

More Ecology of Forest Diseases (Gilbert 2002)

- Density Dependence
- Counterweights to numerical effects
- Disease and competition
- Dispersal and Local Adaptation

Density Dependence

- Most studies have shown a positive relationship between density and disease incidence
 - Shorter distance to be covered
 - Potentially limiting resources

 - However there are examples that show a different pattern, in particular for diseases that are vectored, and for diseases that require an alternate host

Counterweights to numerical effects

- Disease = damage, but communities will compensate
 - Disease reduced number and size of survivors, but at maturity disease-infested plots had the largest trees
 - Survivors produce more seed
- Cross generational effects
 - Diseased mothers will produce inferior seed
 - Diseased mothers will generate progeny that is more resistant to that disease
 - Maternal inheritance or epigenetics

Review

Cell
PRESS

Transgenerational defense induction and epigenetic inheritance in plants

Liza M. Holeski¹, Georg Jander², and Anurag A. Agrawal³

Disease and Competition

- More competition = more stress=more disease
- Disease reduces competitiveness, by reducing growth and ability to use light. Effect is larger than damage
- Apparent Competition: a generalist pathogen reduces growth of two hosts, but allows for the second host to coexist
- Soil feedbacks: Negative feedbacks: build-up of soil pathogens with growth of same species (reason behind need for crop rotation. The more limited the dispersal of the pathogen, the stronger the effect (that's why effect is measurable for soil pathogens). The more important sexual reproduction is in hosts , the slower the effect



650 x 1040

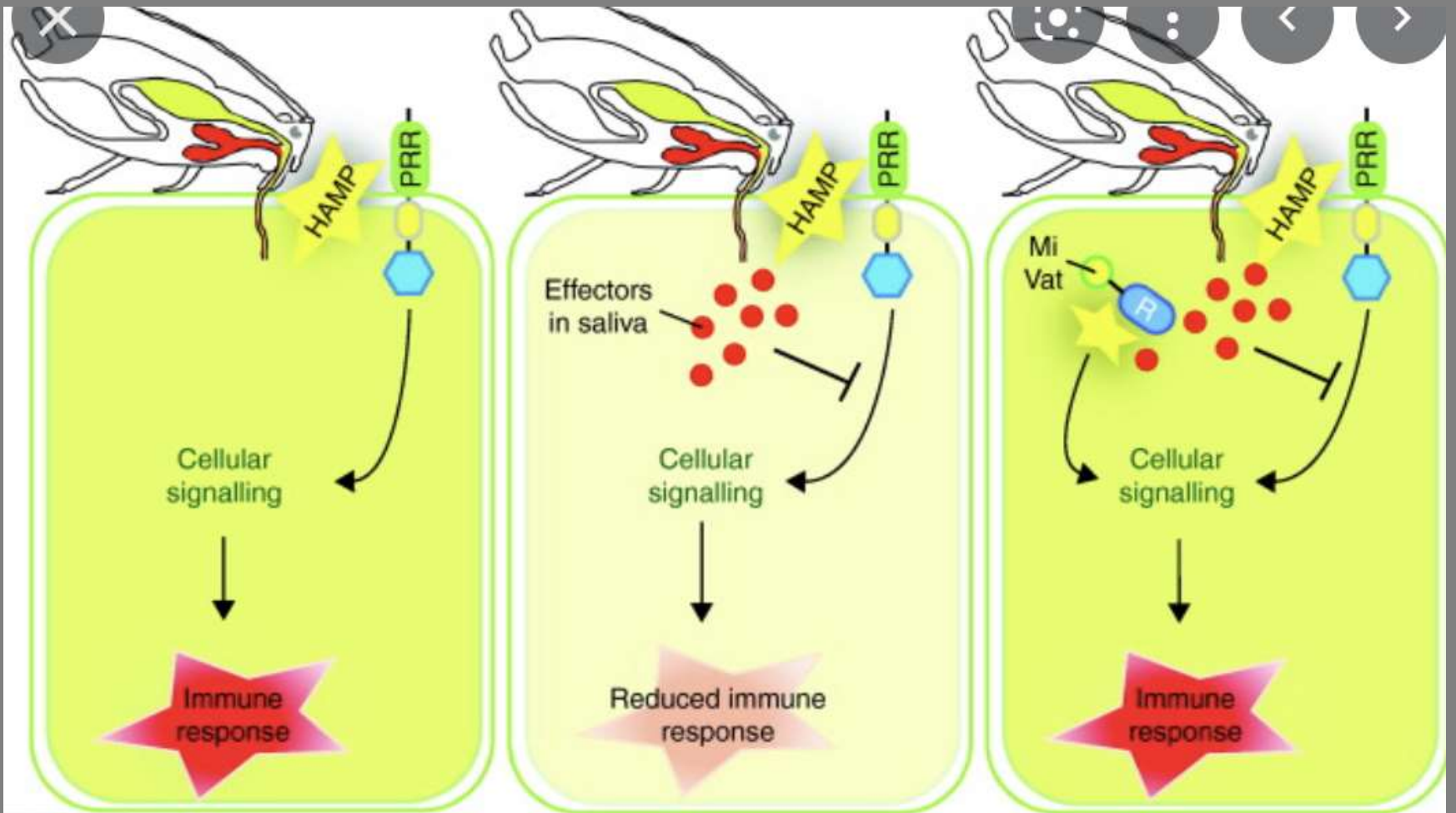
The Red Queen hypothesis:

“here, you see, it takes all the running you can do to keep in the same place.”

- Also known as the co-evolutionary arms race
- The Red Queen Hypothesis (RQH) predicts that **coevolution between hosts and parasites acts to maintain genetic variation through time.**
- A parasite develops a virulence gene and the plant develops a matching resistance gene

Definitions

- **Elicitors:** foreign molecules produced by pathogens (pests and symbionts too) that trigger an immune response
- **Effectors** a molecule produced by the pathogen that suppresses the plant resistant response
- **Receptor:** plant molecule that recognizes elicitor and triggers respo



A quick review of gene-for-gene resistance

Pathogen
genotype

Host
genotype

RR

Rr

rr

WW

-

-

+

Vv

-

-

+

w

+

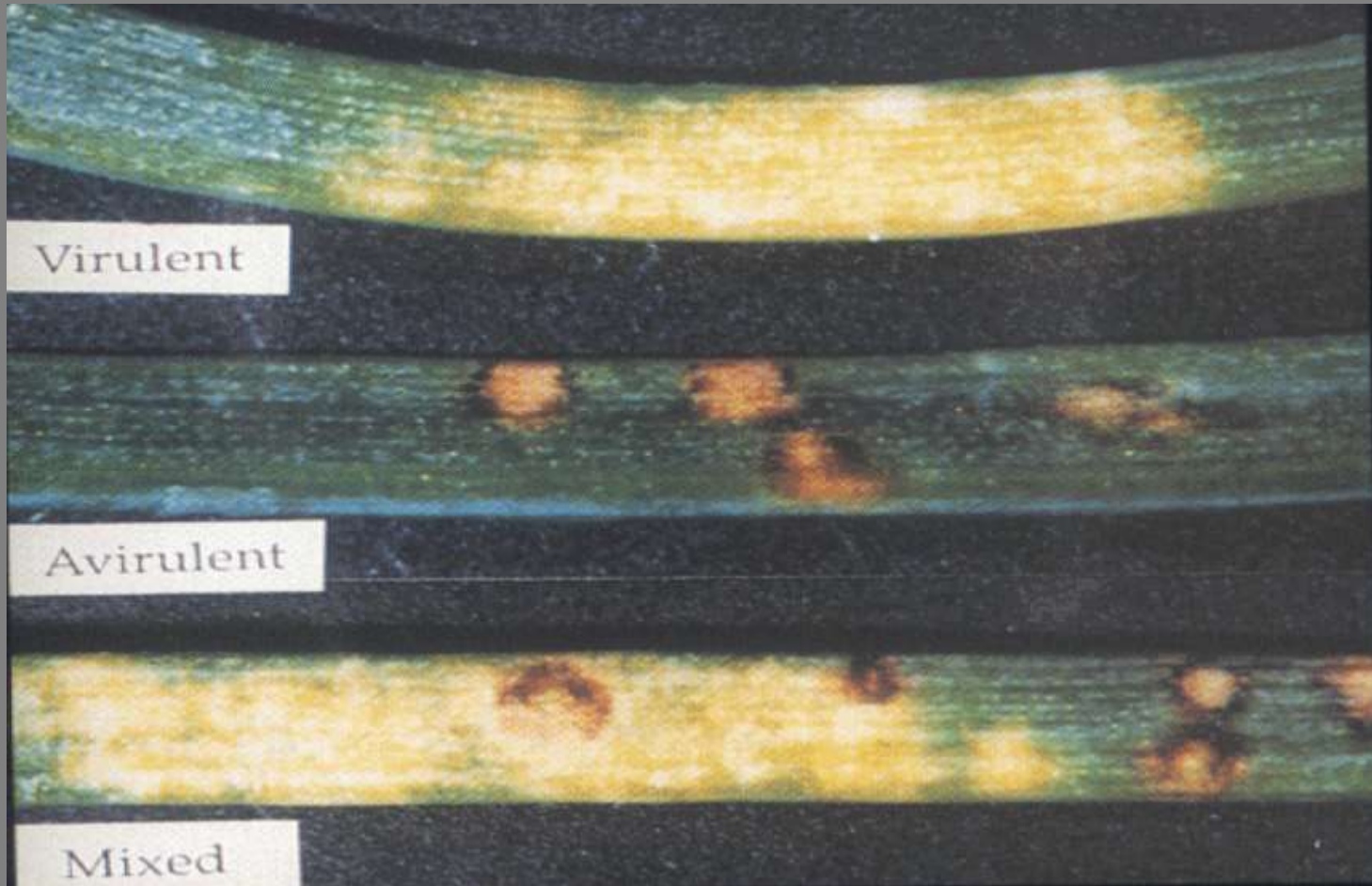
+

+

Some definitions

- Dominant (+, D) vs. recessive allele (-d)
- Virulence is recessive
- Resistance is dominant
- Single gene or vertical resistance (easier to select for, but also easier to overcome)
- Multi gene or horizontal resistance

Lesion types: sugar pine



Why don't plants accumulate infinite numbers of R, resistance genes?

- There is a cost associated with each R gene that is selected by an individual, the more R genes the less energy there is for other activities necessary for survival

Pathogenic microbe must have:

- Avirulence gene (lack of elicitor) and/or presence of effector
- Ability to express pathogenicity genes: for instance cellulases, cutinases or toxins or....effectors