INHIBITION OF MOLD GROWTH BY BACTERIA ISOLATED FROM SOURDOUGH BREAD CULTURES

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Sourdough bread cultures have been reported to delay mold growth in baked goods. This activity is attributed to the presence of lactic acid bacteria and their metabolites. Lactic Acid Bacteria (LAB)

- *Lactobacillus*
- *Pediococcus*
- *Lactococcus*
- *Streptococcus*
- *Leuconostoc*
- *Bifidobacterium*
Antifungal metabolites of LAB

Organic acids

- Lactic
- Acetic
- Propionic
- Caproic

Formic
Butyric
Phenylacetic
Phenyllactic

Heat Stable Low Molecular Weight Compounds

- Esters of Short Chain Fatty Acids
- Reuterin
- Peptide and Proteinaceous
Antifungal LAB Species

*Lactobacillus casei*

*Leuconostoc mesenteroides*

*Lactobacillus rhamnosus*

*Pediococcus pentosaceum*

*Lactobacillus plantarum*

Generally Recognized As Safe (GRAS)
Lactic Acid Bacteria
Important Components

Industrial Starter Cultures
- Dairy
- Meat

Sourdough Bread Cultures

Naturally Occurring Fermentations
- Sauerkraut / Kimchi
- Silage / Ensilage
- Silage Inoculants

*Lactobacillus plantarum*
Detoxification & Removal of Mycotoxins

Binding

Degradation

Inhibition of Mycotoxin Production
Materials & Methods

Lactic Acid Bacteria:

- Eight strains
  
  (01, 02, 03, 05, 011, SF1, SF2, SF21)

- Two different Sourdough cultures
Materials & Methods

Toxigenic Mold Species:

- *Aspergillus flavus* NRRL 1290 (Aflatoxins)
- *Aspergillus parasiticus* NRRL 2999 (Aflatoxins)
- *Aspergillus ochraceus* NRRL 3174 (Ochratoxin)
- *Penicillium verrucosum* NRRL 846 (Ochratoxin)
- *Fusarium proliferatum* M 5689 (Fumonisins)
Methodology

Dual Culture Agar Plate Assay

* de Man-Rogosa-Sharp (MRS) Agar
  - Lactic Acid Bacteria Isolates

* Potato Dextrose Agar (PDA) Overlay
  - Mold Species
Methodology

- MRS inoculated with bacterial strain (1% of grown culture) and overlaid with soft PDA
- Spore suspension ($10^3$ spores) spotted onto the PDA surface
- Incubation for 21 days at 30°C

Inoculate spore suspension & measure colony diameter

MRS inoculated with bacterial strain

Overlaid with soft PDA
Inhibitory Effect of Lactic Acid Bacteria
Inhibitory Effect of Lactic Acid Bacteria

$L.\ casei$  $L.\ rhamnosus$  O1  SF2
Inhibition of *A. flavus* NRRL 1290 by Lactic Acid Bacteria grown on MRS agar

- Complete Inhibition by O1, O3, O5, SF1, SF2, SF21
- Delayed Growth by O2, O11
- Atypical Mycelial Growth, No Sporulation
Inhibition of *A. parasiticus* NRRL 2999 by Lactic Acid Bacteria grown on MRS agar

Complete Inhibition by O1, SF1, SF2, SF21

Delayed Growth by O2, O3, O5, O11

Atypical Mycelial Growth, No Sporulation
Inhibition of *A. ochraceus* NRRL 3174 by Lactic Acid Bacteria grown on MRS agar

Complete Inhibition of Growth by All Strains
Inhibition of *P. verrucosum* NRRL 846 by Lactic Acid Bacteria grown on MRS agar

- Almost Complete Inhibition by All Strains
- Delayed Growth and Incomplete Inhibition by SF1, SF2
- Atypical Growth, No Sporulation
Inhibition of *P. expansum* NRRL 2304 by Lactic Acid Bacteria grown on MRS agar

Complete Inhibition by O1, O2, O3, O5, O11
Incomplete Inhibition by SF1, SF2, SF21
Inhibition of *F. proliferatum* M5689 by Lactic Acid Bacteria grown on MRS agar

Complete Inhibition by All Strains
Fusarium Head Blight affected by Lactobacillus rhamnosus VT1
Conclusions

- All of the lactic acid bacterial strains inhibited growth of mycotoxigenic molds to some degree.
- When mold growth occurred it was atypical and did not form spores.
- One lactic acid bacterial strain reduced the development of *Fusarium* Head Blight in wheat.