



## USDA TART CHERRY ORCHARD MANAGEMENT (RAMP I) FOUR-YEAR SUMMARY FOR UTAH: "MONITORING AND MANAGEMENT ALTERNATIVES FOR CHERRY FRUIT FLY AND PLUM CURCULIO"



Diane Alston, Entomologist, Utah State University  
2008 NW MI Orchard and Vineyard Show, Traverse City, MI


### RAMP Objectives:



- 1A. Develop alternative insect management options for on-farm use (reduce dependency on organophosphate insecticides)
- 1B. Evaluate monitoring and trapping systems
- 1C. Optimize management strategies, tactics, and tools
- 3A. Impacts on ecosystem quality and non-target effects
- 4. Extension and outreach

### Develop alternative insect management options for on-farm use (reduce dependency on OP insecticides)

- A. Western cherry fruit fly
  - i. Imidacloprid (Provado®)
  - ii. Spinosad formulated as a bait (GF-120®)



Photos Courtesy: Shavita A. Shafir, Utah State University, Extension

### Efficacy of new insecticides Commercial orchard trials

Year	Orch #	Treatment*	# CFF larvae <sup>A</sup>	Year	Orch #	Treatment*	# CFF larvae <sup>A</sup>
2004	1	Guthion	0	2005	6	Guthion	0
		Provado	0			GF-120	0
	2	Dimethoate	0	7	Guthion	0	
		Provado	0		GF-120	0	
		Provado	0		GF-120	0	
2005	3	Guthion	0	2006	8	Provado/Guthion	0
		Imidan	0			9	Provado/Imidan
		Provado	0		10	Provado/GF-120	0
		Guthion	0 c		11	Provado/GF-120	0
2005	4	Provado	2.4 a	12	GF-120	0	
		GF-120	0.8 b	13	Provado/Guthion	0.0002	
		Guthion	0	14	Provado/GF-120	0	
		GF-120	0	15	Provado/GF-120	0.0004	
		GF-120	0				

\*Total of 2-6 applications per season, ^Cumulative # CFF larvae per 100 fruit (2,000-5,000 fruit sampled per orchard)

### Efficacy of new insecticides Research orchard trials

Year	Orch #	Treatment*	# CFF larvae <sup>A</sup>	Year	Orch #	Treatment*	# CFF larvae <sup>A</sup>
2004	16	Untreated	44.7 a	2007	19	Untreated	9.1 a
		Guthion	1.1 b			GF-120	1.9 b
		GF-120	0.3 c			GF-120+AA	0.8 b
2005	17	Untreated	9.3 a			GF-120+U	1.4 b
		Guthion	1.3 b			GF-120+TY	0.5 b
		GF-120	0.1 c			GF-120+CCJ	0.9 b
2006	18	Untreated	10.0 a	*Total of 2-6 applications per season; AC=ammonium carbonate, AA=ammonium acetate, U=urea, TY=torula yeast, & CCJ=concentrate cherry juice (10% w/v)  ^Cumulative # CFF larvae per 100 fruit (2,000-5,000 fruit sampled per orchard)			
		GF-120	4.0 b				
		GF-120+AC	3.3 b				
		GF-120+AA	0.3 c				
		Success	2.3 bc				
Provado	1.8 bc						

### Insecticide efficacy summary

- Spinosad (GF-120 and Success) and imidacloprid (Provado) offer greater flexibility in REIs and PHIs than OP insecticides
- GF-120 offers an alternative application method
- The two products differ in pest target stage
  - Provado: larvicide (ovicide), & adulticide
  - Spinosad: adulticide
- GF-120 cannot protect fruit against migrating females that contain mature eggs
  - Prevented fruit injury for orchards ≤ ~ 20 cumulative CFF on traps
- Important to rotate applications of neonicotinoid (Provado) with other insecticide classes
  - Stimulation of spider mites

Develop alternative insect management options for on-farm use (reduce dependency on OP insecticides)

**B. Plum curculio**

**i. Influence of temperature and concentration on the performance of two entomopathogenic nematodes (EPNs)**

■ Laboratory – Wax worm larvae

**ii. Influence of EPN species and concentration on mortality of plum curculio (PC) life stages**

■ Laboratory – PC Colony

**iii. Suppression of PC by EPNs in home yard fruit trees in northern Utah**

■ Field – Brigham City, UT



Mean number of days required to kill 50% of wax worm last-instar larvae by EPNs

Source	Mean mortality of <i>G. mellonella</i> ( $\pm$ SE)
<b>Temperature</b>	
10 °C	14.3 $\pm$ 2.3 a
20 °C	3.2 $\pm$ 0.3 b
30 °C	3.9 $\pm$ 0.5 b
<b>Nematode Species</b>	
<i>H. bacteriophora</i>	8.0 $\pm$ 2.2 a
<i>S. feltiae</i>	5.2 $\pm$ 0.7 a
<b>Nematode concentration</b>	
20 IJs /larva	6.7 $\pm$ 1.6 a
50 IJs / larva	6.5 $\pm$ 1.8 a



Mean maximum corrected percent mortality of wax worm larvae caused by EPNs

Nematode Concentration	Temperature (°C)	Hb <sup>a</sup> (Mean $\pm$ SE)	Sf <sup>b</sup> (Mean $\pm$ SE)
20 IJs / larva	10	72.8 $\pm$ 20.0	100.0 $\pm$ 0.0
	20	98.9 $\pm$ 1.1	100.0 $\pm$ 0.0
	30	78.2 $\pm$ 9.8	61.74 $\pm$ 15.1
50 IJs / larva	10	87.8 $\pm$ 12.2	100.0 $\pm$ 0.0
	20	100.0 $\pm$ 0.0	93.9 $\pm$ 6.1
	30	100.0 $\pm$ 0.0	95.0 $\pm$ 5.0

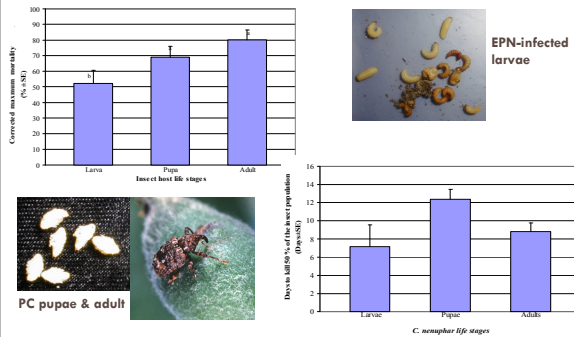
Hb<sup>a</sup> = *H. bacteriophora* and Sf<sup>b</sup> = *S. feltiae*

Influence of temperature and EPN species on total cumulative nematode reproduction

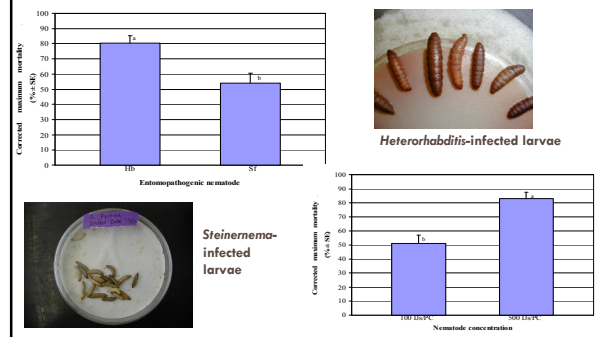
Source	Total cumulative nematode reproduction ( $\pm$ SE)
<b>Temperature</b>	
10 °C	11,150.8 $\pm$ 1,720.8 b
20 °C	143,002.6 $\pm$ 1,0713.5 a
30°C	113,541.2 $\pm$ 1,3883.6 a
<b>Nematode Species</b>	
<i>H. bacteriophora</i>	173,943.5 $\pm$ 1,3409.3 a
<i>S. feltiae</i>	63,187.6 $\pm$ 5,680.8 b



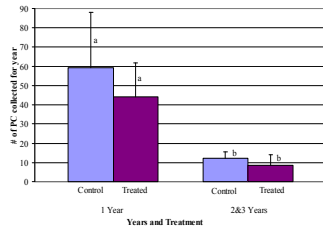
Susceptibility of PC life stages to EPNs



EPN virulence to PC



## Field suppression of PC with EPNs

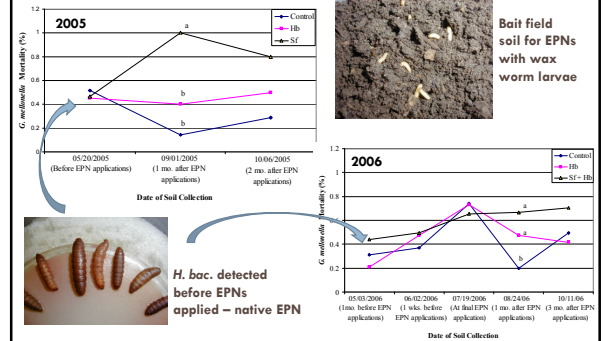


EPNs applied with backpack sprayer



Trunk screen traps monitored PC adults

## Recycling (self-perpetuation) of EPNs in the field



## Evaluate monitoring and trapping systems

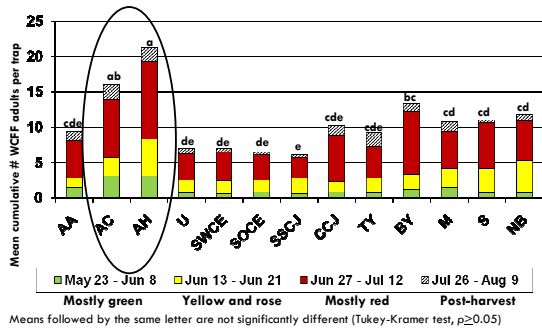
- A. Western cherry fruit fly
  - Trap placement / position
  - Trap density
  - Adult attractants
    - Traps
    - GF-120 droplets
  - Insecticide effects on adult dispersal

## Summary Points on Trap Density and Placement

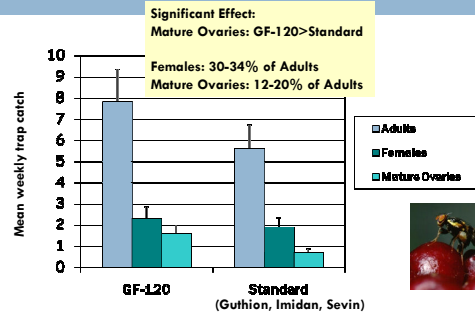
- Higher trap density increased adult trap catch
  - 3 traps per acre > 1 trap per acre > 4 traps per orchard
- Adult catch on border vs. interior traps varied
  - More adults caught on border than interior traps in some years and orchards
  - Varied with primary source of fruit fly population
  - In one study, greater proportion on border traps were males
  - Males may disperse differently than females
- Percentage of adults caught was greater in orchards with traps on both borders and within interiors
  - First catch was an average of 2.4 days earlier
- Adults were caught earlier in orchards with higher fruit fly densities



## Adult attractants on traps



## Insecticide effects on adult dispersal



\*For 16 traps in each treatment of 6 cherry orchards from late May to mid Aug, 2004 & 2005



