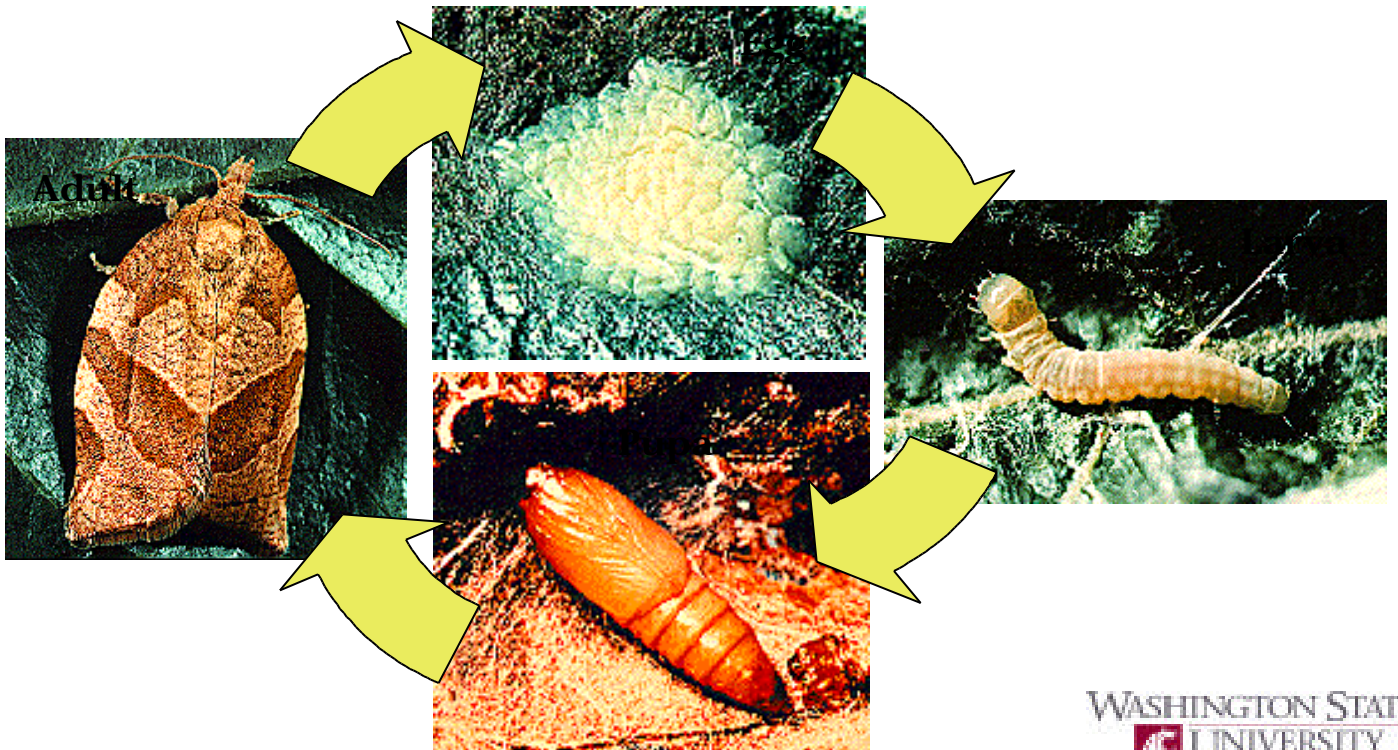


# Leafroller Management in the Year 2001

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# Pandemis Leafroller Life Cycle



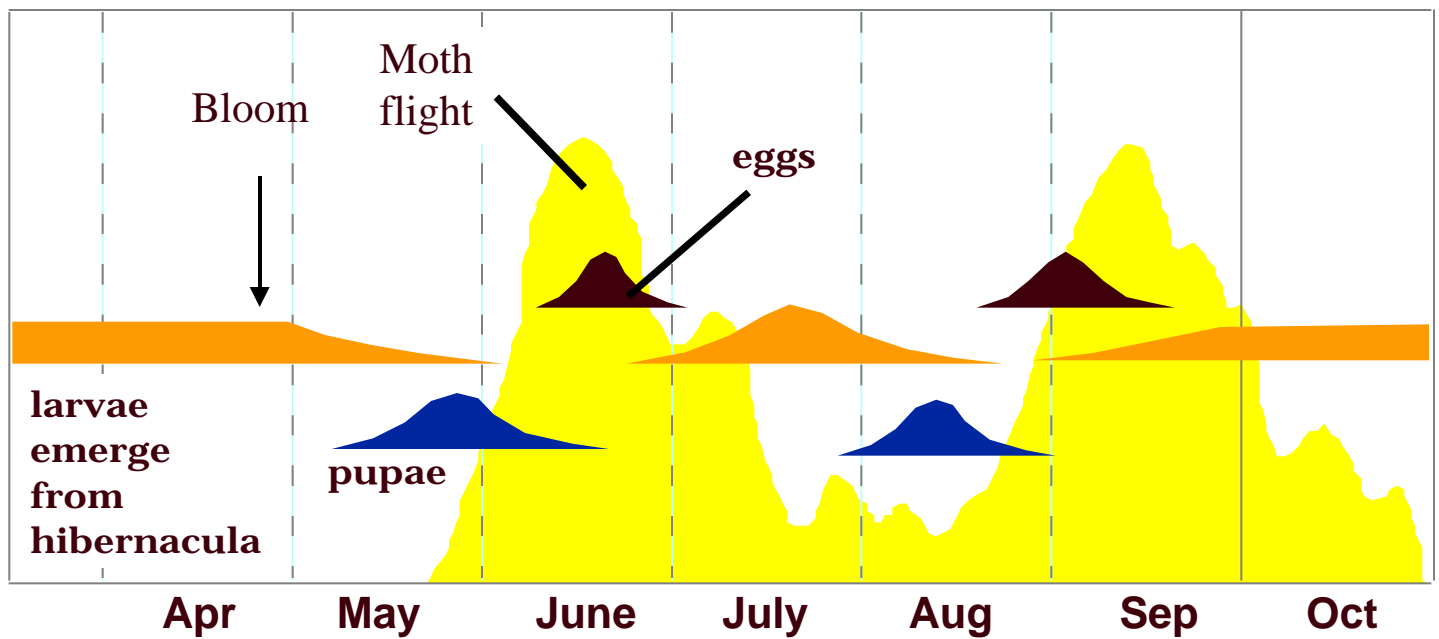
## Typical leafroller injury



## Forms of LR injury



# Typical Leafroller Life History



# Sampling

- Adults
  - Poor correlation between pheromone traps and injury
- Larvae
  - Intensive sampling required to detect small, clumped populations (grid-like pattern)
  - Clusters at PF and shoot-tips from 20% hatch during summer (DD models available)
- Thresholds
  - 2% infested buds or shoots

# Recommended Chemicals

- Clusterbud (HIG in 'Delicious')
  - Lorsban
- Bloom (Pink-Petal fall in apples)
  - Bt's (Dipel, Javelin, Biobit, Crymax, MVP)
- Summer
  - Bt's (Dipel, Javelin, Biobit, Crymax, MVP)

# Lorsban

- Active Ingredient
  - Chlorpyrifos (organophosphate)
- Mode of Action
  - Acetyl cholinesterase inhibitor in nerve synapse
- Use pattern
  - After HIG in apples, prebloom
- Efficacy
  - DD application v. important in LR management
  - Historically most active LR chemical
    - Recent reduction in efficacy noted



## *Bacillus thuringiensis (Bt)*

- Active Ingredient
  - Bacterial insecticide, 'old' chemical
- Mode of Action
  - Toxin activated by alkaline insect gut, v. selective
- Use pattern
  - 2 Apps between pink-PF in apples
  - Target young larvae in summer (20% hatch, + 10d)
  - Must apply while actively feeding
- Efficacy
  - Effective and cheap

# Alternatives

- Growth regulators
  - Confirm/Intrepid
  - Esteem
- Pyrethroids
  - Asana, Pounce, Ambush
- Particle films
  - Surround (recommended prebloom)
- Pheromones
  - Mating Disruption, Puffers, Attract and Kill
- Biological control
  - Predators and parasites

# Confirm/Intrepid

- Active Ingredient
  - Tebufenozide/ methoxyfenozide
- Mode of Action
  - IGRs, molt accelerating compounds (MAC)
  - Must be ingested, specific to lepidopteran
- Use pattern
  - Petal fall app. most effective
    - Sublethal effects on next generation, delayed mortality
  - May target LR and CM with same spray
- Efficacy
  - Intrepid generally more active

# Esteem

- Active Ingredient
  - Pyriproxyfen
- Mode of Action
  - Juvenile hormone mimic, like Comply
  - Suppress embryogenesis
- Use pattern
  - Target larger larvae at PF in apple
    - Delayed mortality, sublethal effect on hatch
  - May target LR and CM with same spray
- Efficacy
  - Provides 'suppression' of LR

# Asana, Pounce

- Active Ingredient
  - Synthetic pyrethroids
- Mode of Action
  - Na channel of nerve membrane, too much Ach
  - Disruptive to integrated mite control in apple
- Use pattern
  - Prebloom against overwintering larvae
- Efficacy
  - May have been responsible for low LR densities in pear

# Surround

- Active Ingredient
  - Particle film technology (kaolin)
- Mode of Action
  - Host masking, reduce oviposition
  - Inhibits movement/colonization of larvae
  - Moderately selective (mite/leafminer biocontrol)
- Use pattern
  - target young larvae (o/w or hatch)
  - Cumulative effect of applications
- Efficacy
  - Specific LR treatments not well studied

# Pheromones

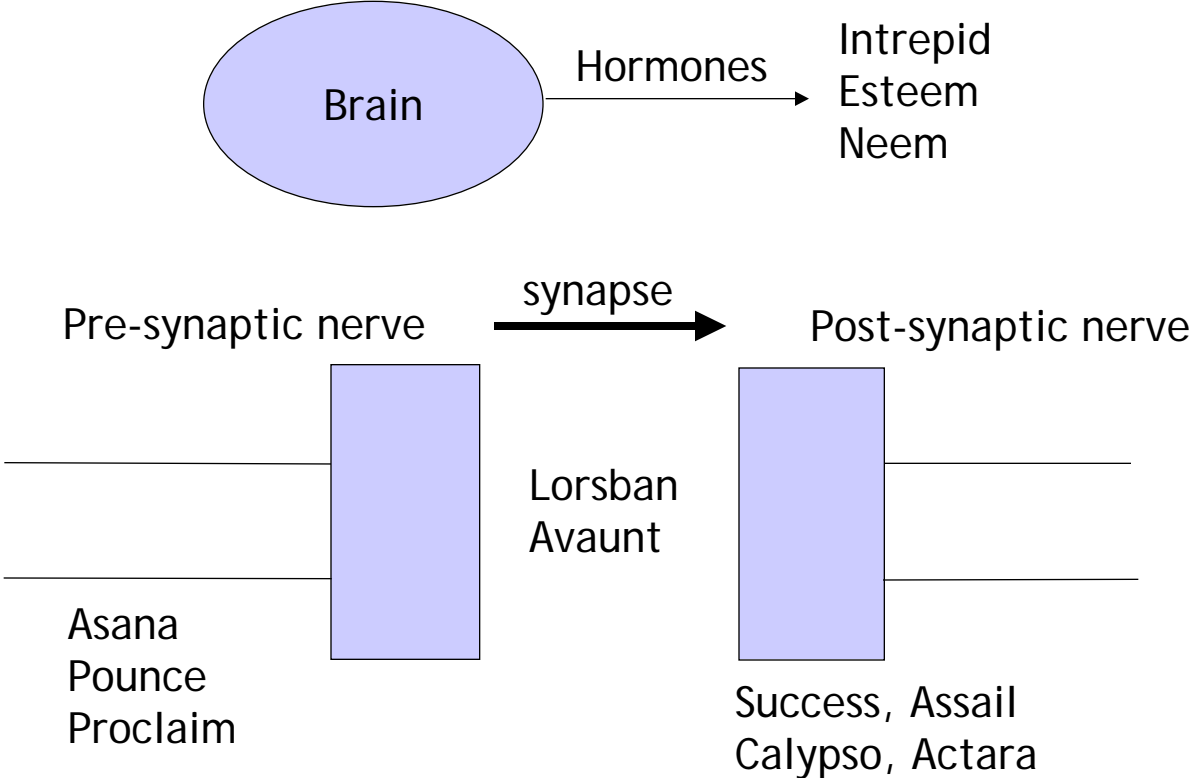
- Mating disruption
  - Delivery technologies
    - Hand applied dispensers
    - Puffers, microencapsulated sprayable pheromone, paraffin wax emulsions
  - Efficacy
    - Reduce populations 50% on average
- Attract and kill
  - Combine pheromone with insecticide
  - Species specific
  - Issues remain with application

# New products in development

- Neonicotinoids (Provado-like, with lep activity)
  - Actara, Assail, Calypso
  - Binds Ach receptor on post-synaptic nerve
- Carbamates (Achase inhibitor like OPs)
  - Avaunt
- Miscellaneous
  - Neem products (IGR activity)
  - Success (Binds Ach receptor on nerve synapse)
  - Proclaim (Agrimek-like, Cl channel on nerve m/b)



# Summary of modes of action



# Biological Control

All life stages except adult are attacked by several different kinds of parasites

