

Intricacies in ecological networks

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Ecological networks

- **Historically**
 - Trophic only
- **Recently**
 - Mutualisms only
- **More recently:**
 - Both trophic and non-trophic
 - **Direct**
 - Pollinators
 - Seed dispersers
 - Other mutualists
 - **Indirect**
 - 'Facilitation'
 - Competition

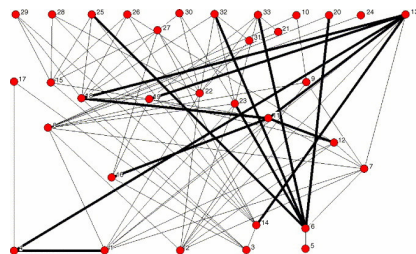
Characteristics of Interactions

- **Direct vs. indirect**
 - Indirect: mediated through other species
- **Physically involved vs. not**
 - Eating species X versus releasing harmful chemicals

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- **Prevalence**
 - Proportion of the population affected
- **Negative/ Positive**
 - Cost/benefit balance
- **Strength**
 - Death vs. slight reduction in fitness
- **Change in time**
 - Interactions temporary or permanent

Mapping trophic and non-trophic effects

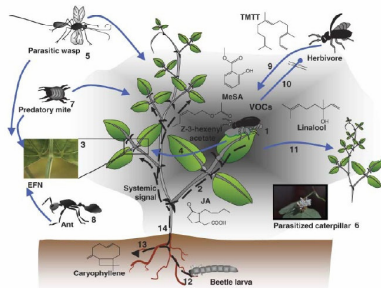


Vasas & Jordan 2006

Interactions

Effect on Y	Effect on X	Name
0	0	Neutralism
-	0	Amensalism
+	0	Commensalism
-	-	Competition
+	+	Mutualism
+	-	Predation/ Parasitism

Example: Parasitoid wasps



Indirect interaction

- Indirect defence: when plants attract, nourish, or house other organisms to reduce enemy pressure.
- Indirect interaction between parasitoids and plants: mutualism?

Parasitoids

- Expected to be highly co-evolved with host and host plant, since entire development is host-dependent
- Approximately 70,000 described species (estimated to be ~1 million)
- Have been shown to respond to host-specific plant alarm volatiles

Aphids

Acyrtosiphon pisum



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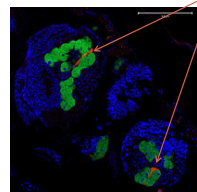
Parasitoid

Aphidius ervi



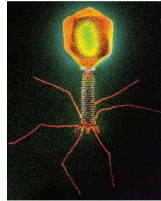
Symbiont

Hamiltonella defensa



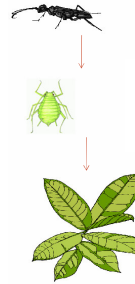
Bacteriophage

APSE

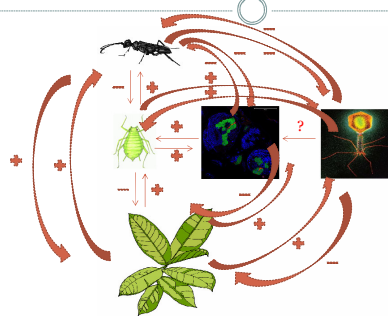


(Generic phage picture)

Interaction

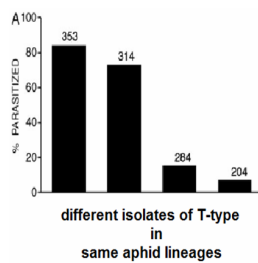


Mapping interactions



Characteristics of interaction

Strength



Prevalence: ?
Cost/ benefit: ?

Other networks

• Applying this to other networks

- Social networks:
 - Strength
 - Interactions with acquaintances vs. good friends
 - Type
 - Interaction with boss vs. mate
 - Relationship in space and time
 - Geographical proximity
 - Length and duration of interaction

Useful for predicting disease transmission

Questions

- Can the complexities of biology ever be captured in schematics?
- How do we detect and evaluate non-visible interactions?
- Do these networks have any predictive power for population dynamics?
- What same patterns might emerge in different communities?

Case studies

- Wolbachia/arthropods
- Parasites
- Endosymbionts
- Competitors
- Vectors
- Viruses
- Multi-faceted interactions
 - Eg. *Manduca sexta* / *Datura wrightii*