

# *Coccidioides posadasii*

cellular organisms - Eukaryota - Fungi/Metazoa group - Fungi - Dikarya - Ascomycota - Pezizomycotina - Eurotiomycetes - Eurotiomycetidae - Onygenales - mitosporic Onygenales - *Coccidioides* - *Coccidioides posadasii*

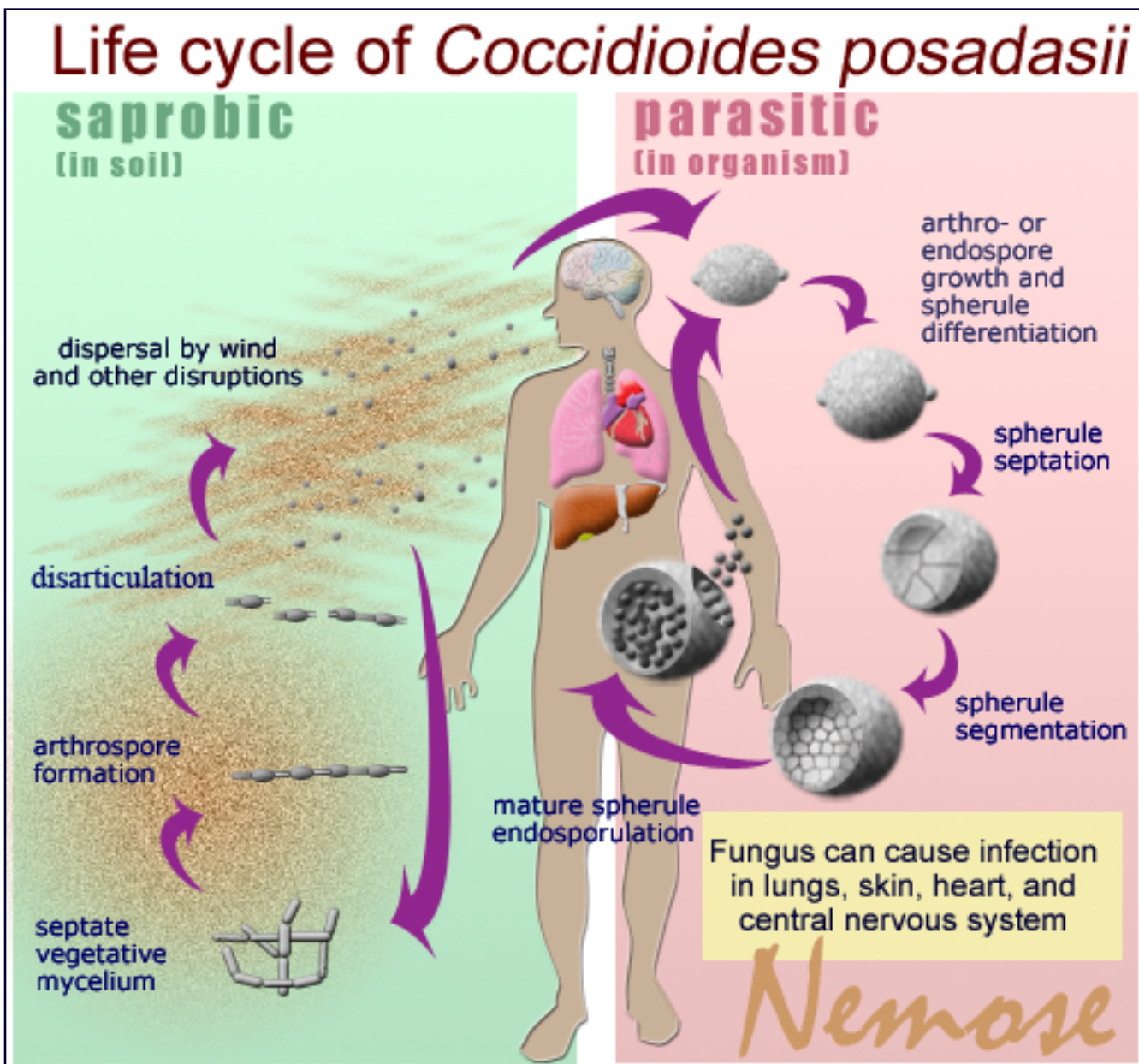
- **Brief facts**
- **Developmental stages**
- **Tissues**
- **Mating types**
- **References**

## **Brief facts**

- *Coccidioides posadasii* is thermally dimorphic soil-dwelling fungi endemic in the United States, Mexico, and Central and South America.
- Molecular studies about the genome of the fungus *Coccidioides* have demonstrated two nearly identical, but well identified species, *Coccidioides immitis* and *C. posadasii*, known as "California" and "non-California" species, respectively. Phylogenetic analyses using single nucleotide polymorphisms, genes, and microsatellites show that *C. posadasii* represents a divergent, genetically recombining monophyletic clade.
- *C. posadasii* is morphologically indistinguishable from *Coccidioides immitis*. Phenotypically it differs from *Coccidioides immitis* by growing more slowly on media

containing high salt concentrations.

- This fungus is a causative agent of **coccidiomycosis** (one of the true systemic mycoses) in humans. The disease is also called **Valley Fever**.
- The fungus belongs to the **mitosporic** or **imperfect** fungi (fungi with no known sexual stage).
- Both *C. immitis* and *C. posadasii* are potential bioterrorism agents. As a result, in the USA and elsewhere, these organisms fall under stringent regulations that governs their possession, use and transfer.



## Developmental stages

- parasitic phase

parasitic form in host lung tissue at 37°C; parasitic phase is initiated immediately in lungs after arthroconidium is inhaled: spores convert to large tissue-invasive spherules (ranging from 20-80  $\mu\text{m}$  in diameter) which can be visualized in sputum, pleural fluid, cerebrospinal fluid, and exudates from draining lesions; parasitic phase is divided into three stages

- spherule initiation

barrel-shaped arthroconidium is rounding up and is expanding isotropically while the nuclei undergo multiple rounds of mitosis, ultimately forming a large multinucleate cell with a central vacuole; spherule wall expansion requires biosynthesis of new cell wall components, as well as degradation of pre-existing ones

- spherule segmentation

by 72 h after initiation, the spherule begins to undergo internal segmentation followed by development of uninucleate endospores; invaginations from the spherule wall are synthesized and segment the protoplasm into compartments that surround a central vacuole; this process involves synthesis of large amounts of chitin

- release of endospores

between 120 and 132 h post-infection, the spherule may rupture and release 200–300 endospores that are capable of re-initiating the parasitic cycle and can also disseminate via blood or the lymphatic system to other parts of the body

- **saprobic phase**

filamentous form living in soil on decaying matter at 25°C

- **asexual sporulation**

sporulation occurs with aerial hyphae undergoing wall rigidification, followed by the thickening of the inner cell wall and autolysis of alternate compartments, with the remaining cells developing into arthroconidia; eventually, the empty autolysed compartments fracture and cylindrical arthroconidia may be dispersed in the environment, where the cycle of saprobic growth and asexual sporulation can repeat itself

## Tissues

### Fungal Components

- **spherule**

structures filled with **endospores** produced by parasitic form of the fungus; spherules have thick lipid-rich membranous outer wall

- **endospore**

the progeny units of the parasitic phase, derived from spherules

- mycelium MeSH

saprobic mycelial phase contains the infectious arthroconidia and is found in the upper layer of the soil in endemic regions

- hyphae MeSH

microscopic threadlike filaments that forms mycelium of the fungus

- arthrospore

**arthroconidium**; asexual spore produced by segmentation of pre-existing hyphae; disturbances of soil contaminated with the organism results in dispersal of the spores; the spores are inhaled and develop into the parasitic form of the fungus (spherules/endospores)

## Mating type (gender)

*Coccidioides* strains contain either a MAT1-1 or a MAT1-2 idiomorph, which is 8.1 or 9 kb in length, respectively, the longest reported for any ascomycete species. These idiomorphs contain four or five genes, respectively, more than are present in the MAT loci of most ascomycetes. All genes in the MAT loci are transcribed. Two genes frequently found in common sequences flanking MAT idiomorphs, APN2 and COX13, are within the MAT loci in *Coccidioides*, but the MAT1-1 and MAT1-2 copies have diverged dramatically from each other. Data indicate that the acquisition of these genes in the MAT loci occurred prior to the separation of *Coccidioides* from *Uncinocarpus reesii*.

- Mat1-1

Isolates: CPA0001-CPA0010, CPA0016-CPA0018, CPA0032-CPA0049, CPA0051, CPA0053-CPA0054, CPA0056, CPA0058-CPA0065

- **Mat2-2**

Isolates: CPA0013-CPA0015, CPA0019-CPA0022,  
CPA0024-CPA0030, CPA0050, CPA0055, CPA0057

## References

### PubMed articles

- Mandel MA. et al. Genomic and population analyses of the mating type loci in *Coccidioides* species reveal evidence for sexual reproduction and gene acquisition. *Eukaryot Cell*. 2007 Jul; 6(7):1189-99. Epub 2007 May 18. **PMID: 17513566**
- Mandel MA. et al. *Coccidioides posadasii* contains single chitin synthase genes corresponding to classes I to VII. *Fungal Genet Biol*. 2006 Nov; 43(11): 775-88. Epub 2006 Jul 20. **PMID: 16857399**

### Websites

- **Fisher MC et al. Molecular and phenotypic description of *Coccidioides posadasii* sp. nov., previously recognized as the non-California population of *Coccidioides immitis*. *Mycologia*, 94(1), 2002, pp. 73–84.**
- **Doctor Fungus: *Coccidioides* sp.**



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