FINAL PROJECT REPORT
WTFRC Project Number: #AE-05-505

Project Title: Distribution of flower thrips eggs in apple blossoms

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Budget History:

Item	Year 1: 15000	Year 2: 15000	Year 3:
Salaries	15,000	15000	
Benefits			
Wages			
Benefits			
Equipment			
Supplies			
Travel			
Miscellaneous			
Total	**15000**	**15000**	

OBJECTIVES:

Describe egglaying preferences of western flower thrips among non-damaging and potentially damaging areas within the flower/fruitlet cluster in apples. Assess whether preference changes with apple phenology.

SIGNIFICANT FINDINGS:

- Developed method to survey tissues for presence of thrips eggs in apple tissues that avoid difficulties in earlier published methods
- Showed that adult thrips numbers in blossoms peaked at full bloom. Egg and nymphal counts lagged adult phenology
- Showed that adults were absent or at low densities at pink, petal fall, and post-petal fall
- Showed that almost no eggs were deposited in damaging areas before petal fall. The calyx was highly preferred until well after petal fall
- As the calyx dried following petal fall, there was a shift of egglaying to the stem and developing fruitlet, but because adults had mostly disappeared from the orchard at this time, only very few damaging eggs were actually found
- To confirm this shift in egglaying preferences, we introduced egglaying adults onto apple clippings in the laboratory. The developing fruitlet became highly preferred as the fruitlet reached the 10-25 mm stage

- **CONCLUSION:** Results suggest that optimal timing for insecticide applications is between full bloom and petal fall.

METHODS

Sampling methods for adults and nymphs followed techniques developed earlier by Miliczky (swishing of clusters in soapy water). Assessment of egg densities was done using methods developed in Horton's laboratory in 2005. Briefly, the tissues are immersed in a warmed solution of white distilled vinegar and blue food coloring. The vinegar and warming allows us to easily tease away the top layer of the plant tissues, exposing the (bluish-colored) oviposition scar and associated egg. Samples were taken at pink, king bloom, full bloom, petal fall, and 10-25 mm fruitlet. Clippings having cut ends placed in water are infested with adult thrips in the laboratory to obtain egglaying at those stages in which adult thrips were absent from clusters in the field.

RESULTS AND DISCUSSION

Figure 1 shows densities of adults, nymphs, and eggs of flower thrips at three orchards. Egg and nymphal population curves trail adult curves, as is expected. Peak egg numbers occurred at full bloom and petal fall. Adults disappeared from clusters at petal fall.

Egg distribution among tissues (combined across orchards) is summarized in Tables 1-2. No or few eggs were found at pink, king, and 10-25 mm fruitlet (as shown also in Figure 1), due to low densities of adult thrips at these times. The calyx was heavily preferred until after petal fall. Eggs deposited in potentially damaging areas were first obtained at full bloom (2005) or petal fall (2006), peaking at petal fall (2005) or 10 mm fruitlet stage (2006).

Because few eggs were present in field material at pink, king, and the 10-25 mm stage, preference could not be reliably assessed. We artificially infested clippings in the laboratory to assess egglaying preferences during these phenological stages (Tables 3-4). At pink and king stages, we obtained large numbers of eggs. None were deposited in potentially damaging areas, suggesting that

even if adults happened to be present in the orchard at those times, eggs would not to be deposited in damaging areas. However, at the 10-25 mm stages, a very high percentage of eggs had been deposited directly on the developing fruitlet. Thus, if egglaying adults happen to be present in clusters at this phenological stage, there appears to be considerable potential for damage. Table 5 summarizes important conclusions from these studies, including timing of infestation and appearance of damaging eggs in the field.

Figure 1. Number of thrips per blossom cluster at each of three orchards, 2005-2006.

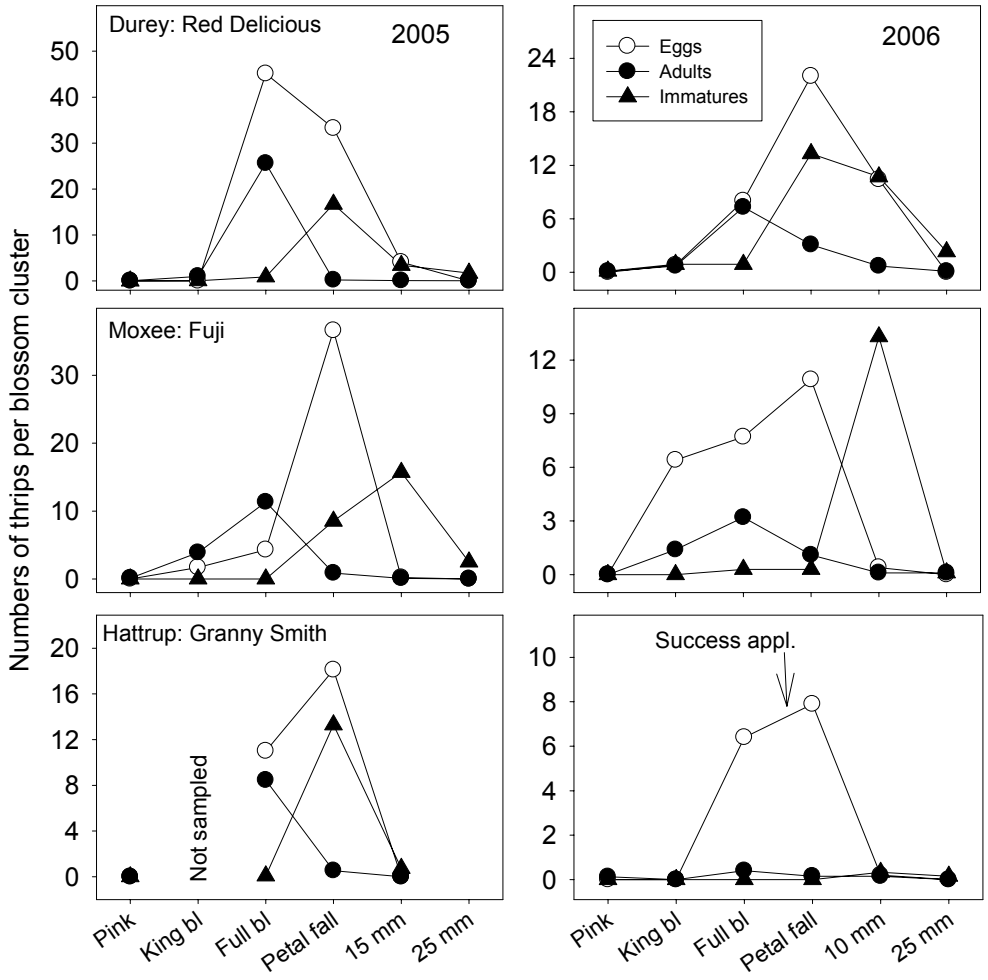

Table 1. Distribution of thrips eggs on field-collected material (2005). Orchards combined.

		Percentage of eggs deposited in:				
Apple stage	**Total # eggs**	**Stamen**	**Calyx**	**Stem**	**Leaves**	***** "Fruitlet"**
Pink	0	--	--	--	--	--
King bloom	16	0	74.2	19.4	6.4	0
Full bloom	286	0.8	84.0	13.0	1.8	0.4
Petal fall	513	4.4	67.2	20.4	4.6	3.4
15-25 mm	31	0	8.5	90.0	0	1.5

*** Potentially damaging eggs

Table 2. Distribution of thrips eggs on field-collected material (2006). Orchards combined

		Percentage of eggs deposited in:				
Apple stage	**Total # eggs**	**Stamen**	**Calyx**	**Stem**	**Leaves**	***** "Fruitlet"**
Pink	0	--	--	--	--	--
King bloom	72	0	50.4	21.7	27.9	0
Full bloom	293	1.0	57.4	27.4	14.2	0
Petal fall	408	2.7	68.6	19.2	8.3	1.2
10 mm	110	4.3	37.6	42.6	3.5	12.1
25 mm	0	--	--	--	--	--

*** Potentially damaging eggs

Table 3. Distribution of thrips eggs on artificially infested material (2005). Includes mix of Red Delicious, Golden Delicious, Fuji, and Granny Smith.

		Percentage of eggs deposited in:				
Apple stage	**Total # eggs**	**Stamen**	**Calyx**	**Stem**	**Leaves**	***** "Fruitlet"**
Pink	769	0	63.7	25.6	10.7	0
King bloom	405	0.4	59.3	29.1	11.2	0
15-25 mm	71	0	31.0	1.4	0	67.6

*** Potentially damaging eggs

Table 4. Distribution of thrips eggs on artificially infested material (2006). Granny Smith clippings.

		Percentage of eggs deposited in:				
Apple stage	**Total # eggs**	**Stamen**	**Calyx**	**Stem**	**Leaves**	***** "Fruitlet"**
Pink	159	0	42.4	29.4	28.3	0
10 mm	50	1.8	45.6	8.8	0	43.9
25 mm	20	0	0	4.8	77.4	17.7

*** Potentially damaging eggs

Table 5. Text summary of results.

	Field-infestation				Artificial infestation: damaging eggs?
	Adults	Eggs	Damaging eggs		
Pink	No	No	No		No
King	Low #'s	Low #'s	No		No
Full	Peak #'s	Peak #'s	No		(not tested)
Petal fall	Low #'s	Peak #'s	Low #'s		(not tested)
10-15 mm	No	Low #'s	Peak #'s		Yes
25 mm	No	No	No		Yes

PRESENTATIONS

Miliczky, E., D. Horton, S. Cockfield and E. Beers. 2005. Spatial and temporal distribution of western flower thrips eggs in apple tissues. 101st Annual Meeting, Washington State Horticultural Assoc., Wenatchee, WA. (Poster)

Miliczky, E., D. Horton, S. Cockfield and E. Beers. 2006. Spatial and temporal distribution of western flower thrips eggs in apple tissues. 80th Annual Conference, Western Orchard Pest and Disease Management, Portland, OR. (Poster)