Physarum

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Myxomycetes

- Myxomycetes are ubiquitous eukaryotic microorganisms, with more than 1,000 species having been identified thus far.
- Climatically they can exist in different types of environments such as in cold, temperate, and arid areas.
- They always exist in forest ecosystems, such as living trees or leaves, decaying wood, and ground litter.
- They are also abundantly found in soil and can prey on surplus amoeba in certain soils.
- Their life cycles undergo conversions from trophic, diploid multinuclear plasmodia to reproductive, haploid fruiting bodies.
- Uninuclear, haploid myxamoebae are released by spore germination, the optimum pH of which is 4.5–7.0.
- It can directly develop into haploid plasmodium, also can form diploid zygotes through heterothallism or homothallism, then gradually develop into amorphous, multinuclear plasmodia via continuous mitosis or fusion with other myxamoebae.
- The formation of fruiting bodies is not a spontaneous process, but rather, it requires a combination of appropriate preconditions such as starvation and light during the plasmodial stage, the occurrence of protoplasmic division, and the gradual development of haploid spores by meiosis.

Life Cycle of Physarum

- The life cycle of *Physarum* starts with the germination of a meiospore under favourable conditions.
- One to four uninucleate haploid biflagellate swarm cells or myxamoebae are released through a slit or pore; the former under wet conditions and the latter under drier conditions.
- Fusion between two swarm cells or myxamoebae followed by karyogamy results in the formation of a zygote which is uninucleate, diploid and amoeboid in form.
- It creeps over the substratum feeding on bacteria and organic matter synthesizing more protoplasm resulting in growth.
- The growth in size is accompanied by repeated and successive divisions of the diploid parent nucleus.
- The divisions are mitotic. As a result of subsequent growth, repeated karyokinesis but no cytokinesis, the zygote gradually becomes changed into a multinucleate amoeboid mass of protoplasm, called the Plasmodium.

...Life Cycle

- The numerous nuclei embedded in its protoplasm are diploid in nature.
- Favourable temperature, abundant moisture and food favour its growth, movement and reproduction.
- In many cases the young diploid plasmodia may combine with zygotes or other plasmodia of the same species or a number of zygotes may coalesce to form a single larger plasmodium.
- In all these cases, the union involves the fusion of their cytoplasm only.
- There is no fusion between the nuclei.
- Eventually the plasmodium in many cases becomes a massive structure called the macroplasmodium or phaneroplasmodium.
- Normally the plasmodium after attaining a certain size and stage of maturity enters the reproductive phase.
- The amoeboid life ceases.
- The slime layer dries.
- The quiescent plasmodium thickens.
- Diploid protoplast concentrates at a few points forming a mound like structure.

… Life Cycle

- The latter grows into a stalked sporangium.
- The diploid protoplasm or of the sporangium cleaves into numerous young spores each of which has a diploid nucleus.
- The diploid nuclei of the young spores undergo meiosis to form meiospores.
- When mature the meiospores are released and dispersed by wind.
- On falling on a suitable substratum and under favourable conditions, the meiospore germinates to release swarm cells or myxamoebae which fuse in pairs to form the zygote in which the diploid condition is re-established.
- Under conditions of stress and strain mature plasmodium by differentiation and cleavage becomes transformed into an irregular hard structure consisting of thick-walled cellular units.
- The former is called the sclerotium and the latter spherules. The sclerotium remains dormant when the conditions are unfavourable for growth.
- With the return of suitable conditions it grows into a new Plasmodium.

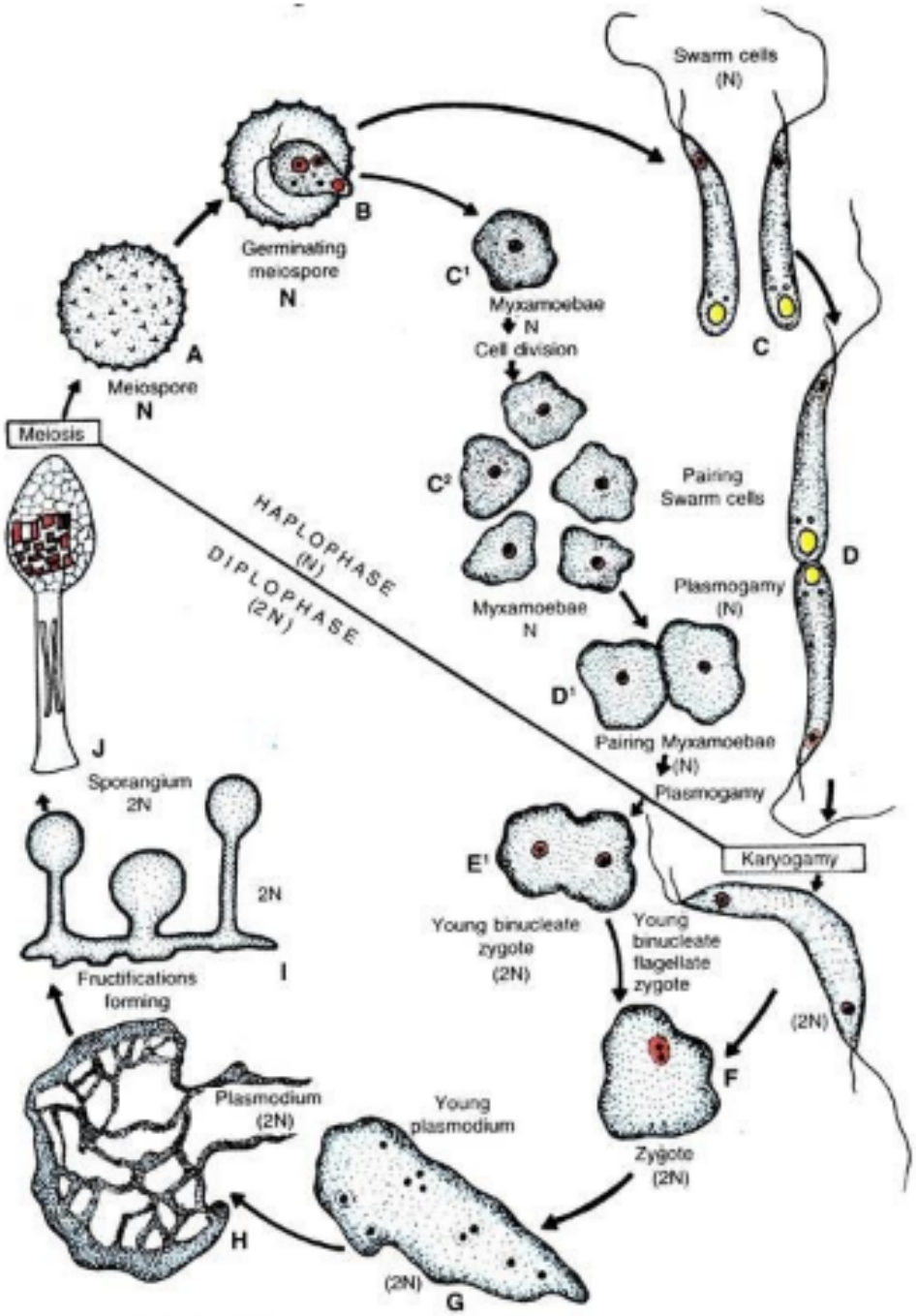

Fig. 2.13 (A-J). *Slime molds.* Pictorial life cycle of *Physarum polycephalum.*

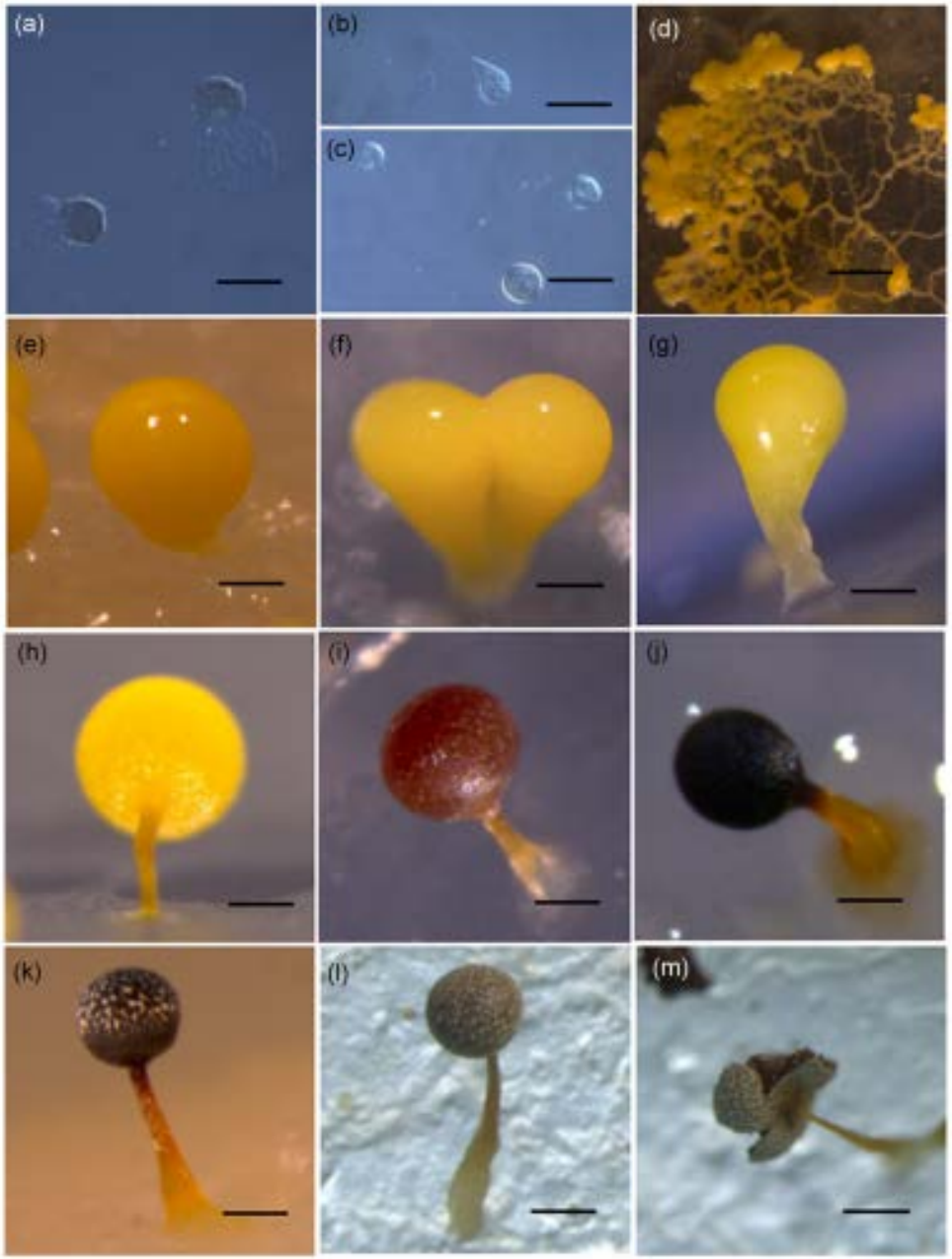

FIGURE 1 The life cycle of *Physarum rigidum* (a) spores with V-shape split and microcysts, (b) swarm cell, (c) rounded myxamoeba with a long flagellum, (d) plasmodia, (e,f) nodule stage, (g) yellow sporangium stage with thick stalk, (h) yellow sporangium stage with thin stalk, (i) brown sporangium stage, (j) black sporangium stage, (k) the black sporangium with calcareous, (l,m) mature stage. *Bar*: a: 15 μm; b,c: 20 μm; d: 0.5 cm; e: 0.1 mm; f–m: 0.2 mm

Alternation of Generations of Slime Mold

- Strictly speaking, there is no alternation of two distinct generations in the life cycle of true slime molds.
- The diploid Plasmodium is the sporophyte. Along with other diploid structures such as the zygote, sporangia and the young diploid spores, it constitutes the sporophyte generation or diplophase.
- There is, however, no gametophyte plant. Meiosis occurs in the young diploid spores. The mature haploid spores (meiospore) and the gametes (swarm cells or myxamoebae) they give rise to on germination represent the extremely reduced gametophyte or haplophase limited only to a few haploid cells.
- Truly speaking there is alternation of sporophyte generation with a few haploid cells in the life cycle. Such a life cycle is called diploid or diplontic. The sclerotia and spherules do not play any role in the phenomenon of alternation of generations. They primarily serve as means of perennation and serve to prolong the diplophase in the life cycle.