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COURSE: BIO 102

QUESTION

1. Classify plants according to Eichler’s grouping of 1883

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| DIVISION | CLASS |
| Thallophyta | Phycotinae (Algae)  Mycotinae (Fungi) |
| Bryophyta | Hepaticae (Liverworts)  Musci (Mosses) |
| Pteridophyta | Psilotinate (Psilotum)  Lycopodinae (Lycopodium, Selaginella)  Equisetinae (Horsetails)  Filicinae (Ferns) |
| Spermatophyta | Gymnospermae (Gymnosperms)  Angiospermae (Angiosperms) |

1. How are algae of importance to man?

Certain species of algae are harvested for food and cosmetics in the Far East. It serves as food for people and livestock, thickening agents in ice cream and shampoo, drugs toward off diseases. Algae are considered nutritious because of their high concentrations of minerals, trace elements and vitamin. Algae have high Iodine content therefore prevent goitre. Seaweeds are sources of three chemical extracts used extensively in food, pharmaceutical, textile and cosmetic industries. Brown algae yield Alginic acid which is used to stabilize emulsions and suspensions; found in products such as syrup, ice cream and paint. Different species of red algae provide agar and carrageen used for the preparation of various gels used in scientific research. Bacteria, Fungi and cell cultures are commonly grown on agar gels. Agar is also used in the food industry to stabilize pie fillings and preserve canned meat and fish. Carrageenan is also used as a thickening and stabilizing agent in products e.g. puddings, syrups, and shampoos. Algae have been used for centuries, especially Asian countries, for their purported powers to cure or prevent illnesses e.g. cough, gout, gallstones, goiter, hypertension, and diarrhea. Algae have been surveyed for anticancer compounds, with several cyanobacteria appearing to contain promising candidates. Diatoms have been used in forensic medicine, as their presence in the lungs can indicate a person died due to drowning. They are indicators of environmental problems in aquatic ecosystem.

1. Describe a unicellular form of algae

CHLAMYDOMONAS

Chlamydomonas represents the unicellular and motile forms of green algae. It is found in stagnant water usually along with other forms. It has flagella as the structures for mobility. The cells are bound by a cellulose cell wall and it also contains organelles. e.g. nucleus, mitochondria, stigma (eyespot),cup-shaped chloroplast, pyrenoid etc. While the nucleus carries the genetic programme of the cell and the stigma is for photoreception, the mitochondria mediates the elaboration of energy molecules and manufactured sugar is processed into starch on the pyrenoid.

1. How does this unicellular alga described in question 3 carry out its reproduction?

In Chlamydomonas, reproduction can either be vegetative (asexual) or sexual.

VEGETATIVE REPRODUCTION

This results in production of daughter cells in which the amount and quantity of

genetic material in the nucleus of the mother cell is maintained in the daughter cells. Thus, if the amount of genetic material in the mother cell nucleus is n, the daughter cells also have n quantity of genetic material. The kind of cell division which maintains the quantity and quality of genetic material is called mitotic divisions. It is responsible for increase in number of cells in unicellular organisms and for increase in size in multicellular organisms. In Chlamydomonas, a cell about to divide loses its flagella. The cell undergoes mitotic division leading to two nuclei i.e. two daughter cells (zoospores) are released. Increase in the population of cells in a colony is achieved by repeated mitotic divisions.

SEXUAL REPRRODUCTION

Certain environmental conditions e.g. lack of nutrients or moisture may trigger the haploid daughter cells to undergo sexual reproduction. Instead of forming into spores, the haploid daughter cells form gametes that have two different mating strains which are structurally similar and are positive and negative strains. Opposite mating strains fuse in a process called isogamy to form a diploid zygote, which contains two sets of chromosomes. After a period of dormancy, the zygote undergoes meiosis, a type of cell

division that reduces the genetic content of a cell by half. This cell division (i.e. meiosis) produces four genetically unique haploid cells that eventually grow into mature cells.

Sexual reproduction involves union of sex cells (gametes). In Chlamydomonas, aggregation of cells (clumping) in a colony occurs under favourable conditions. These cells pair by their posterior (flagellated) ends. This pairing is said to be isogamous because the pairing cells (gametes) are morphologically identical. The cytoplasm of the pairing cells fuse (plasmogamy) and the flagella are lost. The two nuclei fuse (karyogamy); this situation is essentially a fertilization process so that a zygote is formed. In other words, two cells each with n quantity of genetic (nuclear) material (i.e. haploid nuclear material) undergo karyogamy (fusion of nuclei) to produce a single cell with 2n (diploid) nuclear material. The zygote secretes a thick cell wall called a zygospore and may remain dormant in that state for some time.

After karyogamy sometimes, the zygote undergoes two successive cell divisions. While the first division restores the haploid condition by halfing the nuclear material in the two resulting nuclei (reduction division), in the second division, each haploid nucleus undergoes a normal mitotic division. These two divisions which end up with four cells and with n quantity of nuclear material are together known as meiosis. The four products of meiosis are released a s haploid zoospores.

1. Differentiate between the two types of colonial form of algae

The two types of colonial forms of algae are Pandorina and Volvox.

PANDORINA

It usually occurs in water bloom. The colony consists of 16 cells attached to one another. Each cell has many attributes / features in common with chlamydomonas e.g. nucleus, large chloroplast, pyrenoid, flagella and stigma. This colony achieves sexual reproduction by anisogamous pairing (pairing by flagella ends). This colony may be unisexual (only 1 kind of gamete produced) and in some specie, bisexual (male and female gametes produced).

VOLVOX

The genus Volvox (also green colonial form) shows more complex form than Pandorina. There are more cells in the colony, number may run into thousands and connected with cytoplasmic strands that run through the cells. Not all cells form new colonies; but the larger cells at the posterior ends (gonidia) are the only ones that divide to form new colonies. Other cells remain vegetative throughout the life of the colony. Sexual reproduction is oogamous i.e. the male gamete is motile while the female gamete (egg) is not motile. Colonies of Volvox may be either unisexual or bisexual.

1. Describe a named complex form of alga

FUCUS

This is a genus of brown algae whose species are often found on rocks in the intertidal

zones of the sea shores.

The plant body is flattened, dichotomously-branched thallus with a mid-rib, a vegetative apex, a reproductive apex at maturity) and a multicellular disk (hold fast) with which plant is attached to rock surface. The plant body also has air bladders which are believed to aid the plant to float on the water. Various species of focus exist; varying in size from a few centimeters to about 2 metres in length.

They also vary in terms of whether the sex cells are found in the same sexual chamber or in different sexual chambers on different plant bodies. Sexual reproduction is oogamous, sex cells are produced on conceptacles which have openings (ostioles) on the surface of the thallus. In the male conceptacles, one of the diploid cells from outgrowth of the wall of the conceptacles undergoes meiosis, the meiotic product undergo many mitotic divisions to produce antheridium having 64 cells of which cell develops into a biflagellate sperm that swims out of the conceptacle through the ostiole.

In the female conceptacle, similar to the situation in the male conceptacle, leads to the production of an 8 celled oogonium- each becomes an egg which is the female sex cell. Motile sperm cell from the antheridium move through the ostiole into the female conceptacle where the eggs are fertilized and diploid zygote are produced. Apart from the antheridia and oogonia, sterile multicellular filaments (paraphyses) are also produced in the conceptacles which are dispersed among the antheridial and oogonial outgrowths and at the entrance into the conceptacles. The diploid zygote germinates into a new diploid Fucus plant making the diploid the dominant generation.