LEARNING OBJECTIVES

- Describe the ecology and the reproduction of Ascomycetes

The majority of known fungi belong to the Phylum Ascomycota, which is characterized by the formation of an ascus (plural, asci), a sac-like structure that contains haploid ascospores. Many ascomycetes are of commercial importance. Some play a beneficial role, such as the yeasts used in baking, brewing, and wine fermentation, plus truffles and morels, which are held as gourmet delicacies. *Aspergillus oryzae* is used in the fermentation of rice to produce sake. Other ascomycetes parasitize plants and animals, including humans. For example, fungal pneumonia poses a significant threat to AIDS patients who have a compromised immune system. Ascomycetes not only infest and destroy crops directly, they also produce poisonous secondary metabolites that make crops unfit for consumption. Filamentous ascomycetes produce hyphae divided by perforated septa, allowing streaming of cytoplasm from one cell to the other. Conidia and asci, which are used respectively for asexual and sexual reproductions, are usually separated from the vegetative hyphae by blocked (non-perforated) septa.

Asexual reproduction is frequent and involves the production of conidiophores that release haploid conidiospores. Sexual reproduction starts with the development of special hyphae from either one of two types of mating strains. The “male” strain produces an antheridium (plural: antheridia) and the “female” strain develops an ascogonium (plural: ascogonia). At fertilization, the antheridium and the ascogonium combine in plasmogamy without nuclear fusion. Special ascogenous hyphae arise, in which pairs of nuclei migrate: one from the “male” strain and one from the “female” strain. In each ascus, two or more haploid ascospores fuse their nuclei in karyogamy. During sexual reproduction, thousands of asci fill a fruiting body called the ascocarp. The diploid nucleus gives rise to haploid nuclei by meiosis. The ascospores are then released, germinate, and form hyphae that are disseminated in the environment and start new mycelia.
Release of ascospores: The bright field light micrograph shows ascospores being released from asci in the fungus Talaromyces flavus var. flavus.
Figure \( \PageIndex{1} \): Lifecycle of an ascomycete: The lifecycle of an ascomycete is characterized by the production of asci during the sexual phase. The haploid phase is the predominant phase of the life cycle.

### Key Points

- **Ascomycota fungi** are the yeasts used in baking, brewing, and wine fermentation, plus delicacies such as truffles and morels.
- Ascomycetes are filamentous and produce hyphae divided by perforated septa.
- Ascomycetes frequently reproduce asexually which leads to the production of conidiophores that release haploid conidiospores.
- Two types of mating strains, a “male” strain which produces an antheridium and a “female” strain which develops an ascogonium, are required for sexual reproduction.
- The antheridium and the ascogonium combine in plasmogamy at the time of fertilization, followed by nuclei fusion in the asci.
- In the ascocarp, a fruiting body, thousands of asci undergo meiosis to generate haploid ascospores ready to be released to the world.

### Key Terms

- **plasmogamy**: stage of sexual reproduction joining the cytoplasm of two parent mycelia without the fusion of nuclei
- **Ascomycota**: a taxonomic division within the kingdom Fungi; those fungi that produce spores in a microscopic...
sporangium called an ascus

- **ascus**: a sac-shaped cell present in ascomycete fungi; it is a reproductive cell in which meiosis and an additional cell division produce eight spores
- **ascospore**: a sexually-produced spore from the ascus of an Ascomycetes fungus
- **conidia**: asexual, non-motile spores of a fungus, named after the Greek word for dust, conia; also known as conidiospores and mitospores
- **antheridia**: a haploid structure or organ producing and containing male gametes (called antherozoids or sperm) present in lower plants like mosses and ferns, primitive vascular psilotophytes, and fungi
- **ascogonium**: a haploid structure or organ producing and containing female gametes in certain Ascomycota fungi
- **ascocarp**: the sporocarp of an ascomycete, typically bowl-shaped
- **ascomycete**: any fungus of the phylum Ascomycota, characterized by the production of a sac, or ascus, which contains non-motile spores