Impact of Spaceflight on Fungal Antibiotic Susceptibility and Virulence

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Abstract

Fungi, including *Candida parapsilosis* and *Rhodotorula mucilaginosa*, are common in the human epidermis. They can become opportunistic pathogens when the immune system is compromised. Space research examined these fungi from the International Space Station to understand how they respond to space conditions. The ISS isolates displayed increased antifungal resistance (using Fluconazole, Amphotericin B, and Caspofungin), biofilm formation, filamentation, and capsule formation compared to terrestrial controls, suggesting potential implications for spaceflight crew safety.

Introduction & Experimental Design

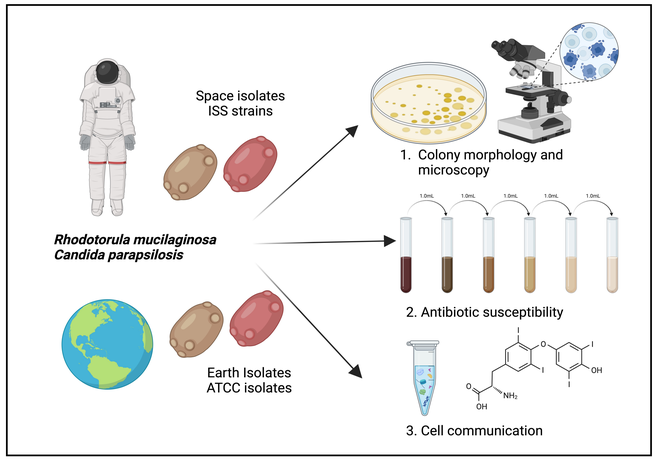

Figure 1: Space and earth isolates demonstrate different phenotypes. Virulence-related assays include observation of colony morphology, antibiotic testing and cell-cell communication assays.

Hypothesis

The ISS Isolates of fungal yeast strains *Candida parapsilosis* and *Rhodotorula mucilaginosa* will show increased virulence and pathogenicity as compared to the ATCC isolates.

Results

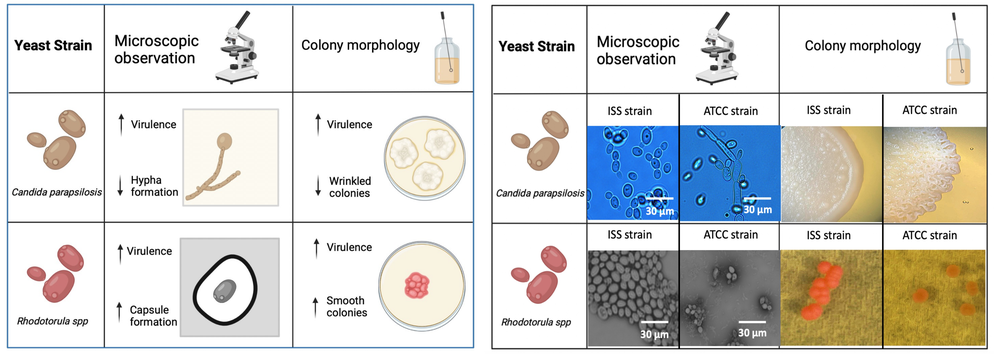

Figure 2: Colony morphology and microscopic observation of filamentation in *Candida* and capsule formation in *Rhodotorula.* ISS isolates demonstrated increased filaments and capsule.

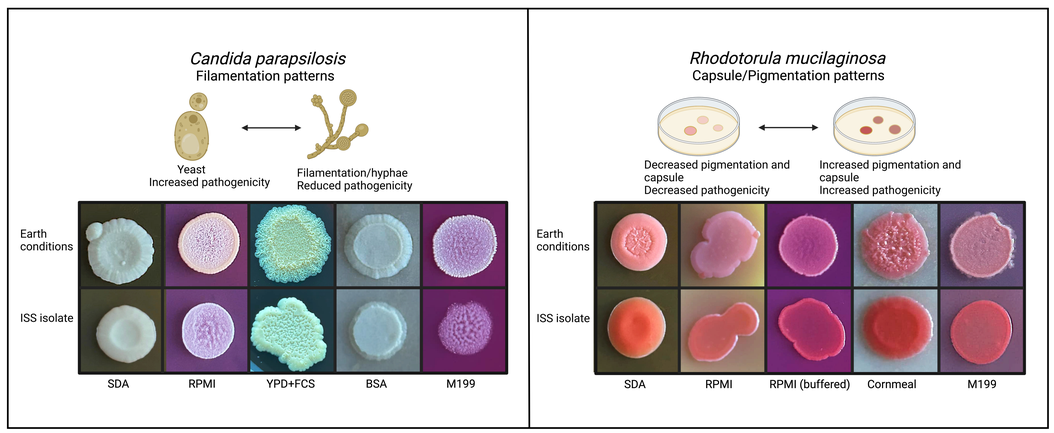

Figure 3: Colony morphology in multiple mycological media. Filamentation is observed as wrinkled colonies (left) and capsule is observed as smooth and shiny colonies (right).

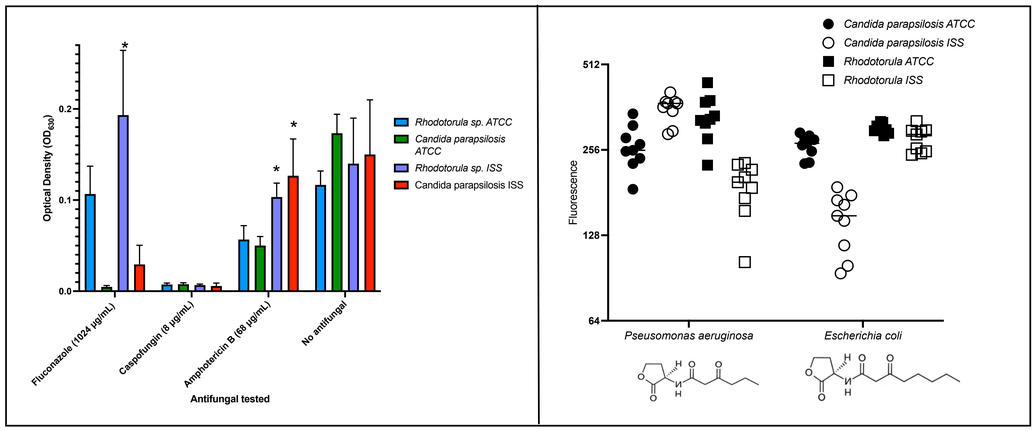

Figure 4: Antimycotic susceptibility tests (left), Increased resistance to Fluconazole and Amphotericin B was observed in both ISS isolates. Cell-cell communication (right) was tested using biosensors that detect production of long and short chain Autoinducers. Increased production of short chain autoinducer was observed in *Candida* (ISS) and high production on long chain autoinducer was observed in *Rhodotorula* (ISS).

Future Perspectives

Secretion:
- Hydrolytic enzymes, protease, and lipase
- Purpose : Development of antifungals for topical and systemic infections

Biofilm formation:
- Peptide or protein inhibitors discovered through signaling pathways
- Purpose: Enhance antibiofilm medications and facilitate inhibition or removal of damaging biological membranes

Pathogenesis:
- RNAi pathway for management of antiviral immunity in *C. elegans*
- Purpose: Control of viral pathogenesis, utilization of more advanced technology to determine additional pathways and mechanisms

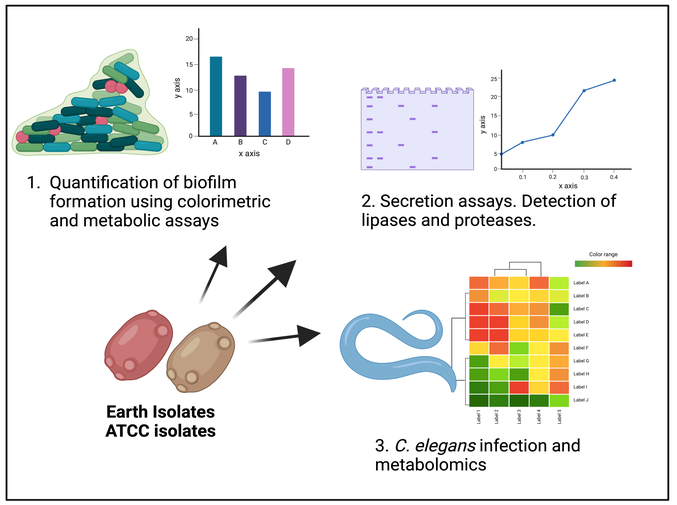

Figure 5: The methods that require further experimentation pertaining to virulence of ATCC and Earth isolates include biofilm formation, secretion assays, and infection of the *Caenorhabditis elegans* species with these strains.

Acknowledgements & References

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