Cherry Fruit Fly Management with Reduced Risk Insecticides

and Recent Advances in Codling Moth Management

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Insecticides Registered for WCFF in Utah

Product	REI	PHI
Imidan*	24 h	7 d
Lorsban*	4 d	14 d
Asana	12 h	14 d
Warrior	24 h	14 d
Guthion	15 d	15 d
Diazinon	24 h	21 d
Dimethoate	Post-harvest	

*for tarts only

Product	REI	PHI
Sevin	12 h	3 d
Malathion	12 h	1/3 d
Diatect	12 h	12 h
Provado	12 h	7 d
Actara	12 h	14 d
Spinosad		
Success	4 h	7 d
Entrust	4 h	7 d
GF-120	4 h	4 h

Efficacy of GF-120 & Provado Field Sites - 2004 & 2005

- 9 study sites
  - 2 were the same research orchard replicated in '04 & '05 (tart cherry)
  - 7 were commercial orchards (2 sweets, 5 tarts)
  - GF-120 applied every 4-7 days; 5-7 applications
  - Provado applied every 14 days; 2-3 applications

Fruit Protection

GF-120 Research Trials, Kaysville (Tart Cherry)

2004

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Control	1211 a	44.7 a
Guthion	249 b	1.1 b
GF-120	187 b	0.3 b

2005

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Control	474 a	9.3 a
Guthion	69 b	1.3 b
GF-120	48 b	0.1 b

6 or 8 reps.; 0.2 acre plots
12 or 16 traps; 3,000 or 4,000 fruits x 3 dates
High WCFF population !

GF-120 On-Farm Trials,2005

Sweet 1

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Guthion	3.4	0
Provado	3.6	2.4
GF-120	4.2	0.8

*Very low crop load

Sweet 2

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Guthion	1.1	0
GF-120	1.4	0

Tart 1

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Guthion	0.4	0
GF-120	0.6	0

Tart 2

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Guthion	0	0
GF-120	0.2	0

5 reps.; 0.4 to 1.2 acre plots; 16 traps; 2,500 fruits x 3 dates

GF-120 Fruit Protection

- Injury in GF-120 plots in 3 out of 6 field trials, but it was low (0.1-0.8 cum. larvae per 100 fruit)
- Detectable injury occurred when:
  - High WCFF adult pop. (48 & 187 mean cum. adults per trap)
  - Low crop load & mod. adult pop. (4.2 mean cum. adults per trap)
- Sites with $\leq$1.4 cum. adults per trap had no detectable injury
- Large enough sources of mature adults caused "small failures" in fruit protection

Provado On-Farm Trials, 2004

Tart 1

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Guthion	0.5	0
Provado	0.8	0

Tart 2

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Dimethoate	4.6	0
Provado	4.5	0

Tart 3

Trt.	Mean Cum. # Adults per Trap	Mean Cum. # Larvae per 100 Fruit
Guthion	0	0
Imidan	0	0
Provado	0	0

5 reps.; 0.4 to 2.4 acre plots; 16 traps; 2,500 fruits x 3 dates

Provado Fruit Protection

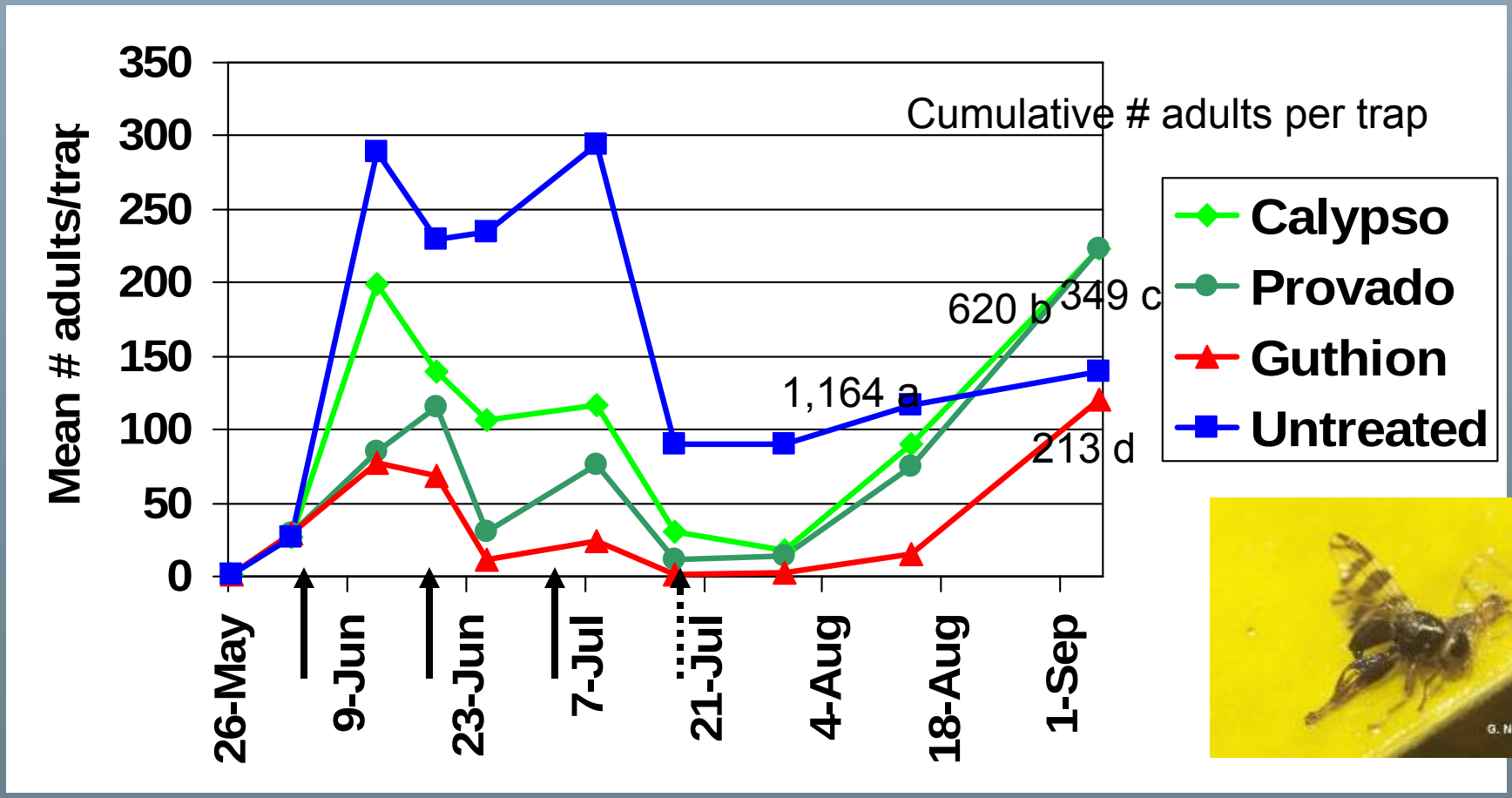
- Injury in Provado plots in 1 out of 4 field trials (sweet; low crop load; 2.4 cum. larvae per 100 fruit; 3.6 cum. adults per trap)
- No injury in tarts (0-4.8 cum. adults per trap)
- Source of adults:
  - Interior traps
  - Border traps
- Risk of fruit injury when adult pops. exceeded 3.6 cum. adults per trap

How do new, reduced risk insecticides kill fruit flies?

Adults

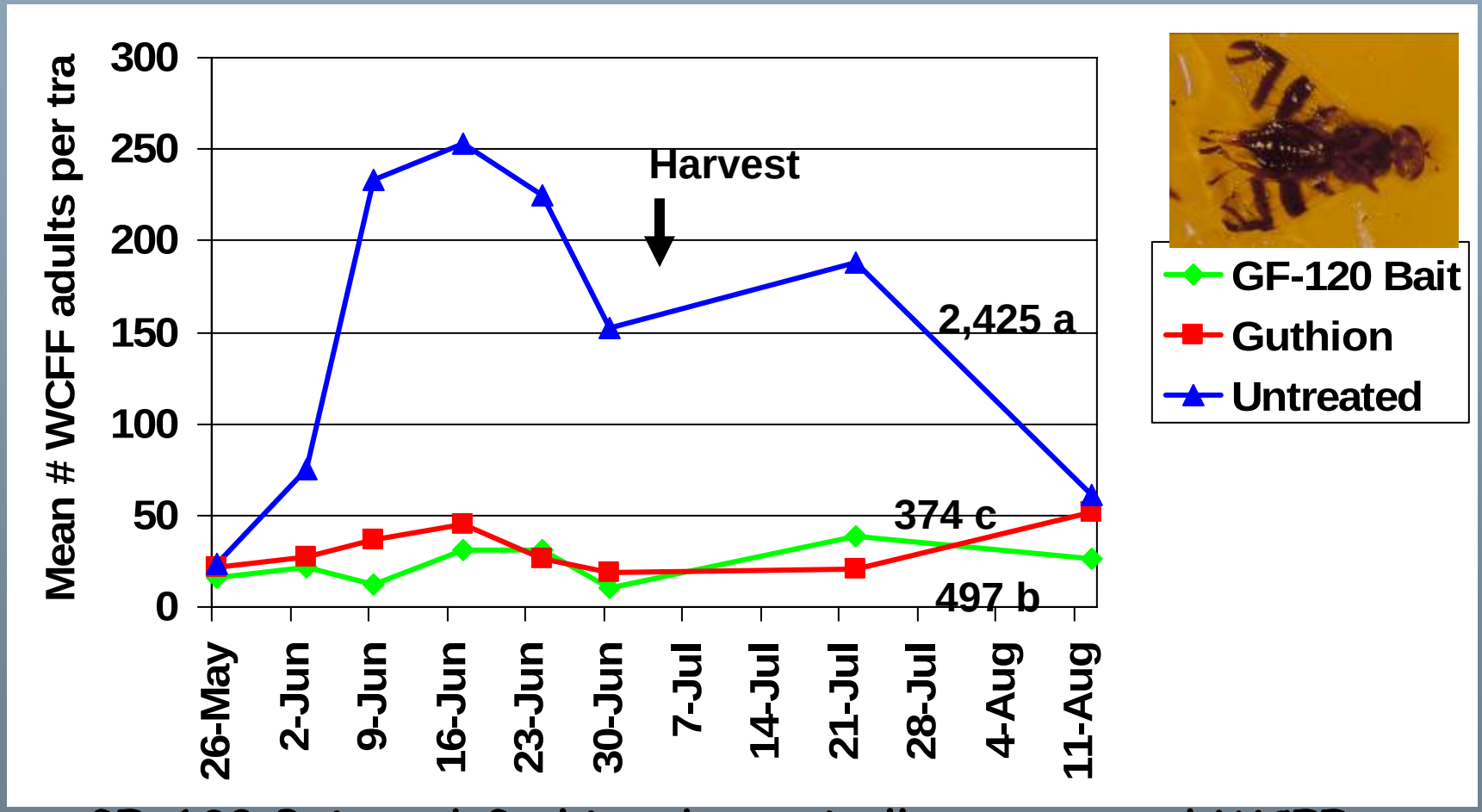
Eggs & Larvae

Neonicotinoid insecticides are only moderate adulticides



Solid arrows indicate insecticide spray timings; broken arrow indicates cherry harvest date

Spinosad is a good adulticide



GF-120 Bait and Guthion dramatically suppressed WCFF pops.
Guthion: 76% flies caught next to Untreated
GF-120 Bait & Guthion suppressed populations post-harvest

GF-120 Mode of Action

- Bait in GF-120 is a weak attractant, but a strong arrestant
- Adult fruit flies that feed on GF-120 are killed quickly
- 0.02% a.i. spinosad is highly toxic to adults when ingested
- Need to keep enough GF-120 available for adult population size
- Not rain-fast
- Reapply every 5-7 d & after rain

Provado Mode of Action

- Systemic – uptake by fruit kills eggs & small larvae
- Contact – weak to moderate adulticide
- Under high populations in Kaysville research orchard – 14 d of fruit protection

How do new insecticides affect mites?

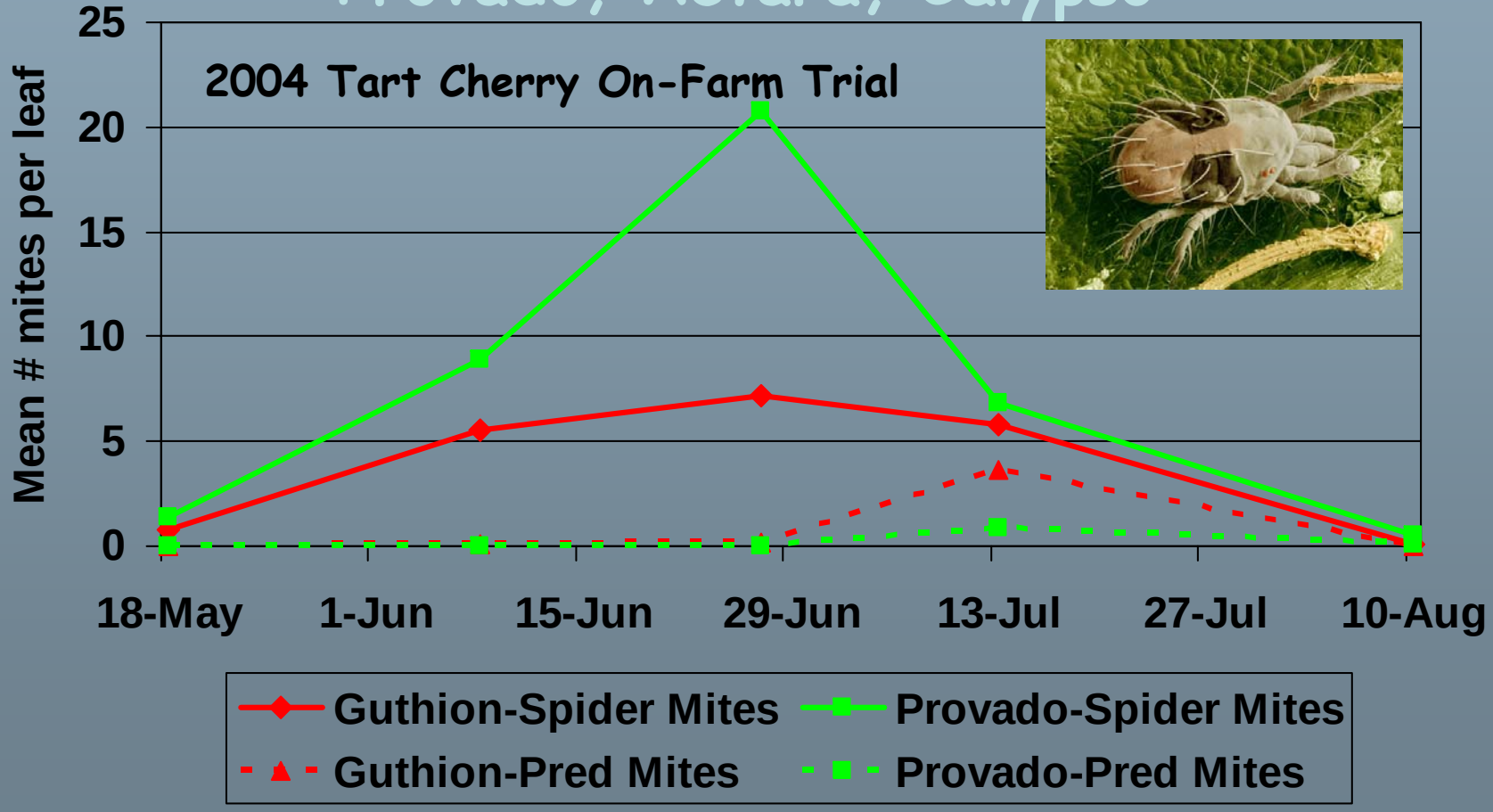
Two spotted spider mites

Mite burn on cherry leaves

Predaceous mite eating spider mite

Spider Mite Population Stimulation with Multiple Applications of Neonicotinoid Insecticides

Provado, Actara, Calypso



Provado increased spider mite densities vs. Guthion

Pred mites increased in mid July – too late

Take Home Points on New WCFF Insecticides

- New insecticides offer greater flexibility in REIs & PHIs
- GF-120 offers an alternative application method
- Differ in target stage efficacy
  - Provado – larvicide, kill eggs/larvae inside fruit
  - Success / GF-120 – adulticide
- Cannot protect fruit against migrating, mature adults – in Utah, ff sources are within & outside orchards
- Rotate neonicotinoid insecticide applications – mite stimulation

Codling Moth Management

- Critical factors:
  - Reduce population size to manageable level
    - Mating disruption
  - Time sprays for peak egg hatch (& peak egg laying) periods
  - Use a diverse management program
    - Avoid insecticide resistance
    - Target eggs & hatching larvae

Codling moth adults in trap

Advantages of Mating Disruption (MD)

- Can reduce populations
- Can reduce fruit damage
- Can save money
- Can reduce worker safety concerns
- Can supplement newer, more selective insecticides
- Can allow biological control agents to increase
- No documented resistance

CM MD Products

- Hand-applied

Product	Company	Load (mg)	Rate per acre
Isomate C Plus	Pacific Biocontrol	110	400
Isomate C TT	Pacific Biocontrol	230	200
No Mate CM	Scentry Biologicals	120	400
Check-mate CM	Suterra	270	200
Disrupt CM Extra	Hercon	180	200

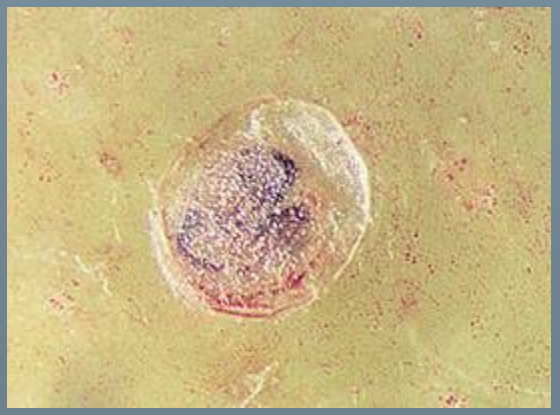
- Aerosol Puffers
- Sprayable
  - Checkmate CM-F

Isomate-C Plus dispenser

Supplemental Insecticides: Target Eggs & Larvae

- Larvicides, Ovicides, or Both (Intrepid, Esteem)
- Larvicides
  - Contact (most)
  - Ingestion (biologicals)
- Ovicides
  - Topical (oil, Assail, Calypso)
  - Residual (Esteem)
  - Both (Intrepid, Rimon)

1st instar larva



CM egg with dead larva

CM Integrated Insecticide Program – Disrupt more than one stage

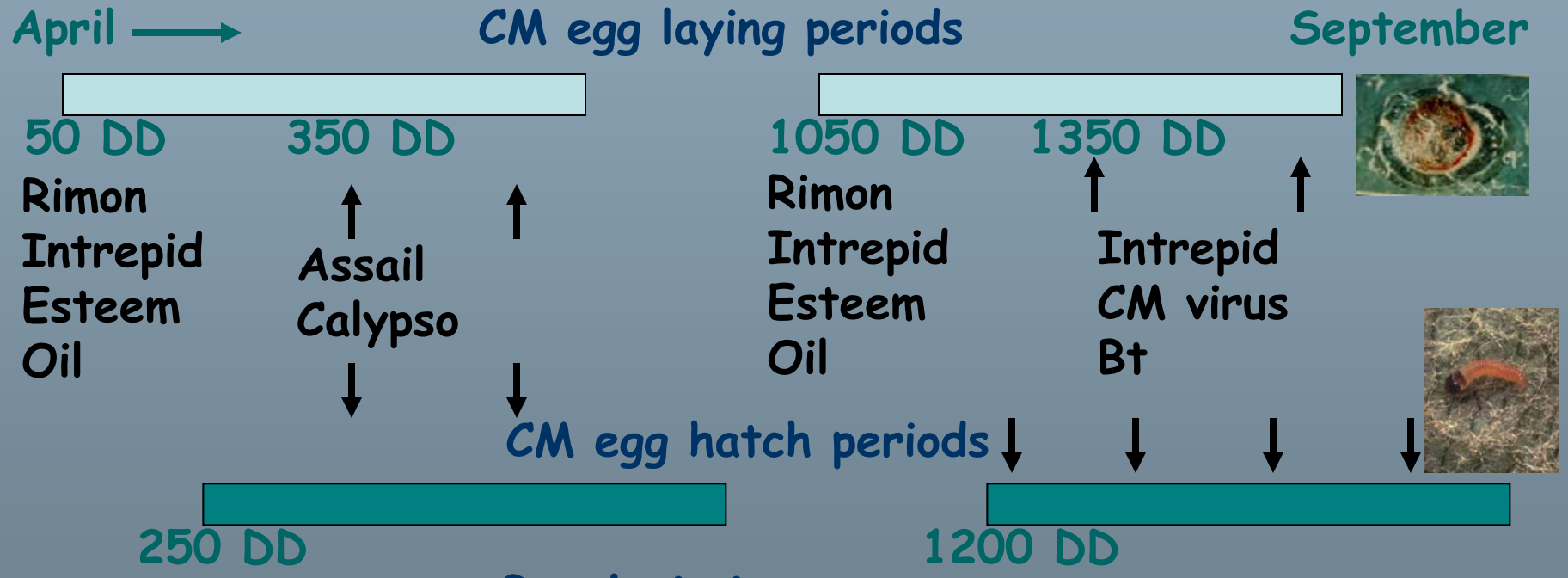
- Ovicide: 50-100 DD
  - Control first ~12% of egg hatch
  - Kill eggs before they hatch, delay larval control
- Larvicide/Ovicide: 350 DD
  - Optimizes residues for ~70% of egg hatch (340 – 660 DD)

For 1st generation:

#1
50-100 DD: Rimon, Intrepid or Esteem
350 DD: Assail
21 d later: Calypso

#2
100 DD: Oil or IGR
350 DD: Assail or Calypso + Rimon or Intrepid

New CM Insecticides Diverse Rotation Program



Good timing
Target different life stages
Rotate within & between CM generations
Mixtures

From Brunner et al. Managing Apple Pests without OPs

CM Adult Monitoring

- Lure options:
  - 1X, 10X, DA (pear ester), Combo
- Trap options:
  - Delta (large, orange) – catch fewer bees, more males
  - Wing – not recommended
- Trap position in tree – upper 1/3 canopy
- Trap density – 1 trap per 2-3 acres
- Trap placement – borders & interior
- Thresholds – vary with lure & time of season (2-4 moths)

Long-term, sustainable CM Mgmt. Program

- MD allows population reduction, if needed
- More options & flexibility for insecticide program
- Target both eggs & larvae
- Use only as many sprays as needed to maintain low CM population
- Monitor moths!

IR-4 Project for a New Cherry Miticide - 2006

- Michigan State U., Rutgers U., & Utah State U.
- Acequinocyl (Kanemite 15SC)
- Cherry (Tart & Sweet)
- Two spotted spider mite, European red mite
- 7 d PHI; 2 applications per season
- Suppresses respiration; mitochondrial electron transport inhibitor (METI)
- Registered on pome fruits, strawberries, ornamentals

Guthion Registration Update

- Group 3 uses – Time limited reg.:
  - Apple, pear
  - Sweet & tart cherry
  - Walnuts, almonds, pistachios
- April 3, 2006 – EPA decision on continuation
- Group 2 uses – Phase out reg.:
  - Peach, nectarine
  - Caneberries
- Group 2 uses terminated in 2005

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