Assessment of foliar fungal diseases of plants

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ASSESSMENT OF FOLIAR FUNGAL DISEASES OF PLANTS

• Learning objectives:

✓ Become familiar with methods used to measure disease intensity

✓ Select the appropriate tool to assess foliar disease

✓ Adapt an existing rating scale for disease assessment

✓ Describe the weaknesses and strengths of using a specific rating scale

✓ Explain the importance of disease assessment
What’s the importance of measuring disease?

“Without quantification of disease, no studies in epidemiology, no assessment of crop losses, and no plant disease survey and their application would be possible”
Campbell and Neher, 1994
Proper disease assessment helps us quantify how effective are specific treatments on controlling disease.
DISEASE ASSESSMENT

- Measure of disease is essential to crop loss studies, disease prediction and development of disease management strategies.

- Assessment can be **quantitative** and **qualitative** or a combination of both.

- **Qualitative measurement** also known as categorical or discrete.

- **Quantitative measurement** is known as continuous.
DISEASE INCIDENCE VS DISEASE SEVERITY

Disease incidence
➢ Used to calculate proportion or number of diseased leaves
➢ It’s a **discrete variable**
➢ Yes = Disease present
➢ No = Disease absent

![Example of disease incidence with 2 out of 6 leaves diseased, 33.3% diseased](image)

Disease severity
➢ Area of the leaf infected by the disease
➢ Assessment of diseased area of a foliar fungal disease is a **continuous variable**

![Example of disease severity with a foliar fungal disease image](image)

*Lopes et al. 2023*
DISEASE ASSESSMENT METHODS

It can be very difficult to measure disease severity of foliar fungal diseases

➢ Direct estimation

➢ Direct estimation with the use of disease diagram

➢ Use of disease scales

➢ Use of ordinal rating scales

Bock et al. 2020
DISEASE ASSESSMENT METHODS

- **Direct estimation**: without the help of diagrams or scales, rate the leaf and assign a disease severity value from 0 to 100% (0 to 1) according to the area affected.

*You can only use one method to assess your foliar fungal disease*
DISEASE ASSESSMENT METHODS

- Direct estimation with the use of disease diagram
  - Graphic representing selected classes of disease severity
  - Also called standard area diagrams

Schneider et al. 2013
**DISEASE ASSESSMENT METHODS**

- **Use of disease scales**: The disease scale is separation of the continuous severity values from 0 to 100% into a finite number of classes.

<table>
<thead>
<tr>
<th>Class</th>
<th>Severity range</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0+ up to 25%</td>
</tr>
<tr>
<td>2</td>
<td>25+ up to 50%</td>
</tr>
<tr>
<td>3</td>
<td>50+ up to 75%</td>
</tr>
<tr>
<td>4</td>
<td>75+ up to 100%</td>
</tr>
</tbody>
</table>
DISEASE ASSESSMENT METHODS

- **Use of ordinal rating scales**: observe a foliar fungal disease and assign one of the fixed number of labeled severity rating classes:
  - 0 = none
  - 1 = slight infection
  - 2 = slight to moderate infection
  - 3 = moderate infection
  - 4 = moderate to severe infection: some dead leaves + all leaves with at least one spot
  - 5 = severe infection: dead leaves + all leaves of several spots
  - 6 = dead

Credits: Juliana Baggio

*This is a popular approach due to the difficulties in the process of evaluating certain types of disease. But it can be tricky during the data analysis*
Challenges of disease rating

• Where is the edge of this spot?
• Where do symptoms start and end?
Challenges of disease rating

Which shade of green is symptomatic?
Challenges of disease rating

Do you have proper lighting during evaluation?

Credits: Galvin Alonzo
Challenges of disease rating

Similar symptoms for different diseases.

Leaf blotch of strawberry caused by *Gnomonia comari*

Leaf spot of strawberry caused by *Neopestalotiopsisssp.*

Credits: Galvin Alonzo
Challenges of disease rating

- Variability between raters
- Evidence after taking the quiz
NON-GRADED QUIZ

You’re going to rate disease severity from 0 to 100% diseased area

Real signs of powdery mildew

White colored area = Area with disease
You’re going to rate disease severity from 0 to 100% diseased area

Real signs of powdery mildew

White colored area = Area with disease
Scan QR code to open answer form

You’ll have 12 seconds to rate each leaf

https://docs.google.com/forms/d/e/1FAIpQLSfZ4xJ8TEtA1gvQ4-bTE7nusJV883FUF4TRgzgrToCcZ4-Q/viewform?usp=sf_link
WHAT ASSESSMENT METHOD DID YOU JUST USE TO RATE DISEASE SEVERITY?
Now, you’re going to rate the same pictures, but in random order, with the help of this diagram set.
GRADED ASSIGNMENT

➢ Students are required to submit their final report, which should include a foliar fungal disease, a description of symptoms, and the method used to assess the selected disease

➢ In class, we will discuss any problems or situations that students may have encountered during their literature review and disease assessment

➢ Students will be encouraged to share the strengths and weaknesses of their assessment methodology and recommendations

➢ The final assignment will be graded based on an assessment rubric worth 25 points.
# Real Severity Values

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Severity Without diagram</th>
<th>Match</th>
<th>Order Number</th>
<th>Severity With diagram</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>9.5</td>
<td>4</td>
<td>1</td>
<td>2.1</td>
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<tr>
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<td>9</td>
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Thank You!
REFERENCES

