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
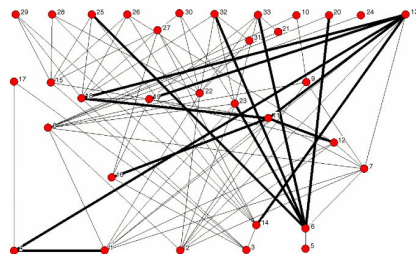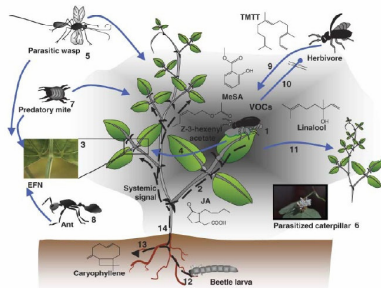

Vasas & Jordan 2006

Interactions

Effect on Y	Effect on X	Name
o	o	Neutralism
-	o	Amensalism
+	o	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

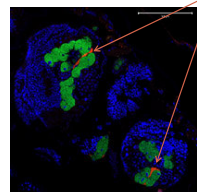*Acyrthosiphon pisum*

©Alex Wild
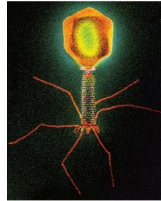
Parasitoid

Aphidius ervi
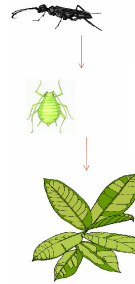

Symbiont

Hamiltonella defensa

Bacteriophage

APSE

(Generic phage picture)

Interaction

Mapping interactions
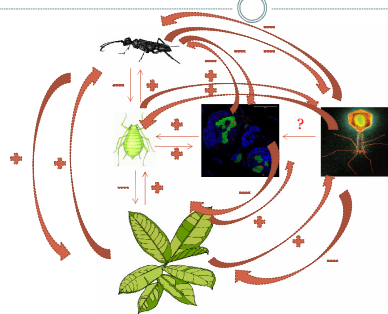
Characteristics of interaction

Strength

different isolates of T-type
in
same aphid lineages
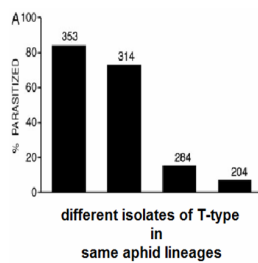
Prevalence: ?
Cost/ benefit: ?

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