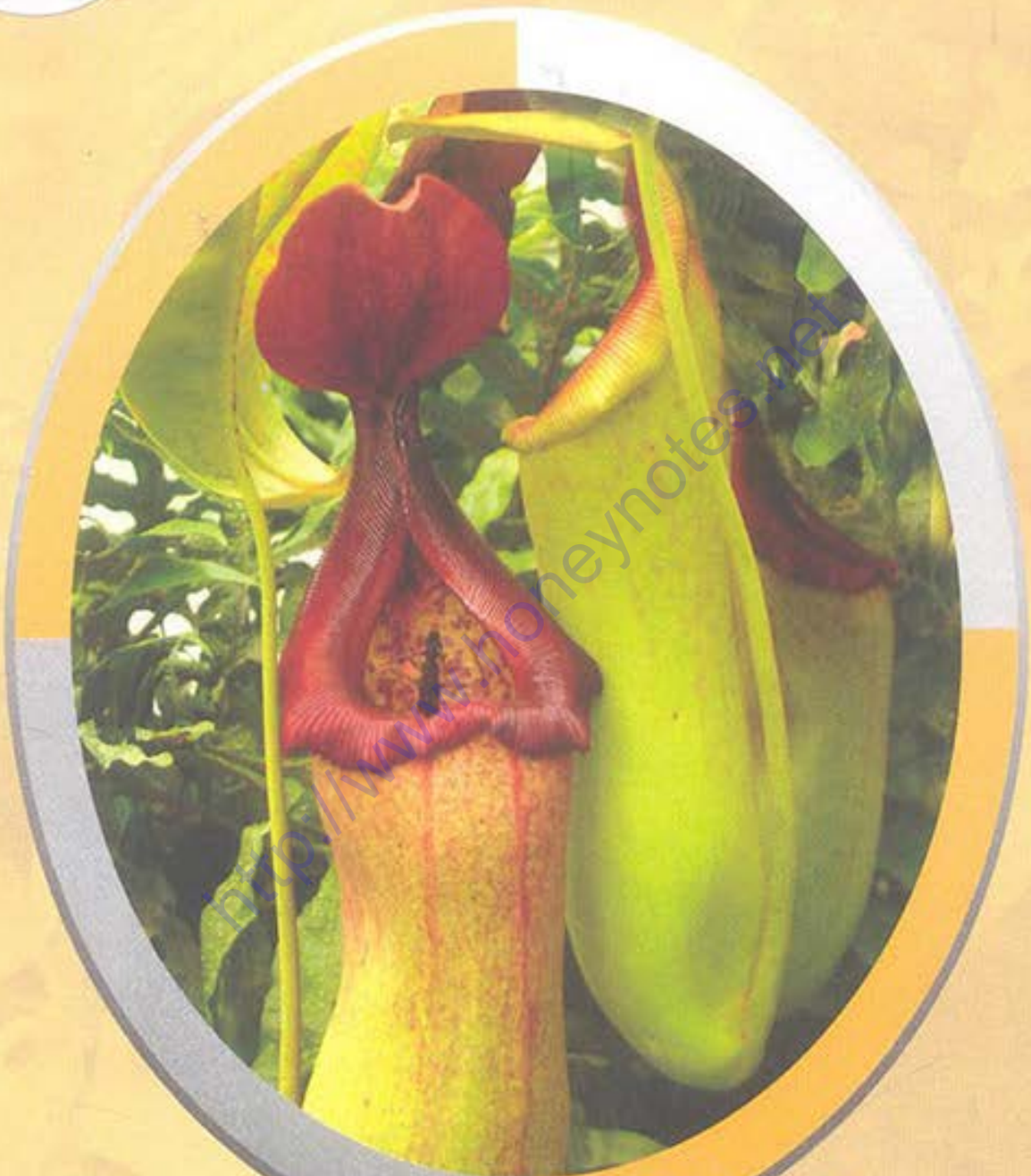
BIOLOGY

11



The Kingdom Protoctista (Protista)

CHAPTER – 7

PLANT LIKE PROTOCTIST

ULVA: (SEA-LETTUCE)

OCCURANCE

- Ulva, commonly called Sea Lettuce, is a marine green alga.
- It is found attached to rocks, along the sea coast in intertidal zones (the area between the high tide and low tide mark)
- In Karachi, it is found on Manora coast.

STRUCTURE

- Ulva exhibits primitive simple multicellular organization.
- The plant body is a thallus, which is flat, erect , wrinkled and sheet like structure having a length of about 30 cm (1ft).
- The thallus is very thin and internally it is composed of two vertical rows of cells only.
- Its lower part forms a "hold fast", consisting of long thread like cells for attachment to the substratum.

REPRODUCTION

Ulva can reproduce sexually as well as asexually.

(1)SEXUAL REPRODUCTION

- Sexual reproduction is isogamous and takes place in sexual plants or gametophyte, which are haploid (n).
- Each cell of the gametophyte produces many biflagellate gametes, which are released in seawater.
- The gametes are morphologically similar or isogametes but the fusion takes place between gametes produce by

two different gametophyte plants, which are termed as positive strain and the negative strain.

- Thus, ulva plant exhibits heterothallism (two type of plant body i.e. gametophyte (n) and sporophyte (2n) ulva).
- After fusion a diploid quadri flagellate zygote is formed.
- Zygote swims for some time then loses its flagella, secretes a wall around itself and undergoes a period of rest.
- Finally the zygote germinates and develops into a new diploid ulva plant, which is called asexual plant or sporophyte.

(2)ASEXUAL REPRODUCTION

- Asexual reproduction takes place by formation of quadri flagellate zoospores in diploid asexual plant or sporophyte, which is morphologically similar to gametophyte.
- Each cell (except the basal cells) of the sporophyte (2n) undergoes meioses or reduction division and forms 8-16 zoospores, which are released in water.
- After swimming they lose flagella and undergo a period of rest.
- Each zoospore ultimately developes and forms haploid sexual plant i.e. gametophyte, thus completing the life cycle.

ALTERNATION OF GENERATION

A distinct regular alternation of generations between the haploid gametophytes (sexual plant) and diploid sporophyte (asexual plant) is present. Since the two plants are morphologically similar so this process is known as "Alternation of generation (isomorphic)"

CHLORELLA

FIGURE 7.2 PAGE # 127.

OCCURANCE

- Chlorella is a fresh water alga found floating in stagnant water of ponds, pools and ditches.
- It is easily cultured and has been used an experimental organism in research in photosynthesis.

STRUCTURE

- The body of chlorella is one celled, spherical in outline and solitary.
- It contains a single nucleus and a cup-shaped chloroplast usually with out pyrenoid.

REPRODUCTION (ASEXUAL REPRODUCTION)

- Reproduction takes place by aplanospore formation, which involves the division of protoplast into 8-16 daughter protoplast.
- Each daughter protoplast secrets a wall to produce a non-motile aplanospore.
- On release from the parent cell, each aplanospore forms a new vegetative cell.

IMPORTANCE

Recently an antibiotic known as "Chlorellin" useful for the control of bacterial diseases has been prepared from the plant.

FUNGI LIKE PROTOCTIST

SLIME MOLD (PLASMODIUM STAGE)

- In initial stages of life cycle, slime mold are creeping masses of living substances, having the consistency of an unboiled egg white and the colour of the yolk.
- It sends out protoplasmic arms that engulf and digest bacteria from the surface of rotten rock or leaves.
- This amoeboid stage of slime mold is called plasmodium stage.
- The plasmodium consists of the cytoplasm in which are embedded many nuclei, food vacuoles and undigested food particles.
- Plasmodia can move along the forest floor, on to dead leaves that are bathed in sunlight.

FRUITING BODY

- In dry warm environment metamorphosis in Plasmodia takes place and it changes into cluster of fruiting bodies.
- Depending on the species the fruiting bodies look like golf balls, feathers, bird cages or worm like and in a great variety of colours.

REPRODUCTION

- Each fruiting body produces a large number of microscopic asexual reproductive cells known as spores.
- Each spore has a single nucleus and a thick protective wall.
- Germination of the spore occurs when there is plenty of water and suitable temperature.
- When a slime mold's spore germinates, it produces one or more tiny cells.
- Each cell has a pair of flagella that propel it through the film of water, which is necessary for its germination.
- These flagellated cells some times function as gametes (sex cells) and fuse in pairs. This is true sexual reproduction.
- Fusion of the gametes forms zygote, which become amoeboid and form a new plasmodium i.e. multinucleated slime mold

PHYTOPTHORA INFESTANS(WATER MOLD)

This fungi like protoctist belongs to family Oomycotes.

It is a pathogenic organism causing. "late blight of potato"

STRUCTURE

- The mycellium consist of Hyphae which are endophytic, branched, aseptate coenocytic, hyaline and nodulated.
- The rounded or branched hustoria are found which absorb food material from the host cells.

REPRODUCTION

Sexual as well as asexual reproductions are present.

(A)ASEXUAL REPRODUCTION

- Asexual reproduction takes place by means of biflagellate zoospores produce inside the productive structure Sporangia.
- The spores are produced on the branched Sporangiophore in favorable condition.
- Sporangiophore coming out through the stomata, in groups on the lower surface of infected leaves.
- The sporangia are produced on the branches of sporangiophore.
- On maturation, the sporangia the detached from sporangiophore.
- On maturation the protoplasm of the sporangium converts into uninucleate, vacuolated and naked zoospores.
- When mature sporangium burst the zoospores liberate in the film.

(B)SEXUAL REPRODUCTION

- Sexual reproduction is zoogamous.
- The female sex organ is oogonium. while the male sex organ is antheridium.
- The antherialium develops first and the oosgonium later.
- Both sex organ may develop on he same Hyphae or on two adjacent Hyphae lying side by side.
- The oogonium hyphae penetrates the antheridium.
- The oogonium is pear shaped and contains a single female nucleus in it.
- The fertilization takes place when the male and the female nuclei fuse in the egg after penetration of the oogonium in the antheridium.
- There is no fertilization tube and after fertilization the thick walled zoospore developed, which is present inside the oogonium.
- The oospore germinates in favorable conditions and produce new mycellium.

- Reduction division occurs during germinates of oospore.

ECONOMIC IMPORTANCE

- The Water Mold causes a disease in potato crop known as “late blight of potato”
- This disease effects both aerial and underground parts and whole plant becomes blighted in severe conditions.
- The disease appears in the form of brown spread patches on leaves and rapidly increases to the whole leaf surface.
- The tuber converts into a rotten pulpy mass emitting foul smell and remains small in size.
- A great danger to potato crop and causes sufficient damage of Potato crop.

EUGLENA

Euglena is an unicellular, flagellated organism. It belongs to the division “Euglenophyta”

OCCURANCE

Euglena commonly found in drains, ponds and is also present in soil, blackish water and even salt water.

DUEL NATURE

- Euglena has characteristics of both animals and plants.
- It is more evolved than green Algae.

STRUCTURE

1. It is somewhat elongated animal, almost pointed at both ends.
2. It has definite and easily stainable nucleus.
3. It has well defined chloroplast as in higher plants.
4. All the Euglena have two flagella usually one of them is long and the other one short by which they can swim activity.
5. They lack the outer cellulose cell wall, instead the protoplasm is bounded by a grooved layer called the “Pellicle”.
6. Euglena has a gullet near the base of the flagella and an

eyespot containing a pigment called “Astaxanthin”.
7. Reproduction is usually asexuality by simple division.

TAXONOMIC POSITION OF EUGLENA

- One of the examples of Eukaryotes is Euglena.
- Belongs to group kingdom Protactista.

PLANT LIKE CHARACTERS IN EUGLENA

1. Presence of Chloroplast.
2. Undergoes physiological, biochemical process of photosynthesis.
3. Behaves as natural autotroph in presence of sunlight.

ANIMAL LIKE CHARACTERS IN EUGLENA

1. Absence of a cell wall.
2. Presence of a mouth with cytopharynx.
3. Eyespot containing animals pigment called “Astaxanthin”.
4. Presence of reservoir.
5. Can easily be converted into heterotopy after the loss of chloroplast.

ANIMAL LIKE PROTOCTISTA

PHYLUM PROTOZOA

GENERAL CHARACTERS

1. Protozoa are microscopic, unicellular (as single cell performs all vital activities) organisms.
2. These organisms are asymmetrical.
3. The body of organism may be naked or covered by pellicle to maintain the shape.
4. Cytoplasm of protozoans is usually divided into outer, ectoplasm and inner granular endoplasm.
5. Cell may be uninucleate or multinucleate. Nuclei are covered by nuclear membrane.
6. Protozoan may be solitary or colonial.
7. They are aquatic and are found in both fresh and marine water.
8. Nutrition may be holozoic (animal like), halophytic (plant like) or saprozoic (subsisting in dead organic matter) or parasitic.

9. Digestion is intracellular and is accomplished inside the food vacuole.
10. Locomotion takes place by flagella, cilia or psendopodia.
11. Respiration takes place through general body surface.
12. One or more contractile vacuoles are present for osmo-regulation.
13. Reproduction takes place by both asexual and sexual methods.
14. The asexual methods include binary fission, multiple fission and budding.
15. Sexual reproductive methods include gamete formation (Isogamies and Anisogamous) or by conjugation.

CLASSIFICATION

About 30,000 species of protozoa are divided into five classes, which differ in their means of locomotion.

1. Class flagellate (Mastigophora).
2. Class sarcodina (Rhizopoda).
3. Class ciliate (Ciliophora).
4. Class suctoria.
5. Class sporozaa.

(1)CLASS FLAGELLATA

1. Locomotary organs are long hair like “Flagella” with are one or two in number.
2. Body is enclosed in a thin covering of “Pellicle”.
3. Asexual reproduction takes place by longitudinal fission.
4. Class Flagella is divided into sub classes.

(A)SUB-CLASS PHYTOFLAGELLATA (PHYTOMASTIGMA)

- Contain chlorophyll and perform process of photosynthesis.

Examples: Euglena and Volvax.

(B)SUB-CLASS ZOOFLAGELLATA (ZOOMASTIGMA)

- Does not contain chlorophyll and are heterotrophic.

Examples: Trypanosome and Leis mania.

Some flagellates are parasites. For example: Trypanosome

is a blood parasite human and causes African sleeping sickness. Its carrier is "Tse Tse fly".

(2)CLASS SARCODINA (RHIZOPODA)

1. Locomotion takes place by "Psendopodium".
2. Body shape is not definite and keep on changing because the pellicle is absent. Some have external sheats or skeletons.
3. Nutrition is mostly holozoic, some are parasite. E.g. Entamoeba, histolytic can cause human dysentery.
4. Example:

i. Entamoeba histolytic is a parasite living in intestine of man. ii. Foraminifera is a group including shelled sarcodimians. E.g. Polystomella. iii. Heliozoa is a group including fresh water organisms having fine, stiff and ray like psendopodia e.g. Actinophrys.

(3)CLASS CILIATA

1. Locomotory organs are cilia which are short, thin, protoplasmic structure, covering the body surface.
2. Body shape is definite and maintained by pellicle.
3. Many ciliates have a groove or depression called "Gullet" into which food can be brought.

This class is divided into two sub-classes.

(i) SUB-CLASS PROTOCILIATA

- Cilia all of equal size and uniformly distributed.
- Cytosomes absent.
- Nuclei two to many but all of one type e.g. Opalina

(ii) SUB-CLASS ENCILIATE

- Cilia of different types and not uniformly distributed.
- Cytosomes usually present.
- Nuclei of two types types Micronucleus and Meganucleus e.g. Paramecium, Balantidium.

(4)CLASS SUCTORIA

1. They are closely related to ciliates, therefore both are includes in same sub-phylum i.e. sub phylum Ciliphora.
2. Young individual have cilia and swim about but the adults

are sedentary and have stalks by which they are attached to the substrate.
3. Body bears a group of delicate cytoplasmic tentacles, some of which are pointed to pierce their prey, where as others are tripped with rounded adhesive, knobs to catch and hold the prey.
4. The tentacles secrete a toxic material which may paralyze the prey.
5. Suctorians have two nuclei i.e. meganucleus and micronucleus.
6. Reproduction is by asexual budding. E.g. Acineta, Ephelota.

(5)CLASS SPOROZOA

1. All are parasites.
2. Lomotary organs are absent.
3. Body covered by a thick cuticle.
4. Asexual reproduction is by multiple fission or sporulation.
5. Sexual reproduction is isogamies or anisogamous.
6. Examples.

i) Plasmodium is a human blood parasite enters the human blood when an infected female Anopheles mosquito bites humans. Plasmodium reproduces asexually in man and sexually in the body of mosquito.
ii) Monocytis lives as a parasites in seminal vesicles of earthworm.

MALARIA

INTRODUCTION

"Malaria is an infectious disease marked by attacks of chills fever, sweating occurring at intervals that depends on the time required for the development of a new generation of parasites in the body".

CAUSATIVE AGENT

Malaria is caused by a protozoan parasite of the genus PLASMODIUM. It was discovered by LAVERAN in 1878.

TRANSMITTING AGENT

Malaria is transmitted into the blood of man by the bite of an infected "FEMALE AND PHELES MOSQUITO". It was discovered by KING in 1717.

SYMPTOMS OF MALARIA

The symptoms of malaria first appear after several days of infection in man. He time taken by parasite before it appears in the blood is called INCUBATION PERIOD.

SYMPTOMS DURING INCUBATION PERIOD

The symptoms that appears in incubation period:

- Nausea.
- Loss of appetite.
- Constipation.
- Insomnia.
- Headache.
- Muscular pain.
- Aches in joint develops.

USUAL SYMPTOMS OF MALARIA

- Onset of malarial fever
- Shauking chills
- Sweating
- Rise in body temp. (may be up 106˚)

MALARIA – A BIOLOGICAL PROBLEM

Malaria has been one of the man's most important biological problems. Millions of people have been killed only because of his disease. To solve this problem, various biological methods were applied to find out in details. Experiments were performed, observation and data were collected, and finally the complete life cycle of the malarial parasite was studied.

STUDYING MALARIA EXPERIMENTALLY

In the experimental study of malaria, several HYPOTHESIS were presented and deductions were made for each of them. Experiments were performed to test the deduction and observations are recorded. If the deductions are proved true, the hypothesis regarded as correct.

HYPOTHESIS (1)

A hypothesis was made about the malarial parasite plasmodium that: “Plasmodium is the cause of malaria”

DEDUCTION

To test the above hypothesis, the following deductions were made: “If the plasmodium is the cause of malaria, then the patients suffering from malaria should have malarial parasite in their blood”.

EXPERIMENT

Experiment were carried out by examining blood samples from malarial patients that showed positive result. To prove it further experiments were repeated whenever malaria accured.

RESULT

In this way the hypothesis that the “Plasmodium is the cause of malaria” was found to be true.

HYPOTHESIS (II)

It was noted that people living around the marshy places were usually have the attack of malaria. Thus the hypothesis was stated “Malaria is associated with marshes”

DEDUCTION

To test the statements, a deduction was made that “If marshes are eliminated”.

EXPERIMENT

On experimental basis, marshes were eliminated and as a result the role of infection of malaria was greatly much reduced.

RESULT

It was this proved that malaria is associated with marshes. Thus the hypothesis stands true. Thus, it is new understood that accurate methods are essential to understood biological problems.

LIFE – CYCLE OF MALARIAL PARASITE

DISCOVERY

Life cycle of plasmodium in ANOPHELES MOSQUITO was first discovered in 1898.

PHASES OF LIFE CYCLE

The life cycle of plasmodium is digenetic involving two phases is two hosts for completion.

1. ASEXUAL PHASE IN MAN (PRIMARY HOST)
2. SEXUAL PHASE IN MOSQUITO (SECONDARY HOST)

1. ASEXUAL CYCLE IN MAN (SCHIZOGONY)

INTRODUCTION

The life cycle of plasmodium in mass is Asexual and is called SCHIZOGONY, because "SCHIZONTS" are produced.

PHASES OF SCHIZOGONY

According to Graham (1948), the life cycle of plasmodium can be divided into four phases;

1. PRE-ERYTHROCYTIC PHASE (LIVER SCHIZOGONY).
2. ERYTHROCYTIC PHASE.
3. POST-ERYTHROCYTIC PHASE.
4. GAMORONY OR GAMETOCYTIC PHASE.

EXPLANATION OF SCHIZOGONY

INFECTION

A healthy person acquires infection when a female Anopheles mosquito, containing infective stages (SPOROZOITES) of parasite is its salivary gland, bites him for sucking his blood.

(1)PRE-ERYTHROCYTIC PHASE

Once with in the human blood, the sporozoites circulate in the blood for about half an hour.

INVASION OF LIVER

After circulation in the blood, the sporozoites get into liver to invade the hepatic cells.

SCHIZONT FORMATION

After penetrating the liver cells, each sporozoite grows for no. of days and becomes a SCHIZONT.

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CRYPTOZOITE FORMATION

SCHIZONT divides to form a large number of uninucleate CRYPTOZOITES, which are liberated when the liver cell burst.

METACRYPTOZOITE FORMATION

The released cryptozoites invade the fresh liver cells and multiply producing enormous no. of metacryptozoites.

(2) ERYTHROCYTIC PHASE

TROPHOZOITE FORMATION

The metacryptozoites after escaping into the blood stream, invade the red blood corpuscles. Each become rounded and is called TROPHOZOITE.

SIGNET RING STAGE

When trophozoite grows in size, the nucleus is pushed to one side into the peripheral cytoplasm. It resembles a signet ring and is preferred to an SIGNET RING STAGE.

MEROZOITE FORMATION

The trophozoite ingesis a large amount of cytoplasm of the R.B.C. The blood H6 is broken down into its protein components, which is used by trophozoite develops into an active amoeboid trophozoite. After active feeding, it becomes rounded and grows in size and become and SCHIZONT. It now undergoes SCHIZOGONY and produces MEROZOITES.

RELEASE OF MEROZOITES IN BLOOD

With the rupture of RBC'S, the merozoites are liberated into the blood plasma. These invade fresh corpuscles to repeat the cycle. The time taken to complete one erythrocytic cycle depends upon the species of Rasnodium.

(3) POST-ERYTHROCYTIC PHASE

Some merozoites produced in erythrocytic phase reach the liver cells and undergo schizonic development. This is known as Post-Erythrocytic Phase.

(4) GAMOGONY

FORMATION OF GAMETOCYTES

When successful asexual multiplication is achieved, the merozoites donot proceed further with the erythrocytic phase but, after entering the RBC, increase in size to form Gamocytes.

TYPES OF GAMETOCYTES

Gametocytes are of two types:

1. Male Microgamo Cycle
2. Female Macrogamo Cycle

The Gametocytes do not divide, but remain within the host blood until they are injected by the vendor, in which they continue their sexual development.

SEXUAL CYCLE IN MOSQUITO

INTRODUCTION

Sexual life cycle of Plasmodium is completed in the gut of Female Anopheles Mosquito resulting in infective Sporozoites. This cycle is completed in 12-23 days.

PHASES OF SEXUAL CYCLE

This cycle comprises of following stages:

1. Gametogony
2. Syngamy or Fertilization
3. Sporogony

EXPLANATION OF SEXUAL CYCLE

(1) GAMETOGONY

Gametogony refers to the Formation of Gametes. The gamocytes are taken up along with the blood into the stomach of the mosquito and develop into gametes.

FEMALE MACROGAMETE

The female gamocytes soon become macrogamete, which is larger in size and ready to fertilize.

MALE MICROGAMETE

Each male gamocyte forms 6 to 8 sperms like microgametes by a process of Exflagellation.

(2) SYNGANY OR FERTILIZATION

ZYGOT FORMATION

Within the gut of mosquito the two gametes of opposite sexes fuse together to form a zygot. This process is called Syngamy.

OKINETE FORMATION

After fertilization zygot differentiates into motile worm-like ookinete.

OOCYST FORMATION

Ookinete penetrates the stomach wall to settle down just under the mid gut. Here after observing nutrients, it develops a cyst around it and becomes spherical. This encysted is called Oocyst.

(3) SPOROGONY

The oocyst then enters a phase of asexual multiplication, the Sporogony.

SPOROBLAST FORMATION

In 6 to 7 days, the nucleus of oocyst divides into several nuclei and cytoplasm envelops each one of them and thus hundreds of oval shaped Sporoblasts are formed.

SPOROZOITE FORMATION

The sporoblast nucleus again divides and forms hundreds of filamentous, uninucleated Sporozoites. The cyst bursts and liberated sporozoites migrates to the Salivary Gland where they await to penetrate to a human host.