The cotton aphid as a pest and vector of *Cotton leafroll dwarf virus*

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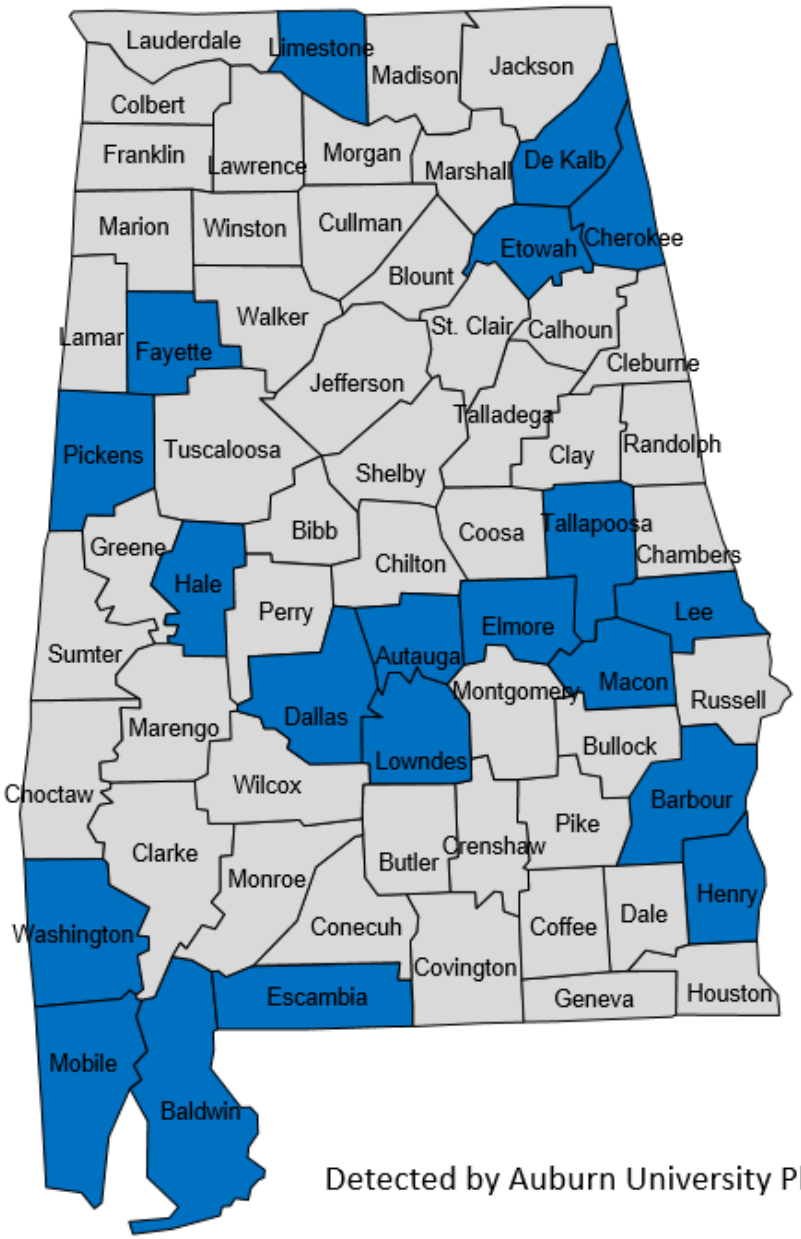
Cotton leafroll dwarf [-like] virus

- Family: *Luteovirus*, Genus: *Polerovirus*
- New report for U.S. - widespread across southern Alabama in 2017 & 2018.
- Sequence divergence high enough to be new species.
- Closely related to South American CLRDVs
  - Typical CLRDV
  - 'atypical' CLRDV



Detected by Auburn University Plant Diagnostic Lab

- December 2018 Distribution Map
- Detections in GA and MS
- Large variation symptoms across AL
- Crop loss more severe in south Alabama
  - Up to 100%
- More severe in late-planted cotton

CLRDV in Alabama in 2018

- The cotton aphid is the reported vector of CLRDV.
- Cotton aphids infest cotton mid-late June
  - Southern AL - Headland
    - Infested cotton week of June 18
    - Populations had not crashed July 10
  - Central AL - Shorter
    - Infested cotton week of June 25th
    - Populations had not crashed July 20th
- CLRDV symptoms appeared September 2018
- Detected in all varieties tested

Kathy Lawrence,
Drew Schrimsher

Austin Hagan

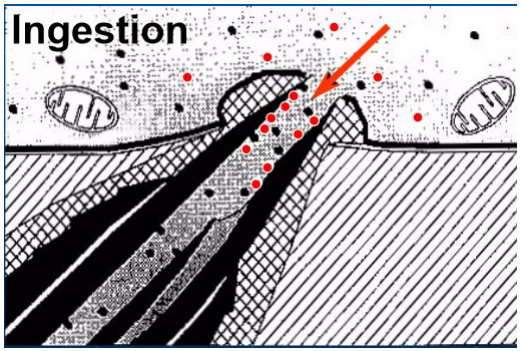
Cotton Aphid - *Aphis gossypii* Reported vector of CLRDV

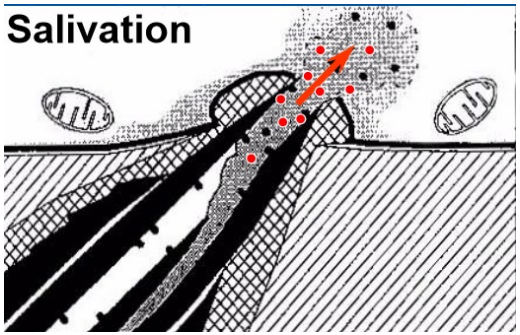
Overview:

- Cotton aphid
- Transmission of CLRDV
- Determinants of Spread
- Management

Modes of transmission for aphid- transmitted viruses

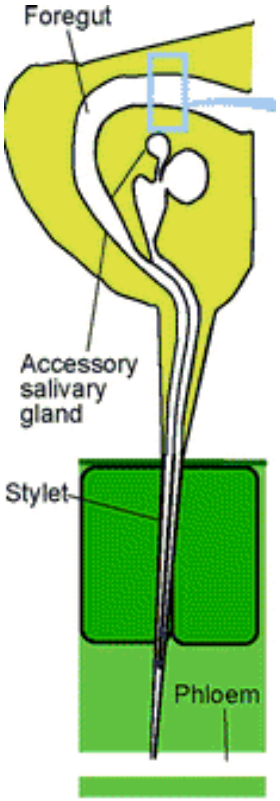
Non-circulative
Non-Persistent



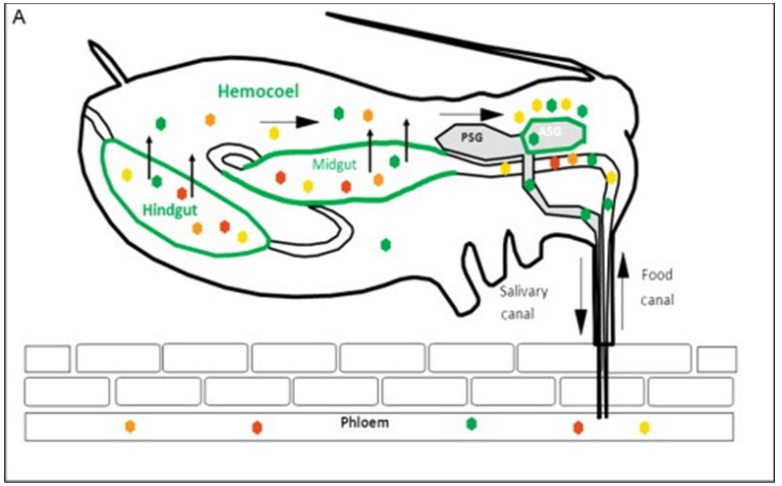


Non-circulative

Semi-Persistent



Persistent
Circulative



Transmission

Aphis gossypii
Cotton aphid

Brazil
Cotton leafroll dwarf virus

Acquisition:

- ?

Transmission:

- Apterous – 1.5 hours
- **Alates – 40 seconds**

Longer feeding increases probability of transmission

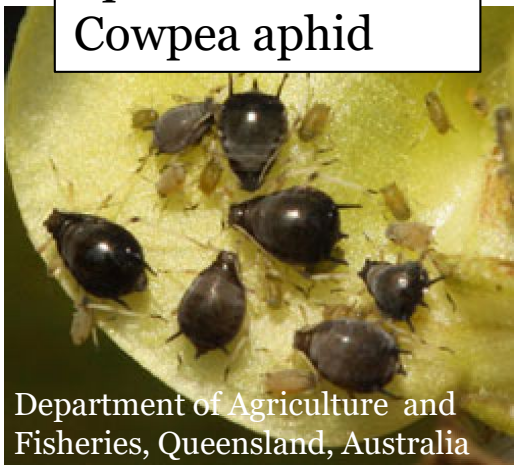
Retention:

- 12 days

**Persistent*

Aphids Colonizing Cotton in the U.S.

Aphis craccivora
Cowpea aphid



Myzus persicae
Green peach aphid

Aphis fabae
Black bean aphid

Rhapalosiphum rufiabdominalis

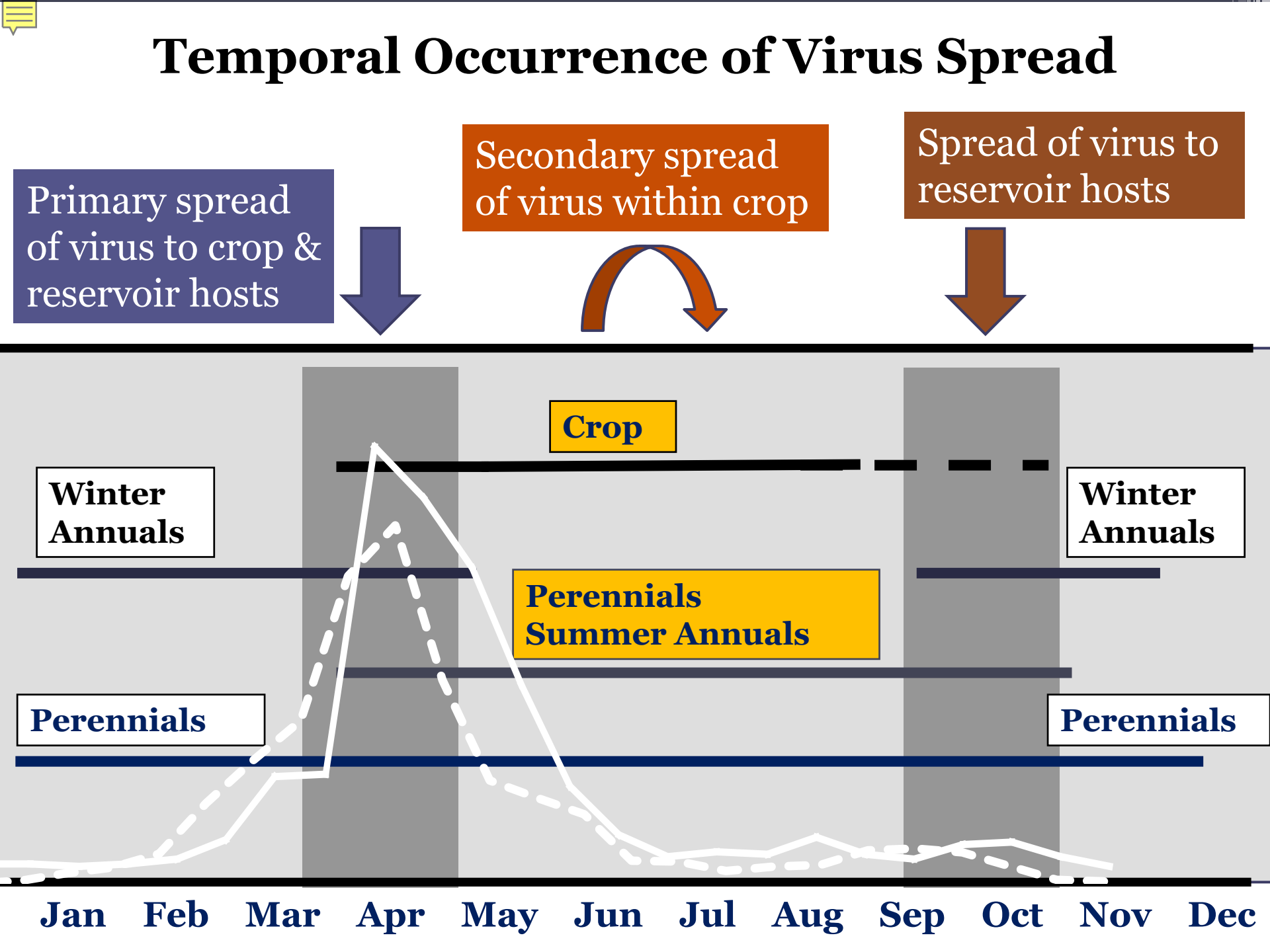
Macrosiphum euphorbiae
Potato aphid

Aphis maidiradicis Forbes
Corn root aphid

Key determinants of spread

- Transmission efficiency of vectors.
- Number of vector species.
- Amount of virus inoculum in landscape.
- Distance of inoculum from crop + dispersal behavior of vectors.
- Population size of vector species / abundance.
- Seasonal population dynamics & timing of movement in landscape.
- Susceptibility of crop to virus.
- Abiotic factors,
  - i.e. temperature (development/population dynamics), precipitation (plant growth, insect dispersal), wind (dispersal).

Temporal Occurrence of Virus Spread



Virus Inoculum

- Amount in landscape – number of host plant for the virus that the aphids will feed on.
- Distance of alternate hosts from crop – incidence decreases as distance from source decreases.

**Influenced by mode of transmission & dispersal behavior of aphid.*

- Flight ability of aphid, potential for long-distance dispersal on wind.
- CLRDV persists in vector for 12 days, which increases the potential for long-distance spread.

Virus Inoculum – Host Range

Cotton aphid

- Broad host range – 300-700 species
- Common crop hosts: Cucurbitaceae, Malvaceae, Solenaceae.
  - *Host-associated biotypes reported among local populations collected from these plant families*
    *not characterized in U.S.
- Overwintering hosts not characterized in southeastern U.S.

CLRDV

- Plants in the family Malvaceae
  - *Gossypium hirsutum*
  - *Gossypium barbadense*
  - *Gossypium mutelinium*
  - *Gossypium punctatum*
- Experimental hosts
  - *Hibiscus sabdariffa*
  - *Sida acuta*

  Fabaceae
  - *Cicer arietinum*
- *Full host range not understood*

Susceptibility of Crop

- Other risk factors – applicable for aphid feeding damage or virus incidence:
  - *Crop phenology* at the time of infestation
  - *Planting date*
  - *Cultivar* – resistant to virus or aphid
  - *Fertility* – aphid growth, plant health
  - *Severity* of infestation
  - *Climatic conditions*

Mature plant resistance

Management of Cotton Aphid in SE

- Current Recommendations for feeding injury (not virus):
- Most years populations are managed naturally by entomopathogenic fugus, *Neozygites fresenii*.
- Insecticide use avoided if possible
  - May be an unnecessary cost - At-risk cotton includes: severely infested young plants, stressed plants (i.e. drought, poor growing conditions), late-season infestations.
  - May disrupt natural enemies & flare other pests, i.e. spidermites, whiteflies, bollworms
  - Insecticide resistance is a concern – resistance reported: carbamates, organophosphates, pyrethroids, cyclodiene organochlorines, phenylpyrazoles, neonicotinoids

Management of disease spread by vectors

- Insecticides to manage **primary spread.**
  - **Killing vectors before they transmit is *not* an effective strategy.** *Can transmit in 40 seconds!*
  - Insecticides effective at reducing transmission have *antifeedant properties* – reduce feeding behaviors associated with transmission.
    - Applications must be timed *before* infestations.
    - Not likely effective at reducing 40 seconds of feeding
- Insecticides to manage **secondary spread.**
  - Killing vector populations in the crop to reduce subsequent spread within the crop can be an effective way to reduce final incidence.

Management of disease spread by vectors

- **Planting date –**
  - younger plants usually more susceptible to virus infection.

- **Resistant varieties**
  - Best way to manage insect-transmitted viruses
  - Currently no commercially available varieties with resistance

2019 Research Priorities

- Determine extent of spread across the cotton belt
- Research on epidemiology and management
  - Aphid infestations
  - Symptom appearance, progression and severity
  - Effect of plant-date
  - Yield effects
  - Epidemiology
  - Diagnostics

Thank you!

Questions?

- Drew Schrimsher, Agri-AFC
- Brad Meyer, Agri-AFC
- Kathy Lawrence, Agri-AFC
- Judy Brown, University of Arizona
- Kassie Conner, AU
- Austin Hagan, AU
- Ed Sikora, AU