

Dr. S. R. SIVAKUMAR
Assistant Professor
Department of Botany
Bharathidasan University
Tiruchirappalli-24
Algae

- **PLANT DIVERSITY-I: ALGAE AND BRYOPHYTES**

- **Biodiversity** is most commonly used to replace the more clearly defined and long established terms, species diversity and species richness.
- Biologists most often define biodiversity as the "totality of genes, species and ecosystems of a region".
- An advantage of this definition is that it seems to describe most circumstances and presents a unified view of the traditional types of biological variety previously identified.

- All living things were traditionally placed into one of two groups, plants and animals.
- This classification may date from Aristotle (384 BC – 322 BC), who made the distinction between plants, which generally do not move, and animals, which often are mobile to catch their food.
- Linnaeus (1707–1778) created the basis of the modern system of scientific classification, these two groups became the kingdom Vegetabilia and Animalia (also called Metazoa).

➤ it has become clear that the plant kingdom as originally defined included several unrelated groups, and the fungi and several groups of algae were removed to new kingdoms.

- Algae belong to the **Kingdom *Protista***
- Algae are eukaryotes (cells have organelles)
- Algae are mostly photosynthetic, like plants:
 - Have 4 kinds of photosynthetic pigments
 - Many accessory pigments – blue, red, brown, gold

- Require moist environments because they lack a waxy cuticle (remember: cuticle prevents water loss in terrestrial plants)
- Can be microscopic or macroscopic: size ranges from bacteria size to 50 meters long!
- Lack vascular (conducting) tissues –
No xylem or phloem
 - No true roots, stems or leaves

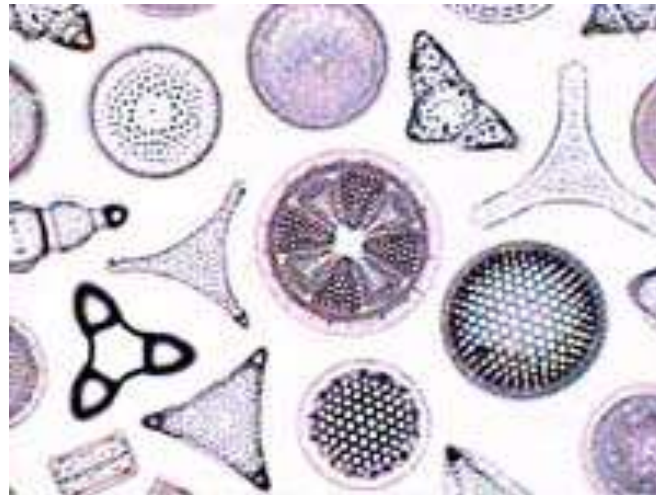
- Modes of sexual reproduction:
 - Both sexual and asexual
- Algae illustrate the importance of photosynthesis to the Earth's ecology!
- algae comprise several different groups of organisms which produce food by photosynthesis and thus have traditionally been included in the plant kingdom.
- The seaweeds range from large multicellular algae to single-celled organisms and are classified into three groups, the brown, red and green algae.

Diversity of Algae

- There are millions of algal species, but we'll focus in these five groups:
- Diatoms
- Dinoflagellates
- Red Algae
- Kelps or Brown Algae
- Green algae

DIATOMS

- Diatoms: Division *Bacillariophyta*
- Large group of algae (many unidentified). Relatively recently evolved group
- Habitat: Diatoms live in cool oceans
- Structure: mostly unicellular, have silica in their cell walls



DINOFLAGELLATES

- About 1,555 species of free-living marine dinoflagellates are currently described.
- Another estimate suggests about 2,000 living species, of which more than 1,700 are marine (free-living, as well as benthic) and about 220 are from fresh water.
- The latest estimates suggest a total of 2,294 living dinoflagellate species, which includes marine, freshwater, and parasitic dinoflagellates.

- A bloom of certain dinoflagellates can result in a visible coloration of the water colloquially known as red tide, which can cause shellfish poisoning if humans eat contaminated shellfish.
- Some dinoflagellates also exhibit bioluminescence—primarily emitting blue-green light.
- In 1753, the first modern dinoflagellates were described by Henry Baker as "Animalcules which cause the Sparkling Light in Sea Water",

Red Algae

- Red algae: Division *Rhodophyta* (4000 species)
- Are some of the oldest eukaryotic organisms on earth (2 billion year old fossils)
- Abound in tropical, warm waters
- Act as food and habitat for many marine species
- Structure: from thin films to complex filamentous membranes

- Accessory pigments! Phycobilins mask the *Chlorophyll a* – thus they look red.
- Due to these accessory pigments, red algae can photosynthesize in deeper waters (at different light wavelengths).



- Commercial uses: **Carrageenan** used for making ice cream, jellies, syrups, breads.
- Also for lotions, toothpaste, pharmaceutical jellies.
- Agar for growing bacteria and fungi for research purposes.
- As food.

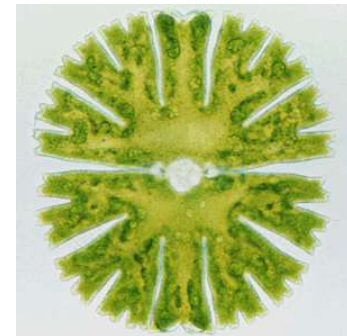
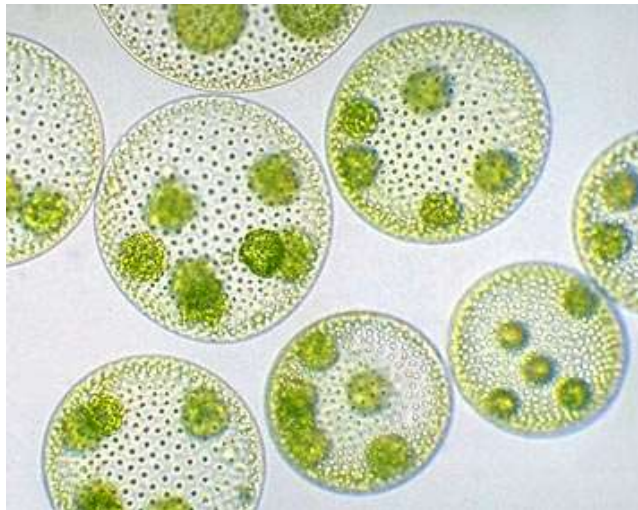


Green Algae

- Division: *Chlorophyta*
- Largest and most diverse group of algae
- Habitat: found mostly in fresh waters and on land.
- Float in rivers, lakes, reservoirs, creeks.
- Can also live on rocks, trees, soil

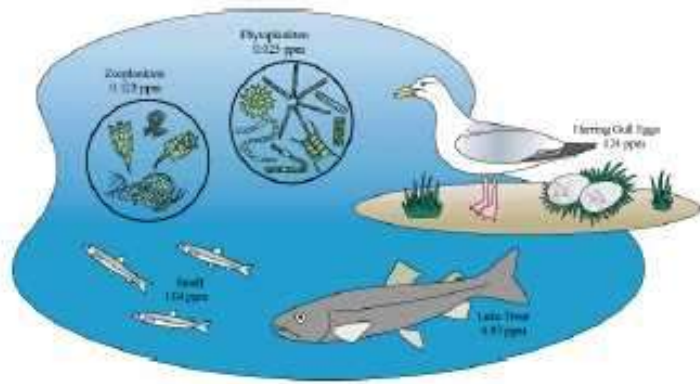


- Sea lettuce (*Ulva*) lives in salt waters along the coast.
- Structure of green algae: from
- Single cells (*Microsterias*)
- Filaments
- Colonies (*Volvox*)
- Thalli (leaf-like shape)



Benefits of Algae

- They are the base of the aquatic food chain – photosynthetic organisms
- Lichens: algae and fungi symbiosis
- Also serve as shelters: Kelps form underwater forests; red alga form reefs



Harmful algae

- Clogging of water ways, streams, filters... makes the water taste bad.
- Can be toxic to animals
- “**Red tides**” caused by dinoflagellates



SEXUAL REPRODUCTION

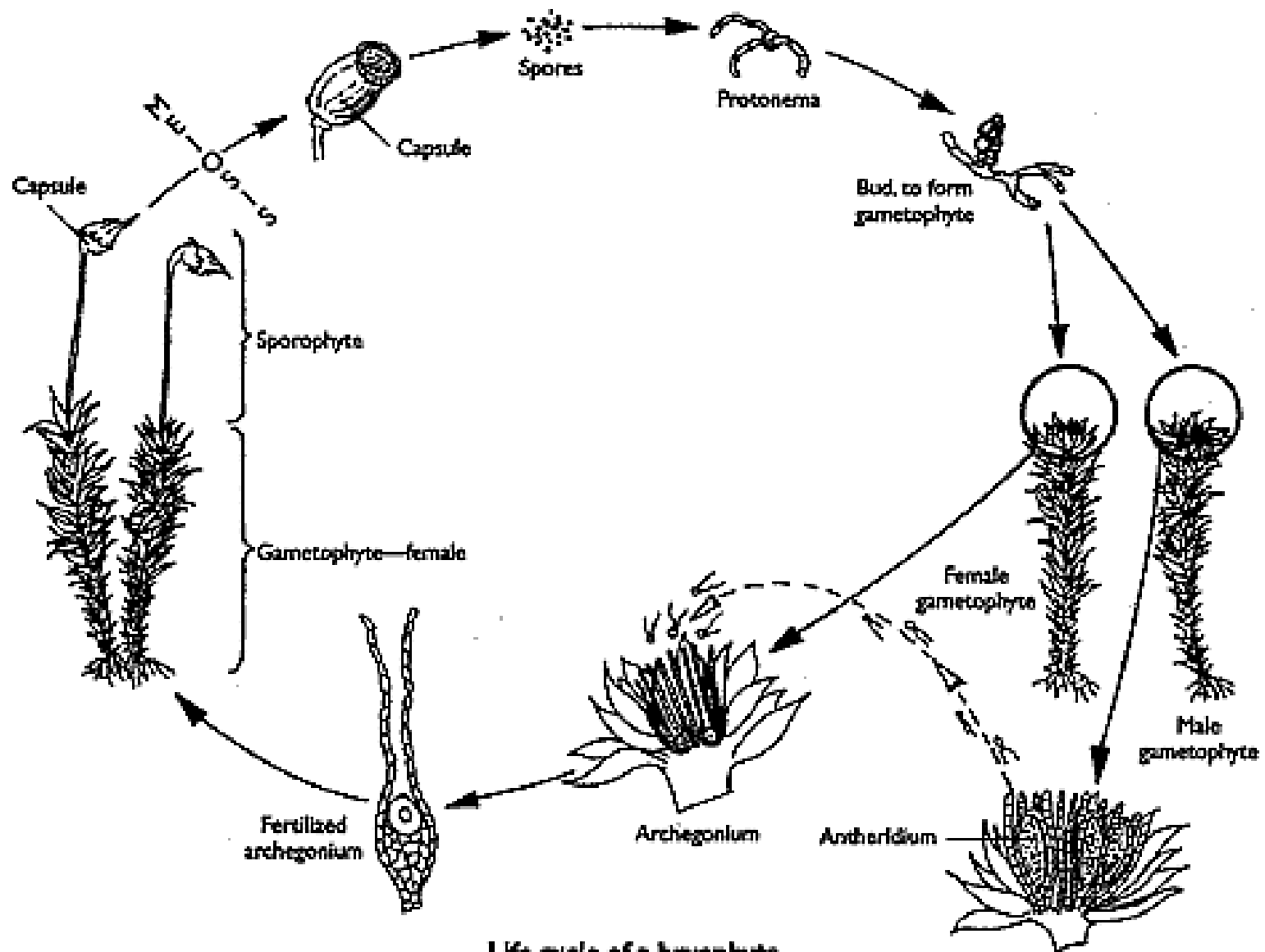
- Algae have motile gametes and single sex organs
- Land plants developed air-borne dissemination of desiccation-resistant stage
- Land plants developed multicellular sex organs
- Sexual reproduction gives plants genetic variability – enable them to adapt better to their environments

Life cycle

- Algae, water dependent life cycle → water independent life cycle in land plants
- Plants developed dryness-resistant gametophytes (spores) or zygotes (seeds)
- Smaller size primitive → larger size plants
- Dominant gametophyte stage (n) → dominant sporophyte stage ($2n$)
- Animals like humans, live in the $2n$ stage. Dominant $2n$ stage
- Single celled gametes are $1n$

Bryophytes

- Bryophytes include mosses, liverworts
- Non-vascular plants, i.e. they don't have xylem or phloem
- Advancements over algae: cuticle, multicellular gametangia, stomata
- Habitat: they require moist environment for active growth and sexual reproduction
- Exhibit alternation of generations: they have a gametophyte and sporophyte generation



Bryophyte reproduction

- Gametophyte plant produces multicellular sex organs:
- **Archegonia** – produces eggs (female)
- **Antheridia** – produces motile sperm (male)
- Outer layers protects and prevents drying.
- Motile sperm must swim to archegonia.
- **Sporocytes** within the Sporophyte undergo meiosis to produce a single kind of haploid spore
- If spore lands on suitable place, it will germinate into a **protonema**, the initial stage of the gametophyte plant