

Ustilago maydis, corn smut

cellular organisms - Eukaryota - Fungi/Metazoa group - Fungi - Dikarya - Basidiomycota - Ustilaginomycotina - Ustilaginomycetes - Ustilaginales - Ustilaginaceae - Ustilago - Ustilago maydis

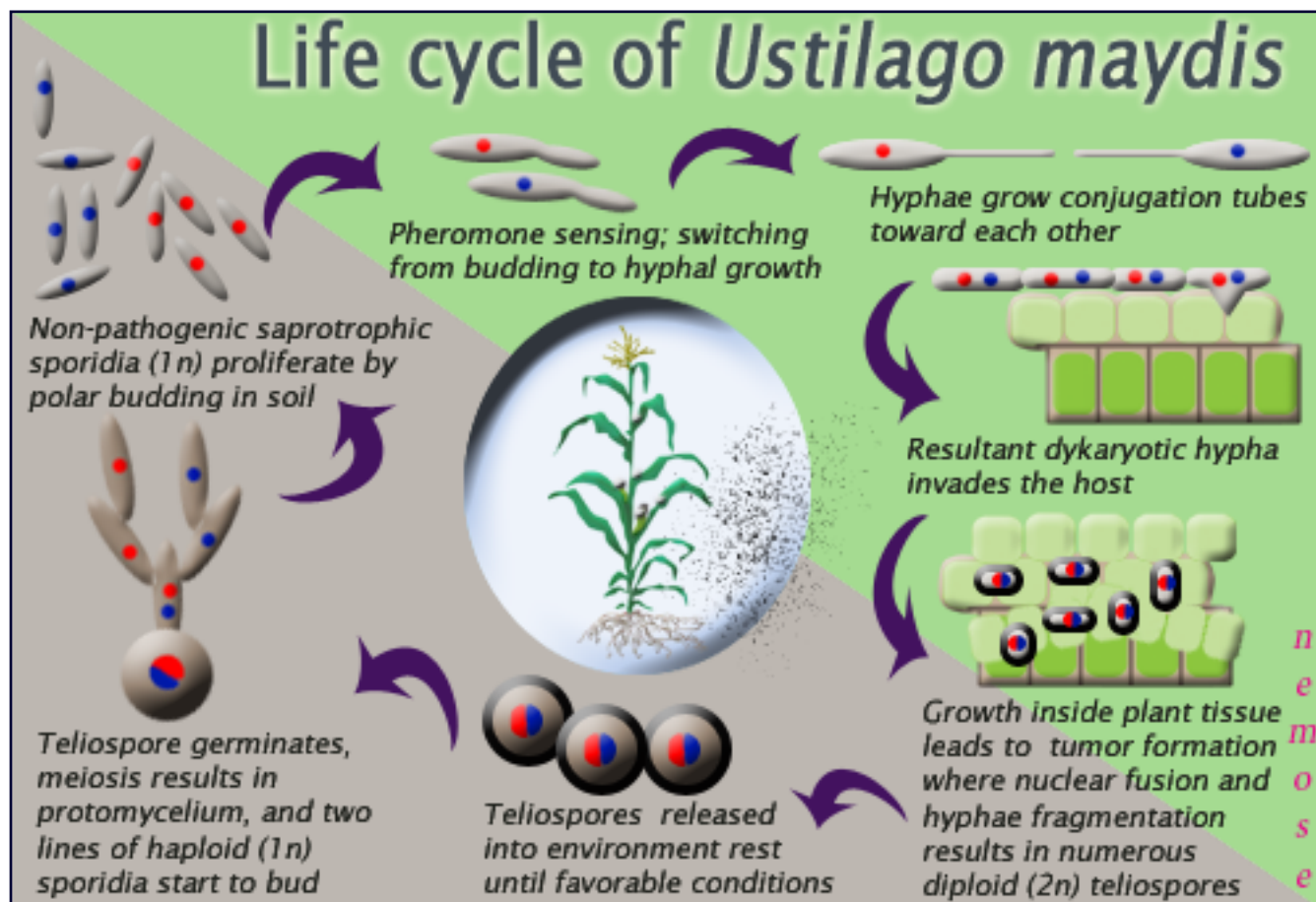
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Brief facts

- *Ustilago maydis* (**corn smut**) is **dimorphic filamentous** fungus that together with mushrooms and many other fungi belongs to phylum *Basidiomycota*. **Dimorphic** means that the fungus exists in two forms: **saprotrophic** yeast-like form that lives on dead organic material and is non-pathogenic and parasitic filamentous form that derives nutrients from its host. **Filamentous** means that unlike yeasts, which cells do not have polarity and proliferate by simple budding *U. maydis* expands its mycelium by polar tip hyphal growth.
- Order *Ustilaginales* contains many important plant pathogens such as *Ustilago hordei*, *Ustilago nuda*, *Ustilago nigra* (oat pathogens), *Tilletia indica*, *Tilletia caries*, and *Tilletia controversa* (wheat pathogens). Of all *Ustilaginales*, *U. maydis* is best known and has rather narrow specificity - it can parasitize only on corn (*Zea mays*) and on its ancestor

teozinte (*Zea mexicana*).

- *U. maydis* causes stunting, chlorosis, and above all, induces formation of galls, or tumors, on infested corn plant, primarily on ears.
- Corn invaded by *U. maydis* is considered a delicacy in Mexico. Traditional Mexican dishes such as **Quesadillas de huitlacoche** or **Sopa de huitlacoche** have been recently introduced into the high-end restaurants with success. The cooking of *U. maydis* infested corn is believed to exist since pre-Columbus era.
- *U. maydis* is used extensively in biological research and is considered a very valuable model system not only in molecular plant pathology but also in studies of eukaryotic cell's signaling pathways, molecular transport, cell division mechanisms, and many other areas.



Developmental stages

Life cycle of *U. maydis* has been subject of intensive research. It has many

fascinating aspects, which cannot be described in this short review. Some of them will be gradually added.

- **non-parasitic phase**

diploid **teliospores** released into environment from corn tumors by parasitic form of the fungus

- **germination**

teliospores germinate under favorable conditions forming **protomycelium**

- **meiosis**

meiosis occurs giving rise to two haploid lines of the fungus

- **saprobic growth**

haploid cells (**sporidia**) start to colonize soil and dead organic matter proliferating by polar budding in yeast-like manner

- **pheromone exchange**

sporidia sense each other by exchanging pheromones; switch from budding to hyphal growth occurs

- **conjugation tubes formation**

cells start to make narrow filaments, which are referred as **mating hyphae** or **conjugation tubes**

- **dikaryon formation**

the conjugation tubes grow toward each other and upon fusion form dikaryon

- parasitic phase

the dikaryon is pathogenic if it resulted from fusion of two **compatible** haploid hyphae

- invasion

infective dikaryon invades the plant through natural openings such as stromata and floral organs

- tumor formation

fungus hyphae grow inside the plant intra- and intercellularly causing formation of tumors

- sporulation

hyphae acquire a round shape, and a thick cell wall is formed; as the spores mature they become pigmented; **karyogamy** takes place with the formation of diploid stage of the fungus; resultant teliospores dispersed into environment and saprobic stage of the fungus begins

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