

## **2009 PROGRESS REPORT: ORGANIC CROPPING RESEARCH FOR THE NORTHWEST**

**TITLE:** Assessing effects of an alfalfa cover crop on biological control and tree nutrition in organic pear orchards

**PERSONNEL:** Vince Jones, Washington State University TFREC, Wenatchee, WA 98801  
David Horton, USDA-ARS, 5230 Konnowac Pass Rd., Wapato, WA 98951  
Tom Unruh, USDA-ARS, 5230 Konnowac Pass Rd., Wapato, WA 98951

**CONTACT PERSON:**

Vince Jones, (509) 663-8181; [vpjones@wsu.edu](mailto:vpjones@wsu.edu)

**REPORTING PERIOD**

April 1, 2009 to March 31, 2010

**KEYWORDS**

pear psylla, cover crop, biological control, tree nutrition

**ABSTRACT**

Organic pear growers must balance the conflicting pressures between nitrogen levels and densities of pear psylla, a nitrogen-loving pest of pears. We are assessing in 3 certified organic orchards and 1 experimental orchard whether planting of alfalfa leads to improved tree nutrition and biological control of psylla. Alfalfa was planted in 2 ft wide strips in 3 organic pear orchards in spring 2008; at the experimental orchard, aisle-wide strips of alfalfa had been planted in spring 2006. Each alfalfa plot was paired with a control (grass) plot. Sampling at the 3 commercial orchards was initiated in spring 2009; sampling of arthropod densities, predator movement, predator feeding, and tree nitrogen was begun in 2007 at the experimental orchard. There was no effect of alfalfa on pest or predator densities in the tree canopy. Tree nitrogen was slightly higher in the cover crop plots than control plots. The movement data have yet to be fully analyzed, but initial results show that tree-collected predators have evidence of having visited orchard floor vegetation; no striking differences were noted between alfalfa and control plots. The feeding data have yet to be analyzed.

**OBJECTIVES**

1. Determine if an alfalfa cover crop leads to an increase in densities of generalist predators in the pear tree canopy;
2. Confirm that increased densities of predators in trees having a cover crop understory are due to movement by predators from cover crop to tree;
3. Assess whether pear tree vigor and foliar nitrogen increase in cover crop plots;
4. Determine whether the increased predator densities in cover crop plots lead to enough of an increase in biological control to offset any increases in psylla fitness associated with the higher nitrogen levels in the cover crop plots;
5. Forward results to growers.

**PROCEDURES**

The studies are being done in 3 certified organic orchards and one experimental orchard. Three blocks were established at each of the organic orchards (Figure 1). One plot in each block has a grass understory and the other has a 2 foot wide strip of alfalfa down the center of 4-8 aisles (Figure 2). The experimental orchard consists of 4 blocks, each with paired alfalfa and grass understory. The alfalfa was planted in 2006, and occurs over the entire width of the

aisle. Pest and predator numbers are being monitored with sweep nets, beating trays, sticky traps, and by taking leaf samples. Predator movement between cover crop and tree is being assessed by applying a protein-based marker (egg white) to the cover crop, and assaying (with ELISA) tree-collected arthropods for presence of the marker. Gut contents of predators are assessed using ELISA. Pear leaves are sampled for determination of nitrogen levels.

#### PROGRESS TOWARD OBJECTIVES

- Sampling of psylla and predators at the commercial orchards commenced in 2009.
- The experimental orchard was sampled for predator densities (3 yrs), pest densities (3 yrs), predator movement (3 yrs; data not fully analyzed), predator feeding (3 yrs; specimens not yet completely assayed), and pear leaf nitrogen (1 date each of 2 yrs).
- Results experimental orchard:
  - substantial increase in predator densities on orchard floor associated with alfalfa cover crop (Figure 3);
  - no correlative effect on predator numbers in tree (Figure 4-5);
  - no effects of cover crop on psylla densities (Figure 6-7);
  - ca. 2% increase (dry weight) in pear leaf nitrogen in alfalfa plots (Figure 8);
  - evidence for movement between orchard floor and tree by some predator taxa, but no real differences between alfalfa and control plots (Table 1).
- Results commercial orchard:
  - pest and predator densities very low in all plots; no effect of alfalfa;
  - pre-experiment sample of leaves for nitrogen done in spring 2008 at each orchard; % protein varied between 11.5 and 15.8%.
- Plans for 2010:
  - a trial will be done at the experimental orchard to assess whether mowing of the alfalfa cover crop prompts movement by natural enemies into the tree
    - protein marker and sticky cards to be used in monitoring movement
    - beat trays and sweep nets to be used in monitoring predator densities

#### OUTPUTS

- Results are to be presented at 2010 Northwest Pear Research Review (Yakima)
- Grower cooperators were kept updated by e-mail

#### IMPACT ON GROWER PRACTICES

None yet

#### INSTITUTION

Washington State University, Pullman, Washington

#### FUNDING SOURCES

Western SARE (2008-2009): \$121,092

Washington Tree Fruit Research Commission - - Pear (2007-2009): \$45,000

#### ORGANIC RESEARCH LAND

Station: 1.3 acres non-organic

On-farm: 6.6 acres certified

#### FARMER COOPERATORS (3)

Campbell Orchards, Tieton, WA

Valicoff Fruit, Wapato, WA

Leach Orchards, Zillah, WA



Figure 1. Plot layout at each of 3 commercial orchards.

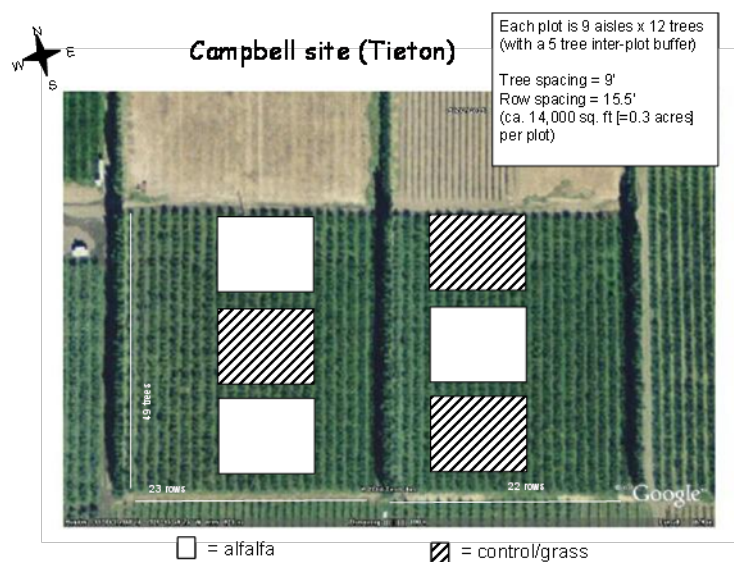
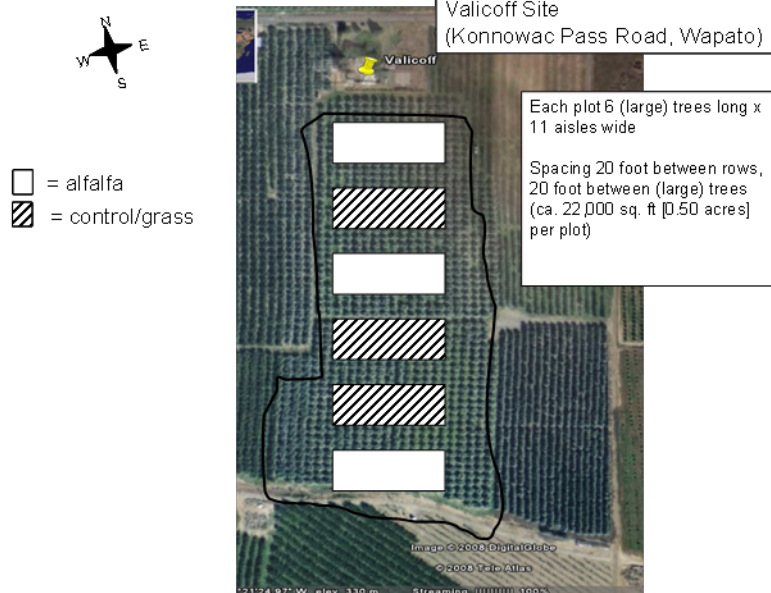




Figure 2. Alfalfa plots in commercial orchards at planting (April 2008) and in summer (late June 2008).

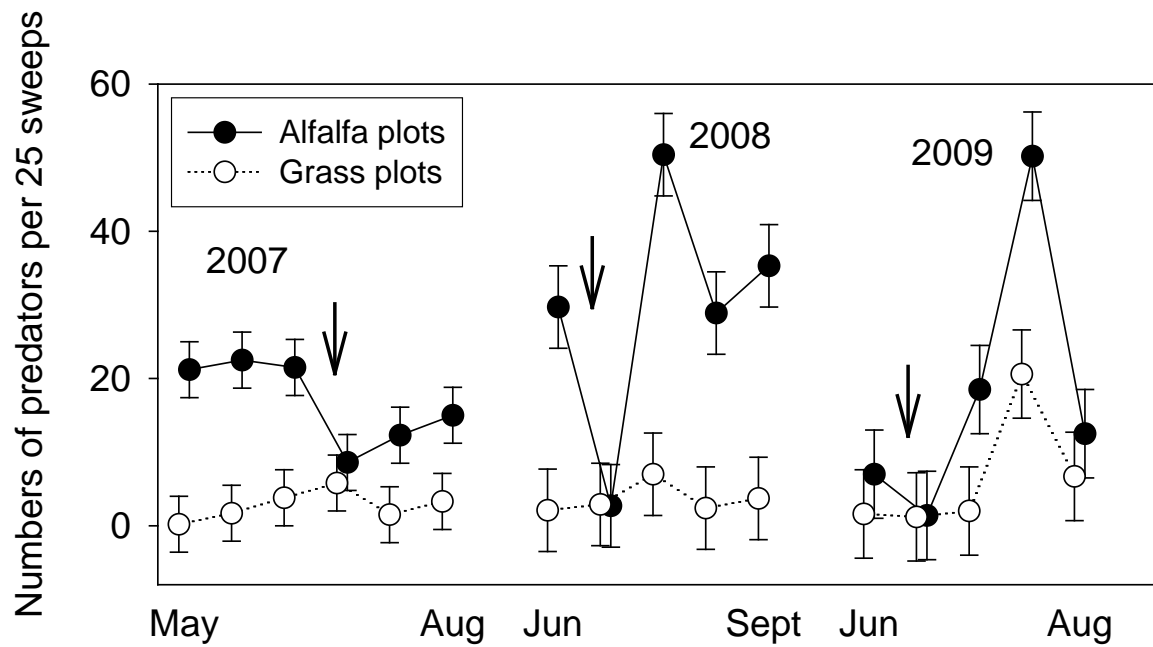


Figure 3. Predators per 25 sweeps; arrows depict mowing dates.

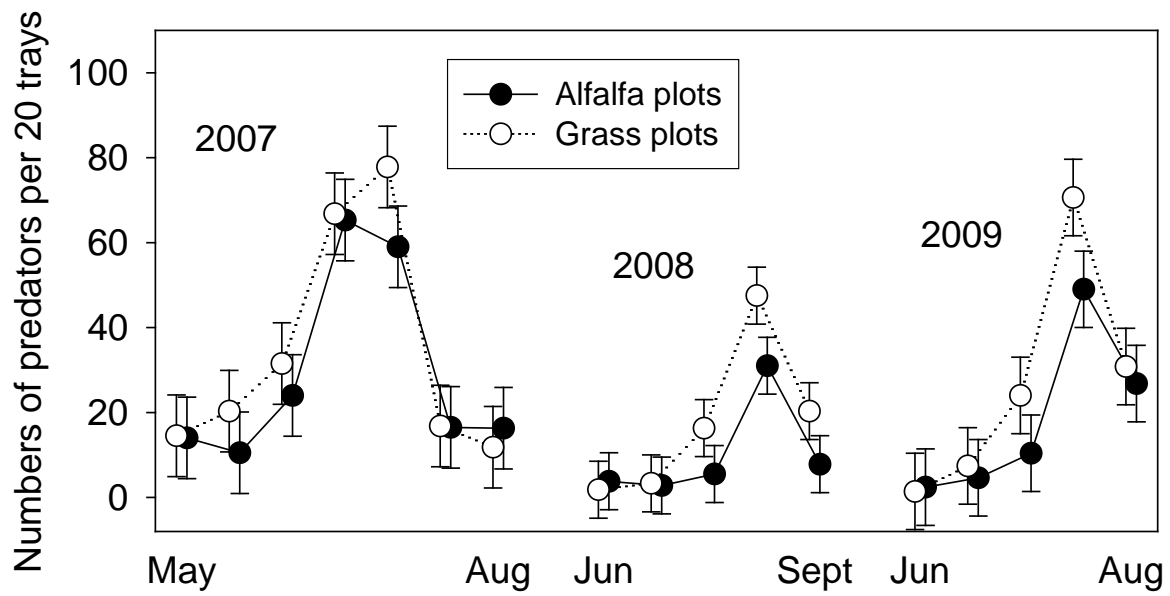
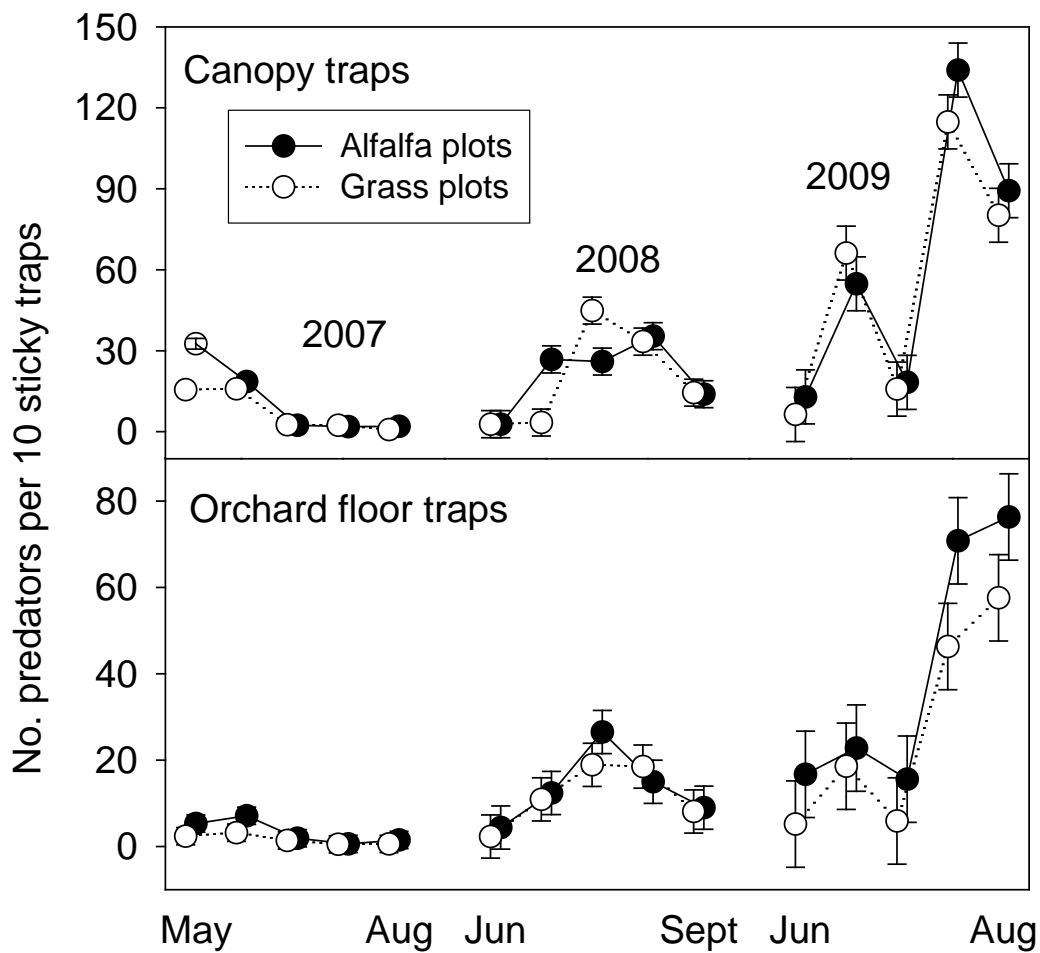


Figure 4 (above). Predators per 20 trays

Figure 5 (below). Predators per 10 sticky traps



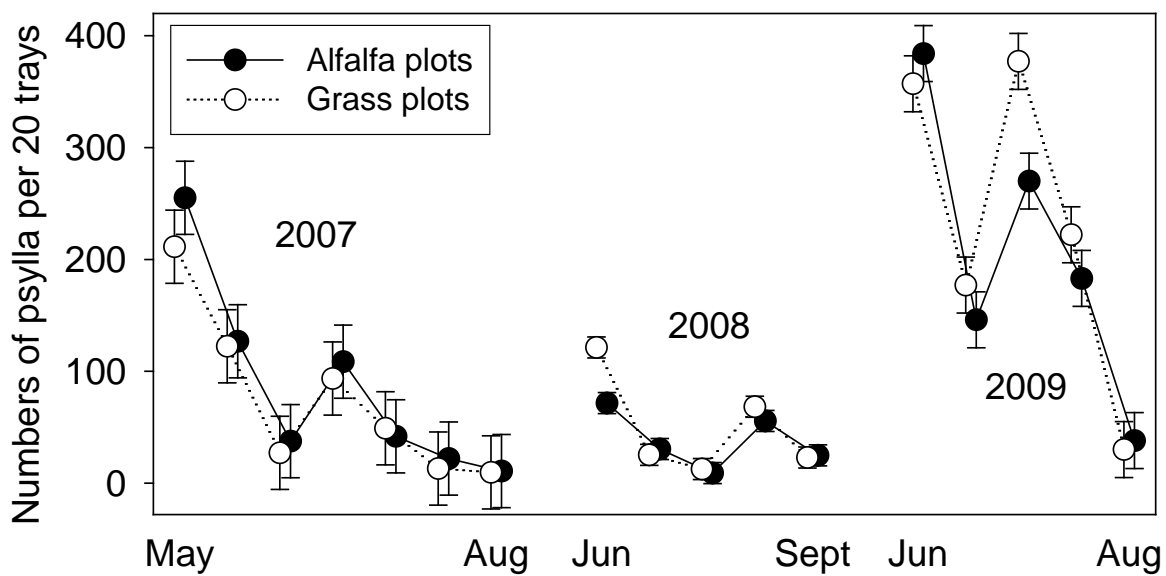
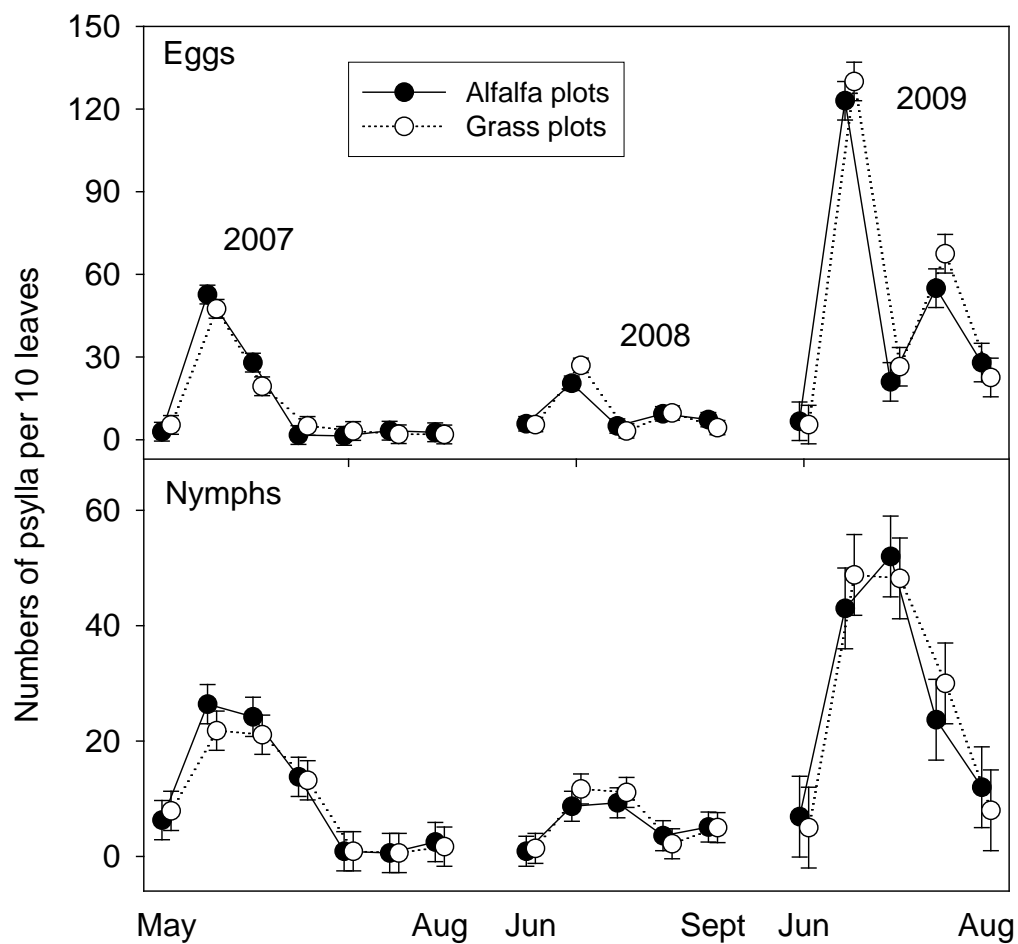


Figure 6 (above). Psylla adults per 20 trays.

Figure 7 (below). Psylla immatures per 10 leaves.



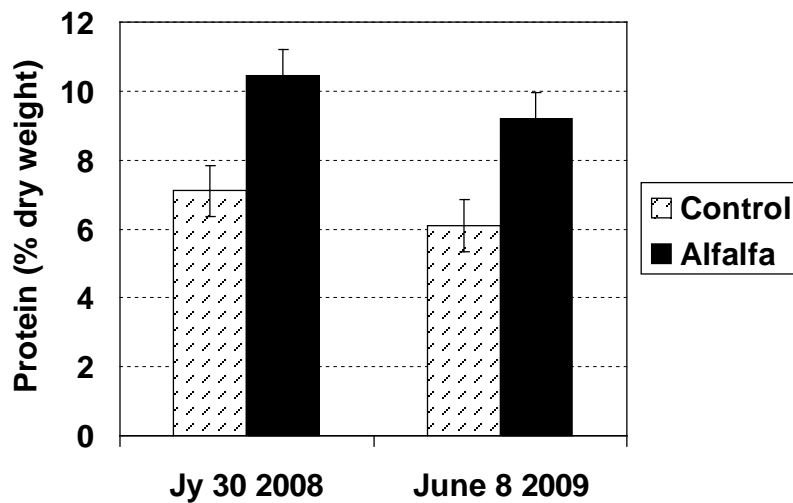


Figure 8. Nitrogen levels in pear foliage.

Table 1. Number of marked / total examined (% marked) predators collected from tree canopy in alfalfa and control plots; summer 2009 data.

	June 2009		August 2009	
	Alfalfa	Control	Alfalfa	Control
<b>TRUE BUGS</b>				
<i>Anthocoris</i>	1/28 (3.6)	0/8 (0)	4/71 (5.6)	8/101 (7.9)
<i>Deraeocoris</i>	5/127 (3.9)	0/93 (0)	12/85 (14.1)	4/81 (4.9)
<i>Orius</i>	0/4 (0)	0/5 (0)	0/2 (0)	0/3 (0)
<i>Nabis</i>	--	--	1/1 (100)	--
<b>TOTAL</b>	<b>6/159 (3.8)</b>	<b>0/106 (0)</b>	<b>17/159 (10.7)</b>	<b>12/185 (6.5)</b>
<b>LACEWINGS</b>				
<i>Hemerobius</i>	0/1 (0)	0/1 (0)	0/1 (0)	--
<i>Eremochrysa</i>	4/31 (12.9)	5/23 (21.7)	18/48 (37.5)	5/16 (31.3)
<i>C. plorabunda</i>	6/17 (35.3)	1/17 (5.9)	5/35 (14.3)	5/14 (35.7)
<i>C. nigricornis</i>	1/1 (100)	0/3 (0)	5/23 (21.7)	0/3 (0)
<i>C. coloradensis</i>	0/1 (0)	1/10 (10.0)	--	--
<b>TOTAL</b>	<b>11/51 (21.6)</b>	<b>7/54 (13.0)</b>	<b>28/107 (26.2)</b>	<b>10/33 (30.3)</b>
<b>LADYBIRD BEETLES</b>				
<i>Hippodamia</i>	0/1 (0)	0/1 (0)	6/27 (22.2)	8/42 (19.0)
<i>Stethorus</i>	0/2 (0)	0/1 (0)	1/5 (20.0)	0/12 (0)
<i>C. transversoguttata</i>	--	0/1 (0)	--	--
<i>Harmonia</i>	--	--	2/6 (33.3)	3/17 (17.6)
<i>Chilocorus</i>	--	--	0/1 (0)	1/6 (16.7)
<i>Hyperaspis</i>	--	--	14/65 (21.5)	0/5 (0)
<i>C. septempunctata</i>	--	--	2/8 (25.0)	1/6 (16.7)
unknown	--	--	0/1 (0)	0/4 (0)
<b>TOTAL</b>	<b>0/3 (0)</b>	<b>0/3 (0)</b>	<b>25/113 (22.1)</b>	<b>13/102 (12.7)</b>
<b>SPIDERS</b>				
	11/99 (11.1)	1/76 (1.3)	5/84 (5.9)	5/68 (7.4)