Sexual Compatibility in Fungi

Mating Systems
Mating Systems in Fungi

*Homothallic (self compatible):
Gametes: \( a \times a \)
Zygote: \( aa \)
Products of meiosis: \( a \)

*Bipolar Heterothallism (self incompatible): single locus!
Gametes: \( A \times a \) or \( + \times - \)
Zygote: \( Aa \) or \( +, - (1:1) \)
Products of meiosis: \( A, a (1:1), +, - (1:1) \)

*Tetrapolar Heterothallism (self incompatible): two loci!
Gametes: \( AB, Ab, aB, ab \)
Zygotes: \( AaBb \)
Products of meiosis: \( AB, Ab, aB, ab (1:1:1:1) \)

Mating Reactions in Tetrapolar Systems (simple version, 2 genes)

<table>
<thead>
<tr>
<th>gametes</th>
<th>AB</th>
<th>Ab</th>
<th>aB</th>
<th>ab</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>[AABB]</td>
<td>(AABb)</td>
<td>(AaBB)</td>
<td>AaBb</td>
</tr>
<tr>
<td>Ab</td>
<td>(AABb)</td>
<td>[AAbb]</td>
<td>AaBb</td>
<td>(Aabb)</td>
</tr>
<tr>
<td>aB</td>
<td>(AaBB)</td>
<td>AaBb</td>
<td>[aaBB]</td>
<td>(aaBb)</td>
</tr>
<tr>
<td>ab</td>
<td>AaBb</td>
<td>(Aabb)</td>
<td>(aaBb)</td>
<td>[aab]</td>
</tr>
</tbody>
</table>

Shaded = compatible (complete clamp connections, produce spores)
[ ] = Incompatible (No go!)
( ) = Partially compatible

A – controls nuclear pairing, initial formation of clamps, conjugate division of nuclei, septation of clamp
B – controls nuclear migration, completion of clamp connections

* Can have multiple alleles, i.e., more than two, e.g., A1, A2, A3, etc.
! Secondary Homothallism, 2-spored basidia
Summary – Homothallic vs Heterothallic Fungi

Sexual reproduction is an essential mechanism in eukaryotic evolution to increase genetic diversity and eliminate deleterious mutations. Fungi show two sexual systems named homothallism and heterothallism. Homothallic fungi reproduce sexually by self-fertilization. These fungi are able to produce both types of reproductive structures or mating types from the same mycelium. They do not depend on a different mating thallus for sexual reproduction. Two types of nuclei are produced from the single mycelium in homothallic fungi to produce a zygote. This is the opposite of heterothallic fungi. Two different mating thali contribute nuclei to form a zygote. Heterothallic fungi are unisexual and produce only one type of mating gametes or structures. They reproduce by outcrossing, which increases the genetic variability in their progeny.