



Title: The Plant Disease Triangle  
- How Plants Defend Themselves, Part II  
Speaker: Dean Glawe

# Plant Pathology 501

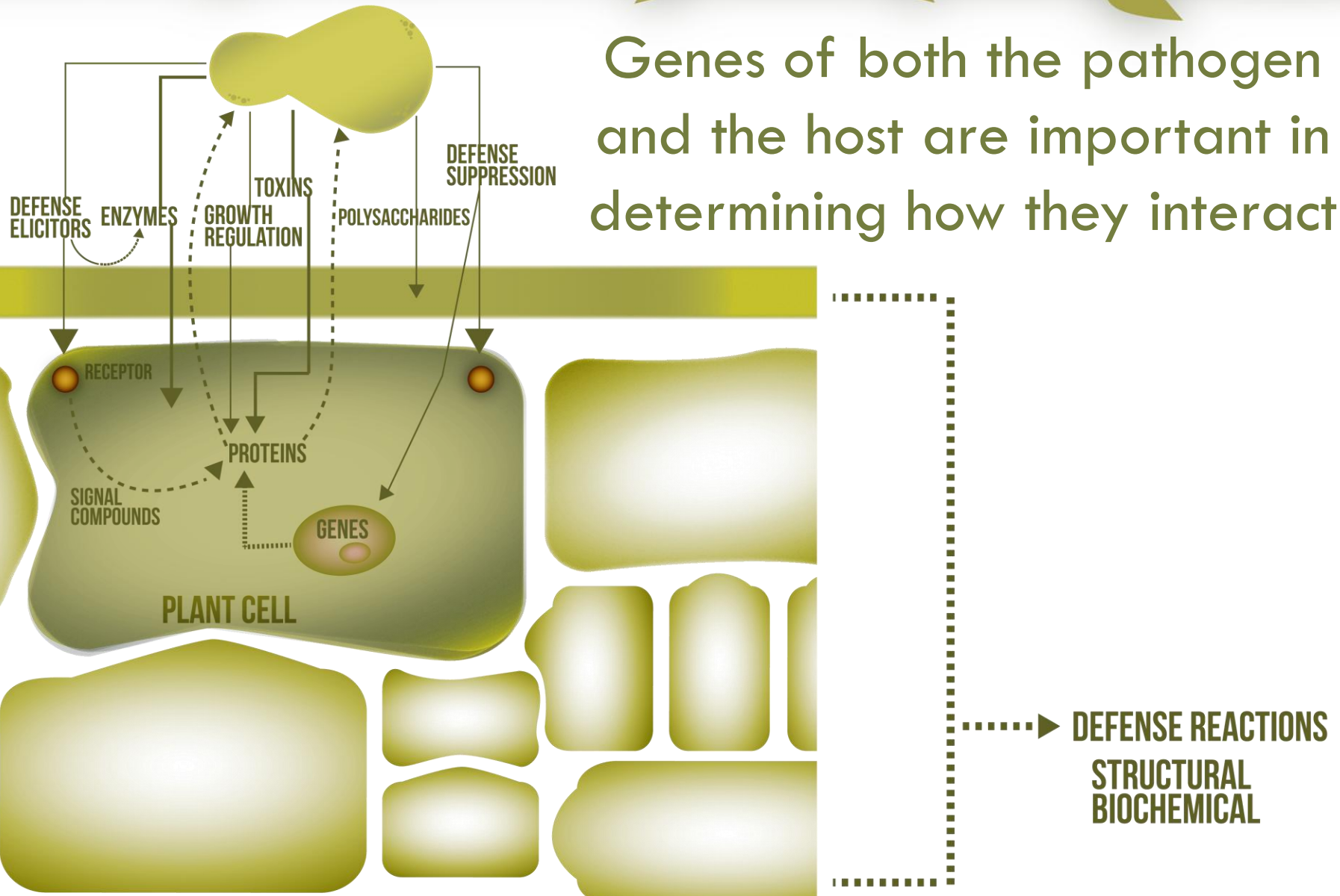
## Lecture 5

### The Plant Disease Triangle—How Plants Defend Themselves, Part II

## Topics Covered in this Lecture

- The gene-for-gene hypothesis
- Co-evolution of hosts and pathogens
- Effects of environmental factors

Genes of both the pathogen and the host are important in determining how they interact



## The gene-for-gene concept

- 1941 Beadle & Tatum, one gene codes for one enzyme
- 1942 H. H. Flor, gene-for-gene concept
  - Single gene responsible for pathogenicity in flax rust fungus
  - The gene in the fungus corresponds to a gene for resistance in the flax (host) plant
  - His idea is applicable to a wide range of plant diseases caused by many different pathogens

## The gene-for-gene concept

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## The gene-for-gene concept

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- Pathogens have dominant avirulence genes (*avr* genes)
- Proteins coded by the pathogen's *avr* genes are called elicitors (they elicit a resistance response in the host)
- Disease develops when the compatible combination of R gene in the host and *avr* gene in the pathogen are present

## The gene-for-gene concept

—why is it important?

- It is a conceptual model that helps explain
  - Why a host may be resistant or susceptible to a pathogen
  - How resistance to a pathogen is a heritable trait
  - How to go about breeding disease resistant plants
  - Why a plant can be resistant to one strain (or population) of a pathogen, but susceptible to another

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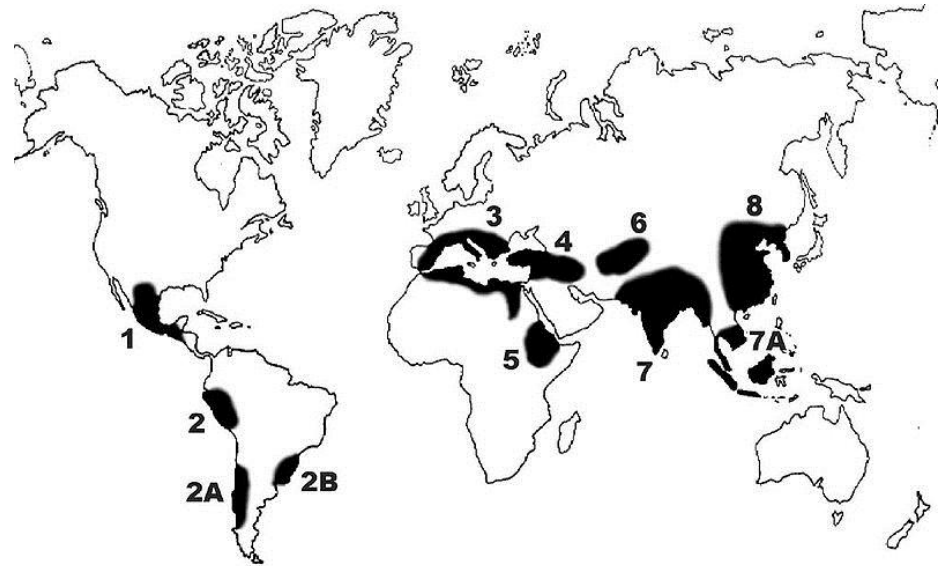
- Plants and their parasites co-evolve together over time
- The geographical center of origin of a plant will tend to be where it and its parasites have co-evolved for the longest period of time
- Such regions are sought by plant breeders who use them as sources of genetic diversity

## Vavilov Centers of Plant Diversity



Nikolai Vavilov  
1887-1943

Illustrations  
from Wikipedia

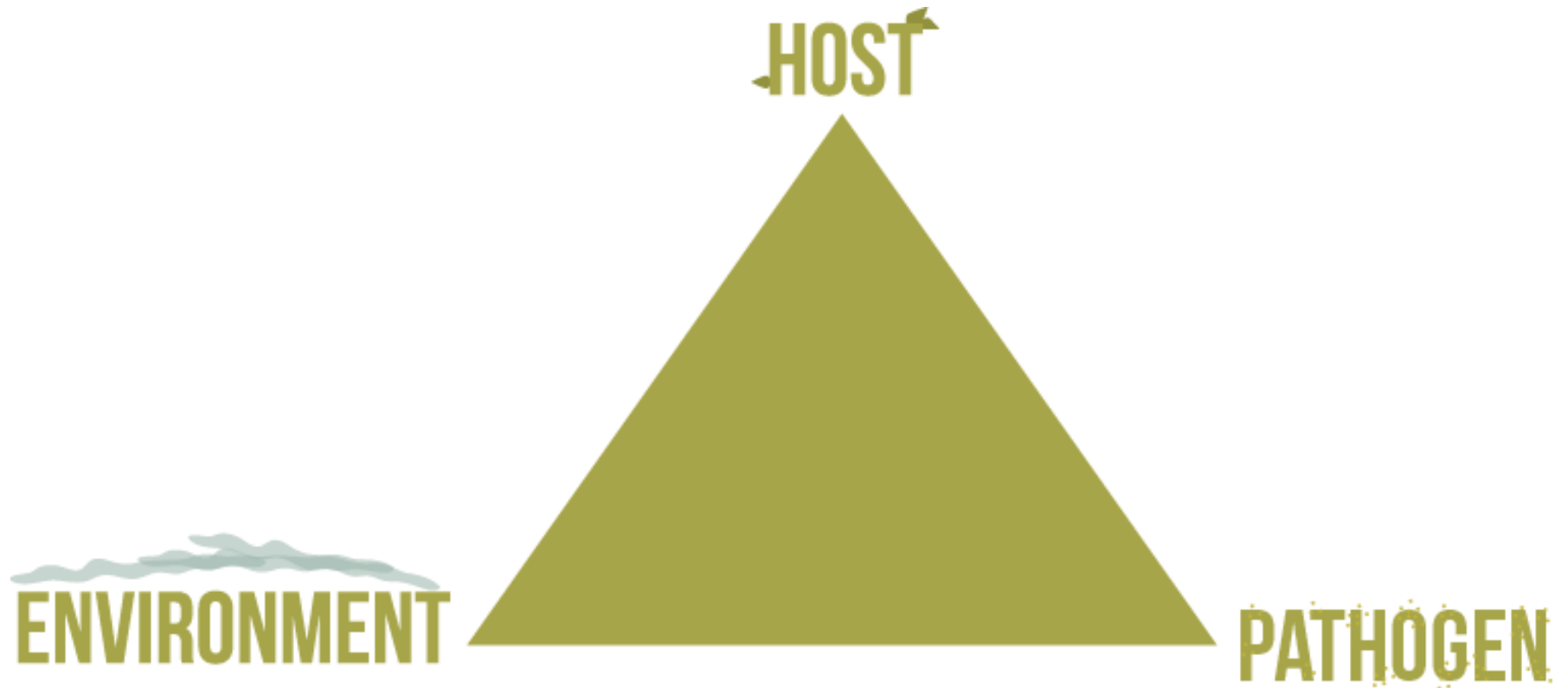


(1) Mexico-Guatemala, (2) Peru-Ecuador-Bolivia, (2A) Southern Chile, (2B) Southern Brazil, (3) Mediterranean, (4) Middle East, (5) Ethiopia, (6) Central Asia, (7) Indo-Burma, (7A) Siam-Malaya-Java, (8) China.

## Host characteristics and plant disease management

- Genetic resistance
- Cultural practices
  - Tillage
  - Pruning
  - Soil fertility
  - Many others
- Sanitation
  - Clean planting stock
  - Removal of plant material likely to harbor inoculum

## The Plant Disease Triangle





## Effects of the physical environment on plant disease development

- Sunlight
- Temperature
- Water
- Relative humidity
- Soil
- Wind
- Other?

## Effects of the physical environment on plant disease development

- Direct effects on plant
- Direct effects on pathogen
- Effects on the interaction of plants and pathogens
- Effects on vectors

## Effects of the physical environment on plant disease development

- Tend to be varied and highly specific to particular plant and pathogen
- We will look at these and other factors when we study individual plant diseases