Plant-pathogen warfare

can we unravel the secret weapon?

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Gordon Research Conferences

Conference Program

Cellulosomes, Cellulases & Other Carbohydrate Modifying Enzymes

July 26-31, 2009
Proctor Academy
Andover, NH

Chair:
Harry J. Gilbert

Vice Chair:
Colin Mitchinson

MEETING LINKS
- Conference History
- Chair Contact Info

SITE & TRAVEL LINKS

MEETING FEES

The 2009 Gordon Conference on Cellulosomes, Cellulases & Other Carbohydrate Modifying Enzymes will present cutting-edge research on the enzymatic degradation of cellulose and other plant cell wall polysaccharides. The Conference will feature a wide range of topics that includes the enzymology of plant structural degradation, regulation of the degradative apparatus, the mechanism of protein complex assembly, the genomics of cell wall degrading organisms, the structure of the substrate and the industrial application of the process particularly within the biofuel arena. Indeed the deployment of plant cell wall degrading enzymes in biofuel processes will be an important feature of the meeting. It should be emphasized that the 2009 Conference will be expanded to include, in addition to cellulase research, recent advances in other plant cell wall degrading enzymes, and contributions from people working on hemicellulases and pectinases will be particularly welcome. Invited speakers represent a variety of scientific disciplines, including biochemistry, structural biology, genetics and cell biology. The interplay between fundamental research and its industrial exploitation is a particularly important aspect of the meeting, reflecting the appointment of the chair and vice-chair from academia and industry, respectively. The meeting will provide opportunities for junior scientists and graduate students to present their work in poster format and exchange ideas with more established figures in the field. Indeed, some poster presenters will be selected for short talks. The collegial atmosphere of this Conference, with programmed discussion sessions as well as opportunities for informal gatherings in the afternoons and evenings, provides an avenue for scientists from different disciplines to brainstorm and promotes cross-disciplinary collaborations in the various research areas represented. The Conference is likely to be heavily subscribed so we would recommend that you submit your application/abstract to the GRC web site as soon as possible.

SUNDAY

2:00 pm - 9:00 pm	Arrival and Check-in (Office Closed 6:00 pm - 7:00 pm)
6:00 pm	Dinner
7:30 pm - 7:45 pm	Welcome / Introductory Comments by GRC Site Staff, Chair and Vice-Chair
7:45 pm - 9:30 pm	**SETTING THE STAGE, MATCHING ENZYME AND SUBSTRATE**
	Discussion Leader: **Edward Bayer** (Weitzmann Institute, Israel)
7:45 pm - 8:15 pm	**Michael Himmel** (DOE-NREL, USA) "Understanding Plant Cell Walls: Towards Improved Biomass Conversion and New Materials"

Plant-pathogen warfare: can we unravel the secret weapon?

COPENHAGEN INSTITUTE OF TECHNOLOGY
AALBORG UNIVERSITET

Role of hydrolytic enzymes produced by the apple plant pathogen *Penicillium expansum* for infection and their application in biomass degradation *

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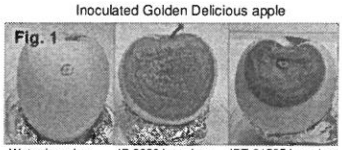
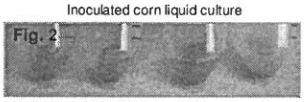
Blue mold decay caused by the necrotrophic fungus ***Penicillium expansum*** is the most important **post-harvest disease in apple** production. Necrotrophs are known to secrete a diverse array of enzymes in order to infect and break down the host. Hydrolytic enzymes are important weapons in this war between host and pathogen. In this study we investigate the **expressed fungal enzymes** in both **complex systems,** like host-pathogen interactions, and during degradation of corn and bagasse wastes by *P. expansum.*

Inoculated Golden Delicious apple



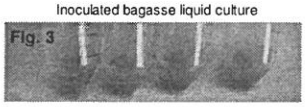
Water inoculum IB 2020 inoculum IBT 21525 inoculum

Inoculated corn liquid culture

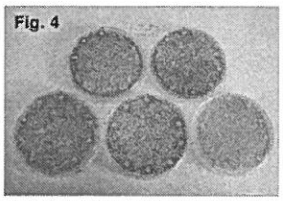


IB 2020 IBT 21525 ML1 water

Inoculated bagasse liquid culture



IB 2020 IBT 21525 ML1 water



AZCL substrates showing enzyme activity

OBJECTIVE

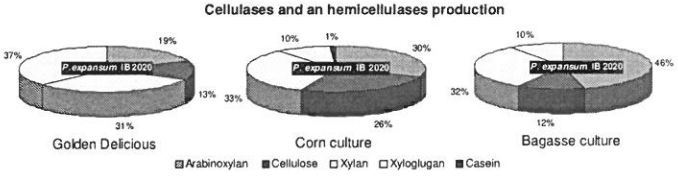
- Study the different **behaviour of three *P. expansum* isolates** (IB2020 and ML1, both isolated from apples, and IBT21525 isolated from Brussels sprouts) when growing on host (Golden Delicious, Red Delicious and Granny Smith apples, fig. 1), in two inert biomasses (corn and bagasse by-products from bioethanol production, figs. 2-3) and also apple pomace (apple juice waste product).
- Identify promising *P. expansum* **enzymes with potential for biomass degradation.**

ACCOMPLISHMENTS

- Study of parameters (pH, lession size and enzyme production in AZCL substrates, fig. 4) during infection of Golden Delicious, Red Delicious and Granny Smith. This was carried out using the isolates IB 2020 and IBT 21525
- Study of pH and enzyme production (AZCL substrates buffered to pH 4 and 6) of the three isolates when growing in corn and bagasse waste liquid culture, fig. 5.

RESULTS

- *P. expansum* lowers the pH of infected apples from 4.3 to 3.5 but in inert biomasses raises it from 6.4 to 7.2
- Agressiveness (lesion size) was biggest for IB2020 on Golden Delicious apple (fig.1).
- From infected apples higher enzyme activity was seen in xylan and xyloglucan substrates whereas arabinoxylan and cellulose substrates were more degraded in inert biomass filtrates. Protease activity was only seen in corn waste filtrates.
- Isolate IB 2020 produces more enzymes than the other isolates in apple and inert biomass systems (fig. 5).



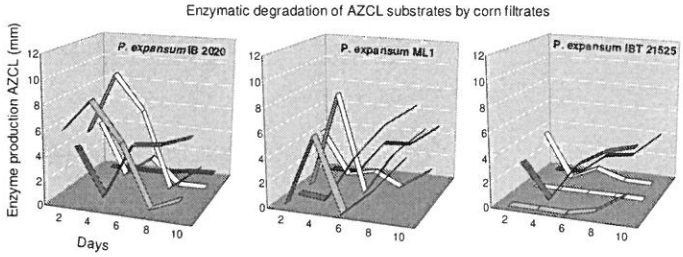
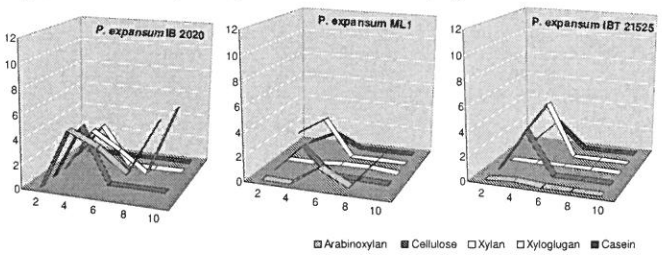


Fig. 5 Enzymatic degradation of AZCL substrates by bagasse filtrates



DISCUSSION

- ***P. expansum*** does not produce specialized structures to penetrate the host but **produce toxins that degrade the cell wall** and allow hyphae to penetrate [1]. There is a **correlation between aggressiveness, toxin production (patulin) and acidification ability** [2]. **We have found a different behaviour** (pH and enzyme composition produced, fig. 6) of the pathogen **when growing in the host** or in inert biomasses. We have also seen big differences between isolates from the same host (fig. 5)
- We expect to **find novel enzymes** in this host-pathogen complex system. Therefore specific enzyme tests will be performed, together with hydrolysis analysis of sugars at different time points of the infection process.

[1] Valentines i Escolà, M.C. 2009. Bases bioquímiques de resistència a *Penicillium expansum* en poma. Lleida, Universitat de Lleida.
[2] Morales, H.; Marín, S.; Obea, L.; Doménech, M.; Ramos, A.J.; Sanchis, V.; 2008. Ecophysiological characterization of Penicillium expansum population in lleida (Spain). International Journal of Food Microbiology 122.3: 243-52.

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