

Can pathogens be sensitive?

Disease control through induction of spore germination

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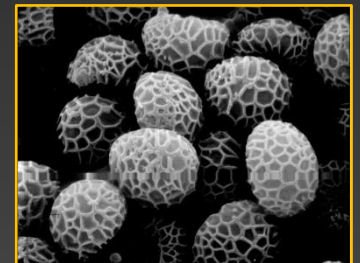
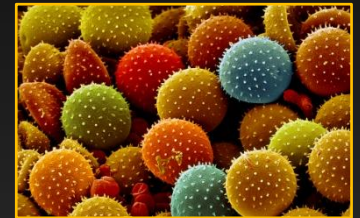
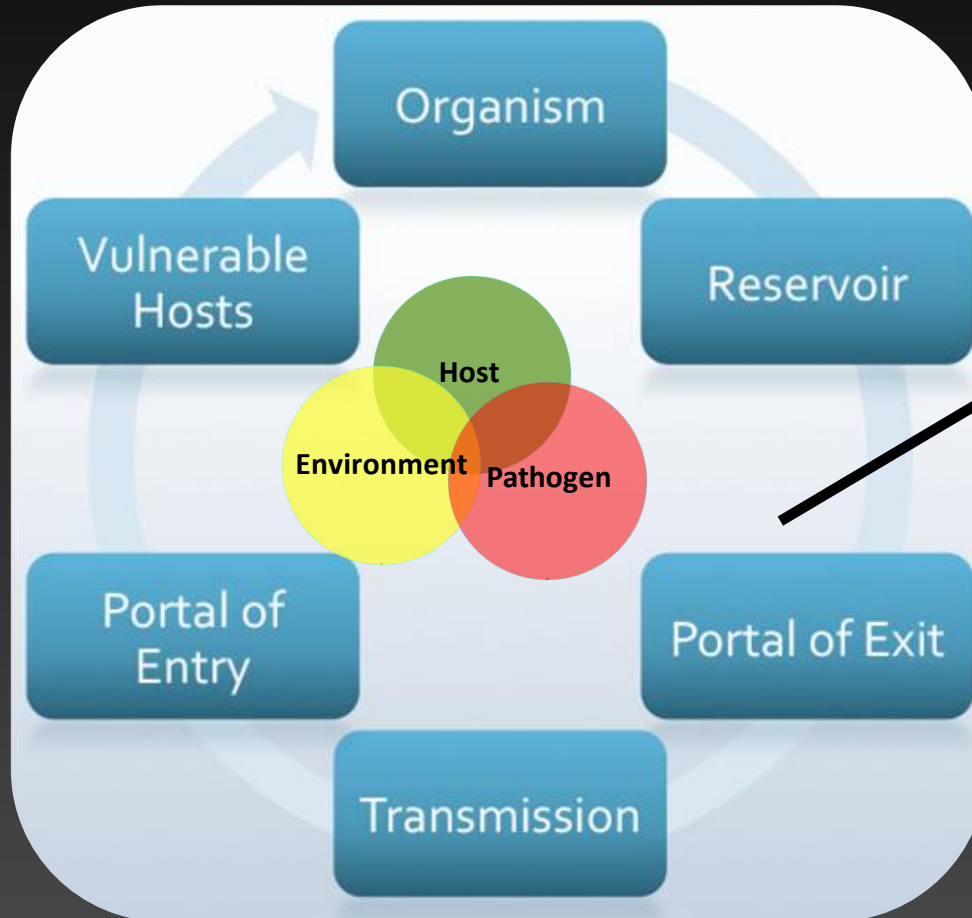
Dr. Dani Eshel



Dr. Amnon Lichter

Pathogen chain of infection

Bacteria/ virus/ parasite/ fungus



Pathogenic fungi

- Contaminate a wide range of fresh and processed foods
- Causing enormous losses and threatening food supply and human health.
- Chemical control measures have been challenged by increasing resistance to many key fungicides

The goal of the proposed work:

To inhibit the pathogen chain of infection by the reduction the spore reservoir

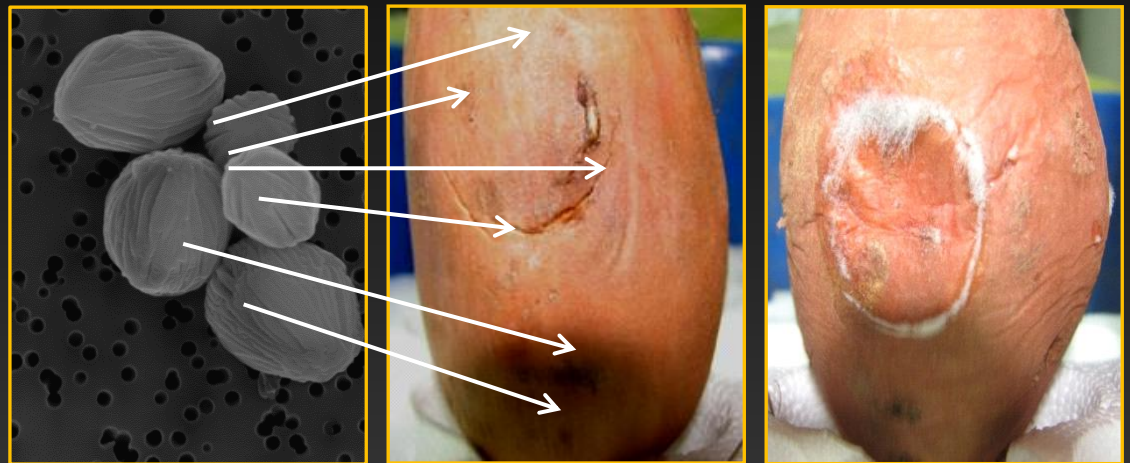
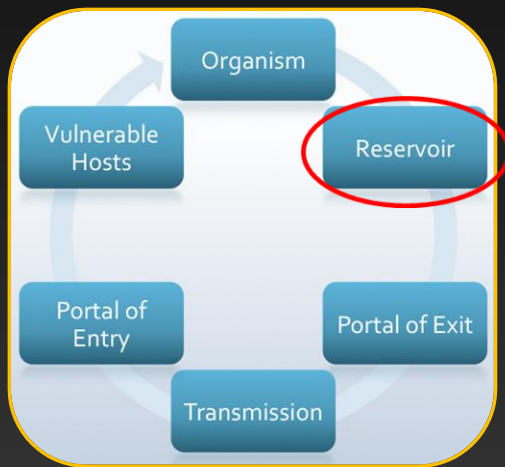


Rhizopus spp.

- *Rhizopus* is a common pre- and postharvest pathogen of many fruits and vegetables worldwide
- Widespread and potentially costly fungal disease



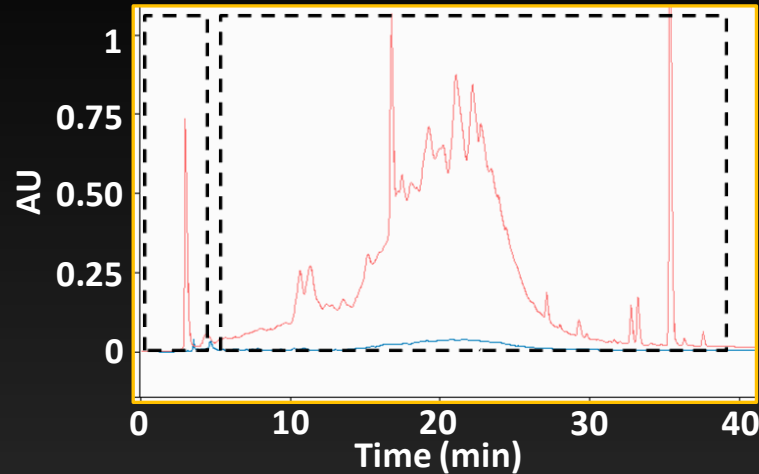
R. oryzae chain of infection – spore reservoir



Sweet potato juice extract - **SPJE**

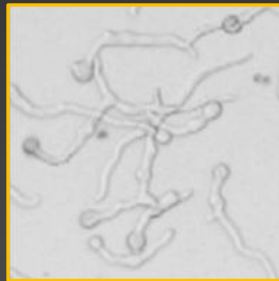
Using the host juice extract to induce spore germination

Which fraction of SPJE induce germination?

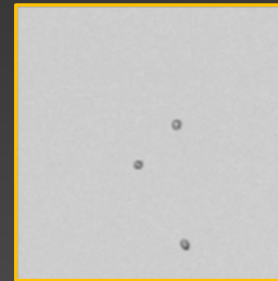


Chloroform extraction and protein removal

Polar fraction

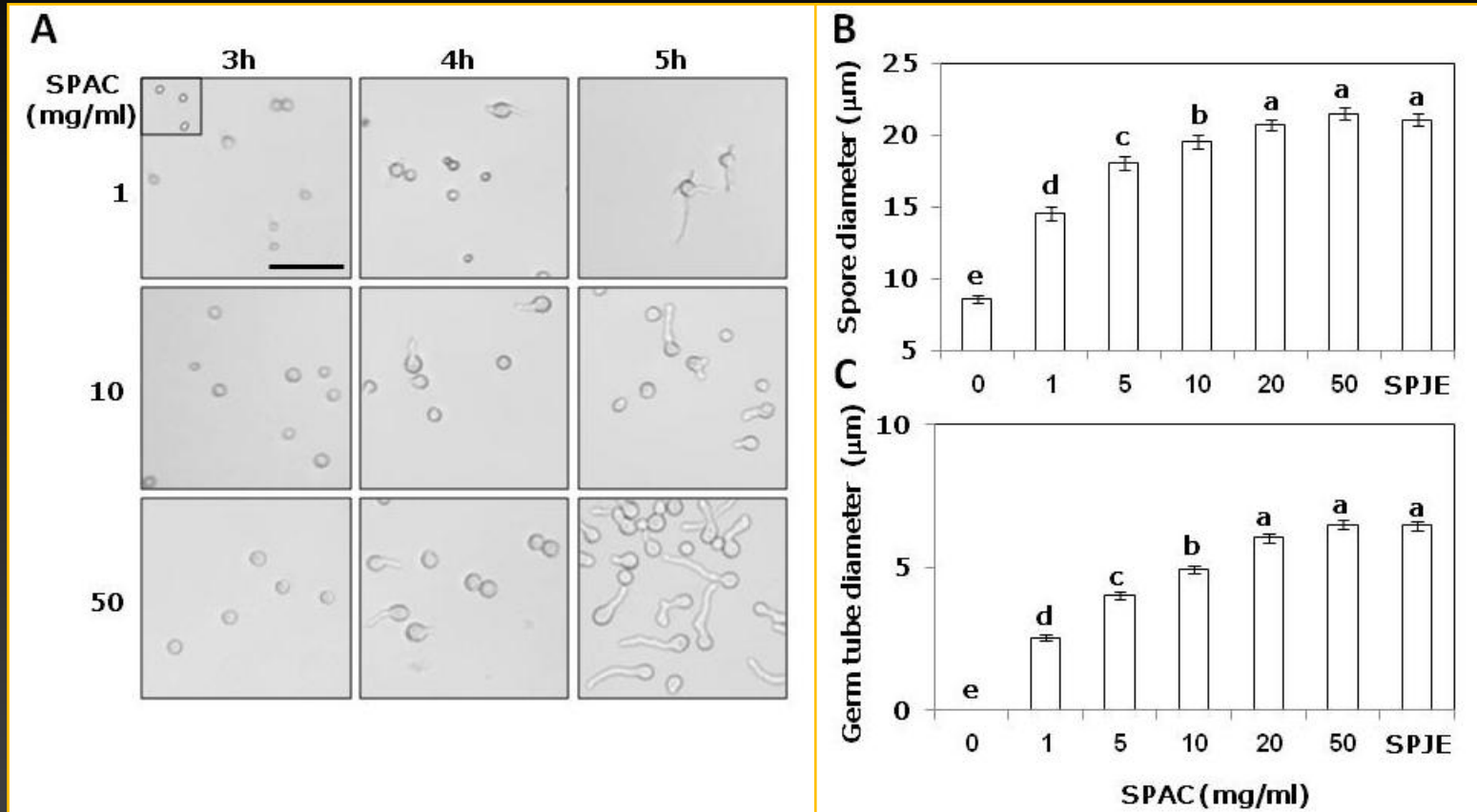


A-polar fraction



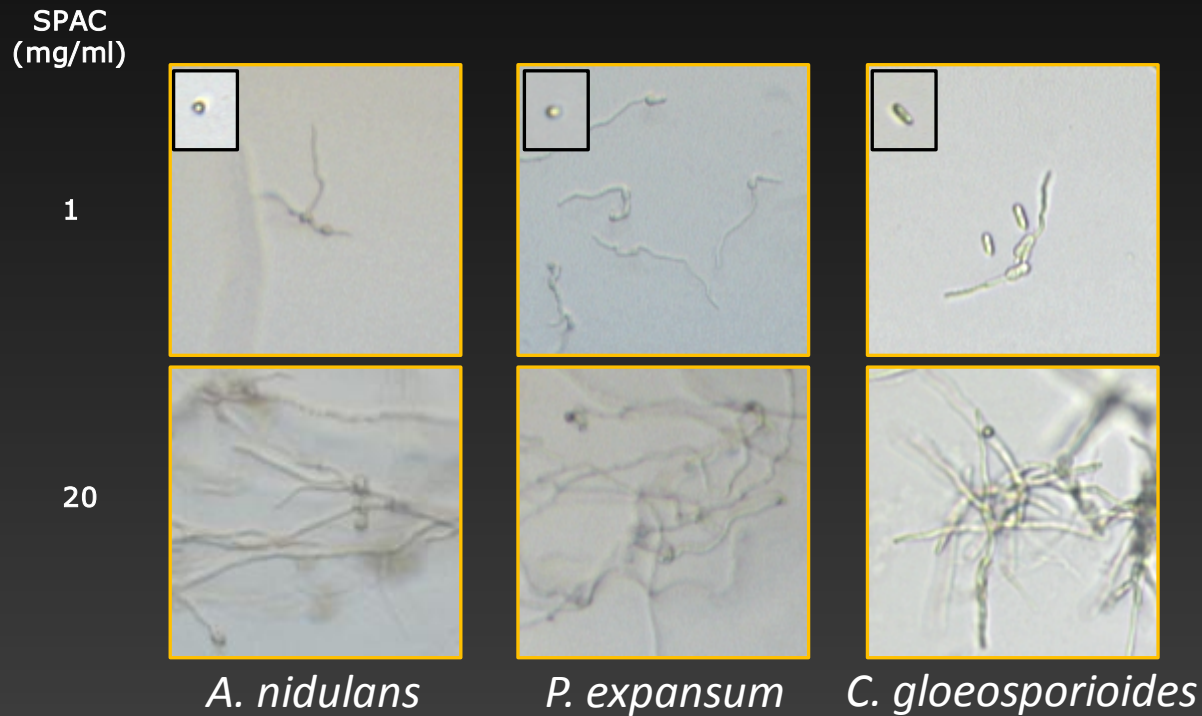
Sweet potato active compounds - SPAC

How does spores response to different doses of SPAC?



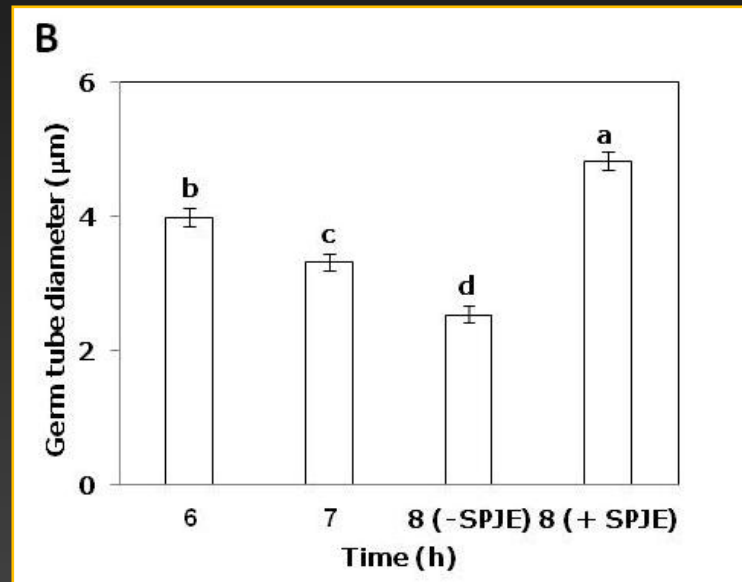
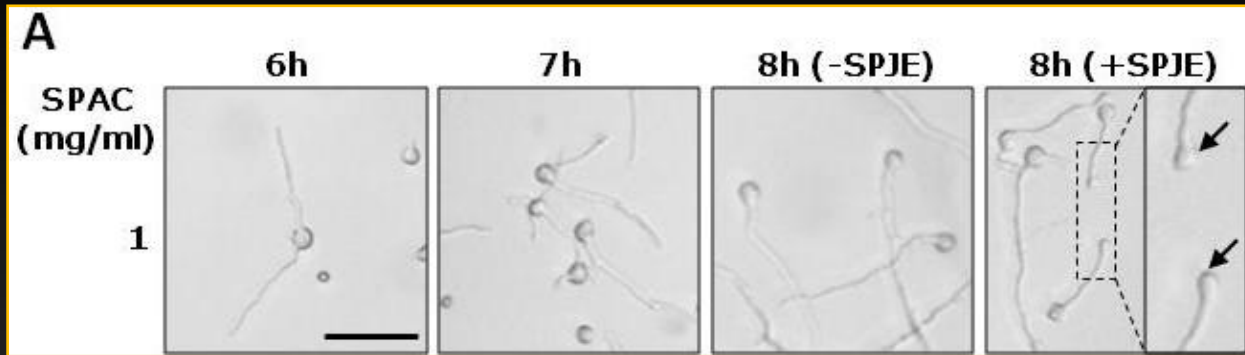
Low SPAC induces non-optimal germination

Host-pathogen specific interaction?

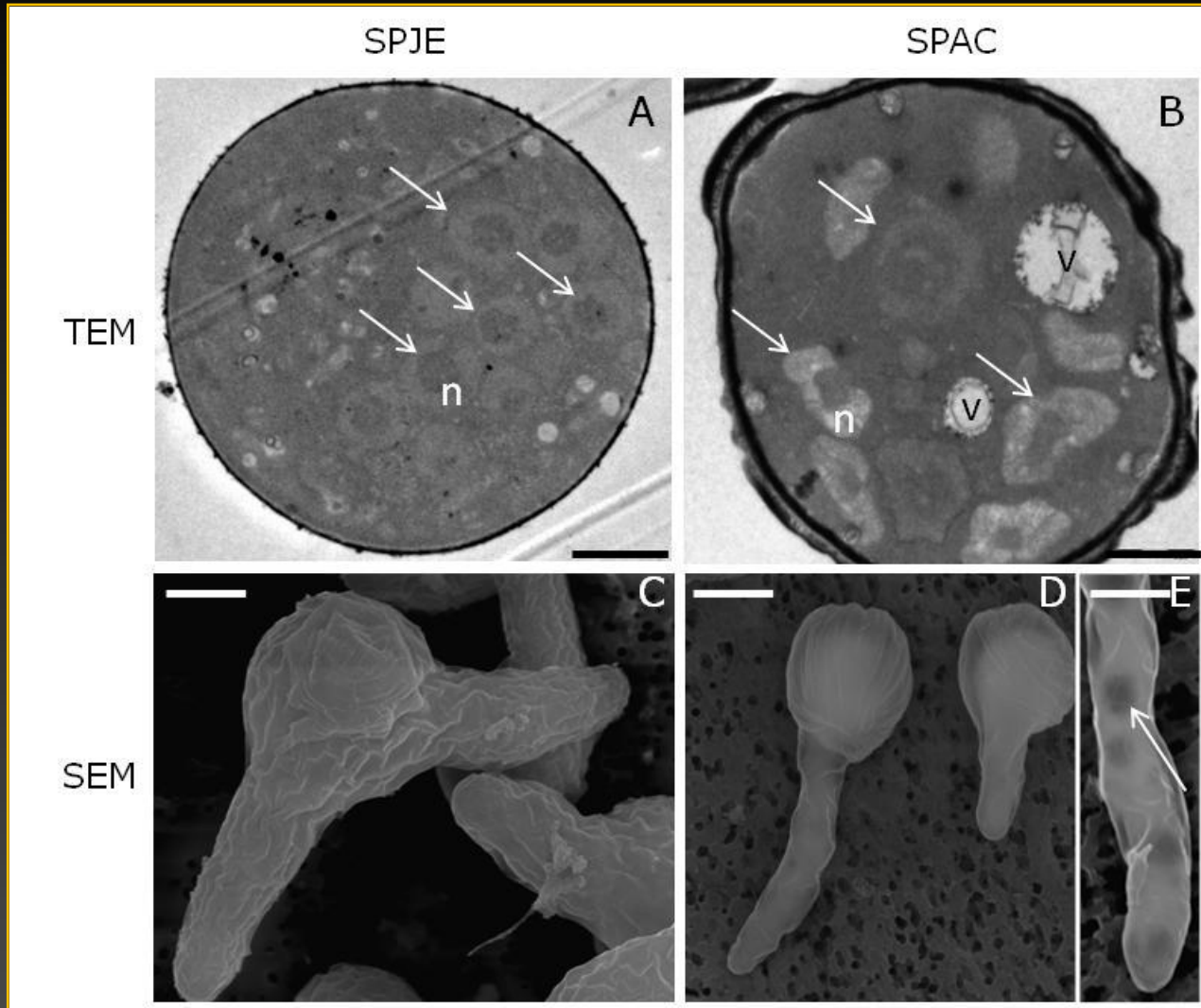


General mechanism of spore germination

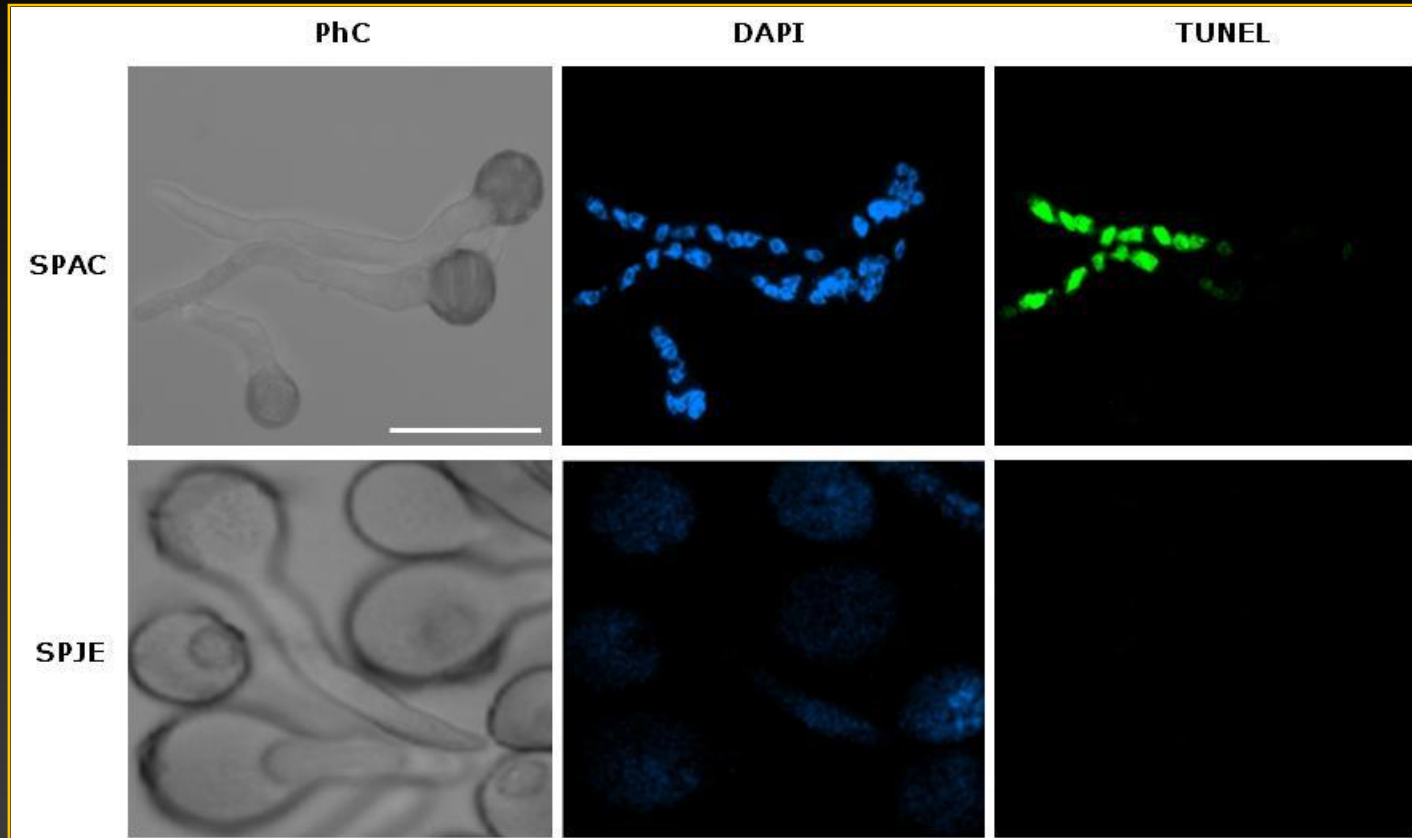
Germ tube decrease at time scale



PCD hallmarks in the deceased germ tube

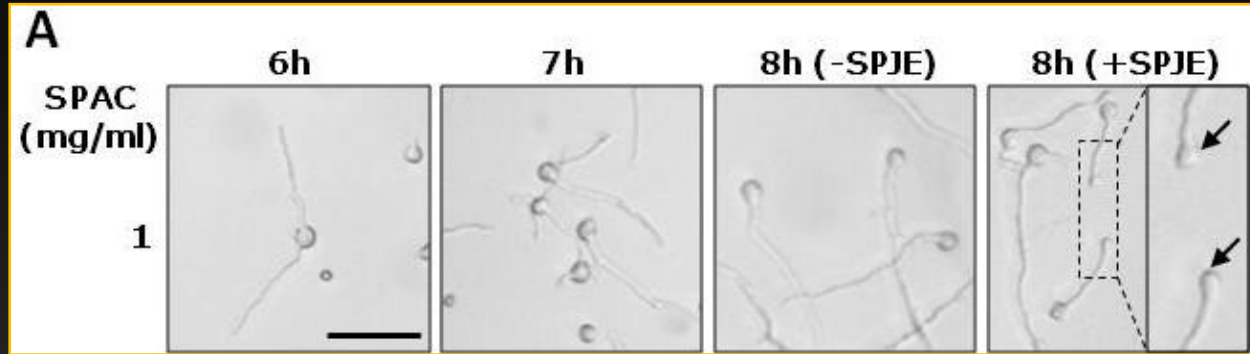


DNA fragmentation



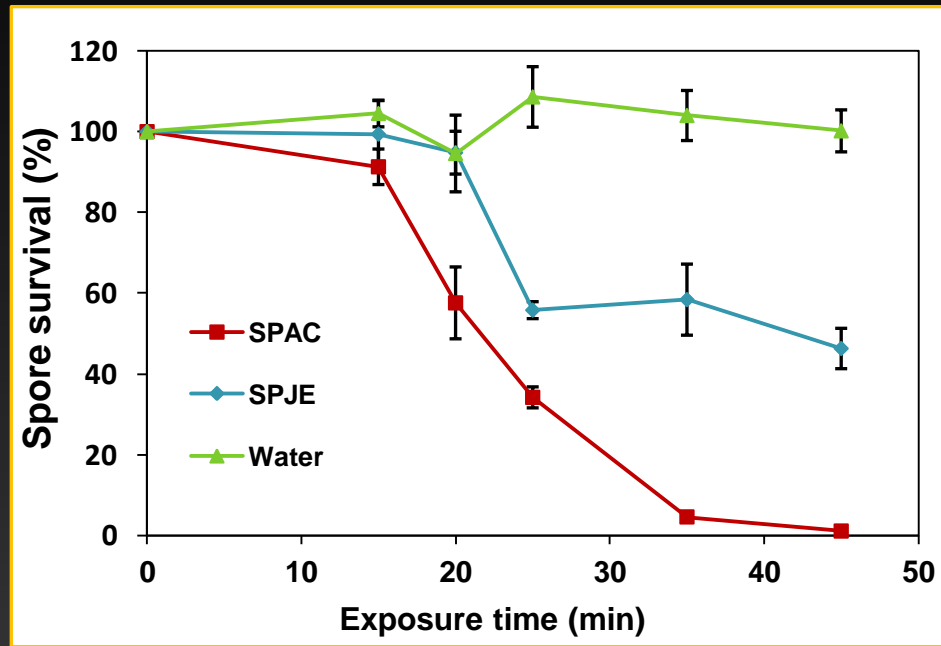
Programmed cell death is induced by low SPAC

Germ tube decrease is reversible



“seduction” model of pathogen control

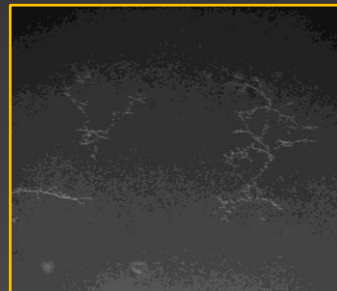
Combined effect of SPAC with heat stress (42°C)



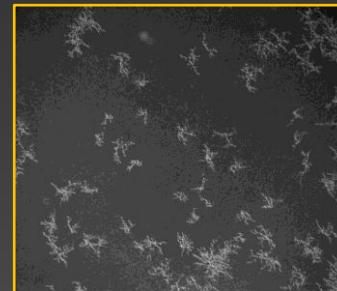
SPJE



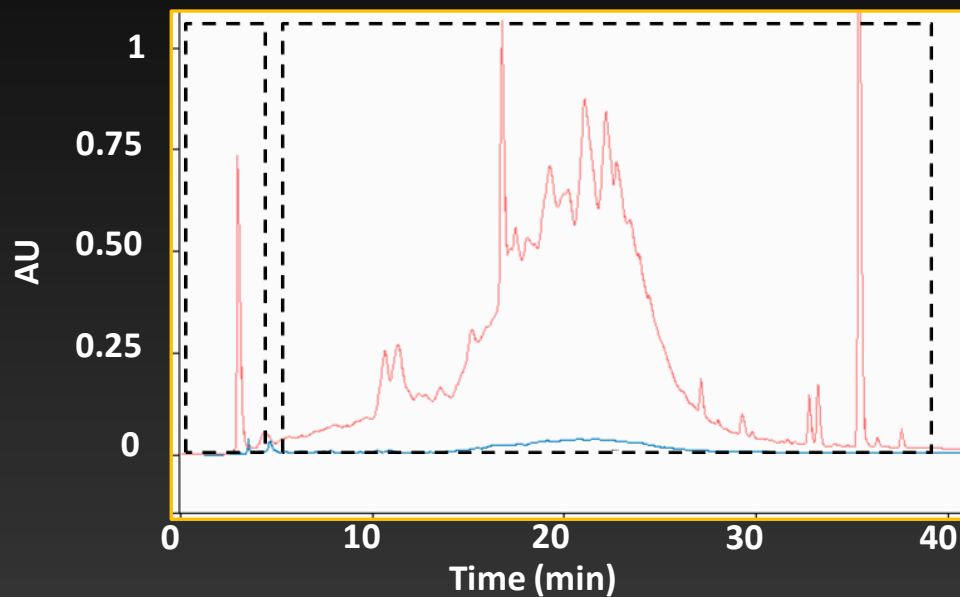
SPAC



Water

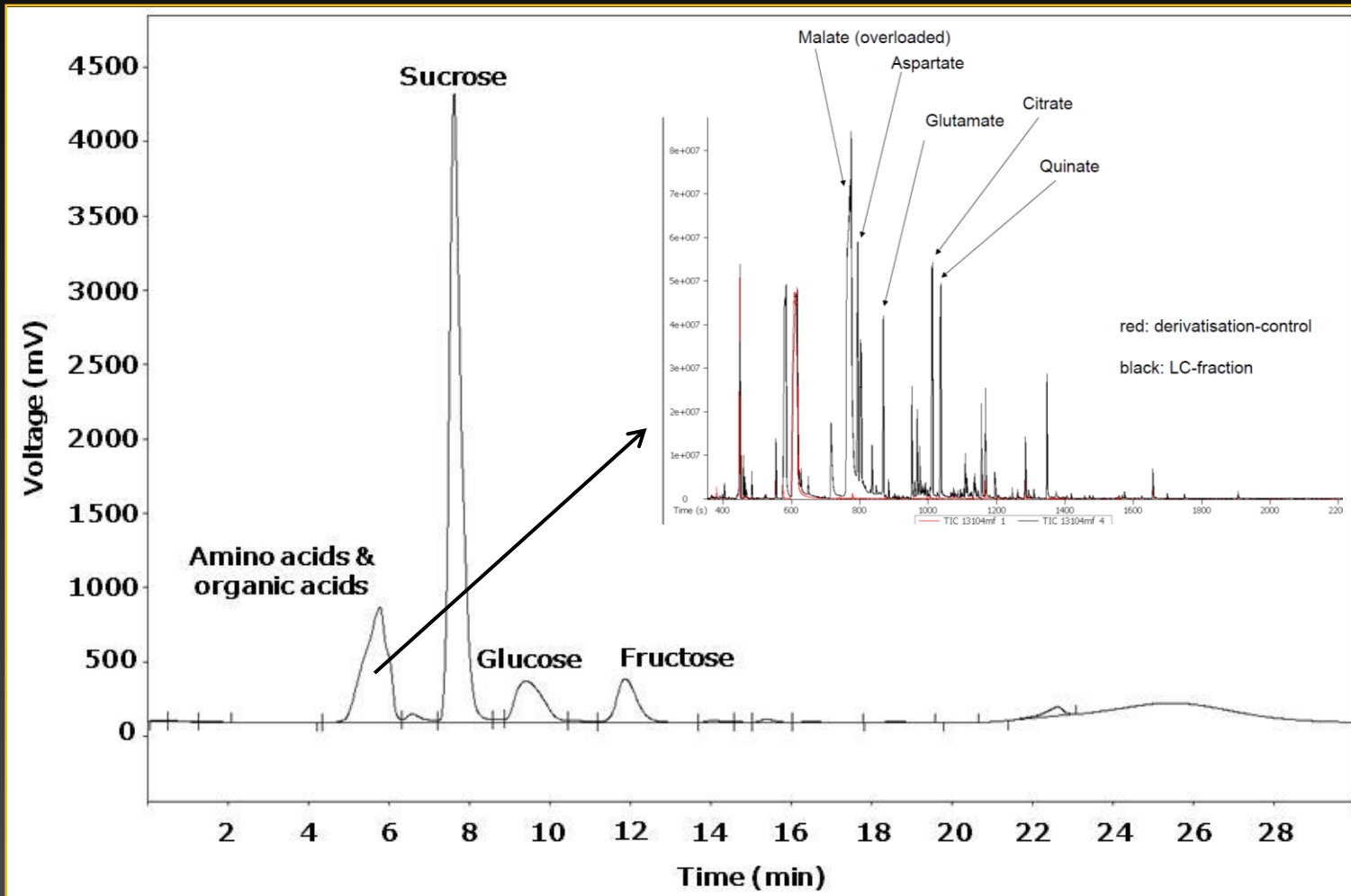


Isolation of the germination inducers from SPJE

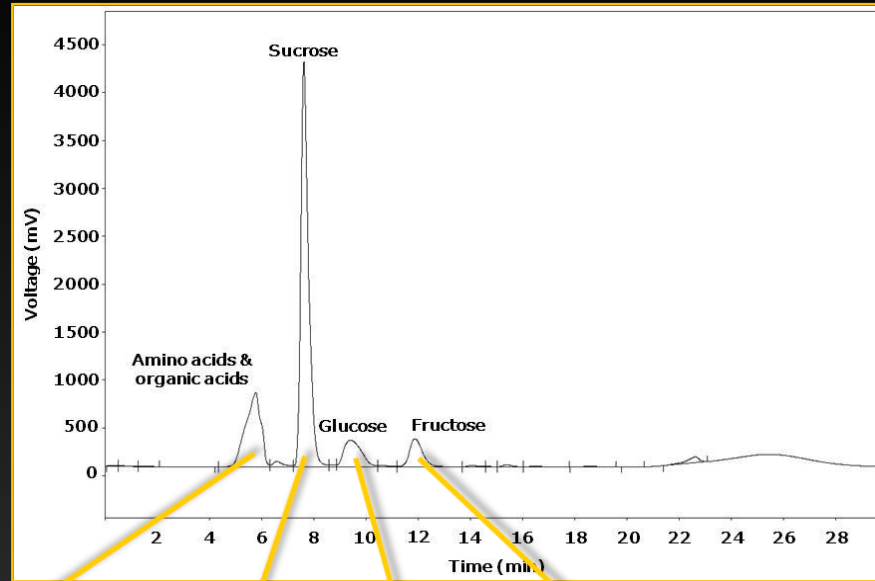


What are the active compounds?
What is the mode of action?

Cation-exchange chromatography of SPAC



Effect of separated SPAC peaks on germination



Amino acids & organic acids (1)

Sucrose (2)

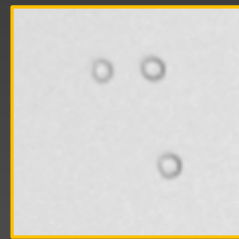
Glucose (3)

Fructose (4)

(1) + (3)



pH 4.5

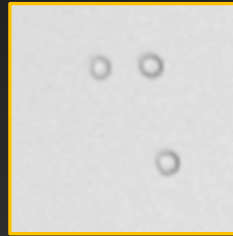


Effect of separated SPAC peaks on germination

Glucose



Glucose + Acidic pH



Glucose + Acidic pH + Amino acids



Amino acid

Proline

Alanine

Asparagine

Glutamine

Arginine

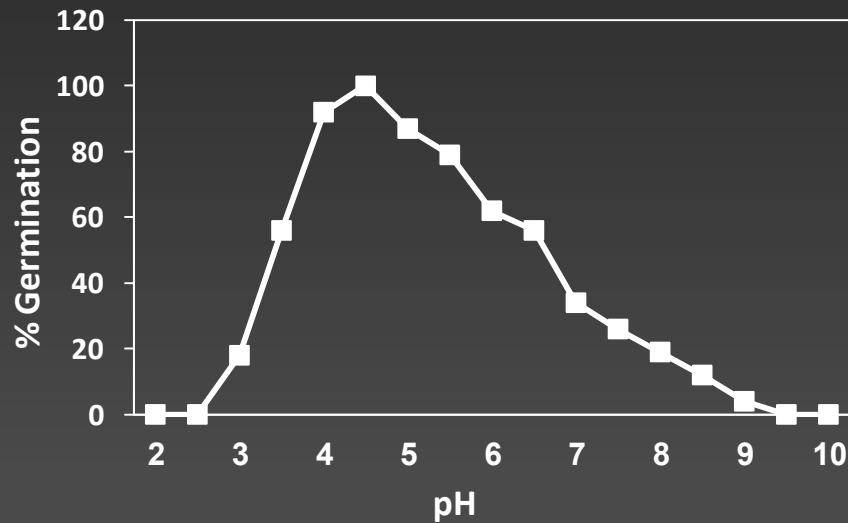
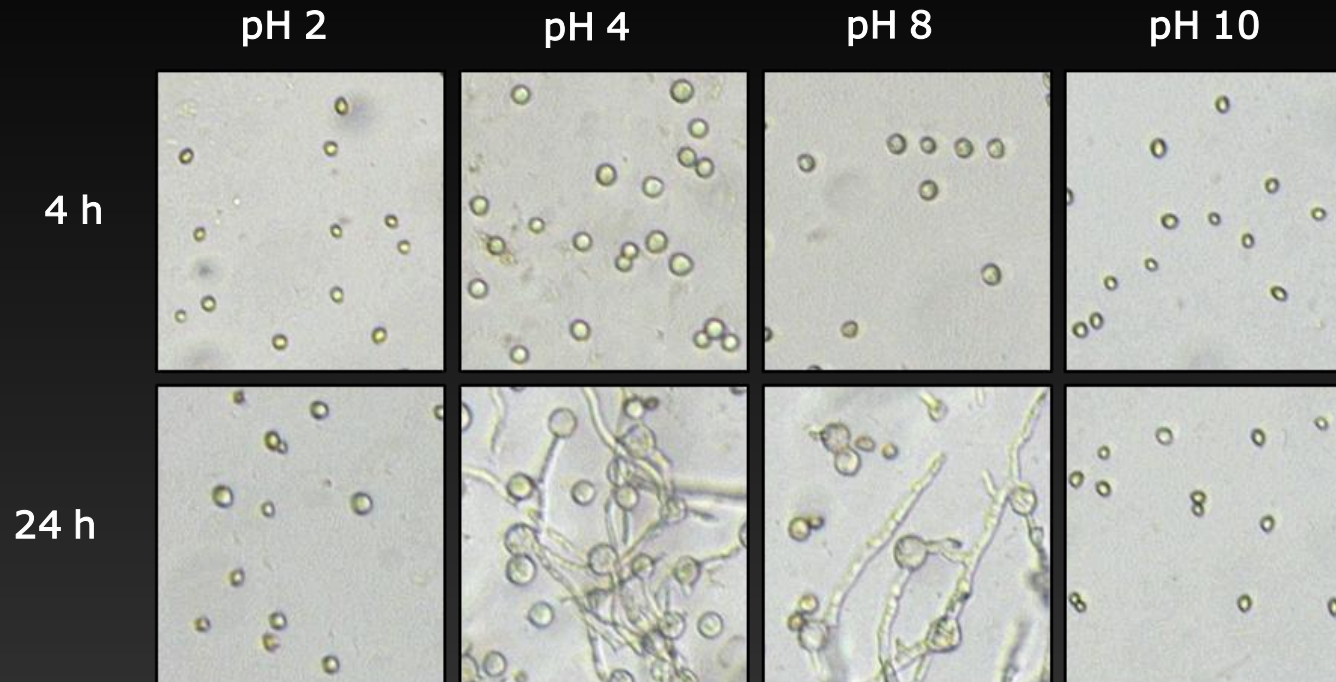
Tyrosine

Phenylalanine

Isoleucine

What is the role of acidic pH in spore germination?

Effect of pH on germination



Pathogen weakening - summary

SPAC induces germination of *R. oryzae* spores and other pathogenic fungi

Spore swelling and germ tube development is correlated to SPAC concentration

Low SPAC concentration induces non-optimal germination and accompanied with PCD hallmarks

In order to inhibit colonies formation, an additional stress should be combined

Practical aspects

“Cocktails” of spore germination inducers with fungicides could increase the efficiency of pathogen elimination



Combination of germination inducers with additional stresses during crop processing

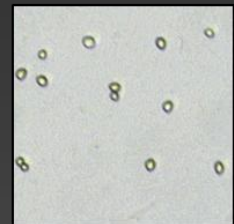


Usage of basic buffers as fungistatic agents

pH 4



pH 10



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