Empower research through comparative genomics & next-gen sequencing

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Empower research through comparative genomics & next-gen sequencing

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Disclosure

for Presentations at ACCME
- Accredited Conferences
DISCLOSURE

• I have no actual or potential conflict of interest in relation to this program or presentation.
Fusarium keratitis outbreak associated with contact lenses
*Fusarium oxysporum* – a fungus

- Macroconidia
- Microconidia
- Chlamydospore

Fourie G. et al. 2011. Infection, Genetics and Evolution
An emerging human pathogen

- Localized skin or corneal infections
- Cause disseminated infections in immunocompromised patients
- Difficult to control (resistant to antifungals), often lethal outcome
Understand pathogenicity using genomics???
Wilt diseases caused by *F. oxysporum*
formae specialis – host specificity

• Each *forma specialis* consists of strains with ability to cause wilt on a unique host or a set of plant host species.

• More than 120 *formae speciales*.
Comparative genomics

F. verticillioides

F. oxysporum

F. graminearum

F. solani

Verticillium dahliae

Magnaporthe grisea

Neurospora crassa

Aspergillus nidulans

0.1 substitution per site
Genomic Structural Difference

<table>
<thead>
<tr>
<th>Genus/Strain</th>
<th>Genome Size (Mb)</th>
<th>Number of Chromosomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>F. verticillioides</em></td>
<td>42</td>
<td>11</td>
</tr>
<tr>
<td><em>F. oxysporum f. sp. lycopersici</em></td>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td><em>F. graminearum</em></td>
<td>52</td>
<td>17</td>
</tr>
<tr>
<td><em>Nectria haematococca</em> (F. solani)*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pairwise comparison revealed highly conservation genome structure.
Pairwise comparison defines lineage-specific chromosomes in *F. oxysporum* f. sp. *lycopersici*. 
Linage specific chromosomes in *F. oxysporum f. sp. lycopersici* (Fol)

Uniquely present in *Fol* genome

Enriched for TE and repeats

Lack house keeping genes

Encode virulence factors

Horizontal transmission introduce disease

Ma et al 2010 Nature
Optical maps reveal unique sets of LS chromosomes in plant and human isolates
Horizontal transfer of lineage-specific chromosomes determines pathogenicity
Tip of the iceberg

• Origin(s) of the LS chromosomes?

• Mechanisms of the transfer?

Many asexual fungal pathogens have variable karyotypes
(Kistler 1992)
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