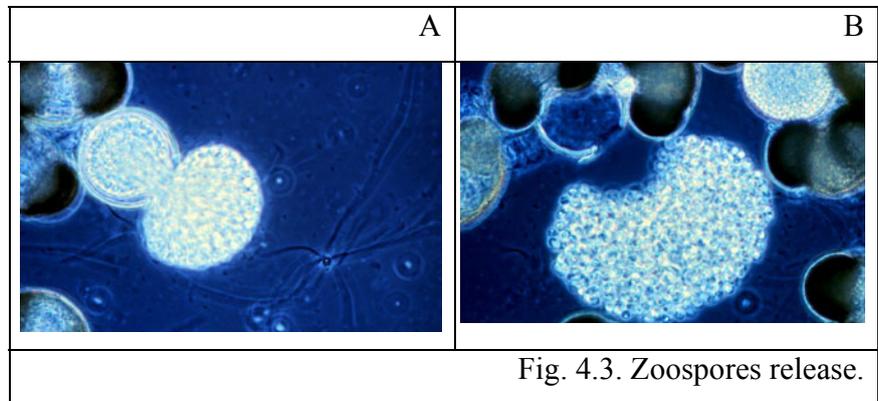


Fig. 4.2. Chytrids Thalli. A-holocarpic (*Chytridium*), B, Eucarpic, monocentric, (*Blyttomyces helicus* Chytrid Fungus Fused Glass) C- Eucarpic Chytrid, D-Zoospore



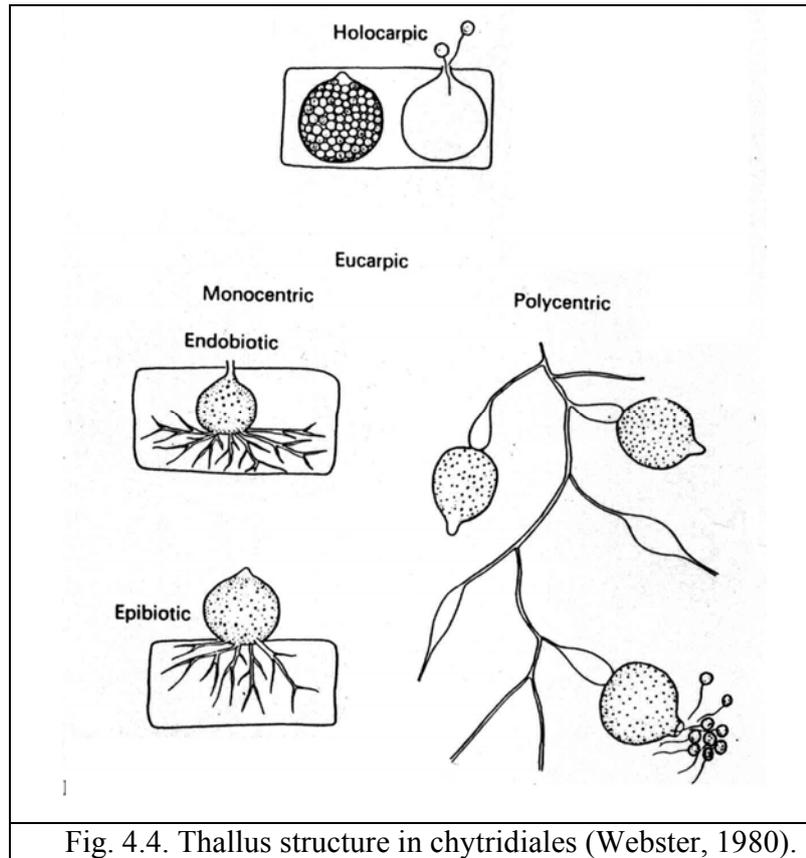


Fig. 4.4. Thallus structure in chytridiales (Webster, 1980).

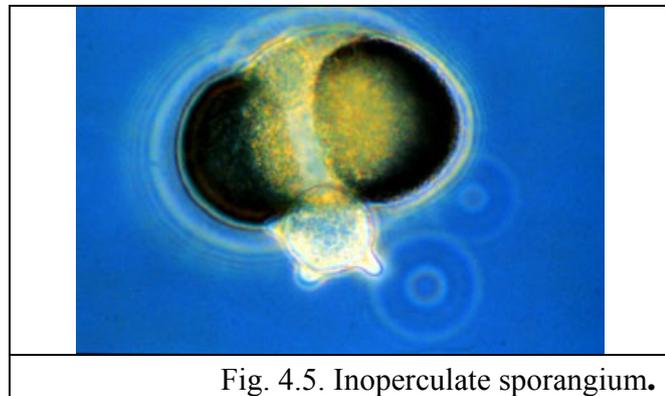
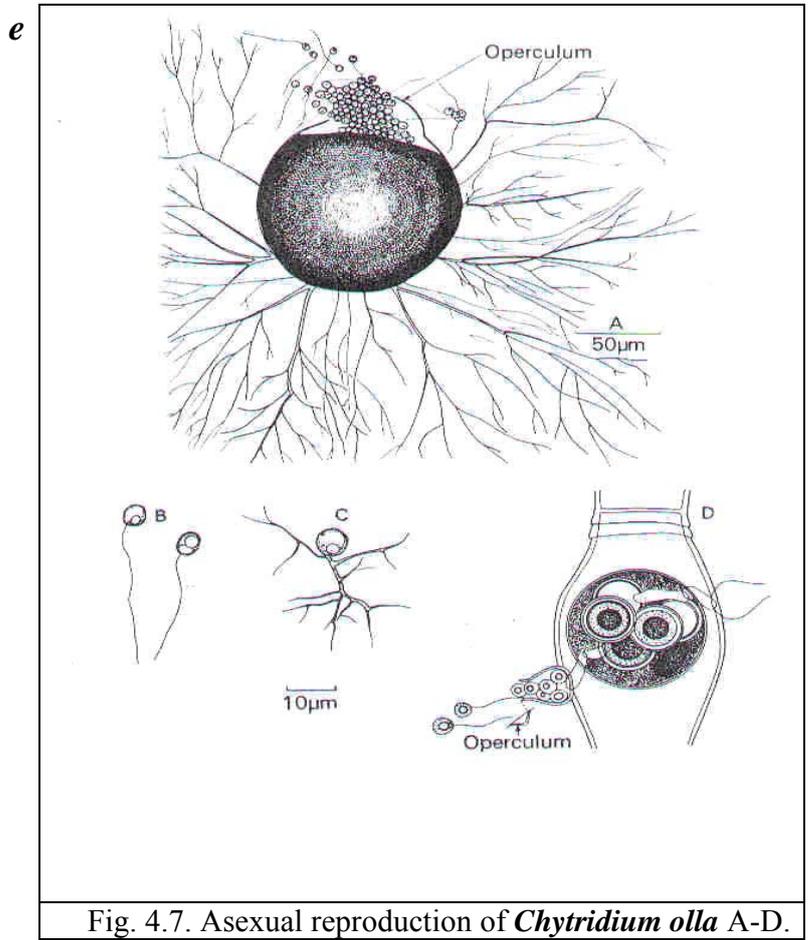
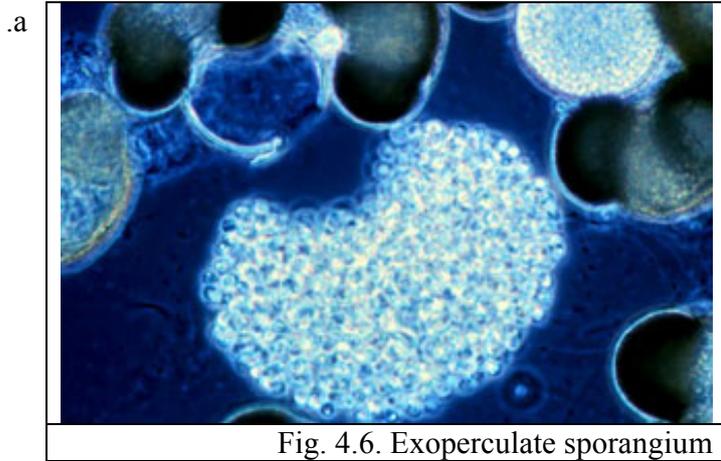


Fig. 4.5. Inoperculate sporangium.



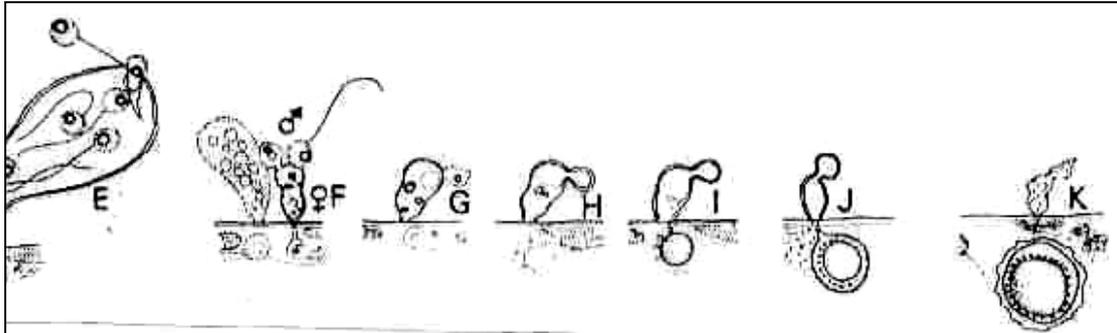
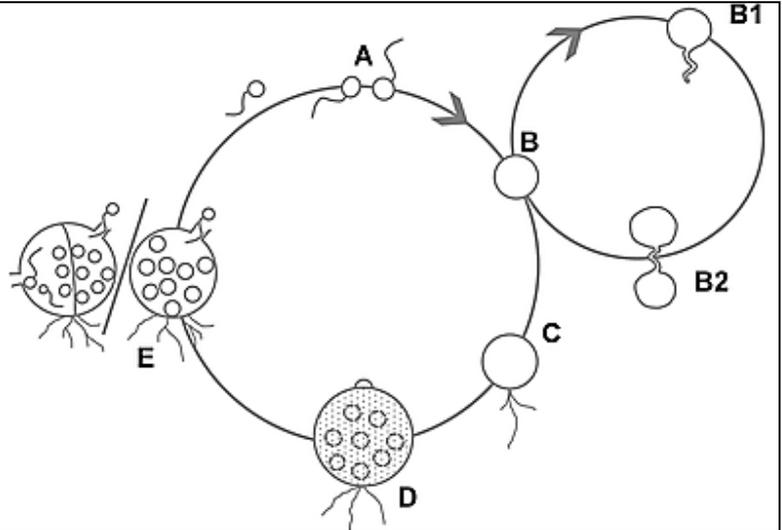


Fig. 4.8. Sexual reproduction in *Chytridium sexual* E-k



Fig 4.9. Since the 1970s, the aquatic fungus *Batrachochytrium dendrobatidis* has triggered die-offs in hundreds of amphibian species such as the common midwife toad (*Alytes obstetricans*). These frogs—arranged in rows by researchers documenting the fungus—died in the French Pyrenees (Photo by Matthew Fisher)



Figs. 4.11. The lifecycle of *Batrachochytrium* species in culture. In culture *B. dendrobatidis* continues the life cycle stages A–E, while in *B. salamandrivorans* additional life cycle stages B1-B2 are observed: (A) flagellated motile zoospores; (B) encysted zoospore; (B1) germling with germtube; (B2) transfer of the cell contents into a newly formed thallus; (C) zoospore cyst with rhizoids; (D) immature sporangium; (E) mature monocentric zoosporangium with discharge tube (at the right), colonial thallus containing several sporangia, each with their own discharge tube (at the left). Modified from Berger et al. (2005)

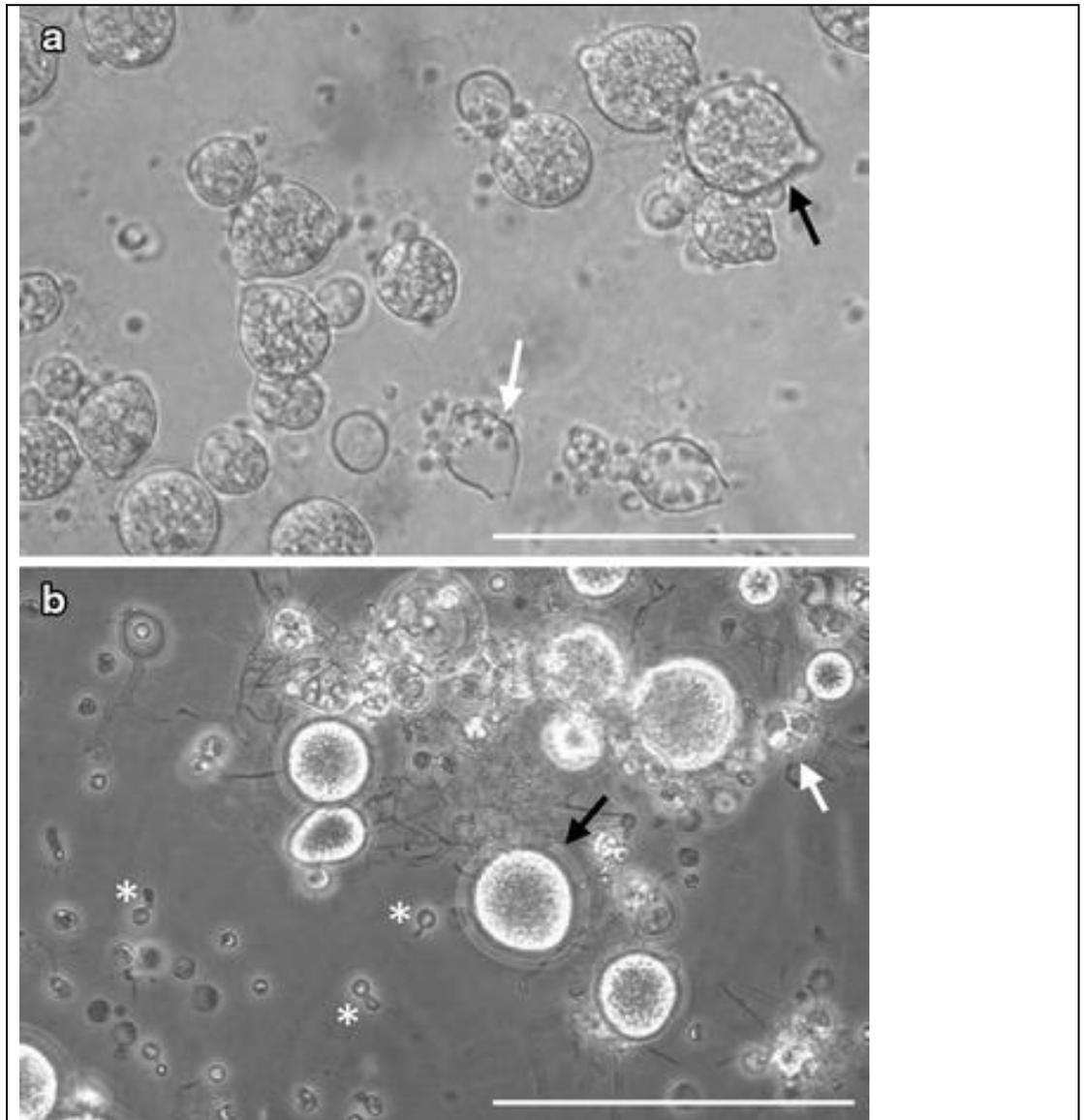


Fig. 4.10 Morphology of *Batrachochytrium* species in culture. **a** Culture of *B. dendrobatidis* on tryptone/gelatin-hydrolysate/lactose (TGhL)-broth, showing abundant mature zoosporangia (black arrow) containing zoospores and empty, discharged sporangia (white arrow); **b** In culture (TGhL-broth) *B. salamandrivorans* is characterized by predominant monocentric thalli (black arrow), few colonial thalli (white arrow) and zoospore cysts with germ tubes (asterisk); scale bars 100 μm *B. dendrobatidis*.

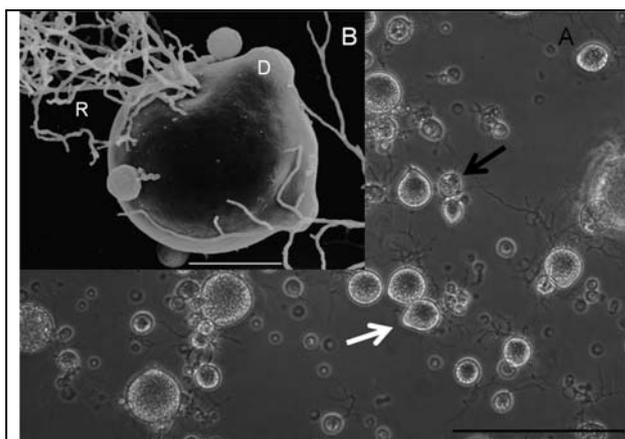
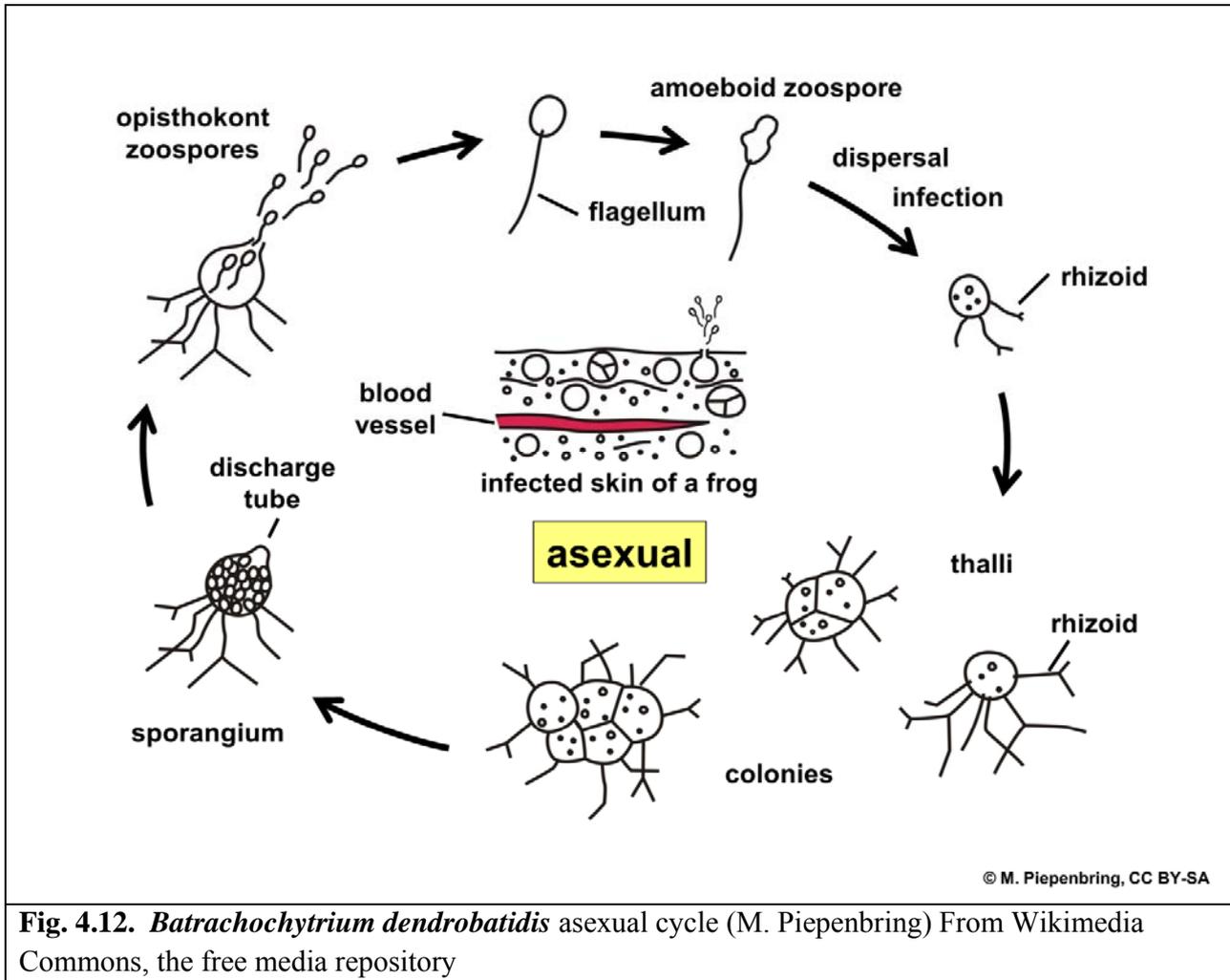


Fig. 4.13. In vitro culture of *B. salamandrivorans* in TGhL broth at 15 °C. (A) **Monocentric** thalli predominate, with the rare presence of colonial thalli (black arrow). Sporangia develop discharge tubes (white arrow) to release zoospores (Scale bar, 100 μm.) (B) Scanning electron

microscopic image of a mature sporangium with rhizoids (R), discharge tubes (D), and germ tube formation (arrow) (Scale bar, 10 μ m.)



Figure 4.14. Dead Bd-infected *Atelopus limosus* at Sierra Llorona.

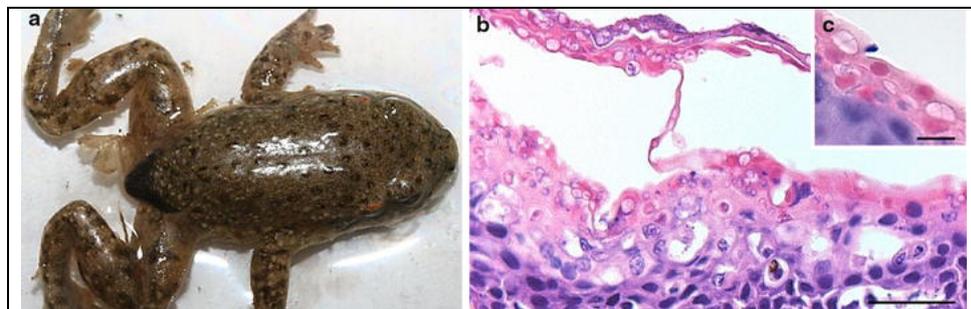
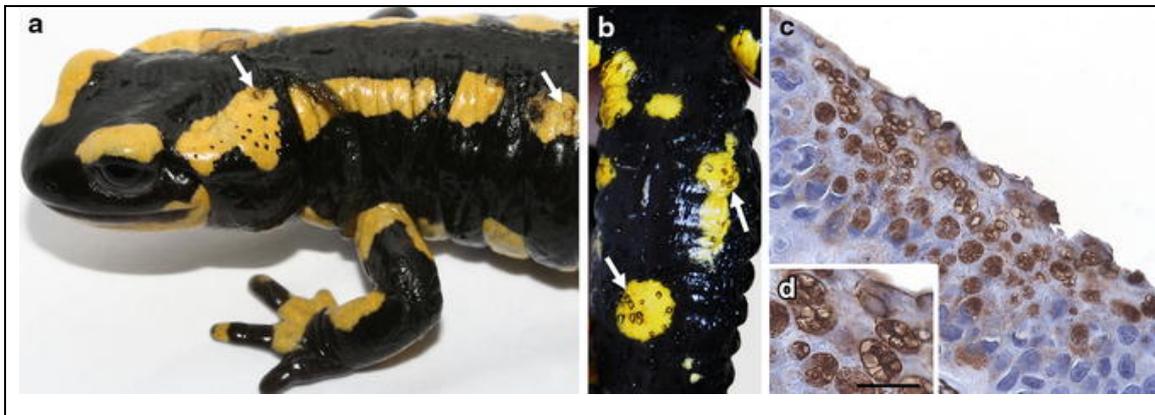


Fig. 4.15 Clinical signs and pathology associated with infection due to *Batrachochytrium dendrobatidis*. a Naturally infected **moribund** common midwife toad (*Alytes obstetricans*) showing abnormal posture (abduction hind legs) and loose sloughed skin; b section through the ventral skin (drink patch) of the same infected toad; infection is characterized by diffuse epidermal hyperkeratosis and hyperplasia combined with the presence of numerous zoosporangia at various stages of maturation; HE; scale bar 50 μ m; c detail of intracellular septate zoosporangia; HE; scale bar 10 μ m



Figs 4.16a, b, c. Clinical signs and pathology associated with infection due to *Batrachochytrium salamandrivorans*. **a** a naturally infected fire salamander (*Salamandra salamandra*) found during a *B. salamandrivorans*-outbreak (Robertville, Belgium) showing several ulcers (white arrows) and excessive skin shedding; **b** extensive ulceration (white arrows) at the ventral side of an infected fire salamander; **c** skin section through an ulcer evidences abundant intracellular colonial thalli in all epidermal skin layers; immunohistochemical stain with polyclonal antibodies to *B. dendrobatidis*; scale bar 10 μ m; **d** magnification of the intracellular colonial thalli from micrograph **c**; immunohistochemical stain; scale bar 10 μ m

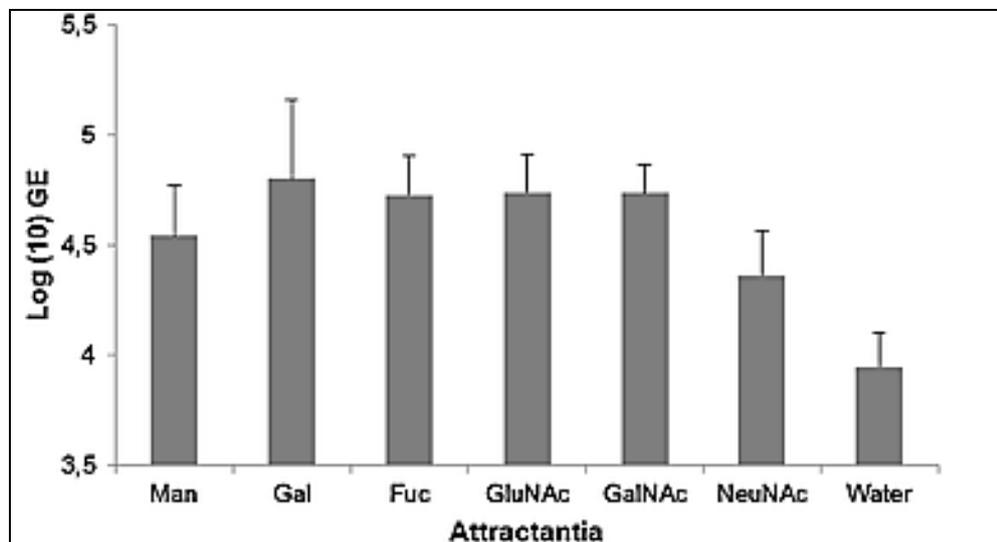


Fig. 4.17. Chemotaxis of *Batrachochytrium dendrobatidis* toward free integumental sugars. The sugars α -d-mannose (Man), α -d-galactose (Gal), α -l-fucose (Fuc), β -d-N-acetylglucosamine (GluNAc), α -d-N-acetylgalactosamine (GalNAc), N-acetylneuraminic acid (NeuNAc) or sialic acid were tested as attractants at a 0.1 M concentration, using a traditional capillary tube test. Water was used as vehicle and controle attractants.

Genomic equivalents (GE) of *B. dendrobatidis* zoospores in the capillaries were quantified after a 90 min using quantitative real-time PCR. Mean \pm standard error of three independent experiments are presented

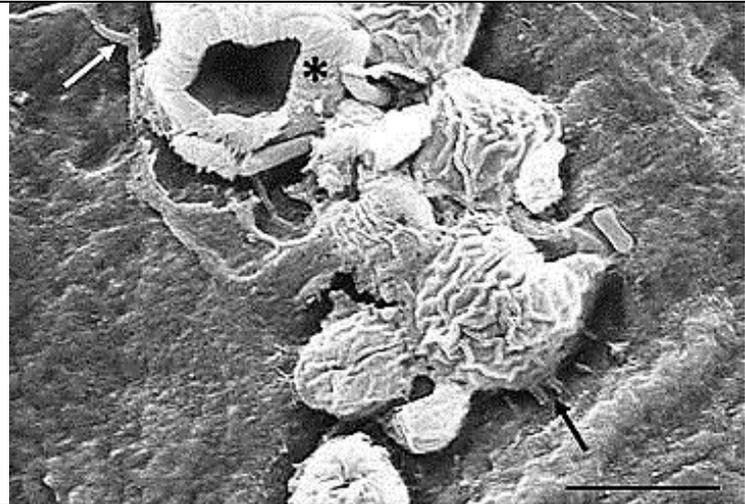


Fig. 4.18. Adhesion of *Batrachochytrium dendrobatidis* to *Xenopus laevis* skin. Adhesion to the epidermal surface is established both by tubular projections, possibly **adhesins** (black arrow) and rhizoids (white arrow). Some encysted zoospores have collapsed (asterisk) due to cell hollowing; scale bar 5 μ m

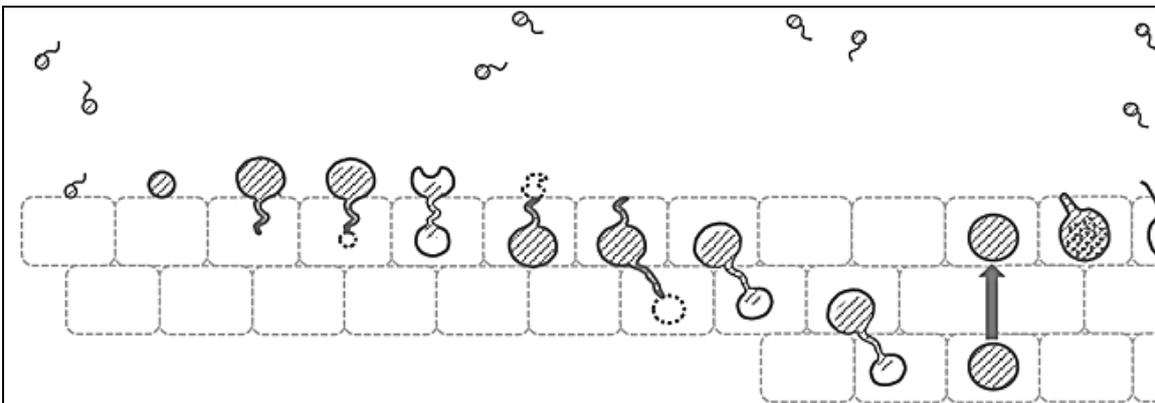


Figure 4.19 .Infection cycle of *Batrachochytrium dendrobatidis* in a susceptible host. The endobiotic lifecycle includes successively germ tube mediated invasion, establishment of intracellular thalli, spread to the deeper skin layers, upward migration by the differentiating epidermal cell to finally release zoospores at the skin surface

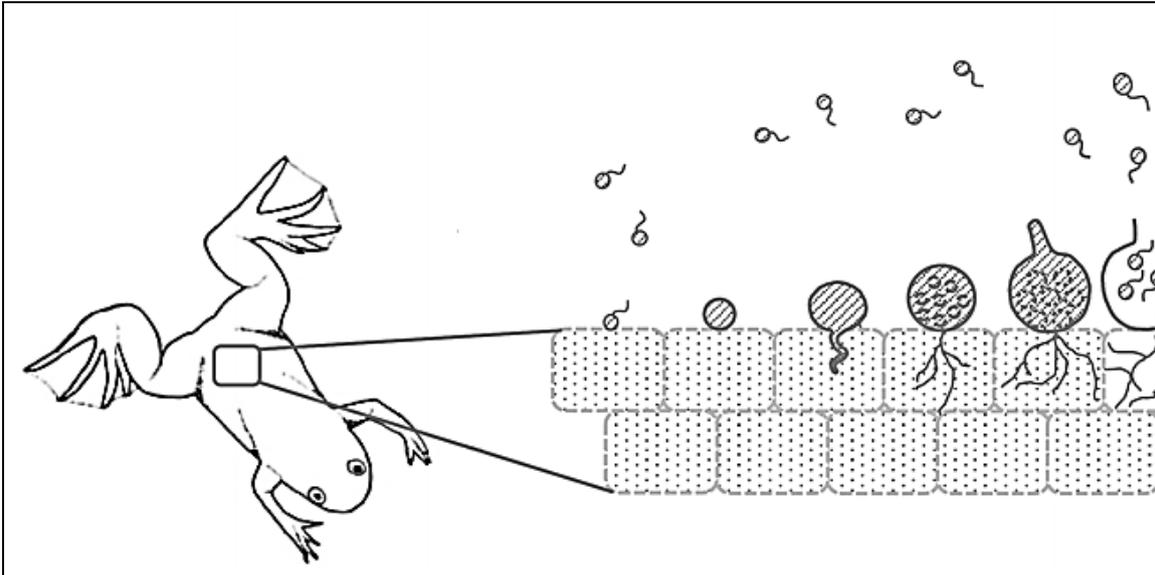


Figure 4.20 . Epibiotic lifecycle of *Batrachochytrium dendrobatidis*. The epibiotic lifecycle observed in skin explants of *Xenopus laevis* includes germ tube mediated invasion, outgrowth of a rhizoidal network, uptake of host cell cytoplasm as nutrient for the growing and maturing chytrid thallus upon the skin surface

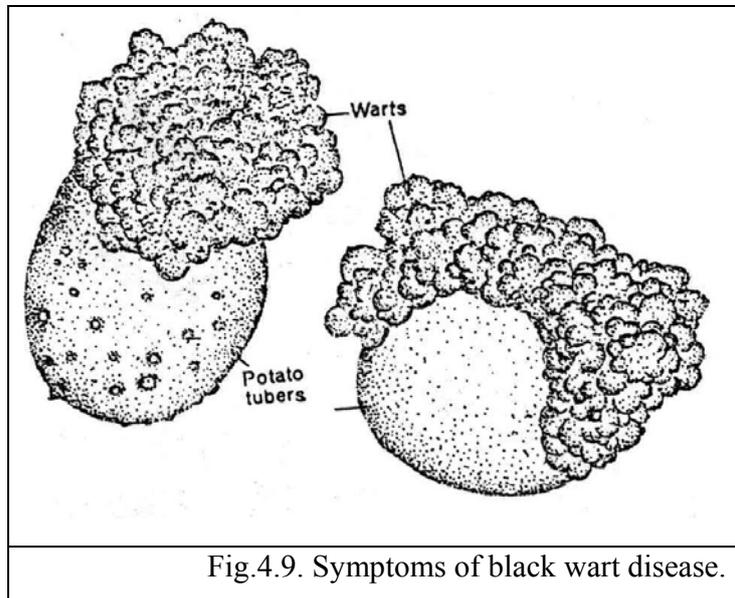


Fig.4.9. Symptoms of black wart disease.

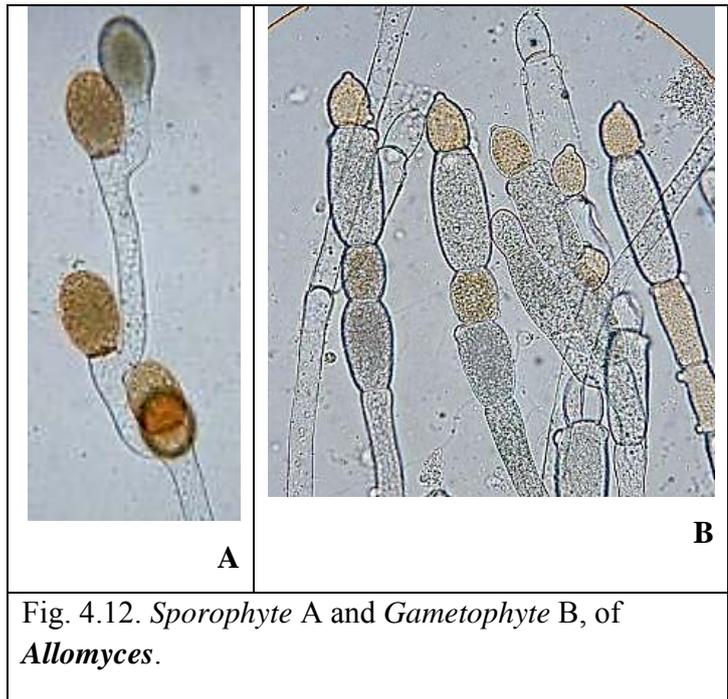
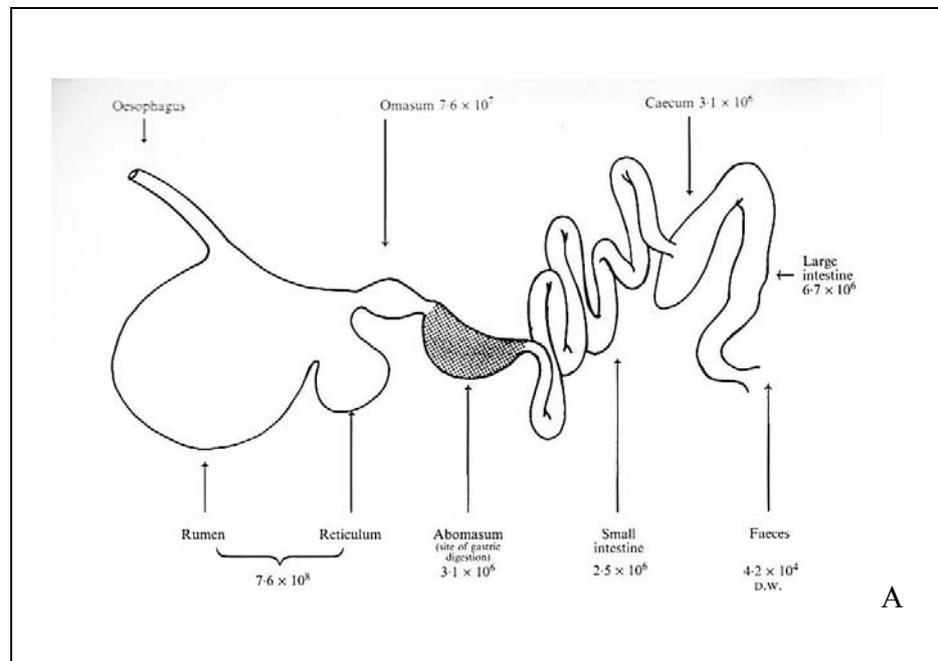


Fig. 4.12. *Sporophyte A and Gametophyte B, of Allomyces.*



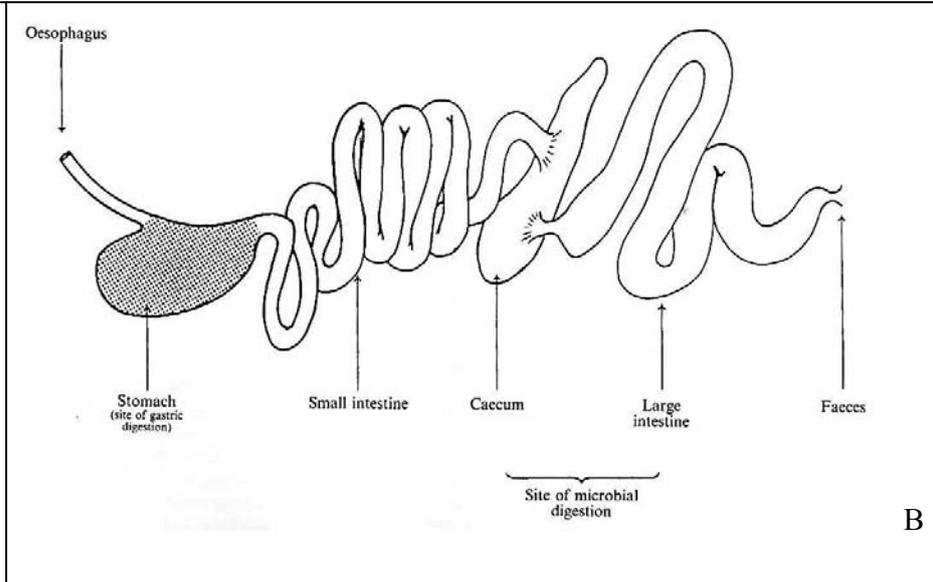


Fig.4.14. Diagram illustrating the fore gut (A) and hind gut (B) of herbivores. (from Trinici *et. al.*, 1994)

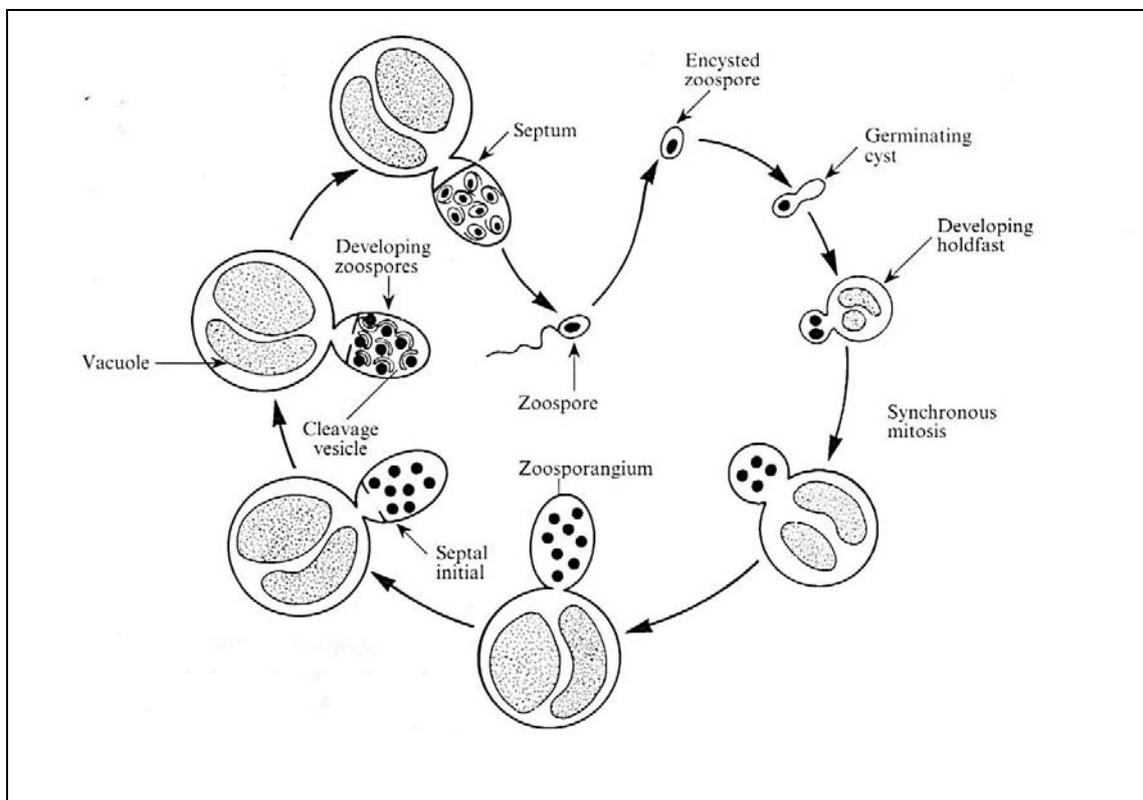


Fig. 4.15. life cycle of *Caecomyces*. (from Trinici *et. al.*, 1994)

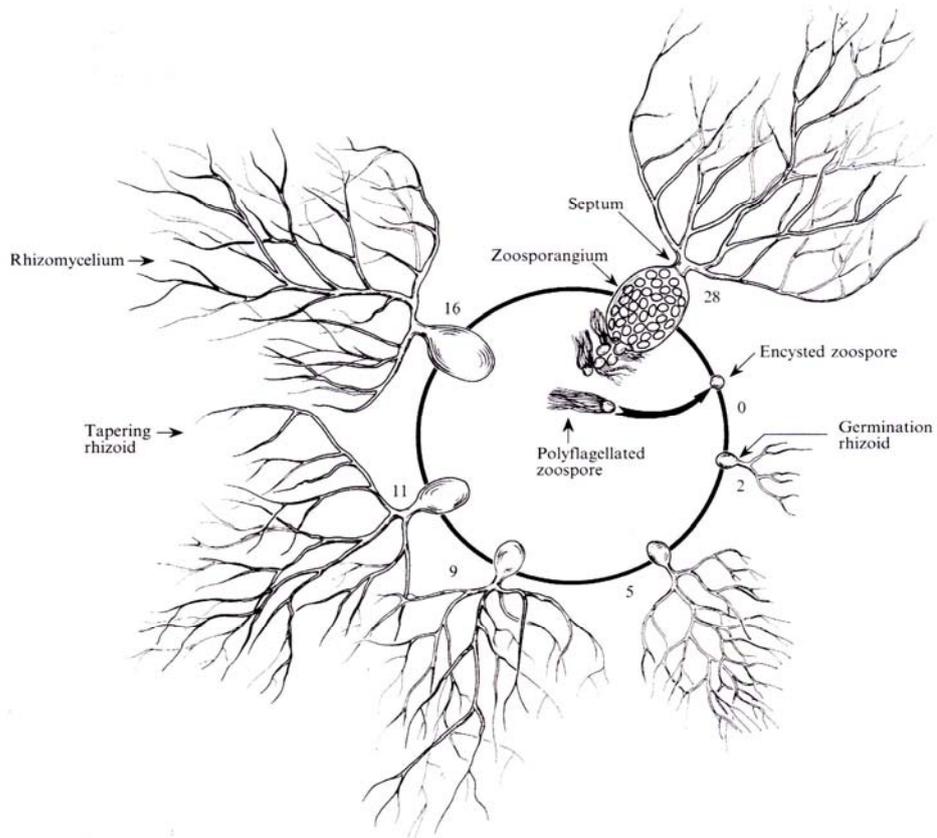


Fig.4.16. Life cycle of *Neocallimastix* (from Trinici *et. al.*, 1994)