Berries: Spider Mite Management & Raspberry Horntail Update

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Urban & Small Farms Conference

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Spider Mites: How Do They Make a Living?

Twospotted Spider Mite, *Tetranychus urticae*

- Prefer undersides of leaves
- Form colonies, webbing: eggs, nymphs & adults
- Very small (0.02 inch length)
- Overwinter as dormant females (orange color) at base of canes & on weeds
- 10-14 day life cycle in summer
- Suck plant sap: fine, gray stippling on leaves

Spider Mites: Caneberry Symptoms

"Mite Burn"

Hot, dry conditions promote mites

"Mite burn": yellow, brown bronzing, begins on lower leaves first

Mites move up from (broadleaf) weeds on the ground

Raspberry leaves are sensitive to mite feeding

Fruiting canes: reduces vigor & berry yield

Primocanes: weakens, predisposes to winter injury

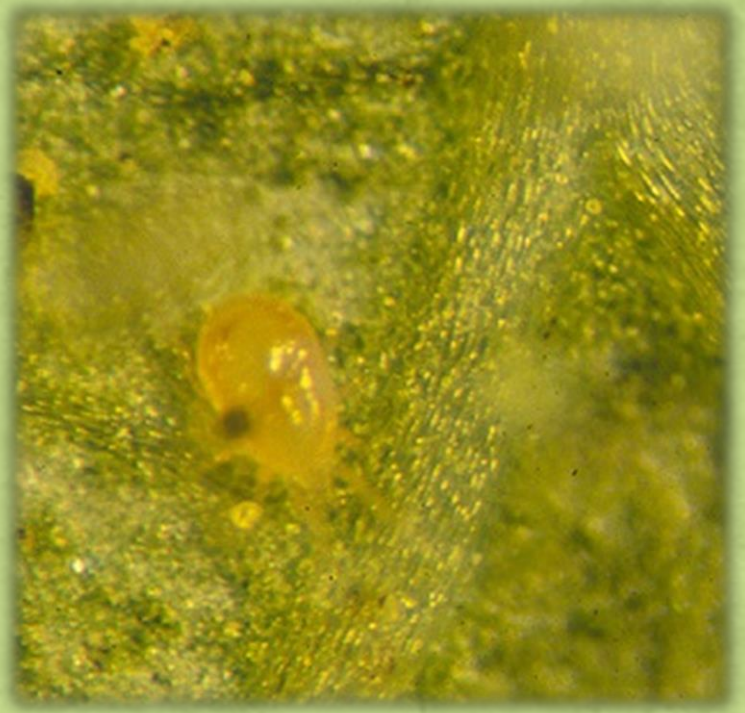
Spider Mite Management: Cultural Control

- Plant vegetation in alleyways (grass)
  - Minimize broadleaf weeds
    - field bindweed, common mallow
- Overhead sprinklers (cool & wet)
- Avoid disturbing ground cover (avoid dust)
- Avoid plant stress – water!
- Macro-tunnels:
  - Good venting, temperature mgmt.
  - Avoid hot, dry conditions
- Cultivar resistance:
  - Heavily pubescent leaves reduce mites

Spider mite-induced defoliation

Spider Mite Management: Biological Control

- Predatory mite
  - *Galendromus* (*Typhlodromus*) *occidentalis*
  - western predatory mite
- Other predators:
  - thrips, pirate & big-eyed bugs, ladybeetles, lacewings
- Naturally occurring
  - Supplemental releases – predatory mite
- Avoid insecticides & miticides toxic to beneficial insects & mites



Western predatory mite, note tear-drop-shaped body

Spider Mite Management: Chemical Control

Less disruptive & organic miticides

- insecticidal soap (M-Pede, others)
- horticultural oil (JMS Stylet Oil, others)
- neem oil (Trilogy, others) – Unkn*
- cottonseed+clove+garlic oil (GC-Mite)

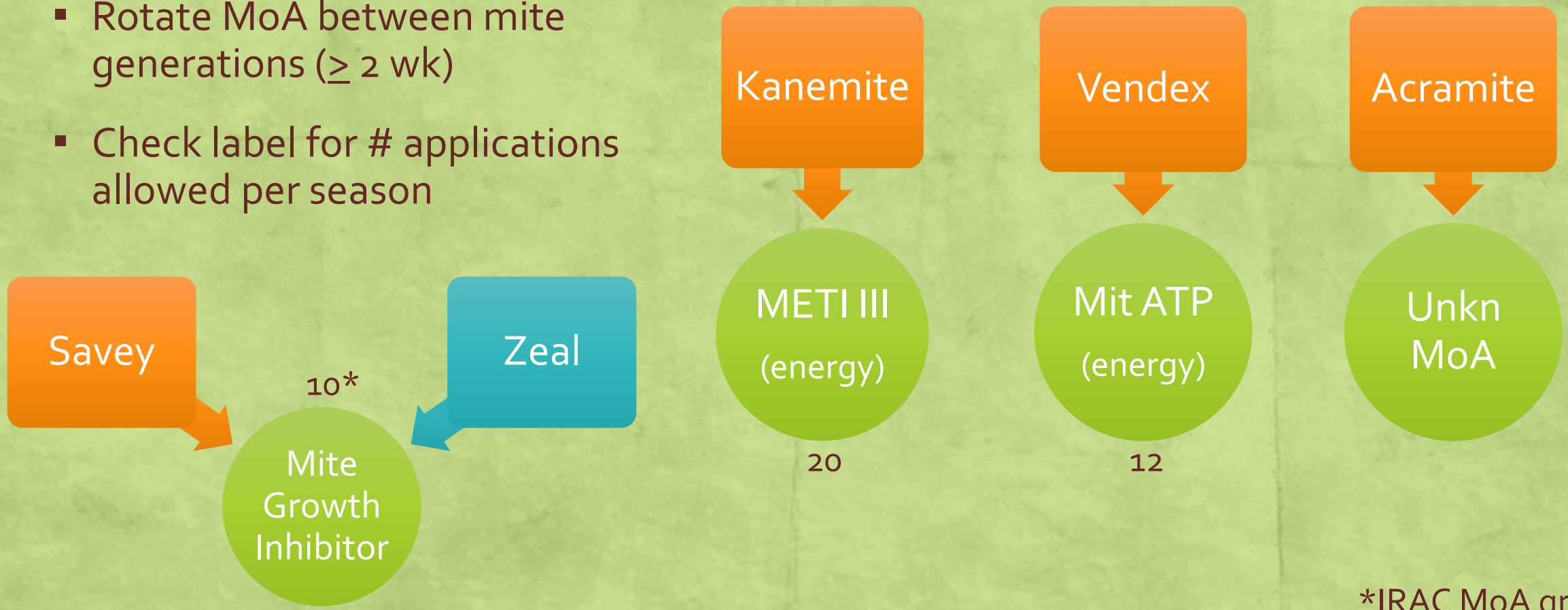
Commercial miticides

- acequinocyl (Kanemite) – 20B*
  - adults, eggs, nymphs; 1 day PHI
- bifenazate (Acramite 50WS) – Unkn*
  - adults, eggs, nymphs; 1 day PHI
- etoxazole (Zeal) – 10B*
  - eggs, early nymphs; 1 day PHI
- hexythiazox (Savey) – 10A*
  - eggs, nymphs; 3 day PHI
- fenbutatin-oxide (Vendex 50WP) – 12B*
  - adults, nymphs; 3 day PHI (raspberry only)

*IRAC MoA groups

Rotate Chemical Groups to Manage Resistance

- Rotate Modes of Action (MoA)
- Rotate MoA between mite generations (≥ 2 wk)
- Check label for # applications allowed per season



*IRAC MoA groups

Berry Spider Mite IPM

Scout leaves on lower canes for mite injury when temperatures rise

Avoid plant stress

Water!

Good plant nutrition

Scout for early signs of mite feeding

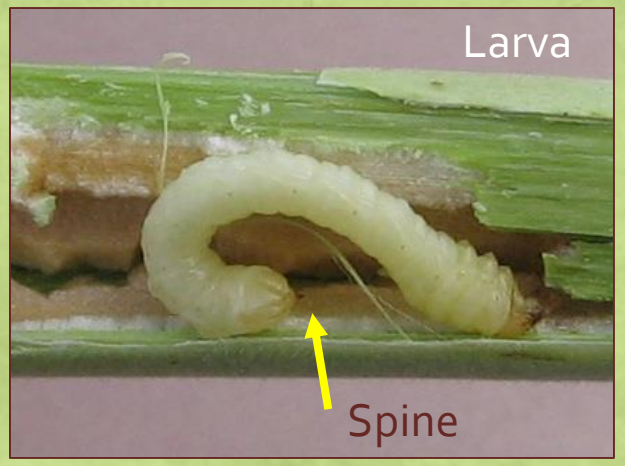
Intervene early:

1) irrigate & cooling, prevent mite dispersal & dust
2) apply less disruptive miticide early in mite population increase
3) Apply stronger miticide, if needed

Observe Pre-Harvest Intervals

Raspberry Horntail, *Hartigia cressonii*

- Major cane-boring insect in Utah
- Wasp (Hymenoptera)
  - Stem sawfly (Cephidae)
- CA, CO, ID & UT



Natural parasitoids – wasps that parasitize RHT & kill it

Raspberry Horntail Biology

- Overwinter in canes within a silk-lined chamber
  - Last instar larva
- Pupate within the chamber in the spring
- Adults emerge
  - Temperature dependent
- Eggs inserted under epidermis of young primocanes
- Larva (winding) tunnels upwards in cambium just under epidermis
  - At cane tip, consumes pith
  - U-turn and tunnels down in pith
- Forms overwintering chamber ~ 1.5-2 ft above cane base
- One generation per year (Jun – Aug)

Clockwise from top left: larva in silk-lined chamber, adult emerging from cane, larva & frass at cane tip, male (left) & female

Summer Raspberry Cultivar Susceptibility

Mean # RHT larvae per row-ft of canes at Kaysville, UT, 2009-2011

Cultivar	# RHT	Cultivar	# RHT
Royalty	0.25 a*	Reveille	2.85 abc
Moutere	0.80 a	Chemainus	2.95 abc
Cascade Dawn	1.25 ab	Canby	3.25 bc
Cowichan	1.55 abc	Georgia	3.65 c
Coho	1.60 abc	Cascade Bounty	3.75 cd
Cascade Delight	1.75 abc	Titan	4.10 cd
Lauren	1.85 abc	Willamette	5.10 cd
Tulameen	2.20 abc	Saanich	5.95 d

*Letters indicate significant differences ($p<0.05$)

Mean # RHT larvae per row-ft of canes at Kaysville, UT, 2013

Cultivar	# RHT
Octavia	0.01
Cascade Gold	0.02
1142-1	0.08
Chemainus	0.25
Prelude	0.34
Nova	0.56
Cascade Bounty	0.95

Fall Raspberry Cultivar Susceptibility

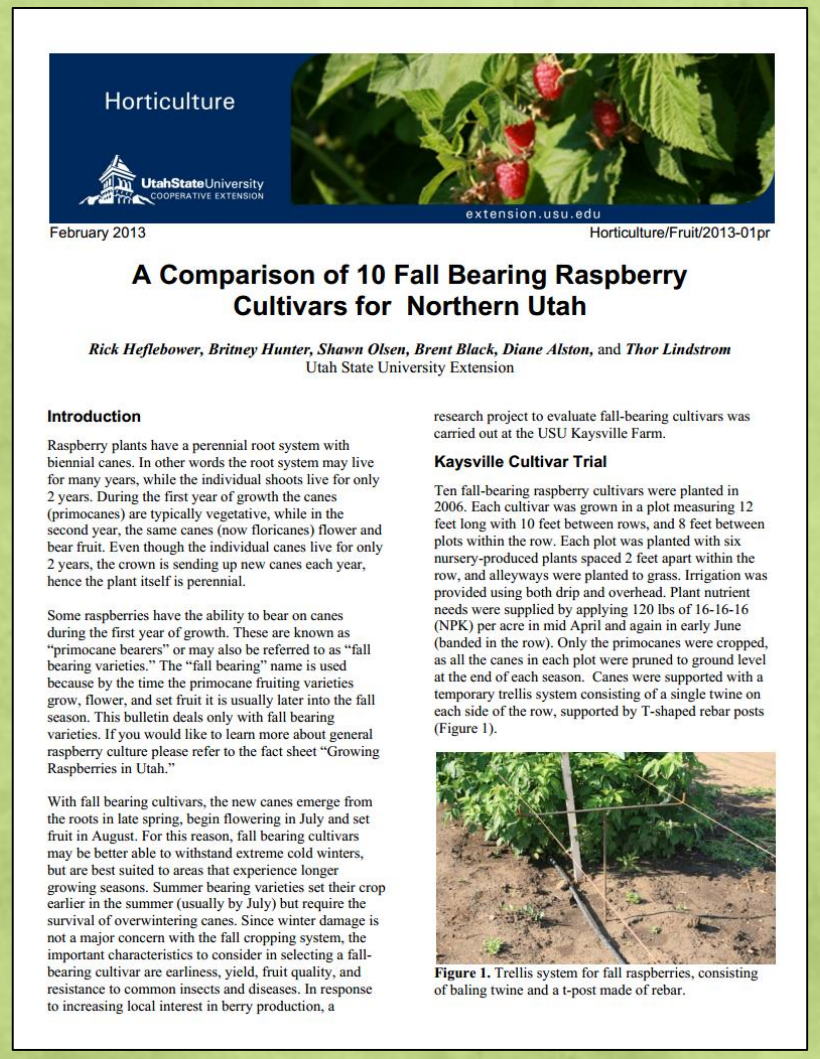
Mean # RHT larvae per row-ft of canes at Kaysville, UT, 2009-2011

Cultivar	# RHT	Cultivar	# RHT
Polana	0.4	Joan J	0.7
Caroline	0.6	Ruby	0.7
Polka	0.6	Himbo Top	0.8
Summit	0.6	Heritage	0.9
Jaclyn	0.6	Anne	1.0

Kaysville, UT, 2013

Cultivar	# RHT
Autumn Treasure*	0.02
Vintage	0.04
Brice*	0.11
Autumn Britten	0.16
Joan J	0.34
Autumn Bliss	0.34
Polana	0.38
Dinkum	0.58

Online Resources



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A Comparison of 10 Fall Bearing Raspberry Cultivars for Northern Utah

Rick Heflebower, Britney Hunter, Shawn Olsen, Brent Black, Diane Alston, and *Thor Lindstrom*
Utah State University Extension

Introduction

Raspberry plants have a perennial root system with biennial canes. In other words the root system may live for many years, while the individual shoots live for only 2 years. During the first year of growth the canes (primocanes) are typically vegetative, while in the second year, the same canes (now floricanes) flower and bear fruit. Even though the individual canes live for only 2 years, the crown is sending up new canes each year, hence the plant itself is perennial.

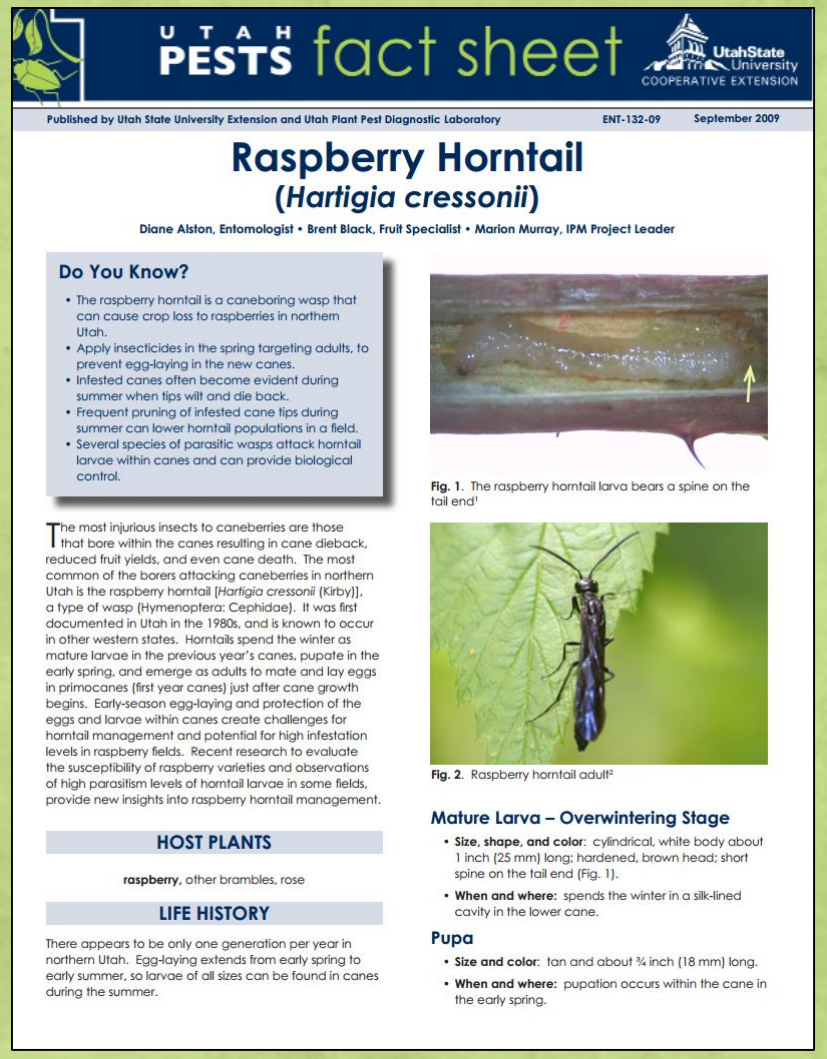
Some raspberries have the ability to bear on canes during the first year of growth. These are known as "primocane bearers" or may also be referred to as "fall bearing varieties." The "fall bearing" name is used because by the time the primocane fruiting varieties grow, flower, and set fruit it is usually later into the fall season. This bulletin deals only with fall bearing varieties. If you would like to learn more about general raspberry culture please refer to the fact sheet "Growing Raspberries in Utah."

With fall bearing cultivars, the new canes emerge from the roots in late spring, begin flowering in July and set fruit in August. For this reason, fall bearing cultivars may be better able to withstand extreme cold winters, but are best suited to areas that experience longer growing seasons. Summer bearing varieties set their crop earlier in the summer (usually by July) but require the survival of overwintering canes. Since winter damage is not a major concern with the fall cropping system, the important characteristics to consider in selecting a fall-bearing cultivar are earliness, yield, fruit quality, and resistance to common insects and diseases. In response to increasing local interest in berry production, a research project to evaluate fall-bearing cultivars was carried out at the USU Kaysville Farm.

Kaysville Cultivar Trial

Ten fall-bearing raspberry cultivars were planted in 2006. Each cultivar was grown in a plot measuring 12 feet long with 10 feet between rows, and 8 feet between plots within the row. Each plot was planted with six nursery-produced plants spaced 2 feet apart within the row, and alleyways were planted to grass. Irrigation was provided using both drip and overhead. Plant nutrient needs were supplied by applying 120 lbs of 16-16-16 (NPK) per acre in mid April and again in early June (banded in the row). Only the primocanes were cropped, as all the canes in each plot were pruned to ground level at the end of each season. Canes were supported with a temporary trellis system consisting of a single twine on each side of the row, supported by T-shaped rebar posts (Figure 1).

Figure 1. Trellis system for fall raspberries, consisting of baling twine and a t-post made of rebar.



UTAH PESTS fact sheet

UtahState University COOPERATIVE EXTENSION

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Raspberry Horntail
(*Hartigia cressonii*)

Diane Alston, Entomologist • Brent Black, Fruit Specialist • Marion Murray, IPM Project Leader

Do You Know?

- The raspberry horntail is a caneboring wasp that can cause crop loss to raspberries in northern Utah.
- Apply insecticides in the spring targeting adults, to prevent egg-laying in the new canes.
- Infested canes often become evident during summer when tips wilt and die back.
- Frequent pruning of infested cane tips during summer can lower horntail populations in a field.
- Several species of parasitic wasps attack horntail larvae within canes and can provide biological control.

The most injurious insects to caneberries are those that bore within the canes resulting in cane dieback, reduced fruit yields, and even cane death. The most common of the borers attacking caneberries in northern Utah is the raspberry horntail [*Hartigia cressonii* (Kirby)], a type of wasp (Hymenoptera: Cephidae). It was first documented in Utah in the 1980s, and is known to occur in other western states. Horntails spend the winter as mature larvae in the previous year's canes, pupate in the early spring, and emerge as adults to mate and lay eggs in primocanes (first year canes) just after cane growth begins. Early-season egg-laying and protection of the eggs and larvae within canes create challenges for horntail management and potential for high infestation levels in raspberry fields. Recent research to evaluate the susceptibility of raspberry varieties and observations of high parasitism levels of horntail larvae in some fields, provide new insights into raspberry horntail management.

HOST PLANTS

raspberry, other brambles, rose

LIFE HISTORY

There appears to be only one generation per year in northern Utah. Egg-laying extends from early spring to early summer, so larvae of all sizes can be found in canes during the summer.

Fig. 1. The raspberry horntail larva bears a spine on the tail end[1]

Fig. 2. Raspberry horntail adult[2]

Mature Larva – Overwintering Stage

- **Size, shape, and color**: cylindrical, white body about 1 inch (25 mm) long; hardened, brown head; short spine on the tail end (Fig. 1).
- **When and where:** spends the winter in a silk-lined cavity in the lower cane.

Pupa

- **Size and color**: tan and about ¾ inch (18 mm) long.
- **When and where:** pupation occurs within the cane in the early spring.

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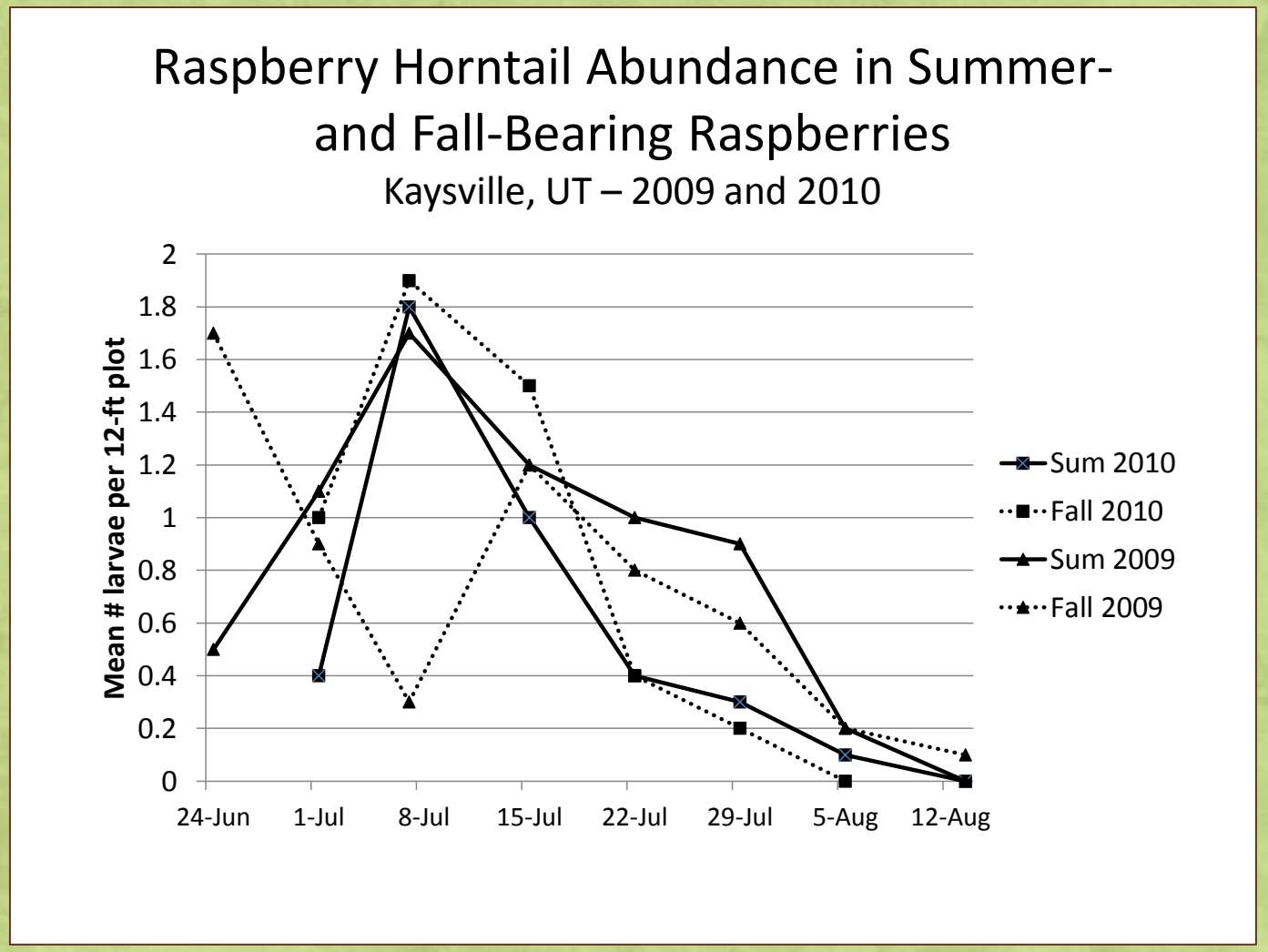
RHT Larval Phenology (development over time)



Adult Emergence


Yellow trap not attractive

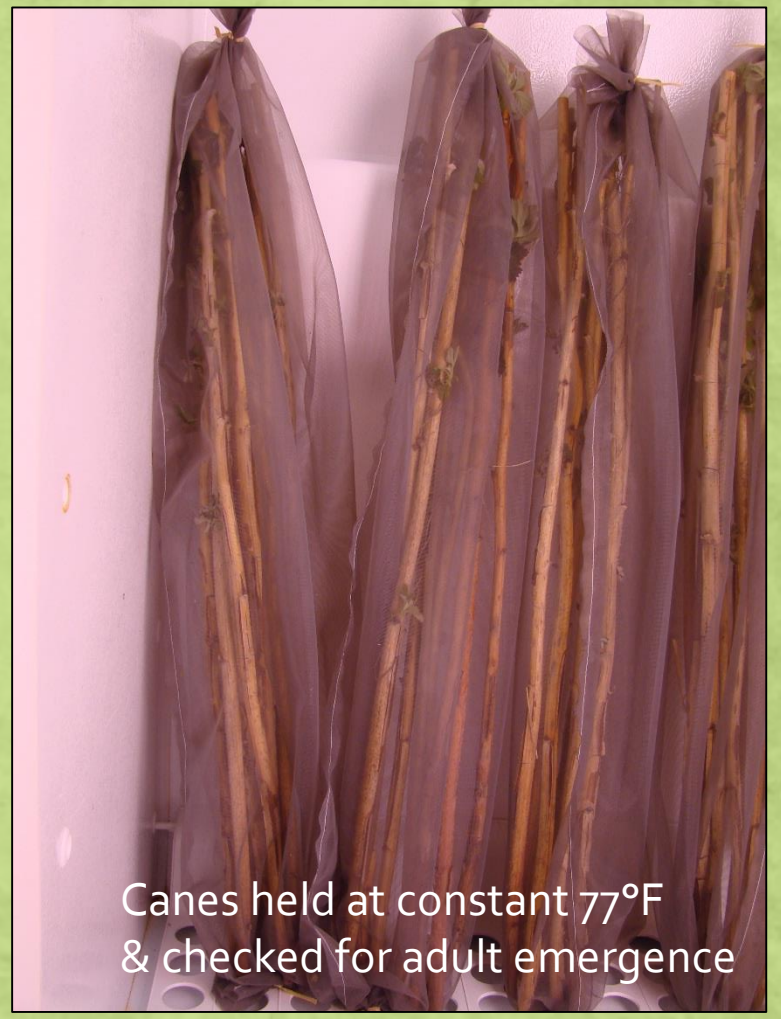

RHT adult ready to emerge


Scouted canes for RHT beginning in May

Emergence:
~ 500 DD (base 50°F) to 1760 DD
Average dates:
June 12 to August 3

Study sites:
Laketown, Paradise, Wellsville, Kaysville, Alpine


RHT tunnel


Canes held at constant 77°F & checked for adult emergence

Degree-Day Model

Predict emergence of RHT adults from overwintering chambers in canes

Parasitism of RHT Larvae

Percentage of horntail larvae parasitized, Kaysville, UT, 2009 & 2010

Date	Summer Cultivars		Fall Cultivars	
	2009	2010	2009	2010
June 24	0	-	9.1	-
July 1	-	0	-	25.6
Jul 15	35.1	25.8	41.7	20.0
Jul 22	-	73.1	-	47.1
Jul 29	98.4	59.1	100	33.3
Aug 5	61.5	80.0	25.0	0
Aug 13	70.0	-	40.0	-

Natural Enemies (Biological Control)

- 3 species of parasitic wasps attacked horntail larvae (late June – Sep)
- Parasitism occurred near cane tip (smaller diameter, horntail larva consumes pith, softer cane tissue facilitates insertion of the parasitoid's ovipositor, space for parasitoid to develop)

Parasitoid Cast I

-Ichnuemonidae
-Long ovipositor
-Ectoparasite
-Solitary

Parasitoid Cast II

- Pteromalidae
- Ectoparasite
- Gregarious
  - ~3-20 larvae/horntail

Parasitoid Cast III

Eurytomidae
Tenuipetiolus sp.
This genus known to parasitize cecidomyiids & cynipids in plant galls

Raspberry Horntail IPM

- Select cultivars with more resistance
  - Fall-bearing less susceptible than summer-bearing
- Prune out infested canes before adults emerge (by May)
  - Look for tunnels in cane pith
- Apply insecticide at 500 DD to target adults before eggs are laid; repeat based on protection interval of product (emergence ends 1760 DD)
  - Carbamate:
    - carbaryl (Sevin)
  - Pyrethroids:
    - bifenthrin (Brigade, Capture), esfenvalerate (Asana), fenpropathrin (Danitol), zeta-cypermethrin (Mustang Max)
  - Organophosphates:
    - diazinon (Diazinon), malathion (Malathion)
- Frequent pruning of infested cane tips during summer can lower the horntail population in a field
- Parasitic wasps attack horntail larvae within canes and provide biological control
  - Parasitism peaked in late-July to early August
  - Parasitism provides horntail suppression, but may not be a stand-alone control

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BERRY CROPS

Raspberry crown borer

If you are noticing entire canes wilting in your raspberry field, it is possibly damage from the raspberry crown borer. Larvae are actively feeding in the roots and crowns, and entire canes can be killed in response to the feeding. Often, the canes can be easily pulled out of the ground. You may see some tunnelling in the lower part of the cane.

The crown borer is a clearwing moth, and the larvae live and bore into the crown and roots of blackberries, raspberries, loganberries, and wild brambles. The problem with this pest is that low levels of infestation can suddenly develop into a severe problem, so it is important to keep an eye on the health of your plants during the entire season.

The crown borer larvae actually spend two years feeding and developing in the plant, and the damage is most evident during the second year of larval activity. Early in their life cycle, they are feeding on the smaller roots, and as they get larger, they move to the crown. Pupation occurs in the crown in mid to late August.

Early fall is the best time for treatment because larvae will leave the crowns and move to the roots for the winter. At least two years of diligent treatment is necessary in an infested field.

Treatment: drench roots with bifenthrin in early fall

Raspberry Horntail

Continue to cut off the tops of wilted canes and kill the larva inside. Sometimes, the cane is "hollow" where the larva is inside, and you can squish the cane to kill the larva.

By keeping up with keeping the plants free of horntail larvae, you are reducing the population for future infestations.

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Slideshow Available

www.utahpests.usu.edu