TOPIC: PLATYHELMINTHES:PARASITES AND PARASITIC ADAPTATIONS(II)

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CHAPTER 7
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5. **VAST REPRODUCTION**: Reproduction is well developed as the parasite lives in the hostile environment. It is subdivided as:

(a) **Efficient reproductive system**: Complexity in the reproductive system gradually increases from free living forms to the parasitic ones. Large number of testes, ovaries, vitelline follicles are present in the parasites. In cestodes about 90% of the available space of the body is occupied by reproductive organs.

(b) **Hermaphroditism**: All trematodes and cestodes are hermaphrodite except few like Schistosoma. The hermaphroditism is an adaptation advantageous to parasitic mode of life, to overcome the search of the mate. In parasites both self and cross fertilization can occur.

(c) **Multiplication of reproductive organs**: In cestodes reproductive organs are much more elaborate and are repeated in each proglottid. Each mature proglottid possesses one (T. solium) or two sets (Diphylidium) of male and female reproductive organs. This is called multiplicity of reproductive organs. In each gravid proglottid, all other organs of the system degenerate to make room for the uterus which is greatly enlarged and branched to accommodate a large number of eggs.

(d) **Large egg production**: The egg production in helminthes is astronomical. The female Ascaris lumbricoides lays about 2 lac eggs/day. Trematodes usually produce a few thousand (10,000) eggs but cestodes produce very large number of eggs e.g., Taenia solium produces a few thousand eggs/segment.

The high production of eggs is simply to reach the proper destination because a parasite has to face a number of hazards.

(e) **Larval multiplication**: In addition to large egg production, method of asexual reproduction at larval stage is peculiar in Helminths. Each sporocyst produces 5-8 redia. From each redia 14-20 cercaria are produced. In case of cestodes larval multiplication takes place in some forms e.g., A hydatid cyst developing from a single egg may contain thousands of scolices.

(f) **Complex life cycle**: The complexity of life cycles in which more hosts are involved helps deriving maximum benefits from different hosts and in the proper distribution and dispersal of the parasite.

6. **PENETRATION GLANDS/HISTOLYTIC GLANDS**: In order to penetrate into the host the parasites have developed certain structures or glands e.g., Miracidia larva has a conical process at the anterior end called apical papillae. There are a pair of penetration glands inside the body near the anterior end. These glands, called the histolytic glands secrete histolytic enzymes that help in dissolving the hosts' tissue to penetrate into it.

   Adult worms lack these penetration glands except hookworms (Ancylostoma) which possesses these glands in the buccal region whose secretion has anticogulating and histolytic action.

7. **CYSTOGENOUS GLANDS**: In most cercaria a large number of dark or brown cystogenous glands are found beneath the cuticle. These glands help in secreting a protective cyst around the cercaria transforming it into metacercaria. These cysts help metacercaria to overcome unfavourable conditions and protect them till they are finally eaten up by their proper host.

II. PHYSIOLOGICAL ADAPTATIONS

1. **PROTECTIVE MECHANISM**: Most of the parasites live within the body of hosts and hence have to protect themselves from various substances produced by the host e.g., the parasites living in the alimentary canal of the host has to protect itself from the action of the digestive juice of the host.

   The tapeworms accomplish this by:

   a) Stimulate the wall of gut to produce mucous, which then forms a protective clothing around the parasite.

   b) By secreting antienzymes to neutralize digestive enzymes of the host i.e., in order to protect themselves from being digested by the hosts' digestive enzymes parasites produce some

substances which inactivate the hosts digestive enzymes. Green in 1957 reported the presence of Trypsin and Chymotrypsin inhibitors in the body wall of Ascaris.

c) Parasites continuously renew their protective body covering (i.e., tegument). Lime cells in the body wall of tapeworms neutralize the acids produced by the host.

d) Parasites possess a high range of pH tolerance 4 – 11.

e) Blood parasites are known to withstand the effects of antibodies and phagocytes by some mechanism.

2. **NUTRITION**: The nutritional requirements of the parasites are fulfilled by the host. Trematodes and Nematodes which possess an alimentary canal, though reduced, feed on both digested and semidigested food. In cestodes alimentary canal is absent, they feed on digested food only. Microtriches, tegument etc help in absorption of food.

3. **RESPIRATION OR ANAEROBIOSIS**: The pH tolerance of the parasites is high from 4-11. The intestinal parasites live in an environment completely devoid of free oxygen, the respiration is of anaerobic type consisting of extracting oxygen from the food stuffs. In the absence of oxygen, energy is obtained by the fermentation of glycogen in which glucose is broken down into lactic acid.

4. **OSMOREGULATION**: The osmotic pressure of body fluids of endoparasites, especially in case of Trematodes, is almost the same as that of the host so there is no necessity of osmoregulation. But in the intestinal tapeworms (cestodes) the osmotic pressure is slightly higher than that of the surrounding medium. This permits absorption of nutrients through their body wall as they lack alimentary canal.

5. **PERIODIC APPEARANCE**: There are some parasites which appear at definite period. The microfilariae of W. bancrofti circulate into the peripheral blood circulation in the night between 10.00 p.m. to 4 a.m. – the period when Culex bites a man (nocturnal habit) since they require Culex mosquitoes for further development. Thus their migration is correlated with the nocturnal habit of Culex.

6. **NEOTENY**: It is a special phenomenon in which the larvae are capable of reproduction and they produce young ones. Ligula (Cestode) exhibits neoteny and this can be considered as an adaptation for parasitic mode of life.

7. **HIGH FERTILITY**: Parasites develop enormous fertility producing millions of fertile eggs. This is correlated with the passive transference of the infective stages of the parasites from one host into another, while passing through the complex life cycle, these potential offsprings face several hazards as a result of which, a very small percentage of the total eggs produced reaches adulthood e.g., Fasciola, if the eggs fall in water, if the first larva (miracidium) finds a suitable snail within a limited period, if the cercaria encyst on vegetation within the reach of final host and if the metacercaria happen to be ingested by the proper final host, only then the life cycle is completed.

   The larval stages also multiply e.g., a sporocyst produces a number of redia. A single redia produces a number of cercaria larvae. Similarly, a single Hexacanth may multiply by generating buds which produce daughter and grand daughter scolices (Hydatid of Echinococcus).

8. **TRANSFERENCE OF EGGS OR INFECTIVE STAGES**: This is another major problem for which the parasites have to develop adaptations. Transference from one host to another is either:

   (a) Active transfer: This is a less common method. The infective stages are actively transferred to final host. The larval stages of most parasites bore directly through the skin of their hosts such as the larvae of Hookworms and Schistosomes.

   (b) Passive transfer: This is the most common method and usually results from the careless habits of the host and is achieved in several ways such as contamination, inoculation. Oral infection occurs when the host takes uncooked food or contaminated water. The intermediate host, such as mosquitoes, inoculate parasites when they suck the blood of hosts.

9. **USE OF HOST'S HORMONES**: Some parasites use hormones of the host e.g., life cycles of frog and a frog trematode parasite (Polystoma integerrimum) infecting it synchronise. It has been seen that when the frog produces eggs, the parasite also produces eggs. This means that frogs secrete some hormones for producing eggs; the same hormones are used by the parasite to produce eggs.

CONCLUSION: The parasites are intelligent enough as are the other orgaisms which have accepted the challenge of the changing environment of host and have constantly modified / changed in order to survive in an efficient way in the hosts hostile environment. The parasites always change in such a way so as to

establish an equilibrium with the host and as long as this equilibrium is maintained there are no consequence of the disease in the host but when the equilibrium is shifted the disease occurs.