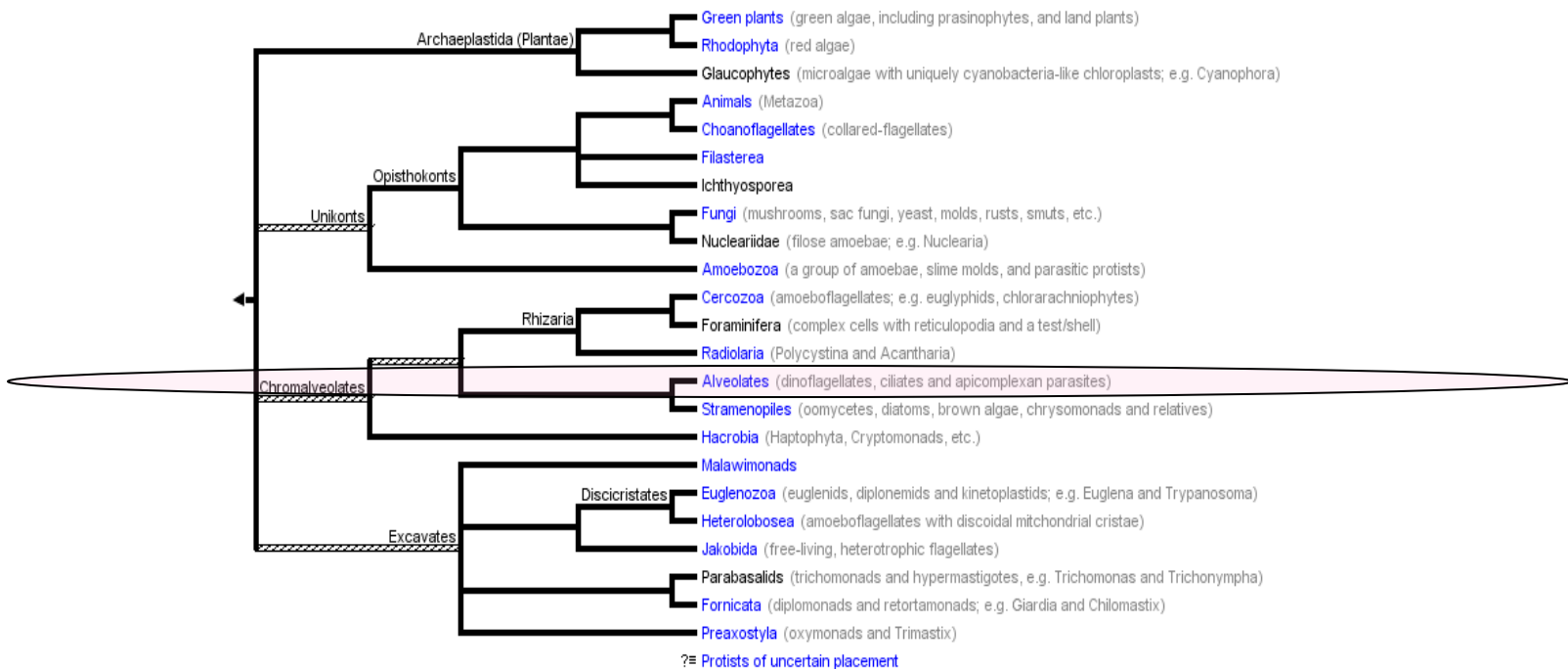
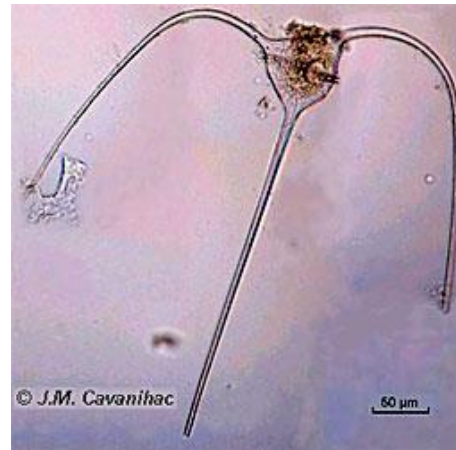
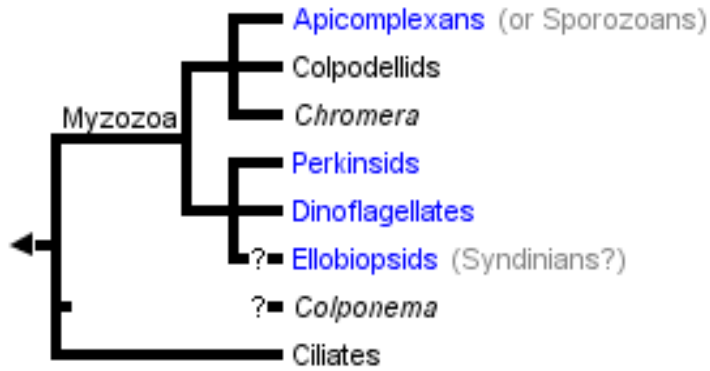


# Lineage *Alveolata*

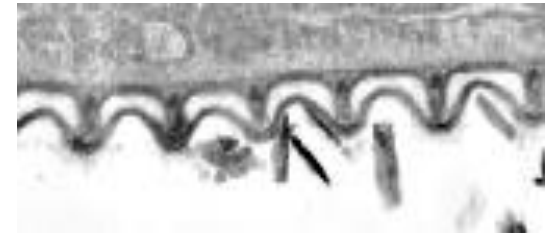


<http://tolweb.org/Eukaryotes/3>

# Lineage *Alveolata*

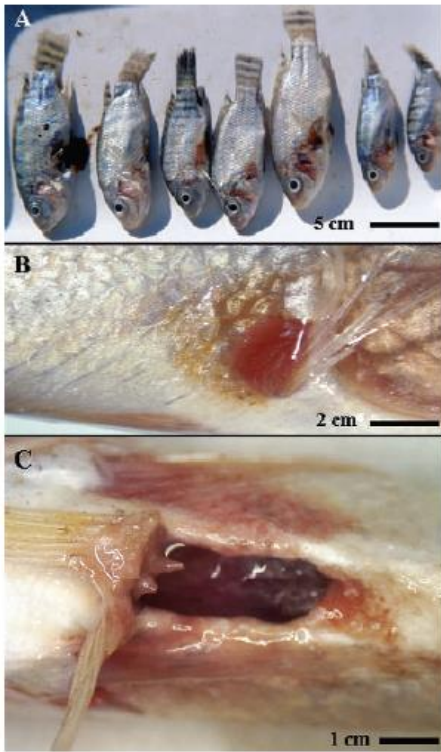


*Ceratium tripos*  
Dinophyceae

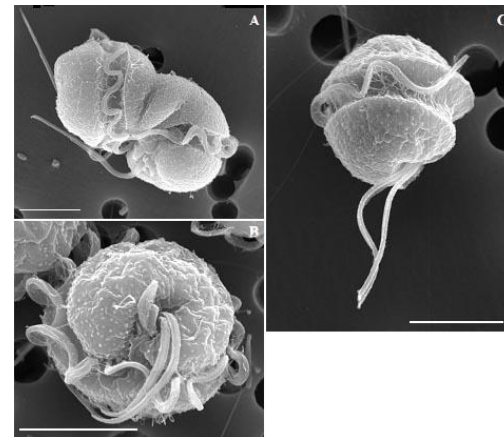
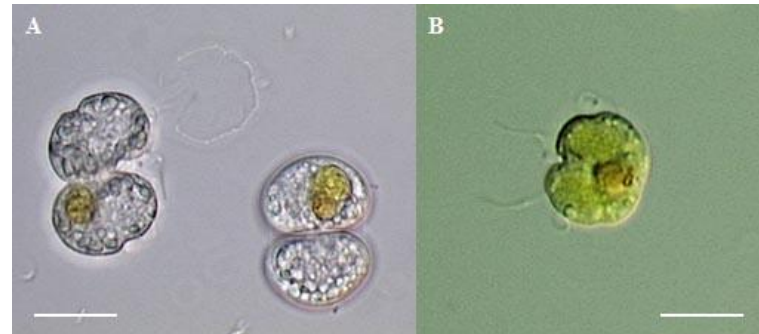


<http://tolweb.org/Alveolates/2379>

# *Dinophyceae* (Dinoflagellates)

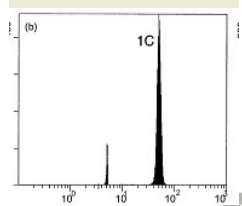


Glasgow *et al.* (2001)

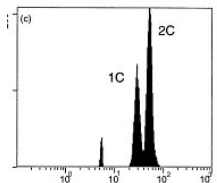
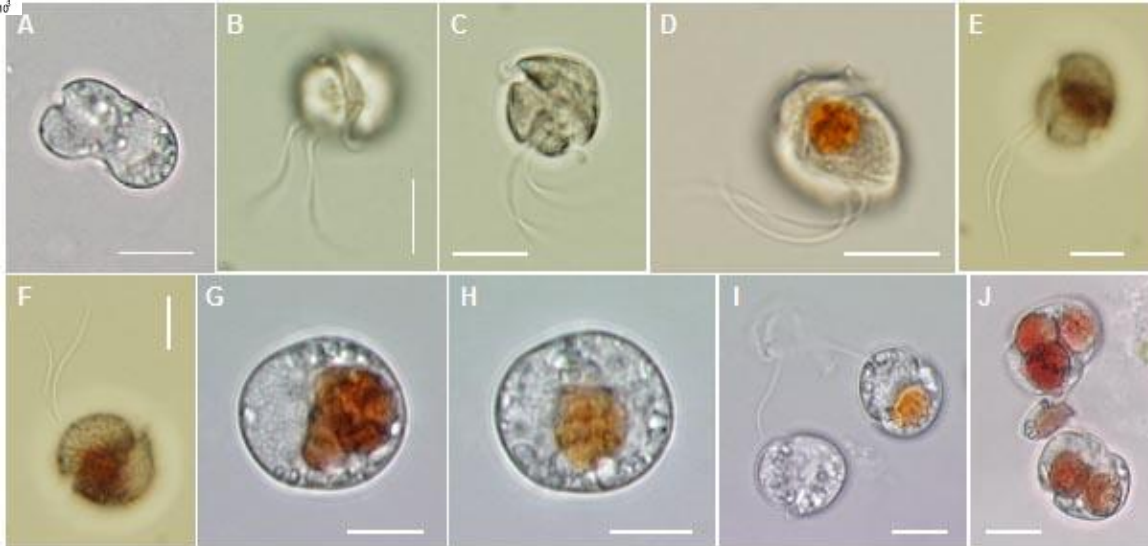


*Pfiesteria* spp.

# *Dinophyceae* (Dinoflagellates)



$n + n$



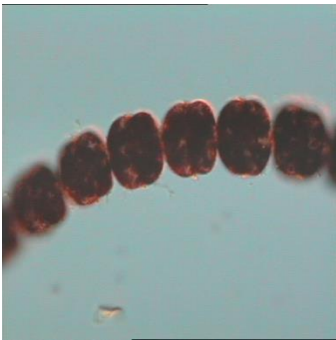
$2n$

$n$

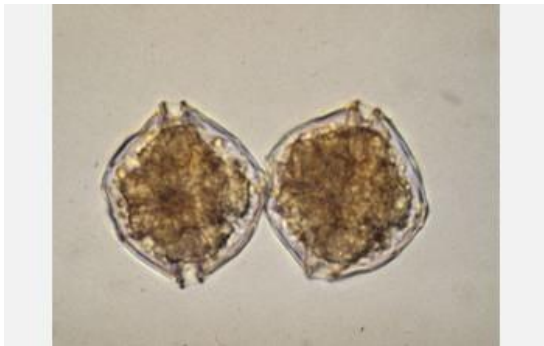
Life cycle with zygotic meiosis

# *Dinophyceae* (Dinoflagellates)

Red tides and PSP (*Paralythic Shellfish Poisoning*)



*Gymnodinium cantenatum*



*Alexandrium fundyense*



# Dinophyceae (Dinoflagellates)

## Posisoning by contaminated bivalve molluscs

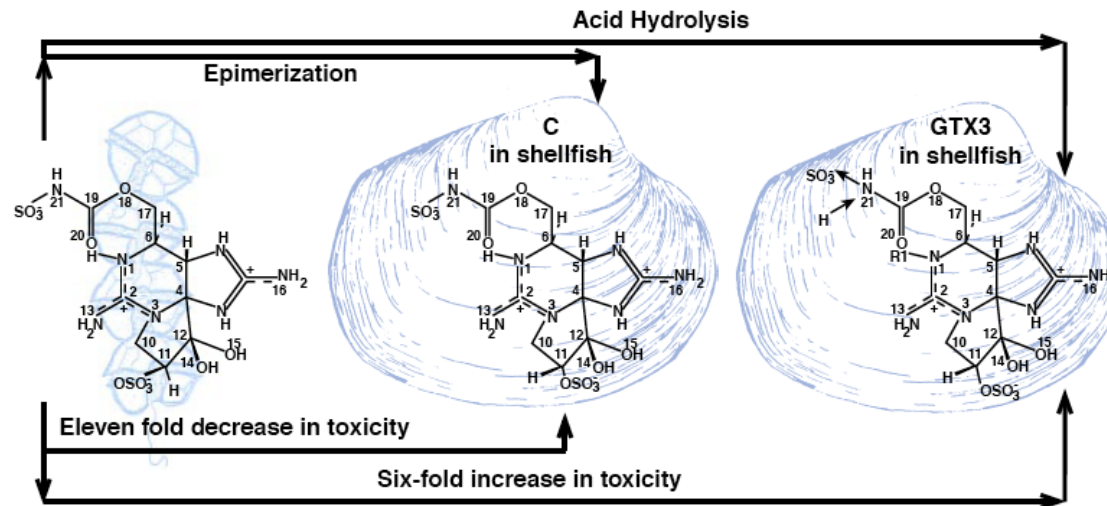


Figure 1: Molecular transformations change the toxicity of the saxitoxin molecule. The diagram illustrates two common types of chemical transformations that occur when the saxitoxin is passed on from algae to shellfish.

LaRonde et al (1996)

saxitoxin is a neurotoxin that can cause paralysis and death by asphyxia

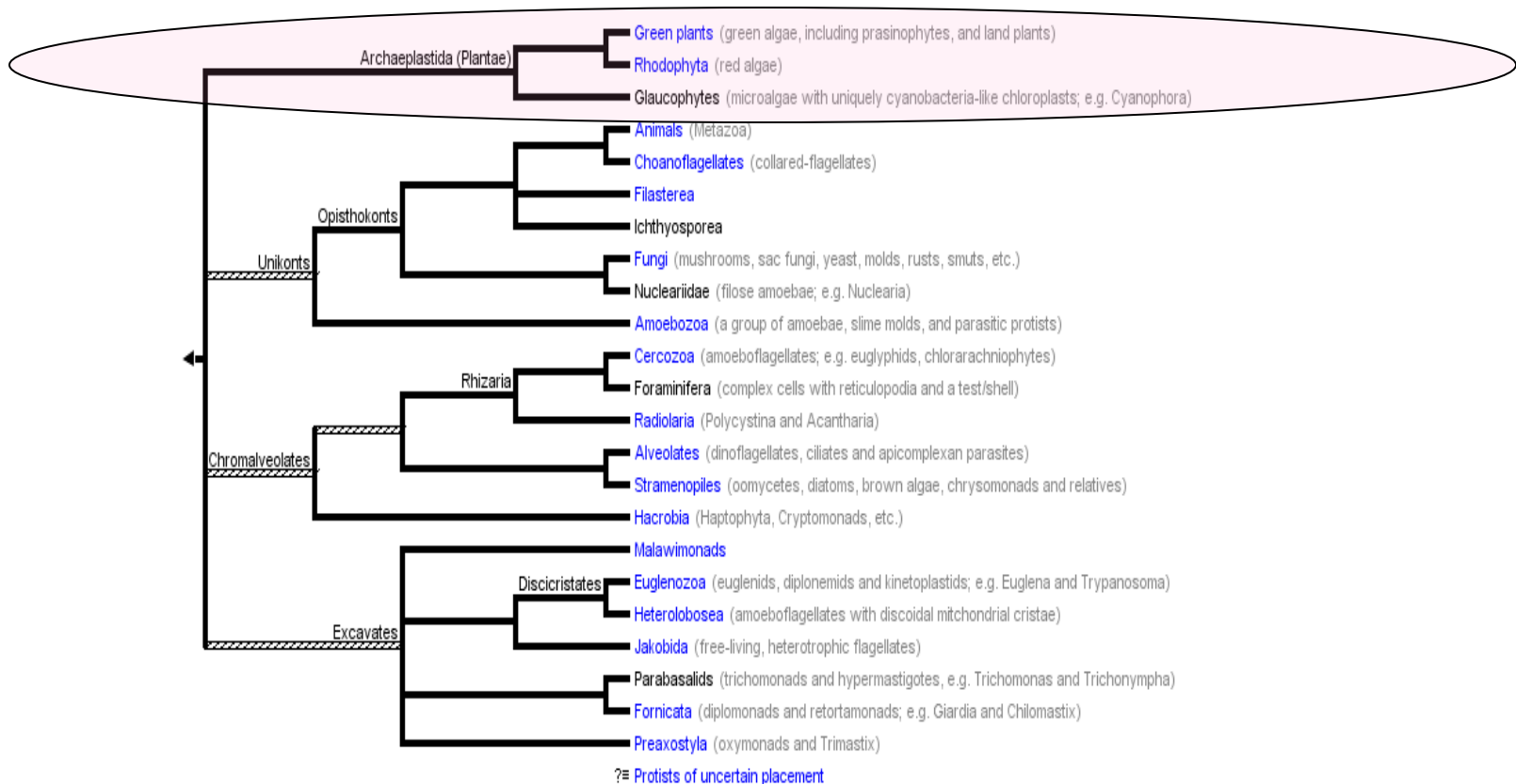


# *Dinophyceae* (Dinoflagellates)

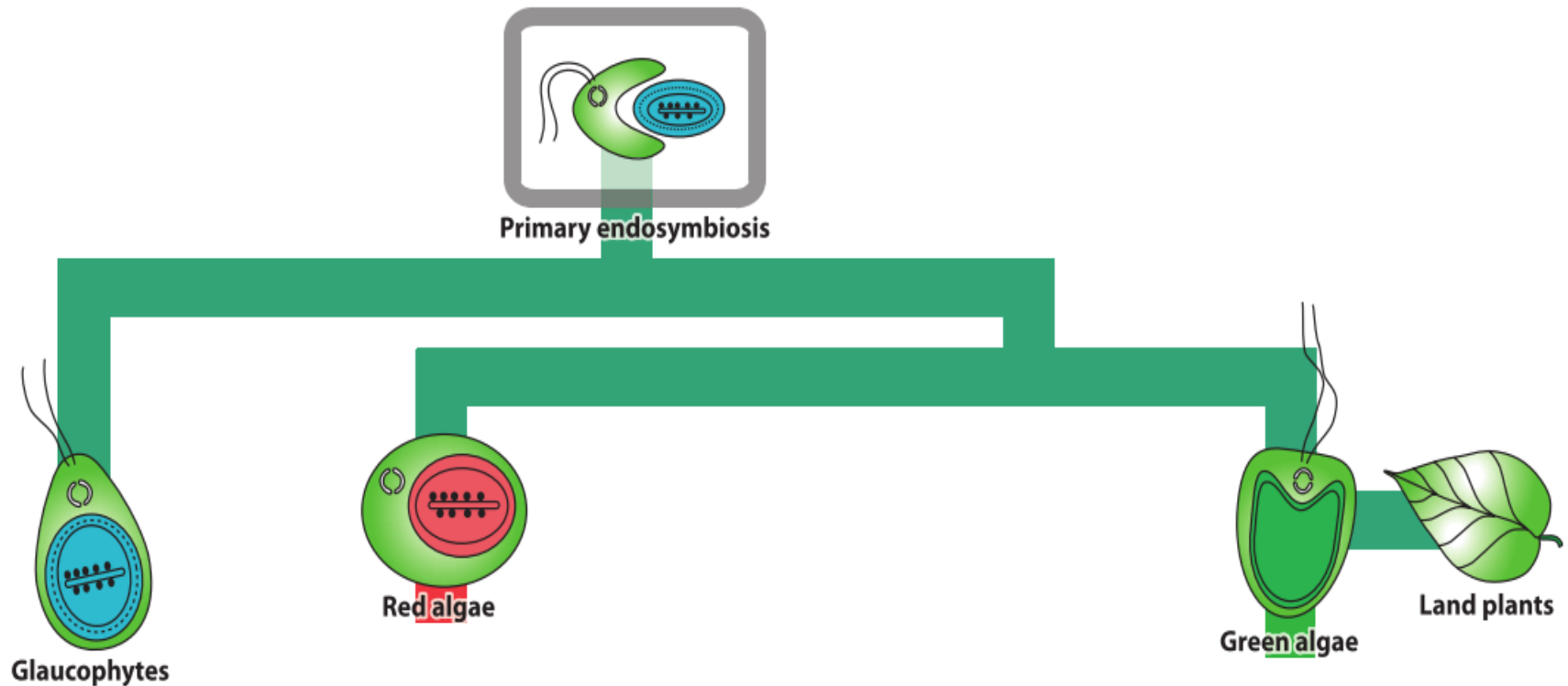
---

- Members of the *Alveolata* sub-lineage
- They are micro-predators
- They have chlorophyll *c*
- Their chloroplasts, when they have them, have 3 membranes.
- Related to the obligate parasites *Apicomplexa*, which have chloroplasts (sometimes vestigial) with 4 membranes (e.g., *Toxoplasma* and *Plasmodium*)

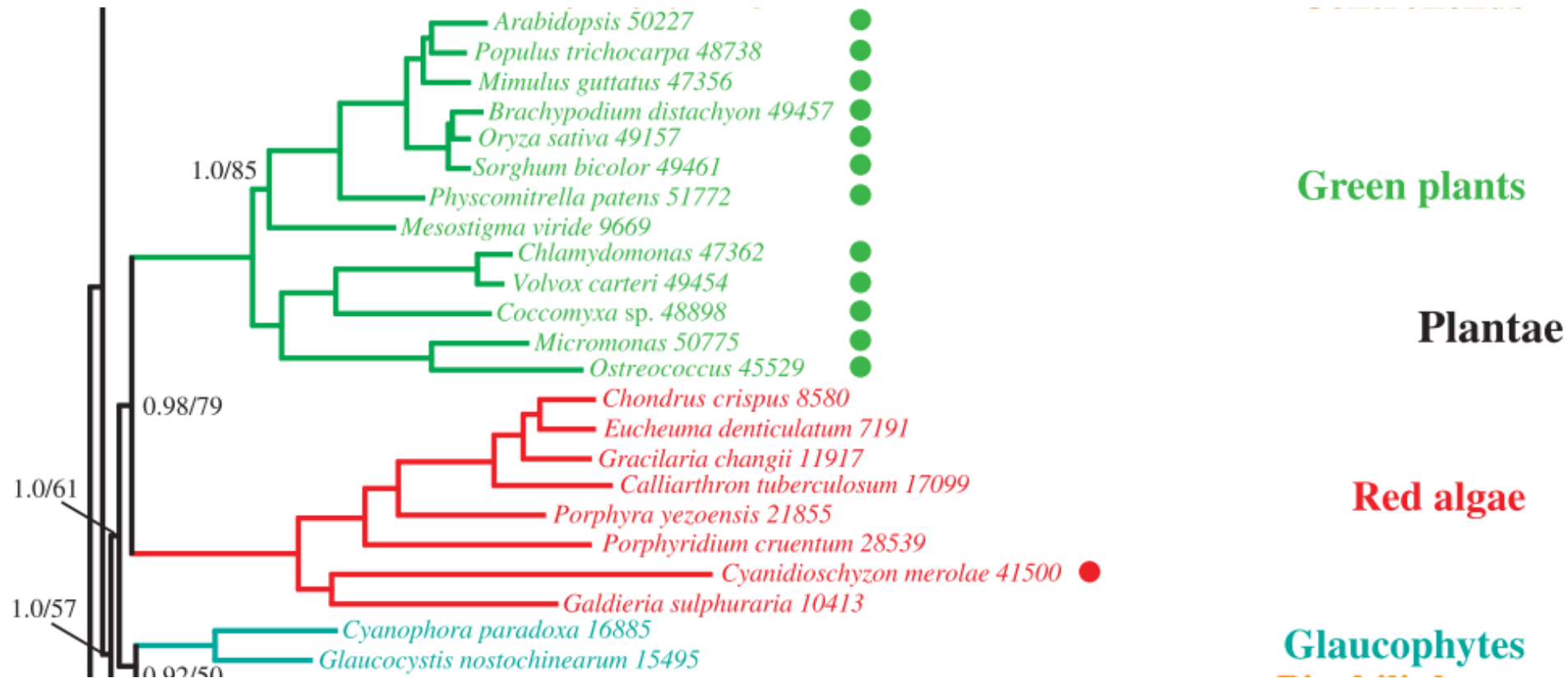
# Lineage Archaeplastida



# Lineage Archaeplastida



# Lineage Archaeplastida



Burki et al. (2012)