Raspberry Horntail Management – 2011

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The raspberry horntail, *Hartigia cressonii* (Kirby), is one of three economically important caneborer pests of brambles in Utah. Research on the insect's biology and susceptibility of summer- and fall-bearing raspberry varieties to the insect was initiated in 2009. Results are being used to develop best management guidelines for the insect.

Objectives

1. To evaluate the susceptibility of summer- and fall-bearing raspberry varieties to attack by the raspberry horntail.
2. To characterize the phenology (seasonal timing of activity) and abundance of raspberry horntail to aid in the development of optimal timings for management.
3. To survey for natural enemies (parasitoids) of the raspberry caneborer in northern Utah.

Methods

Kaysville research farm experiments

Seventeen summer-bearing varieties and 10 fall-bearing varieties of raspberries were evaluated for larval infestation at the Utah State University research farm in Kaysville, UT (Davis County), from 2009-2011. Raspberry plots were 12 ft long and replicated four times in a randomized complete block design. Beginning in mid to late June each year, plots were visually inspected weekly for canes with wilted tips indicating infestation by a raspberry horntail larva. Infested canes were cut at ground level, labeled, and returned to the lab for processing. The entire length of each cane was measured and then split open with a utility knife. The presence of a horntail larva (dead or alive) and parasitoids (larvae, pupae, and adults) was determined, as well as the distance from the cane base to the beginning of the larval tunnel, from the cane base to the current position of the larva, larva body length and head capsule width, and the directional orientation of the larva within the cane (head up or down). Live parasitoid larvae and pupae were reared to adulthood by cutting out a short section of the cane containing the parasitoid, sealing the cane closed with parafilm, placing the cane in a press-seal plastic bag with a moist filter paper, and placing the samples in an incubator at 77-81°F at 16 hr light and 8 hr dark. Upon emergence, adult parasitoids were collected into 70% ethanol for later identification.

Commercial field surveys

In each year, several commercial raspberry fields of various varieties were surveyed several times per month from June through August for infestation by the raspberry horntail. Canes with wilted tips were collected, returned to the lab, and processed as described above. In May and June of 2011, four commercial summer-bearing raspberry fields were surveyed weekly for overwintering horntail larvae in the floricanes. Canes were checked for the presence of a horntail tunnel in the pith, and those with tunnels were cut at ground level and returned to the lab. In the lab, canes were

placed in groups of 10-15 inside sleeve cages made from no-see-um netting (Seattle Fabrics, Inc., Seattle, WA), the bases of the canes placed in a tub with water, and placed in an incubator at 77-81°F. Cages were checked two to three times per week for adult horntail emergence. Three to four hundred total canes were collected and evaluated for timing of adult emergence. Cumulative degree-days (heat units) above 50°F were calculated from daily maximum and minimum temperatures since March 1 at a nearby USU weather station, and from temperatures maintained in the incubator after canes were collected.

Statistical analyses

Larval cane infestation was compared among years and raspberry varieties with analysis of variance (SAS Ver. 9.2, SAS Institute, Cary, NC). When significant, means were separated with Tukey's test (α=0.1). Data were normally distributed; data were not transformed.

Results and Discussion

Susceptibility of raspberry varieties

Larval infestations were greater in 2009 than in 2010 and 2011 for both summer- and fall-bearing raspberry varieties (Table 1). Beginning in 2009, infested canes were removed weekly from the plots, so it is not surprising that infestation levels decreased in the two succeeding years. These results support the value of frequent removal of infested canes; however, pruning alone did not eliminate the infestation. There were significant differences in horntail infestation among summer- but not fall-bearing varieties (Table 2). There were no interactions among year and variety indicating that varieties responded similarly among years.

Table 1. Influence of year (2009-2011) upon mean number of horntail larvae per 12-ft-row at the Kaysville research farm.

Year	Summer-bearing	Fall-bearing
2009	7.9 ± 0.9 a	13.4 ± 1.3 a
2010	3.9 ± 0.5 b	5.0 ± 1.0 b
2011	3.9 ± 0.5 b	5.7 ± 0.9 b
P>F	*0.002*	*0.007*

Table 2. Influence of summer- and fall-bearing varieties of raspberries upon horntail larval infestation of canes (per 12-ft-row) at Kaysville for 2009-2011.

Summer-bearing varieties		Fall-bearing varieties	
Variety	**Mean ± SE**	**Variety**	**Mean ± SE**
Royalty	0.5 ± 0.2 a	Polana	4.2 ± 0.9
Moutere	1.6 ± 0.5 ab	Caroline	6.7 ± 1.7
Cascade Dawn	2.5 ± 0.6 ab	Summit	6.8 ± 2.2
Cowichan	3.1 ± 0.5 abc	Jaclyn	7.5 ± 1.6
Coho	3.2 ± 1.1 abc	Polka	7.8 ± 2.4
Cascade Delight	3.5 ± 0.8 abc	Joan J	8.0 ± 1.8

WDNV2	3.6 ± 1.1 abcd	Ruby	8.0 ± 2.8
Lauren	3.7 ± 1.3 abcd	Himbo Top	9.6 ± 1.3
Tulameen	4.4 ± 0.6 abcde	Heritage	10.3 ± 3.3
Reveille	5.7 ± 1.1 bcde	Anne	11.5 ± 3.2
Chemainus	5.9 ± 1.3 bcde	*P*>F	*0.49*
Canby	6.5 ± 1.5 cde		
Georgia	7.3 ± 1.5 cde		
Cascade Bounty	7.5 ± 1.4 cdef		
Titan	8.2 ± 2.4 def		
Willamette	10.2 ± 2.4 ef		
Saanich	11.9 ± 2.8 f		
P>F	*0.001*		

Horntail phenology and abundance

Raspberry horntail overwinters as a fully grown larva within a silk-lined cocoon in the cane pith. Overwintering chambers were 5-34 inches above the cane base; most were at 16-24 in high. Pruning fall-bearing canes (primocanes) below a height of approx. 12 inches in the spring before horntail adults emerge will reduce the population.

Raspberry horntail larva in overwintering chamber (left), adult horntail emerging from cane (center), and adult emergence hole in cane (right).

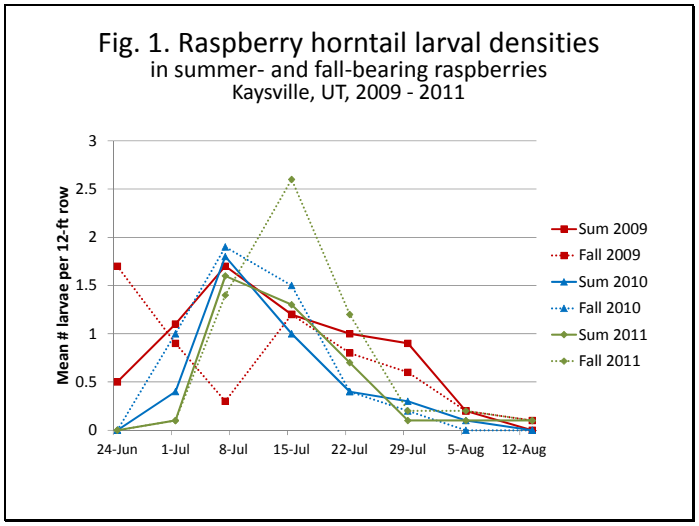
In the spring, the earliest emergence of horntail adults following field collection and holding at 77-81°F for about a month was on June 10. Adults continued to emerge throughout June to early July. Degree-days required for emergence ranged from 505 to 1,018 with an average of 736 DD (Table 3). Further refinement of a DD model to predict adult emergence will continue in 2012.

Table 3. Timing of adult raspberry horntail emergence from summer-bearing floricanes of various varieties collected from four commercial fields in northern Utah, 2011(n=42 canes with emerged adults).

Adult RHT emergence date	Field collection date	Degree-days (base 50°F)
June 10	May 14	827
June 13	May 11	1018
June 20	June 13	505
June 24	June 13	613
June 30	June 24	623
July 8	June 24	831

Adult females laid the majority of their eggs on the lower third of canes. Larval tunnels were initiated at a mean of 28 inches above ground level. Larvae tunneled upward feeding just under the bark in the cambium. When they reached the upper 5 to 6 inches of the cane, they molted into the last instar and fed heavily throughout the pith. This heavy feeding induced the cane tip to wilt and upper leaves to curl and turn brown at the edges. Larvae then made a u-turn and headed down the cane tunneling through the softer center pith. Once they reach the approx. bottom third of the cane, the larva makes another u-turn so that it is facing upwards. It then forms its pupation chamber.

Cane-tip wilting was first detected in late June in 2009, and in early July in 2010 and 2011. The temporal pattern of larval abundance in canes was similar between summer- and fall-bearing varieties, and among the three years (Fig. 1). Densities of larvae peaked in early to mid July, and then declined until few were found by mid August.



Parasitism

Parasitism of horntail larvae was detected from late June through mid August in the three years of study (Table 4). Horntail larvae in summer-bearing varieties weren't parasitized until mid July. Parasitism peaked in late July, and averaged 78.3% in summer-bearing varieties and 40.0% in fall-bearing varieties.

Table 4. Mean percentage parasitism of horntail larvae in summer- and fall-bearing raspberries at Kaysville, 2009-2011.

Date	Summer	Fall
Jun 24	0	9.1
Jul 1	0	22.8
Jul 15	34.2	24.8
Jul 22	50.5	58.5
Jul 29	79.9	69.4
Aug 5	73.8	41.7
Aug 13	73.3	32.5

Two primary parasitoid wasp species have been found to date.

An Ichneumonid wasp (female) (left) is a solitary ecto-parasitoid whose larva feeds externally on the host insect (left-center); and a Pteromalid wasp (female and male) (right-center) is a gregarious ecto-parasitoid (ca. 3-20 larvae per host) (right).