Assessment of foliar fungal diseases of plants

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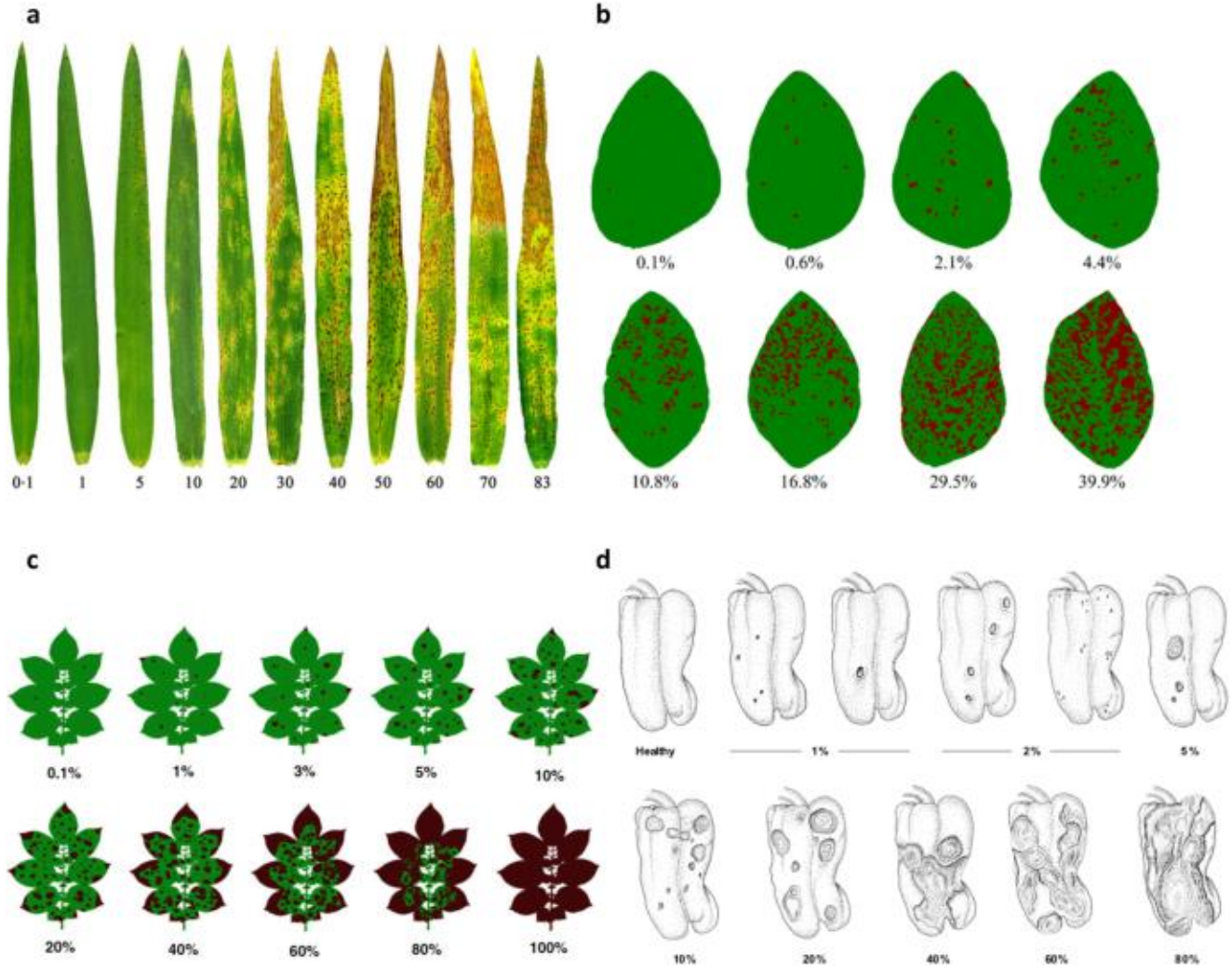


Bock et al. 2020

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

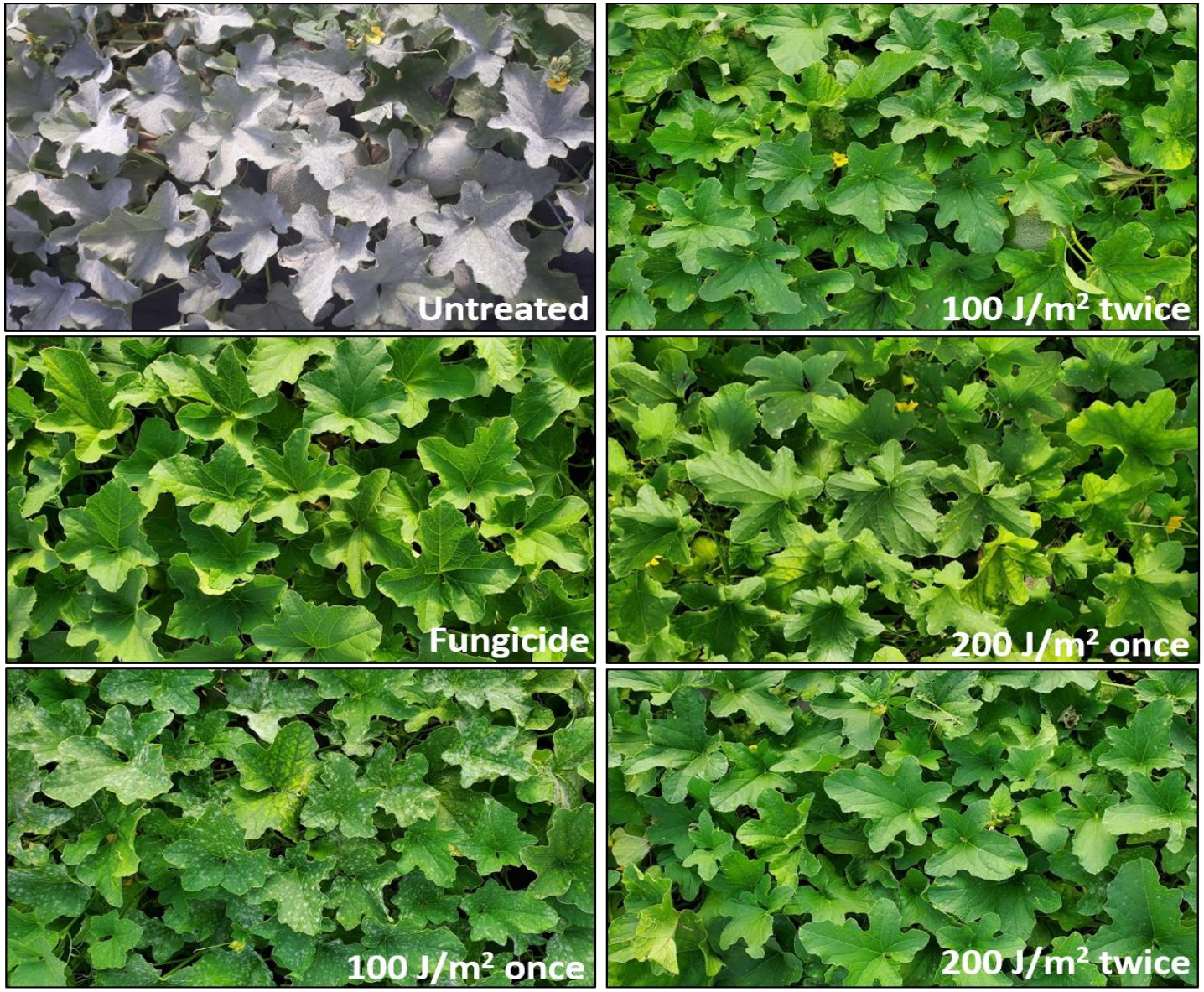
✓ Explain the importance of disease assessment

ASSESSMENT OF FOLIAR FUNGAL DISEASES OF PLANTS

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.

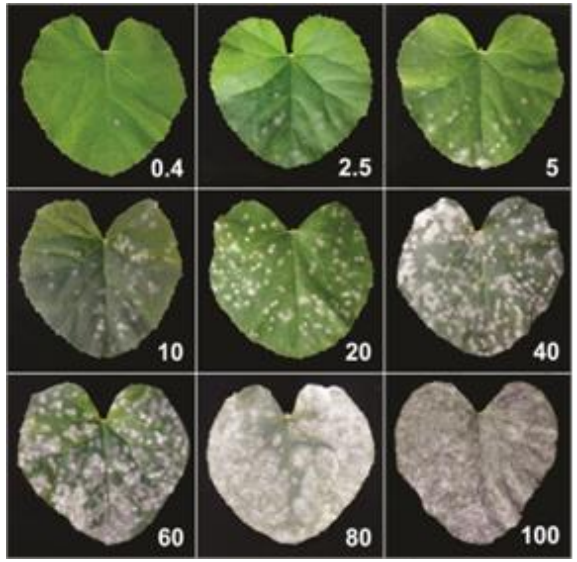


Lopes et al. 2023

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.

https://mvmagazine.com/news/2022/11/13/whither-beech



Lopes et al. 2023

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

2 out of 6 =
33.3% diseased

Disease severity

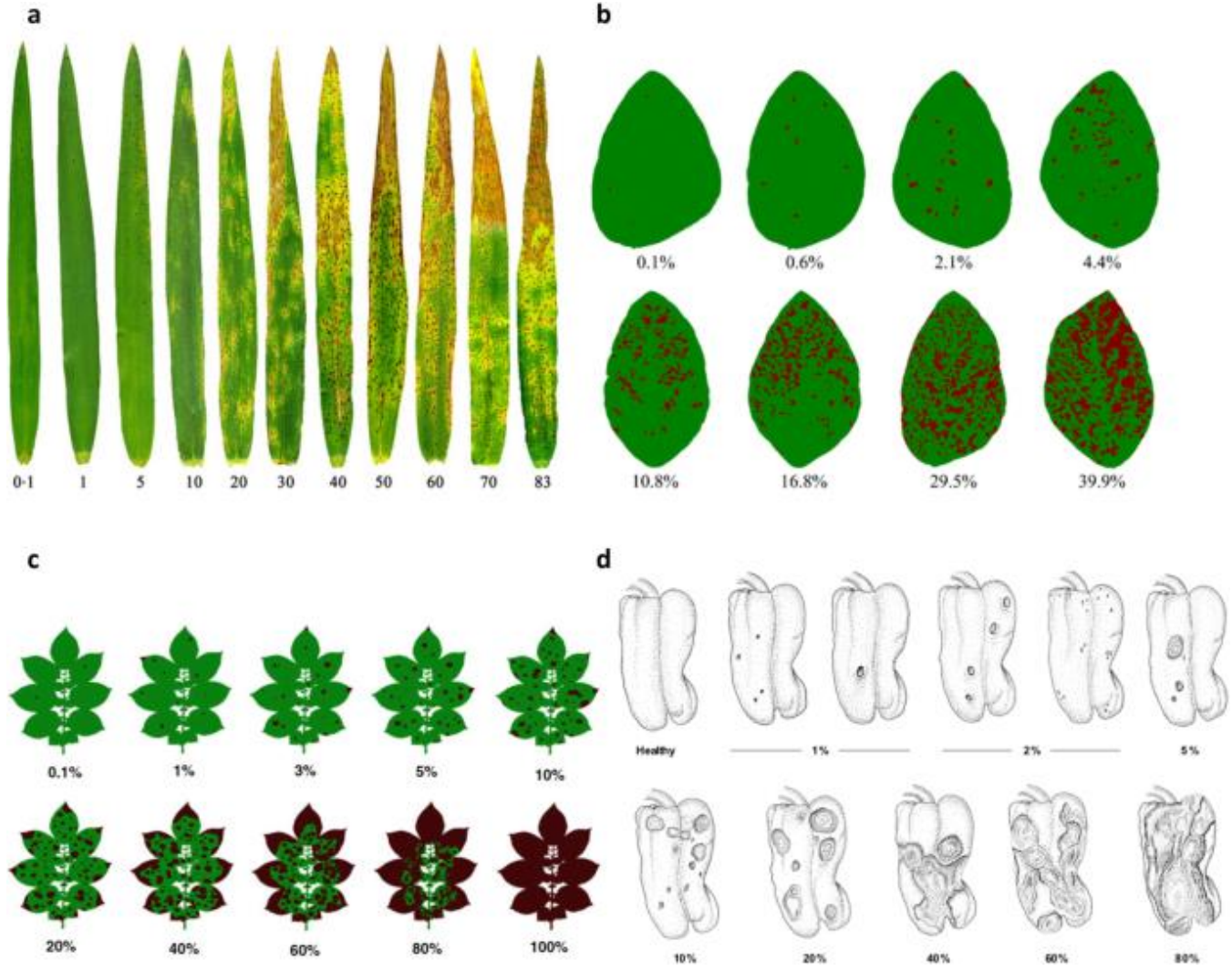
- Area of the leaf infected by the disease
- Assessment of diseased area of a foliar fungal disease is a **continuous variable**

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

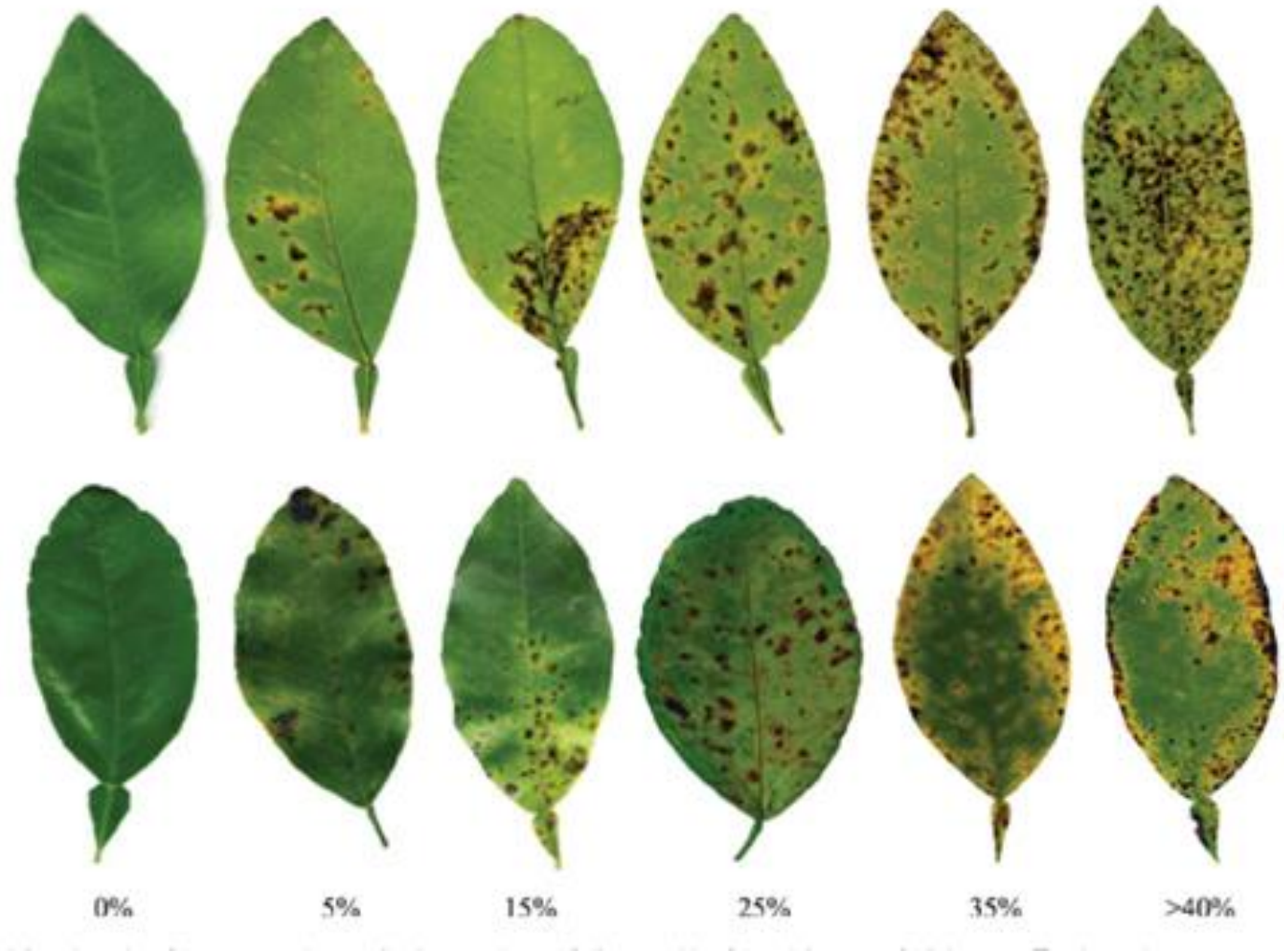
- **Direct estimation**: without the help of diagrams or scales, rate the leaf and assign a disease severity value from 0 to 100% (0 to 1) according to the area affected.

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

Credits: Eva Mulandesa

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

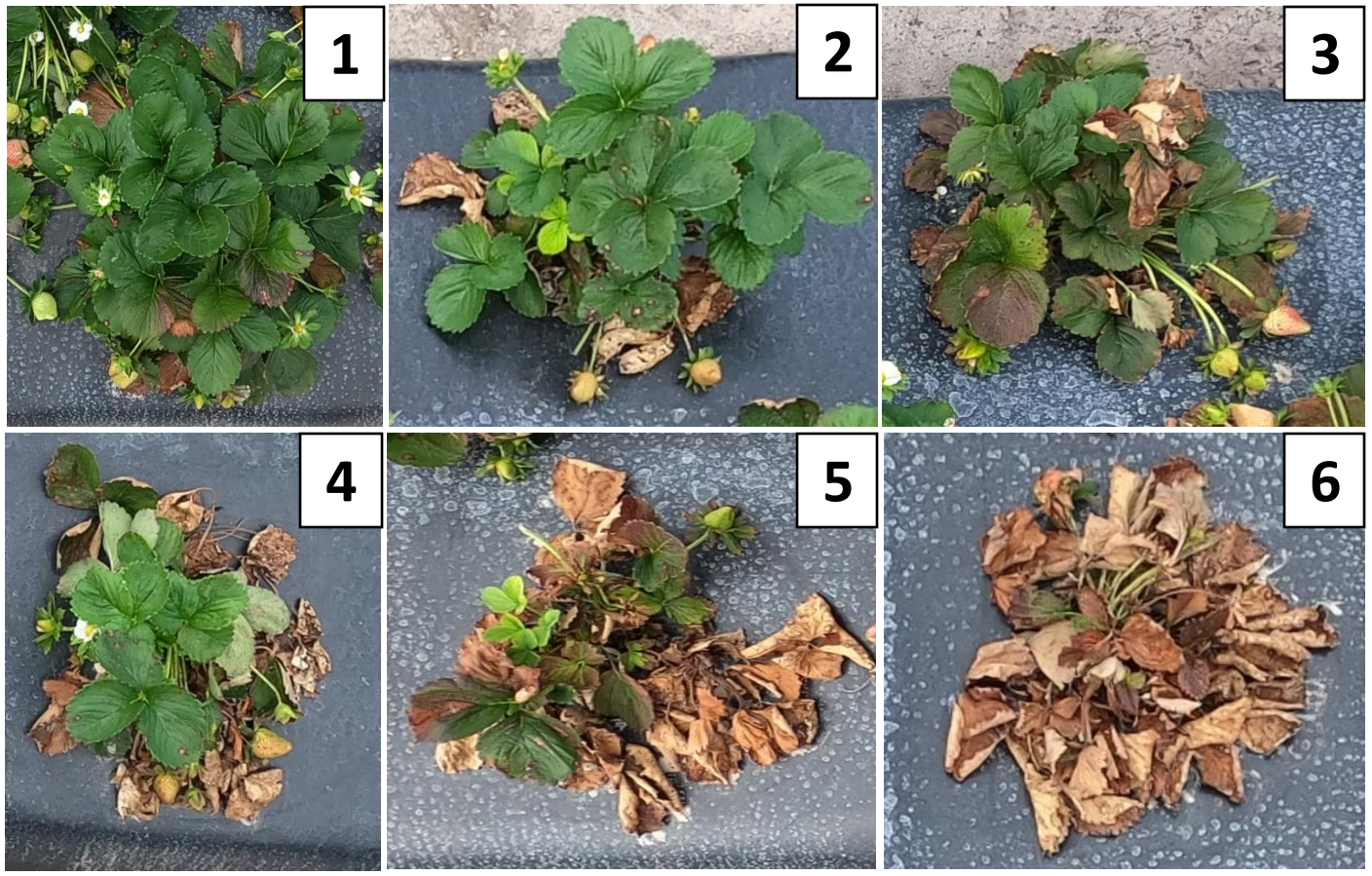
DISEASE ASSESSMENT METHODS

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

Class	Severity range
0	0
1	0+ up to 25%
2	25+ up to 50%
3	50+ up to 75%
4	75+ up to 100%

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

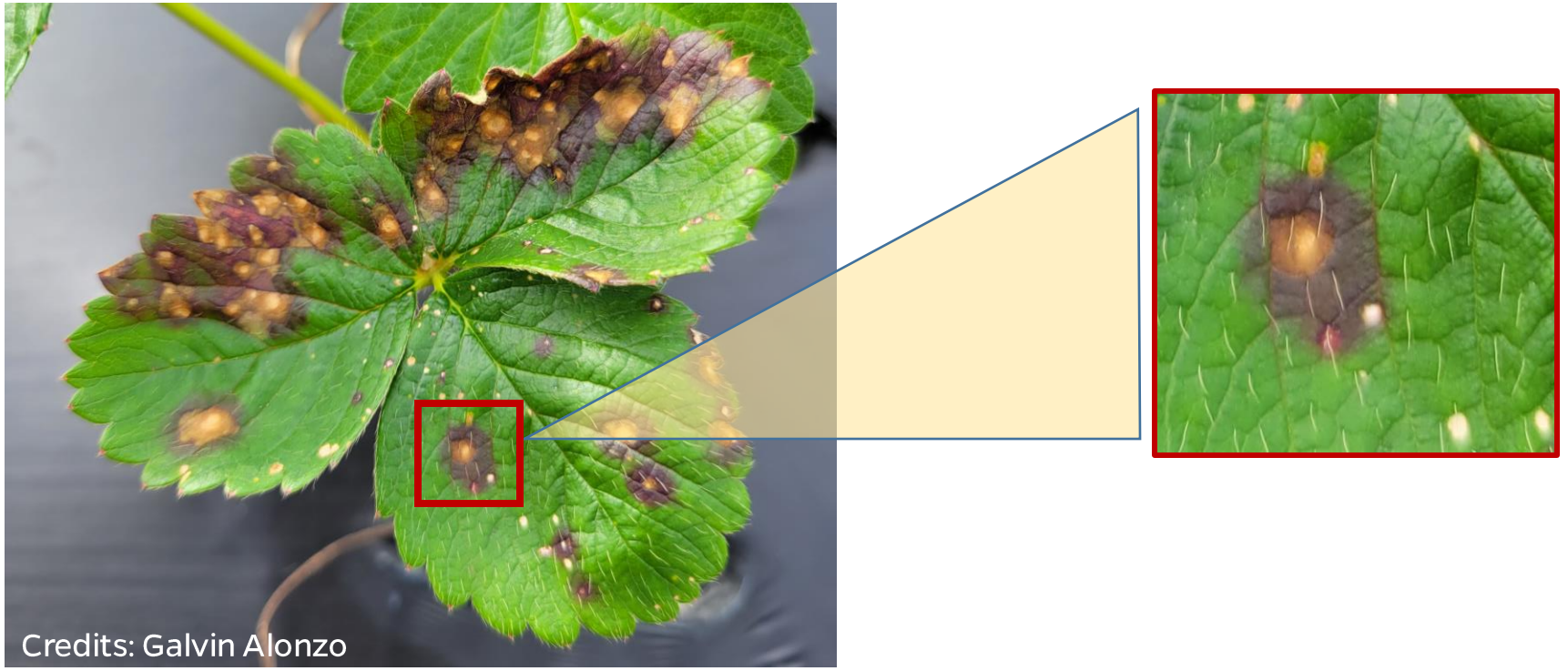


Credits: Juliana Baggio

*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

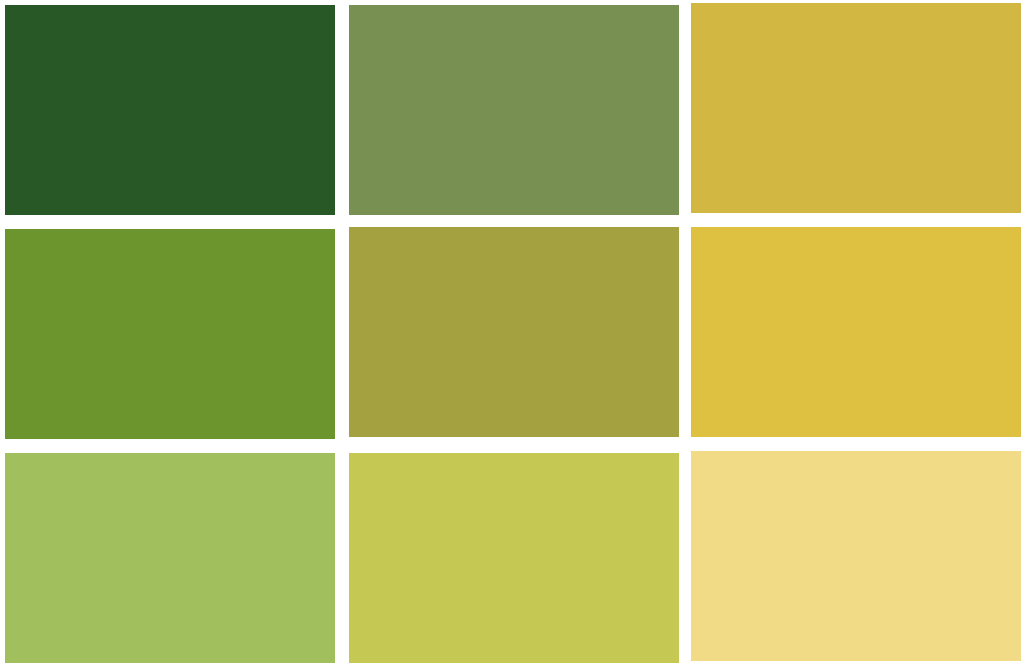
Challenges of disease rating

- 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?

Challenges of disease rating

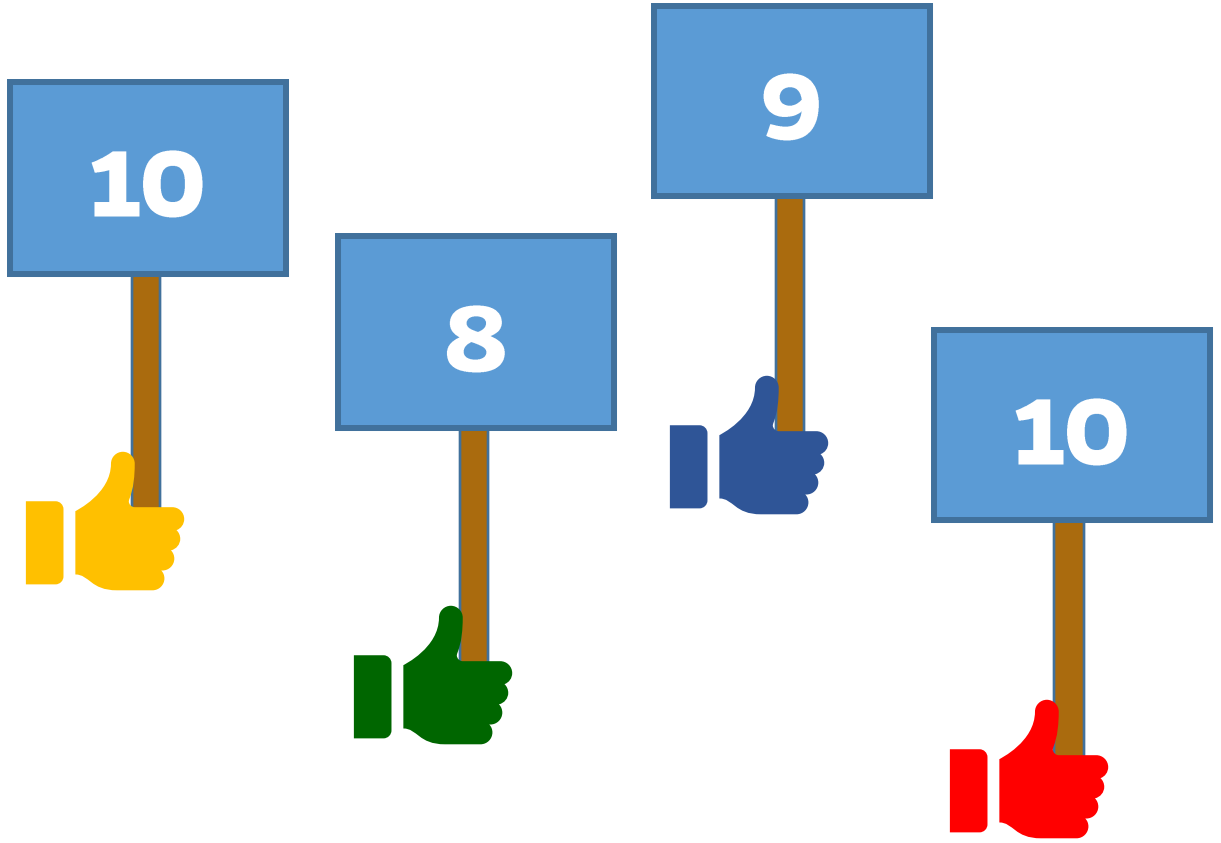
Similar symptoms for different diseases.

Leaf blotch of strawberry caused by *Gnomonia comari*

Leaf spot of strawberry caused by *Neopestalotiopsis* sp.

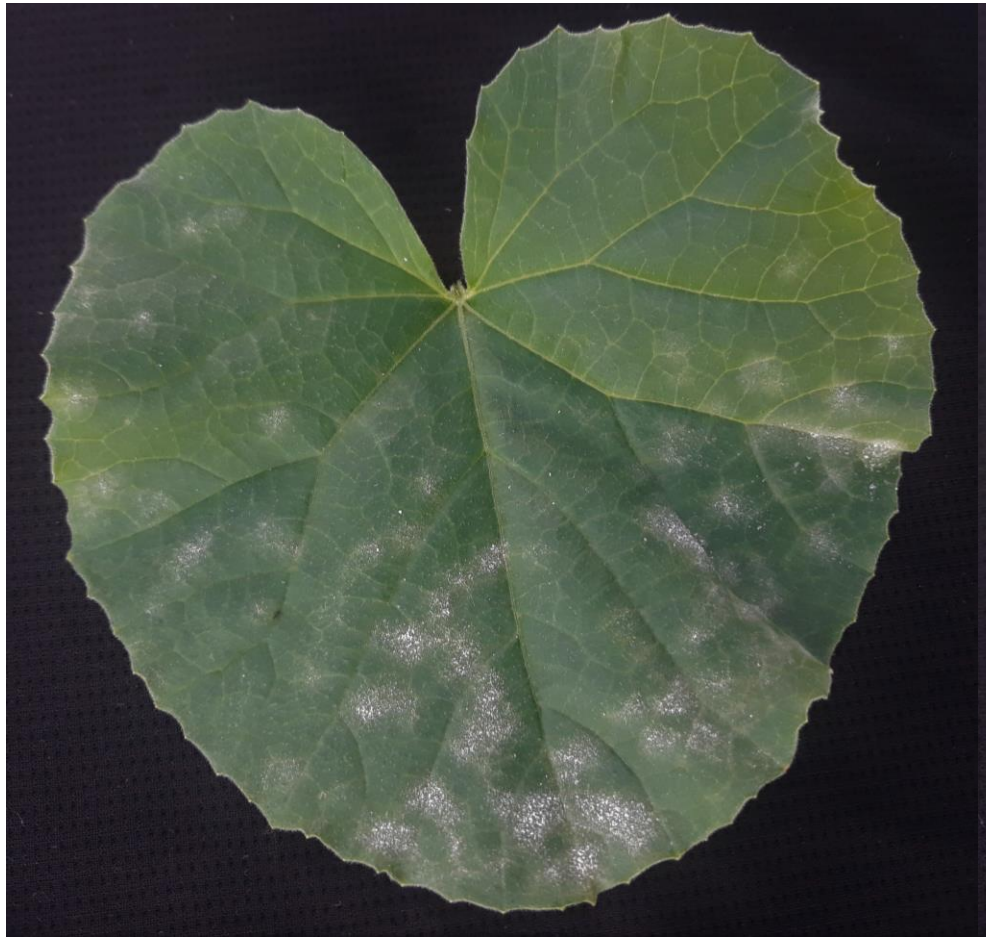
Challenges of disease rating

- 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-_bTE7nusJV883FUF4TRgxzgrToCcZ4-Q/viewform?usp=sf_link


1


2

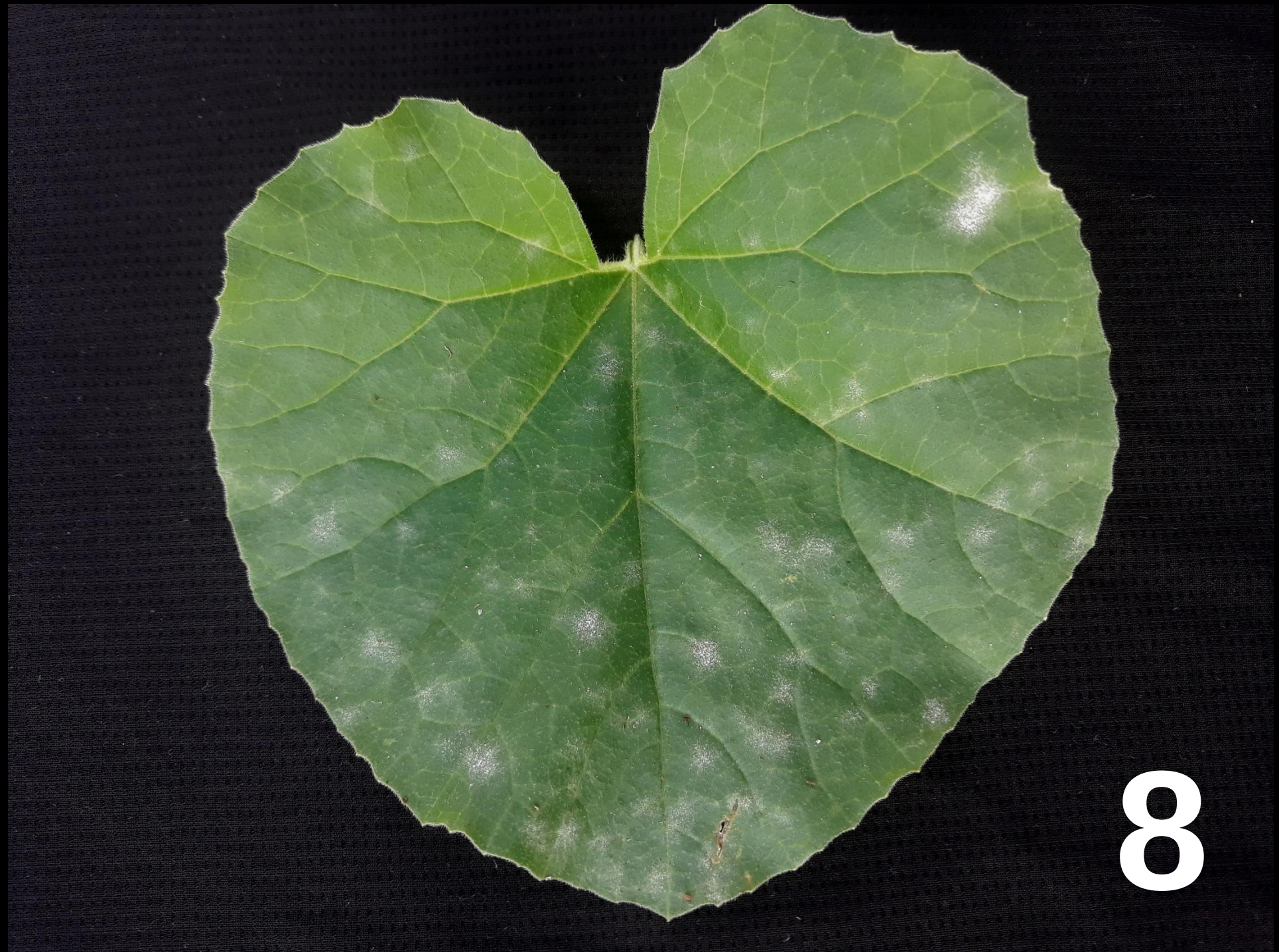

3


4


5


6


7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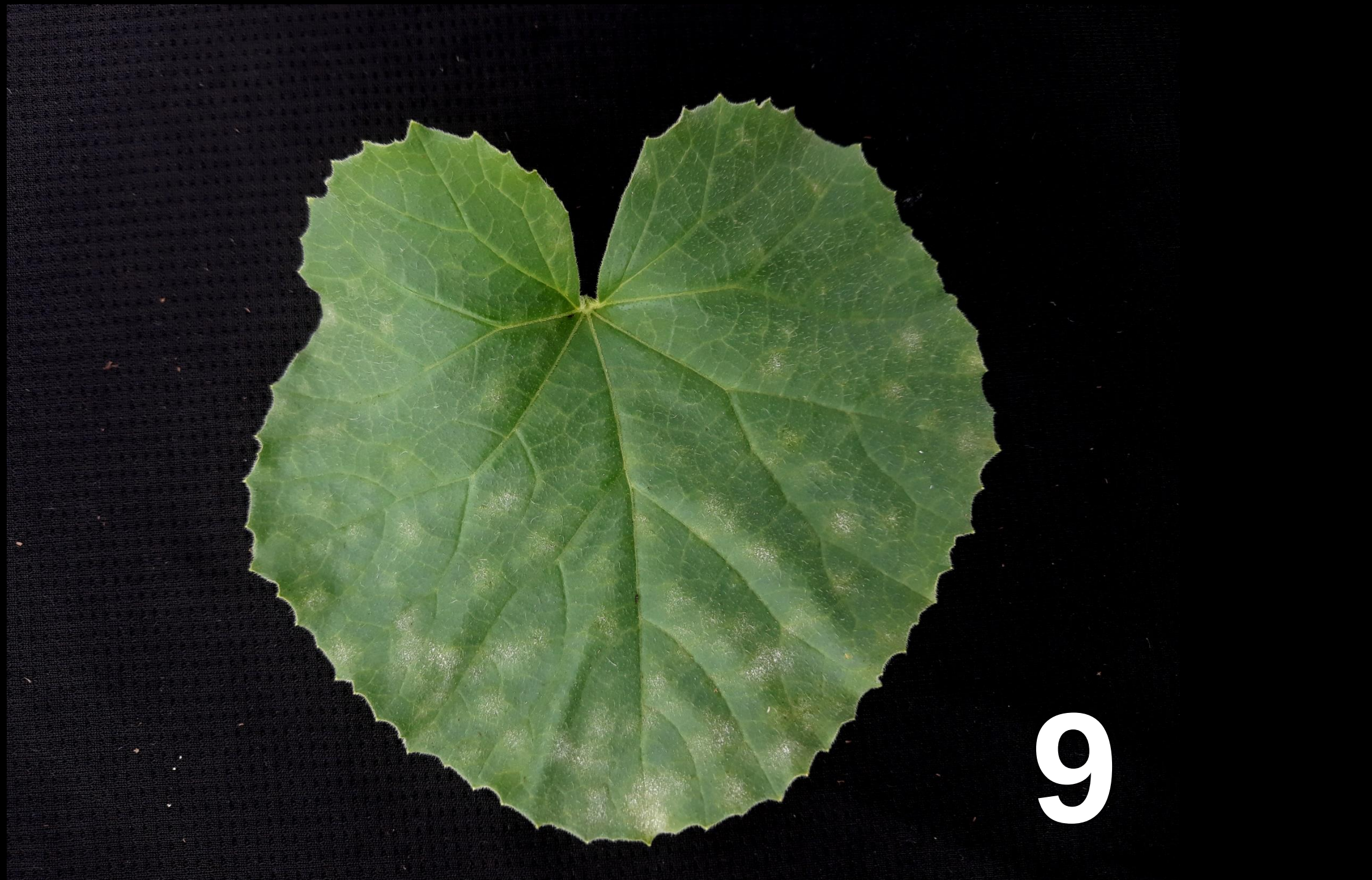
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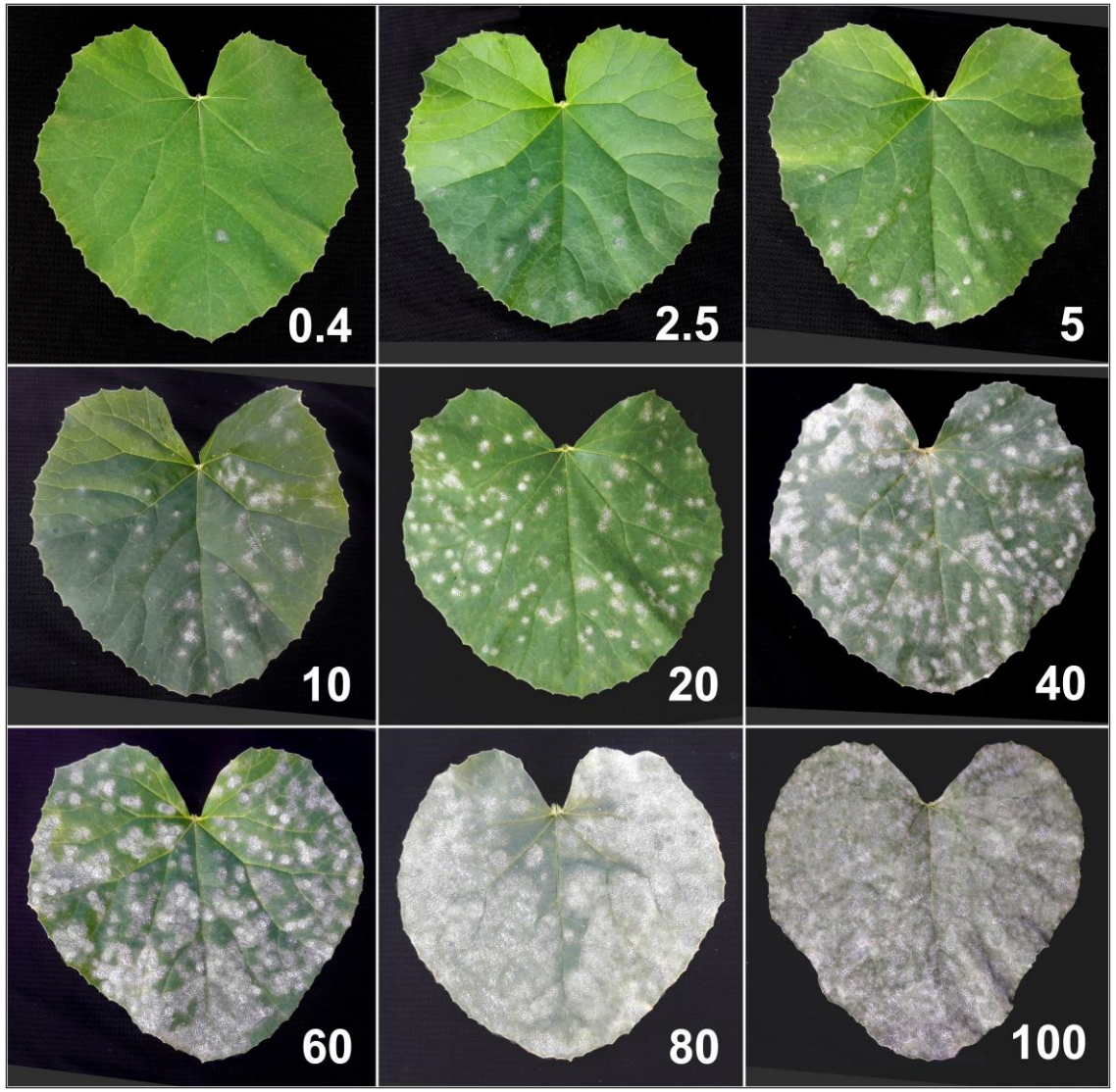
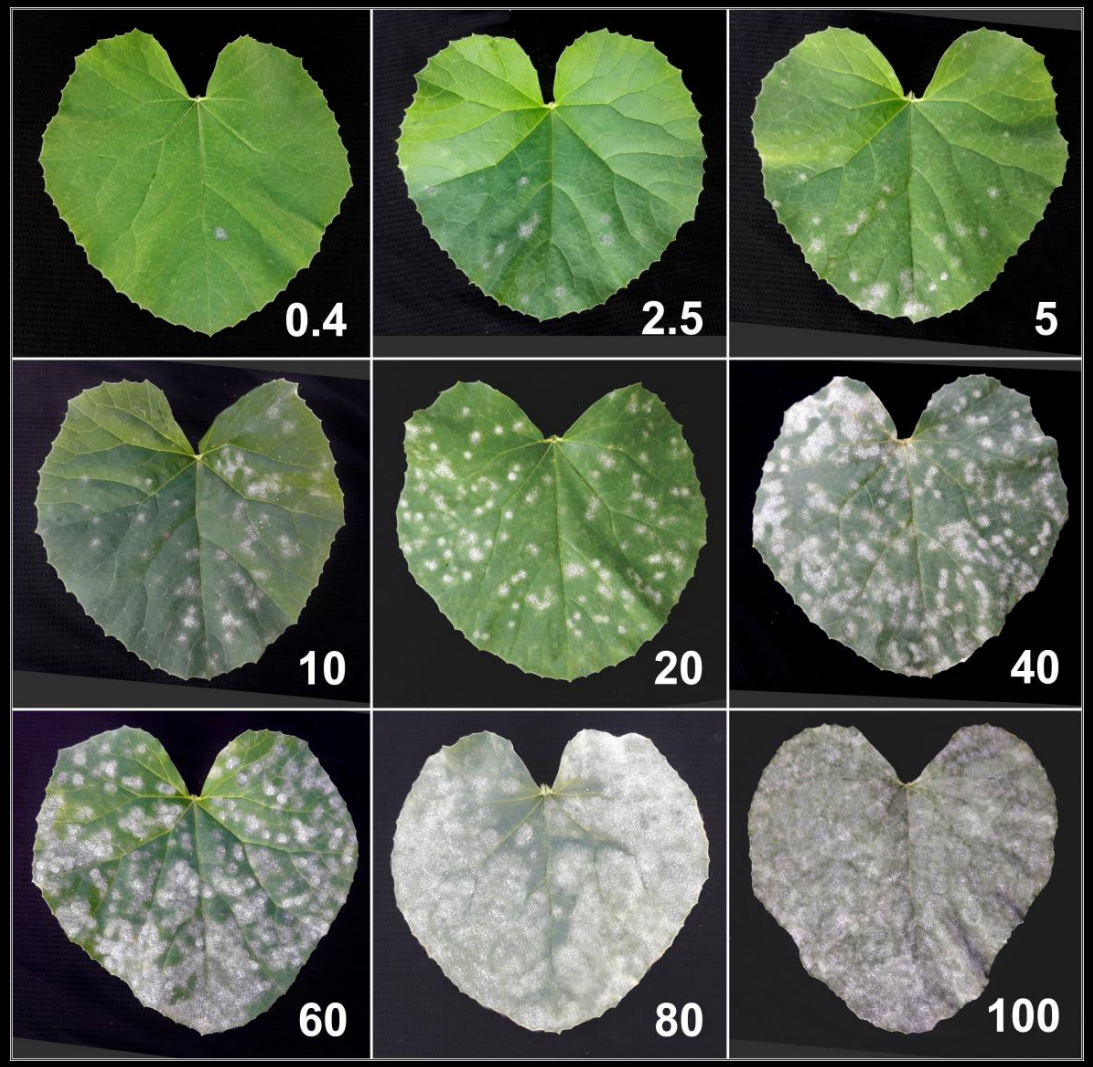
WHAT ASSESSMENT METHOD DID YOU JUST USE TO RATE DISEASE SEVERITY?

NON-GRADED QUIZ



Now, you're going to rate the same pictures, but in random order, with the help of this diagram set.



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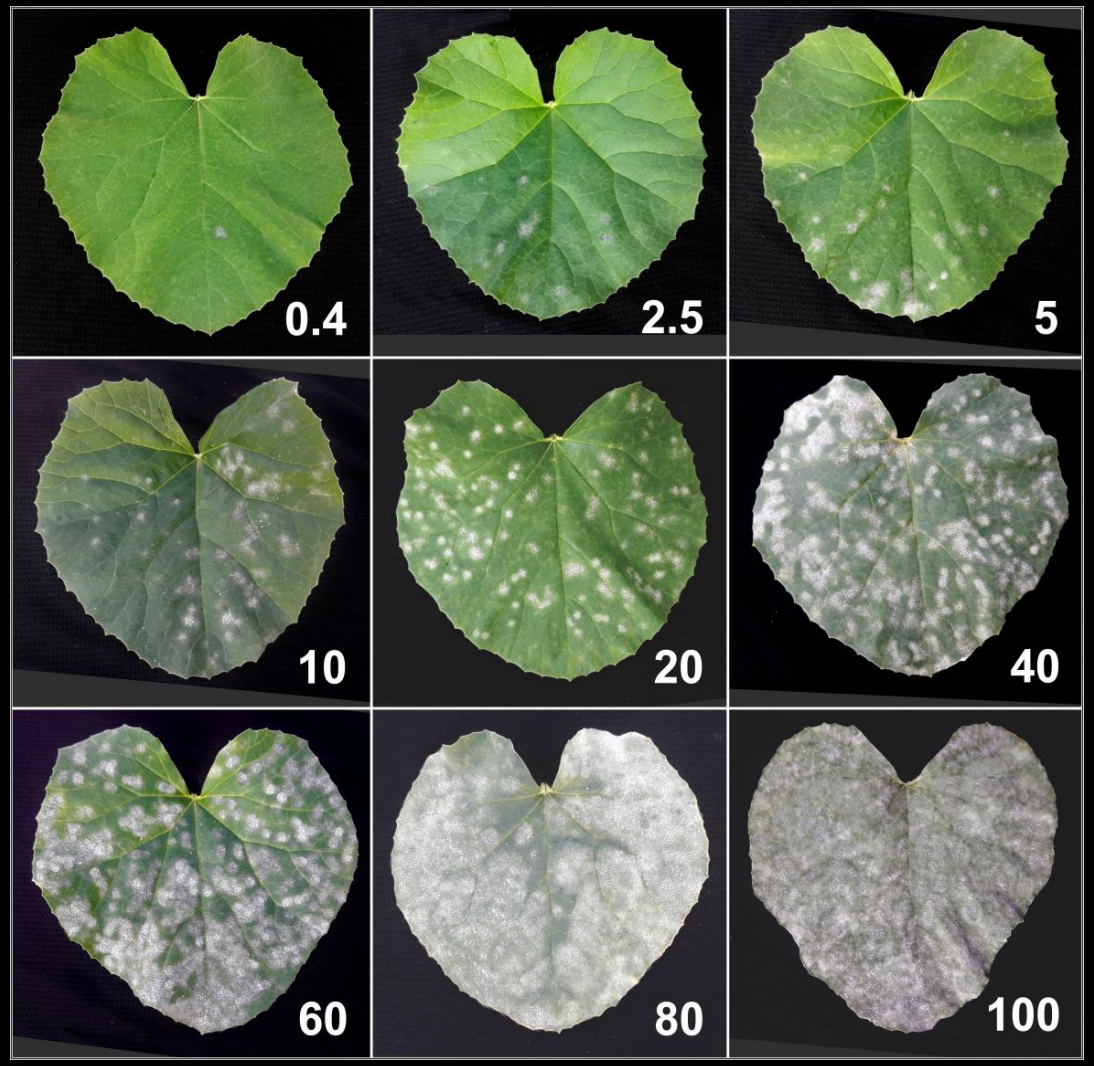

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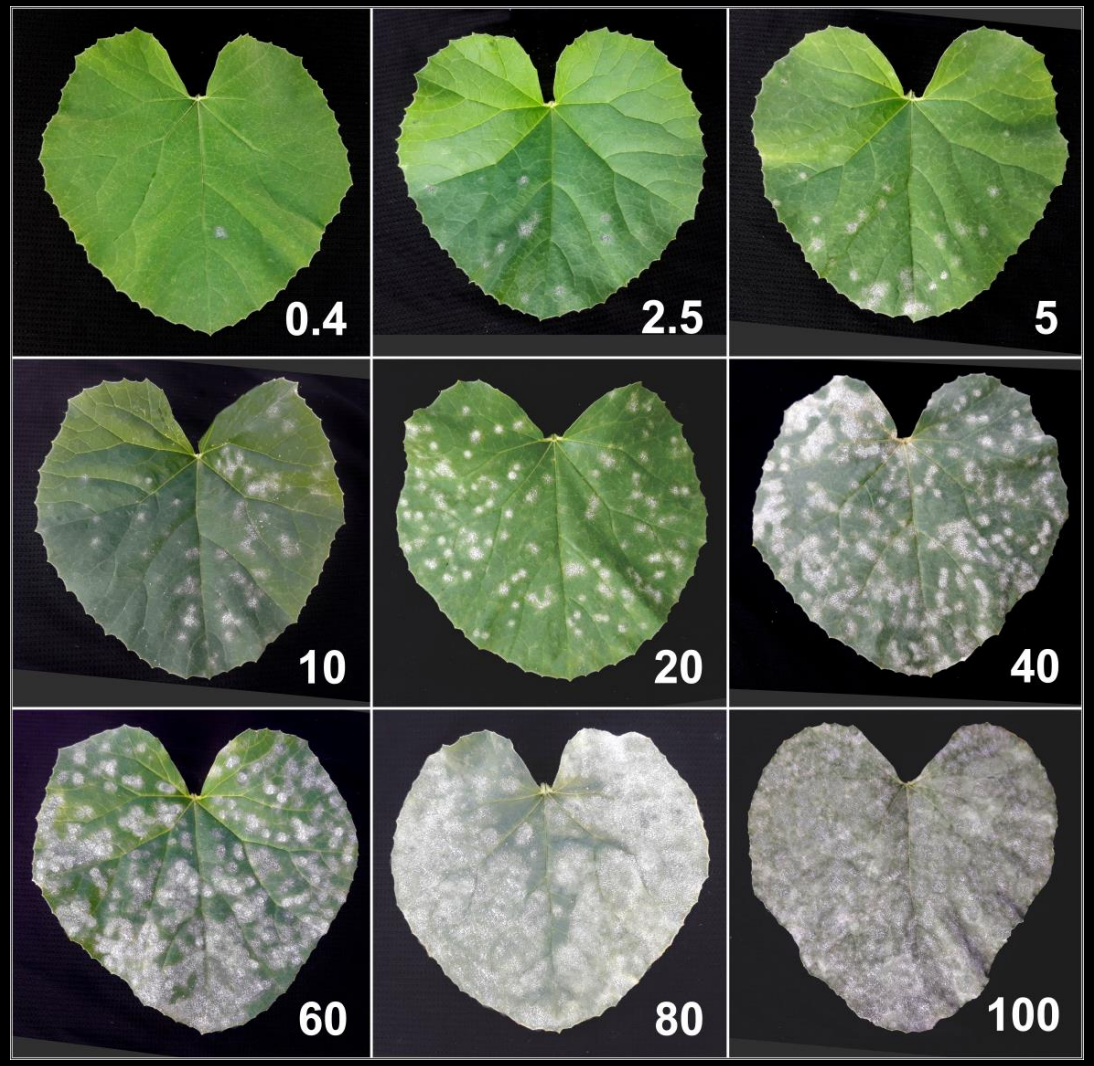

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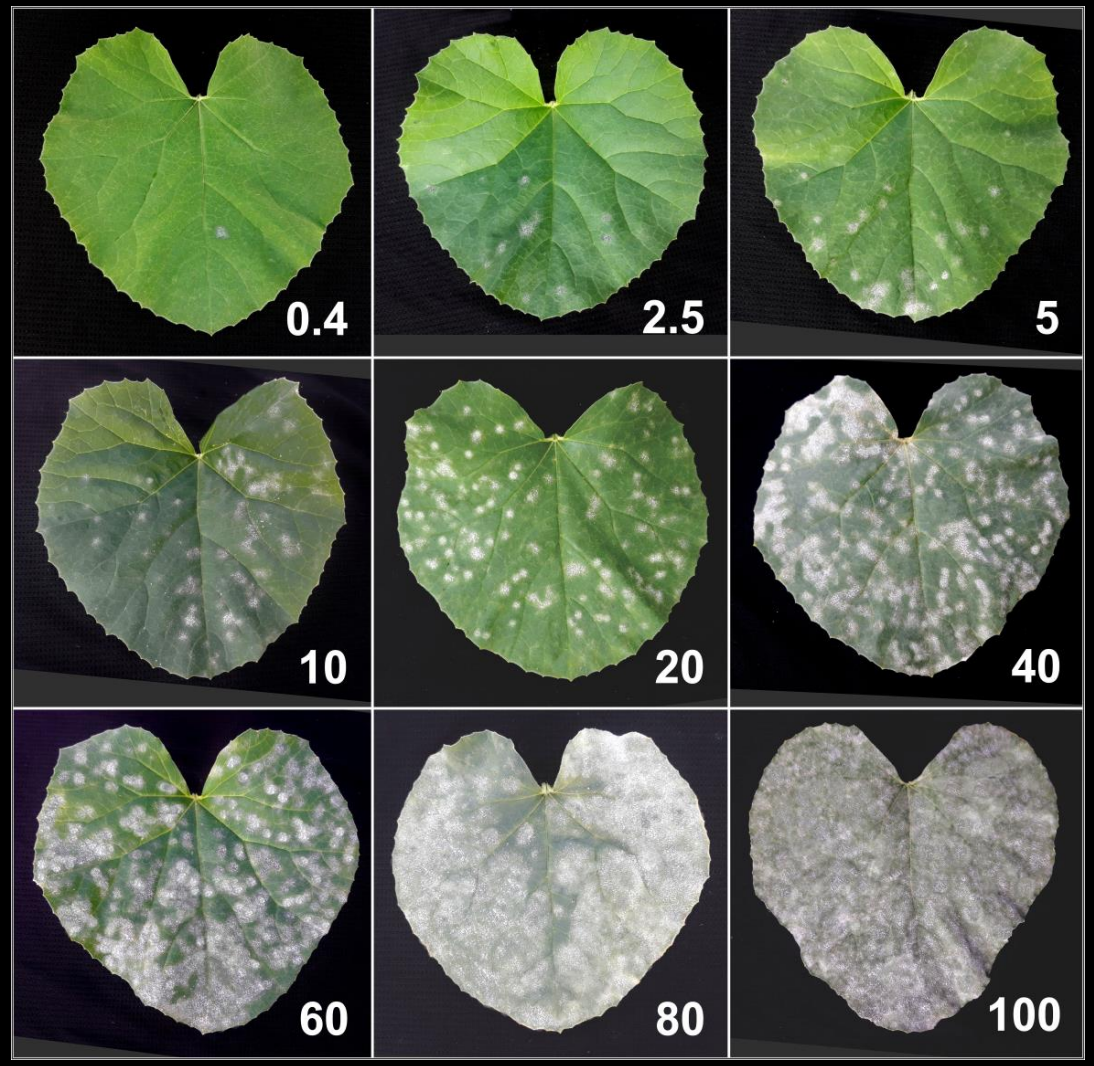

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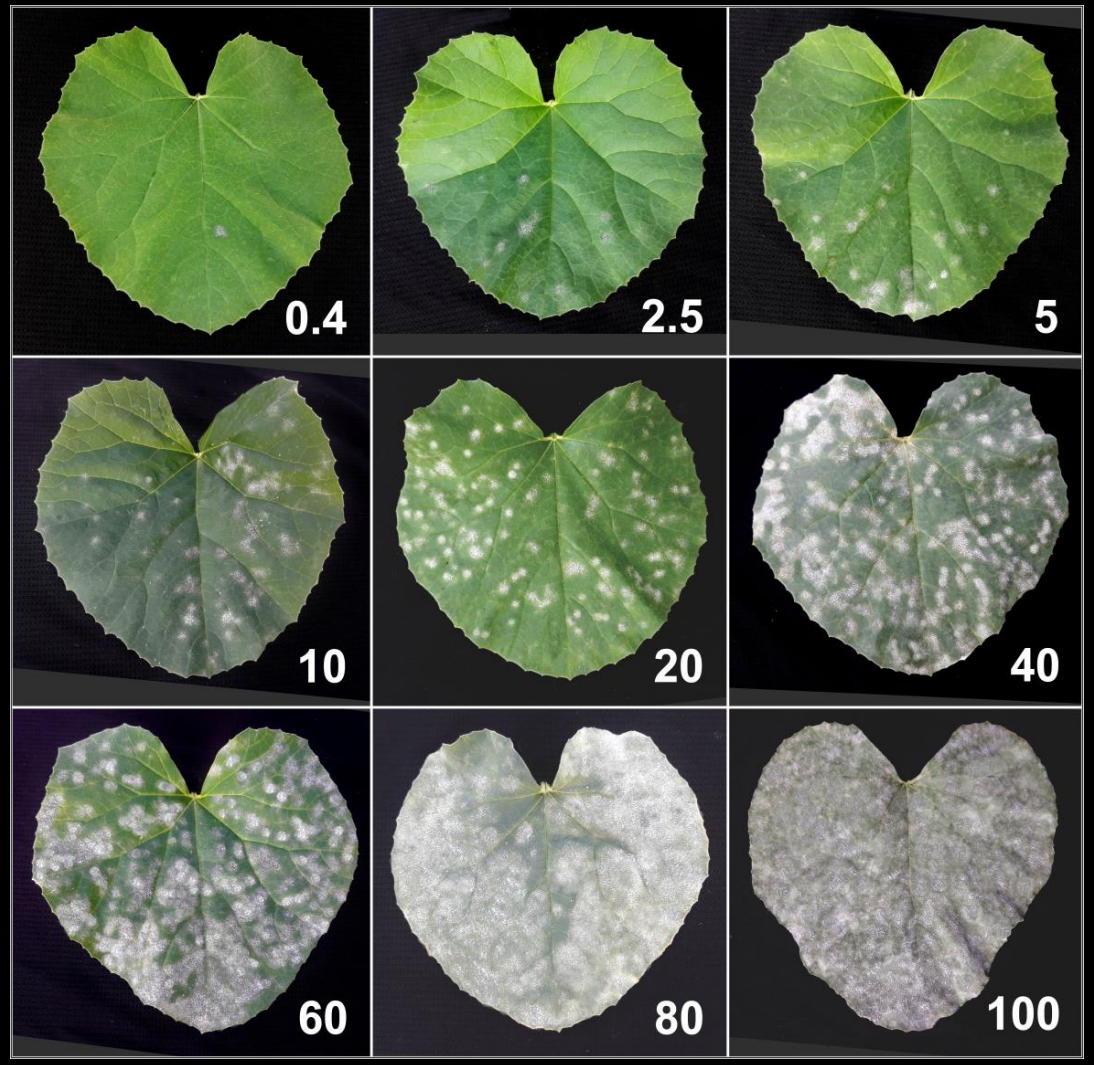

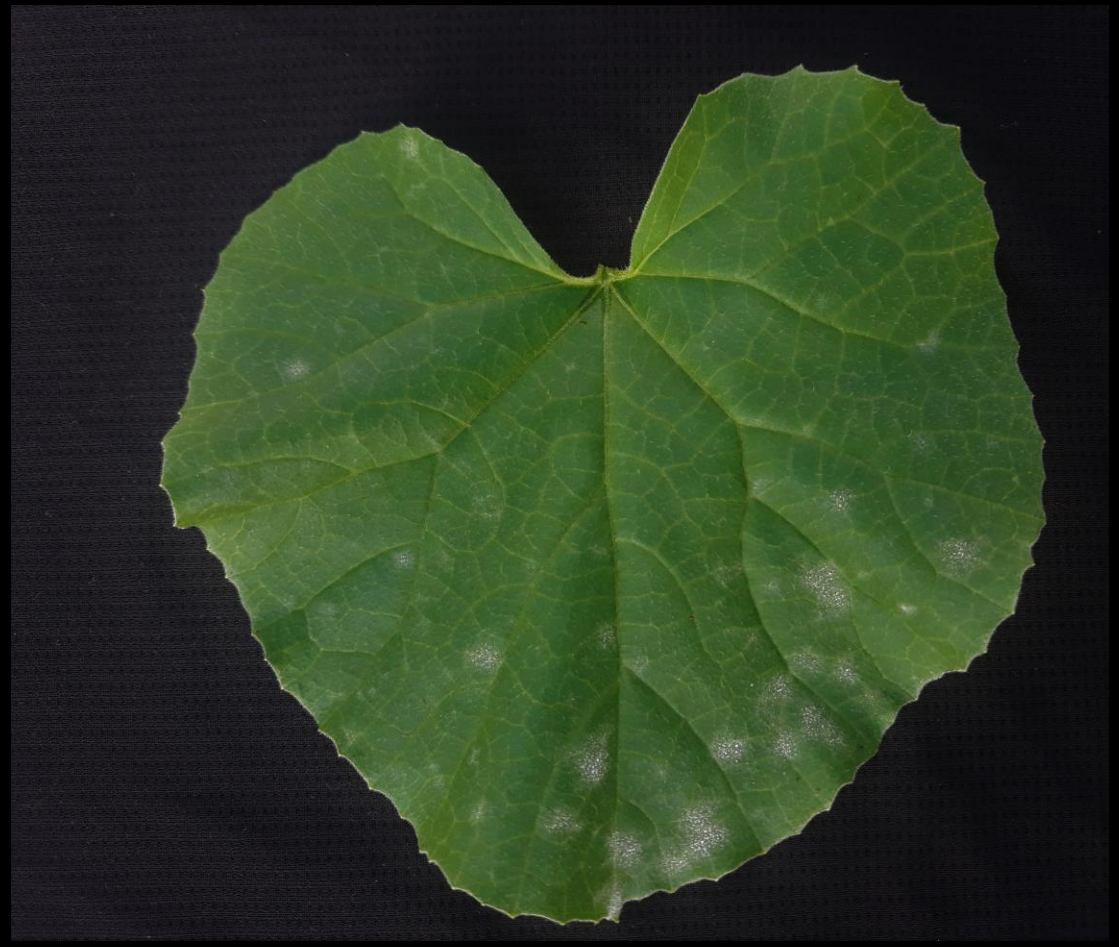

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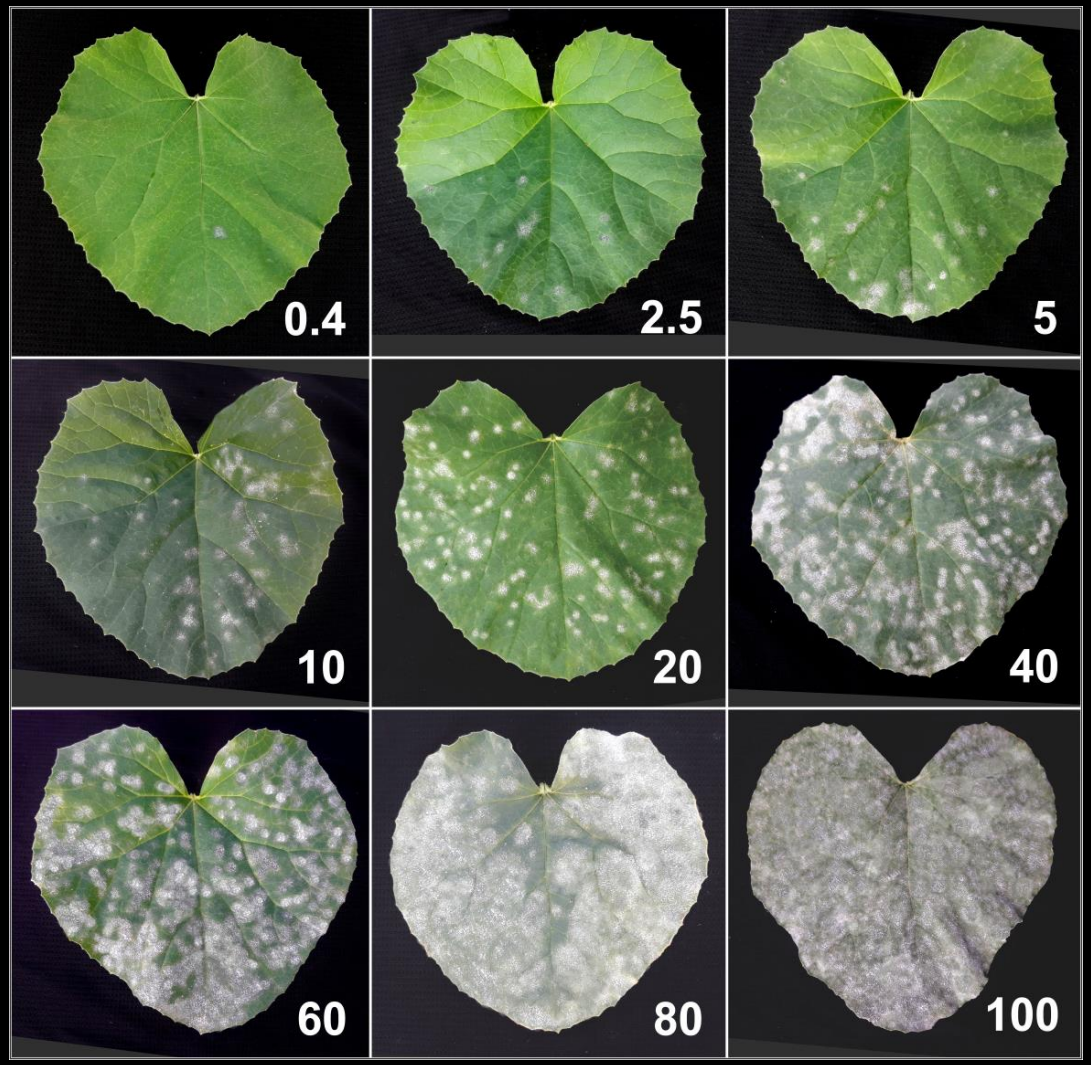

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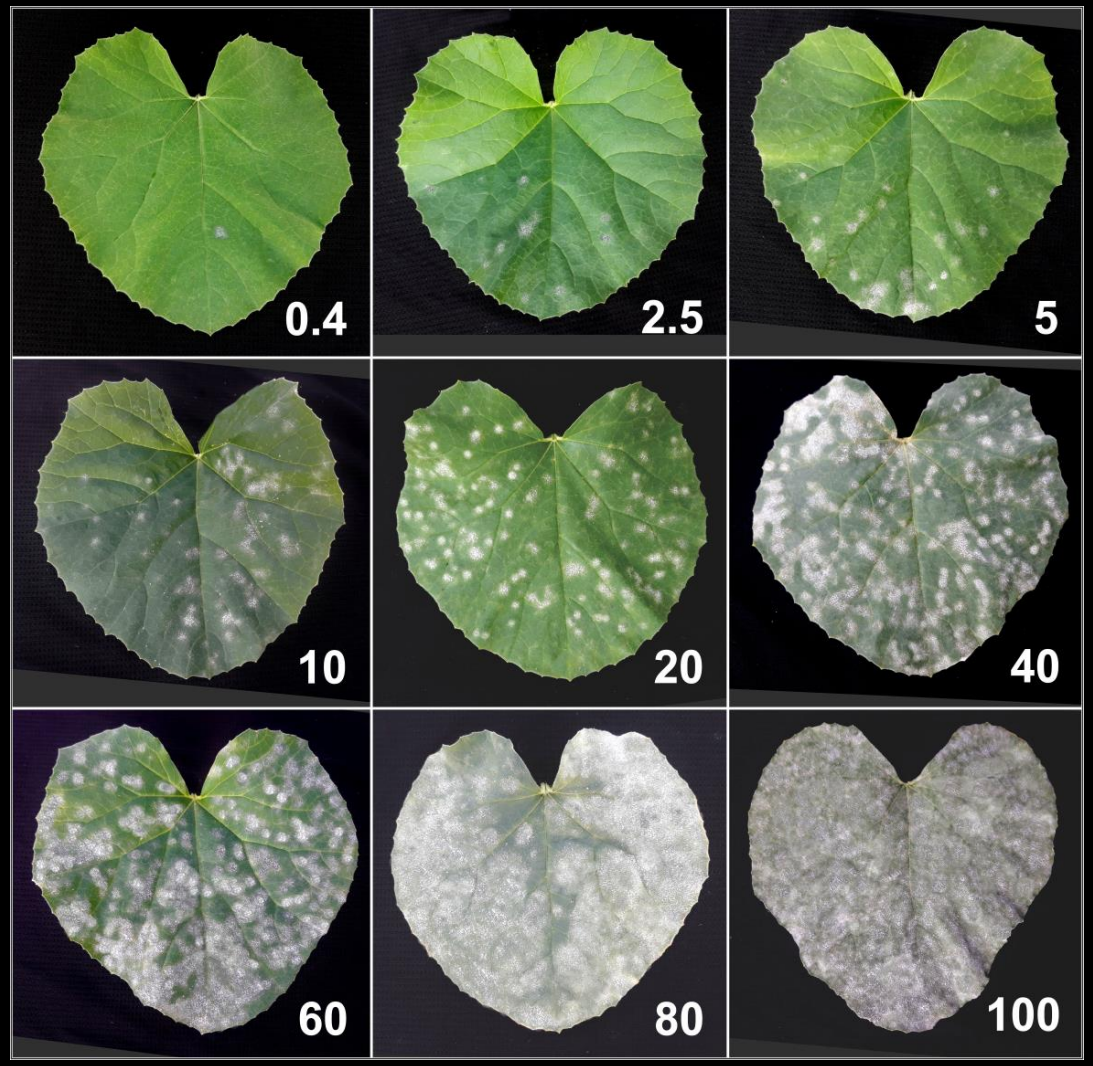

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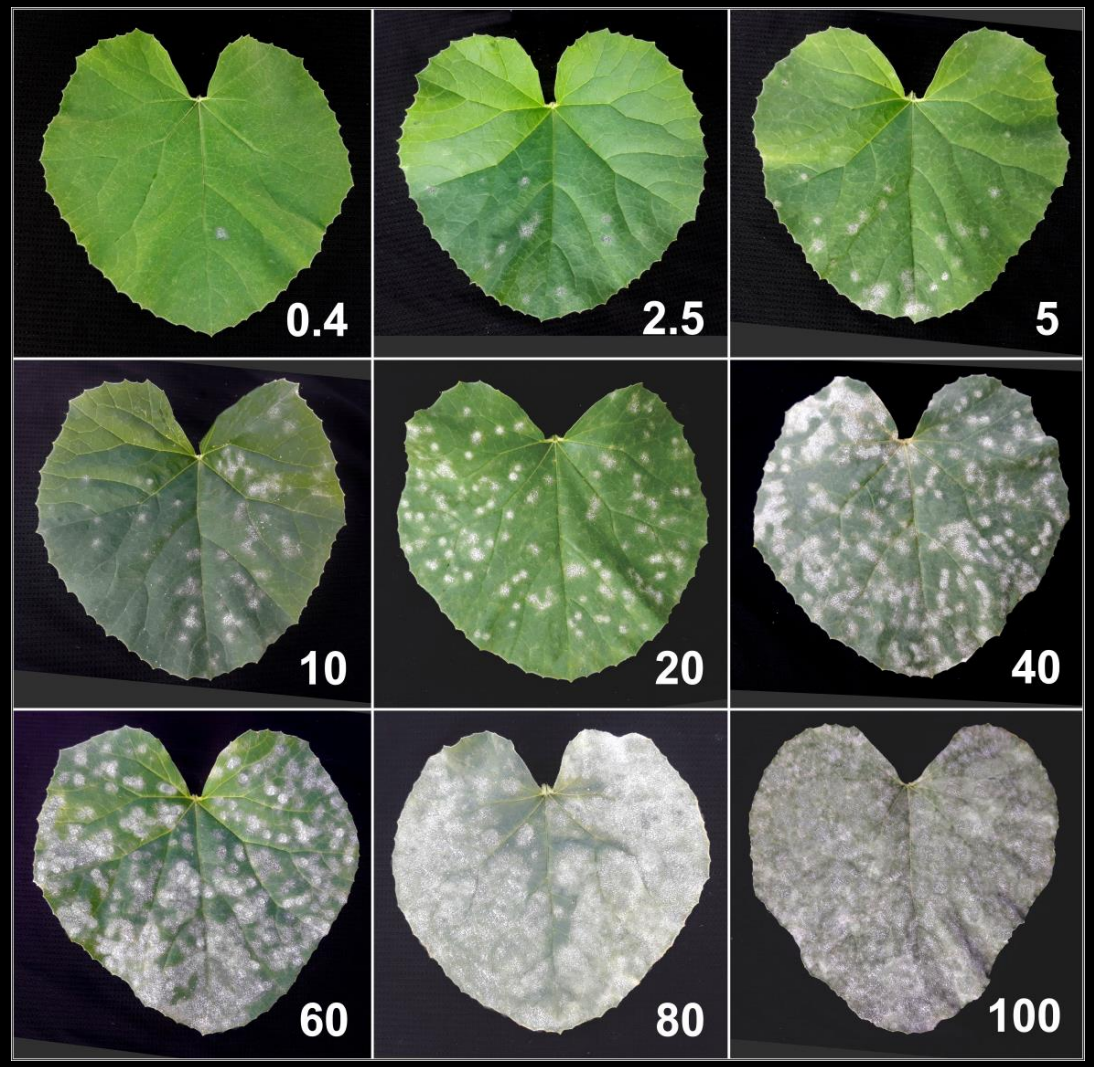

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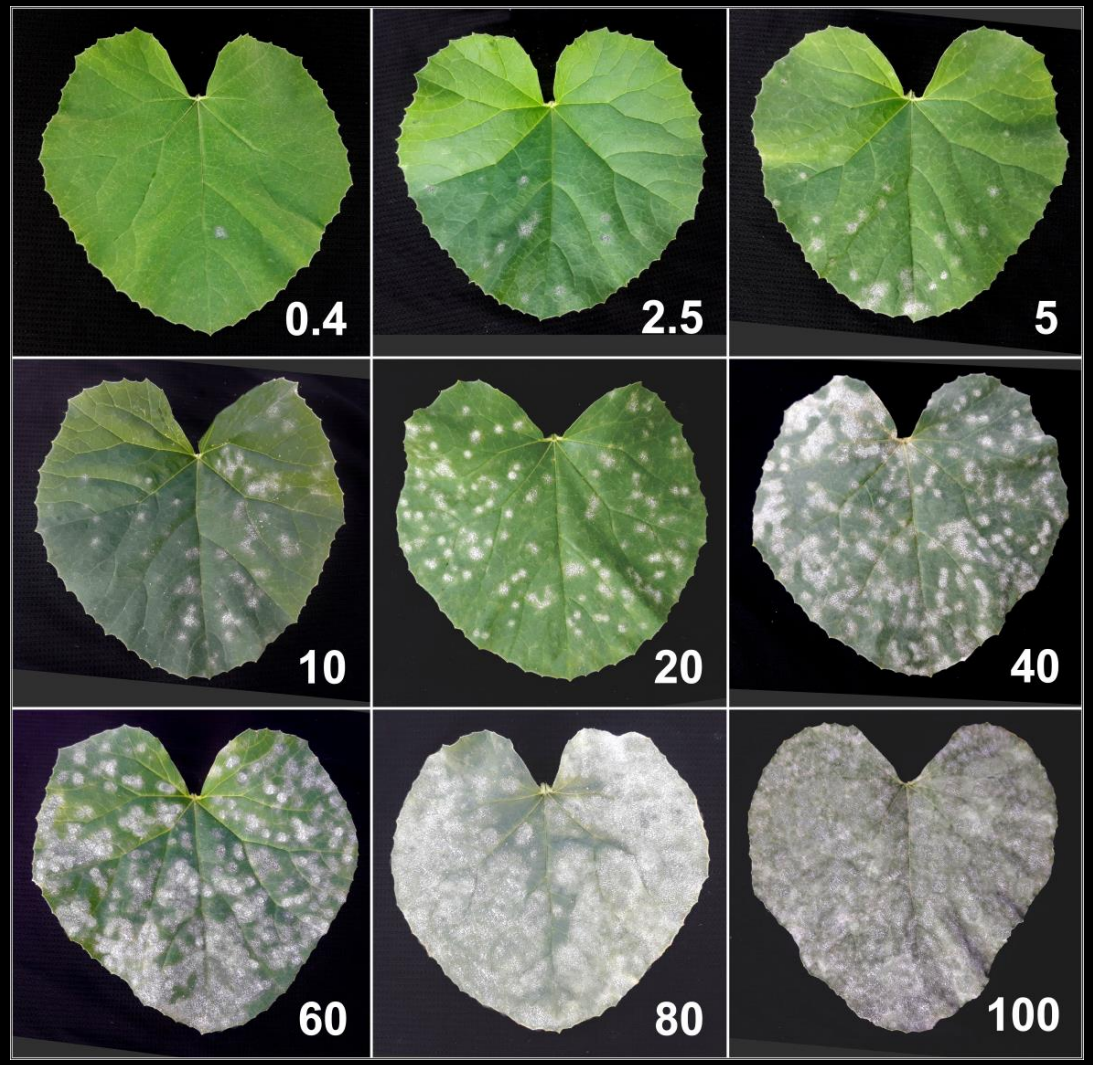

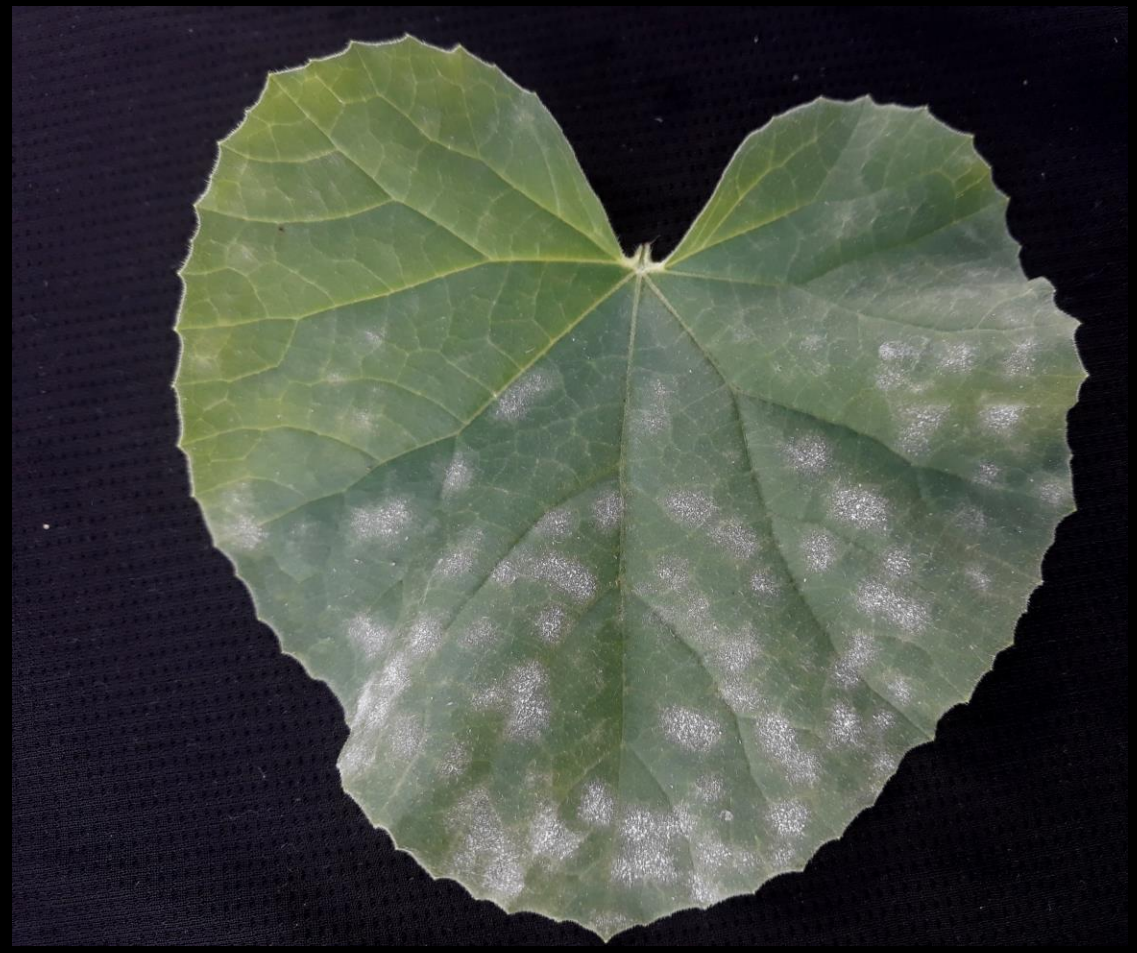

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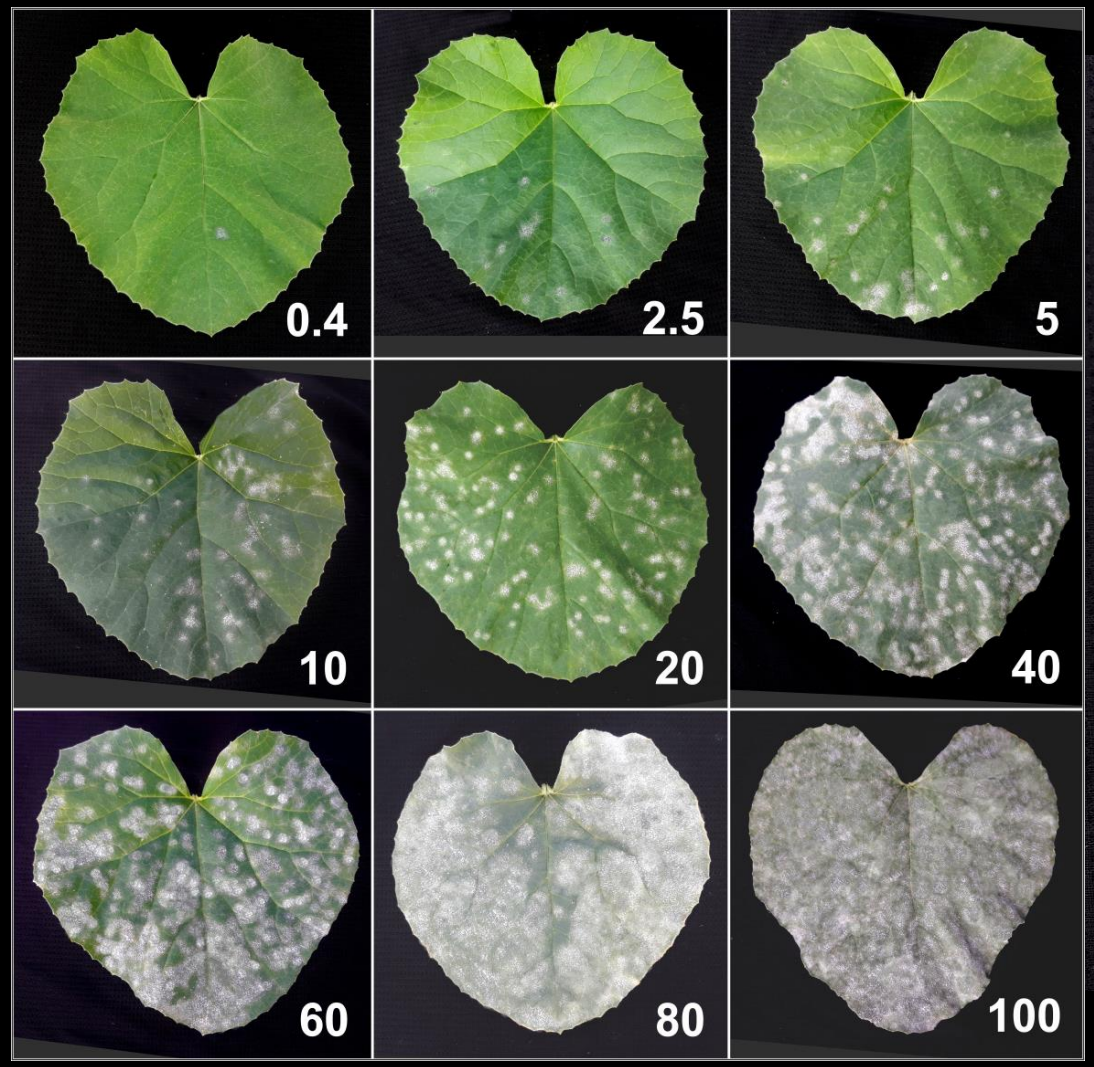

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GRADED ASSIGNMENT

- 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

Order Number	Severity Without diagram	Match	Order Number	Severity With diagram
1	9.5	4	1	2.1
2	40	1	2	9.5
3	40.1	5	3	60
4	2.1	3	4	40.1
5	60	6	5	4.4
6	4.4	8	6	9.6
7	5.3	2	7	40
8	9.6	7	8	5.3
9	9.8	10	7	23.4
10	23.4	9	10	9.8


Thank You!

REFERENCES

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- Schneider, Steven & Da Graca, John & Skaria, M. & Little, Christopher & Setamou, Mamoudou & Kunta, Madhurababu. 2013. A Visual Rating Scale for Quantifying the Severity of Greasy Spot Disease on Grapefruit Leaves. *International Journal of Fruit Science*. 13. 459-465. 10.1080/15538362.2013.789273.