Zero-Inflated Poisson (ZIP) Traits

with

block effects
Motivating data set

- Plant Sciences Institute
- Shoot counts with zero inflation
- Blocking structure
- Previous analysis based on normality (transformed counts)
Shoot Count Trait

Motivating data

Trait: Shoot regeneration of plants in tissue culture

*Arabidopsis Thaliana* parental inbred lines

Columbia  
Landsberg erecta

*Arabidopsis Thaliana* parental inbred lines
Shoot Count Trait

Procedure

Get root explants of recombinant inbred lines, transfer to callous induction medium, transfer to shoot induction medium.
Shoot Count Trait

Count of shoots on plants grouped by previously detected QTL based on normal model (one predictor C or L → 2 groups)

\[ n = 102 \text{ Recombinant Inbred Lines (RILs), markers coded (0,1)} \]
\[ b = 6 \text{ blocks} \]
\[ N = n \cdot b = 612 \text{ observed counts} \]
Shoot Count Trait

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MLEs via EM Algorithm

2 QTLs detected, modify method to fit mixture of 4 ZIPs
- 2 predictors, each C or L
- 1 ZIP for each QTL genotype group \( \{LL, LC, CL, CC\} \)
MLEs via EM Algorithm

Parameter estimates for mixture of four ZIPS.
Each ZIP is associated with one of the QTL groups in \{LL, LC, CL, CC\}.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>LL</th>
<th>LC</th>
<th>CL</th>
<th>CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>(p)</td>
<td>0.578</td>
<td>0.018</td>
<td>0.754</td>
<td>0.168</td>
</tr>
<tr>
<td>(\lambda)</td>
<td>2.918</td>
<td>4.774</td>
<td>2.587</td>
<td>2.641</td>
</tr>
</tbody>
</table>
Experimental Design: Blocks

$b$ blocks each containing one observation from $n$ RILs

$y_{ij} \equiv$ observed count at block $i$ for RIL $j$