

Protecting individual pines from bark beetles: systemic insecticides & semiochemicals

S.L. Smith, USDA Forest Service, Forest Health Protection, R5,
Susanville, CA

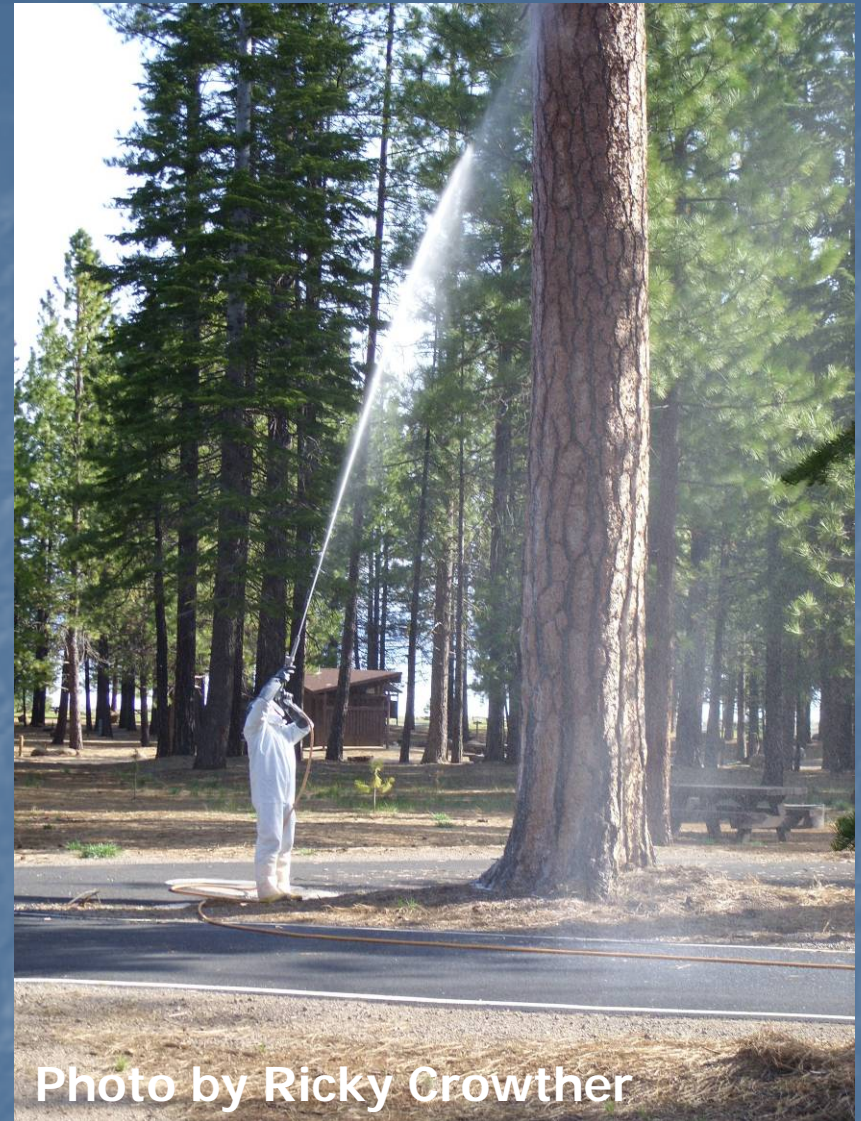
B.L. Strom, USDA Forest Service, Southern Research Station,
Pineville, LA

Presented by

Danny Cluck, USDA Forest Service, Forest Health Protection,
R5, Susanville, CA

Treatments that consistently protect individual high value pine trees from bark beetles are currently limited to insecticides sprayed onto tree boles; however, situations exist where this application method is not possible.

- rust resistant sugar pines
- high elevation pines like whitebark or foxtail



To increase treatment options available to land managers, we are evaluating semiochemicals and systemic insecticides for effectiveness in single tree protection against bark beetles.



Louisiana:

Stem-injected emamectin benzoate (EB) is being evaluated in laboratory bioassays with pine bolts to determine its effects, movement patterns, effective dosages and durability in loblolly pine against the southern pine beetle.

California:

Stem-injected EB is being tested as a tree protectant against mountain pine beetle in sugar and western white pines. We are also assessing the ability of semiochemicals to inhibit Jeffrey pine beetle response to baited traps.

Emamectin benzoate (EB)

EB is touted as an effective prophylactic treatment of pines against bark beetles. Data gathered in the western U.S. have not supported this claim; however, the lack of residual chemistry data causes some difficulties in interpretation.

- Submitted for EPA registration as TREE-äge™.
- Active ingredient: emamectin benzoate which is a glycoside insecticide.
- “Warning” label.
- Primary route of toxicity is through ingestion, but may also have some contact toxicity.
- Formulated to translocate in the tree’s vascular system when injected.



TIIRA

Section 24(c) Special Local Need Label

FOR DISTRIBUTION AND USE ONLY WITHIN THE STATE OF MICHIGAN

TREE-äge™

EPA SLN No. MI-080001

For control of Emerald Ash Borer in Ash Trees (*Fraxinus spp.*),
Tree Injection Only

Active Ingredient:

Emamectin Benzoate¹ 4.0%

Other Ingredients: 96.0%

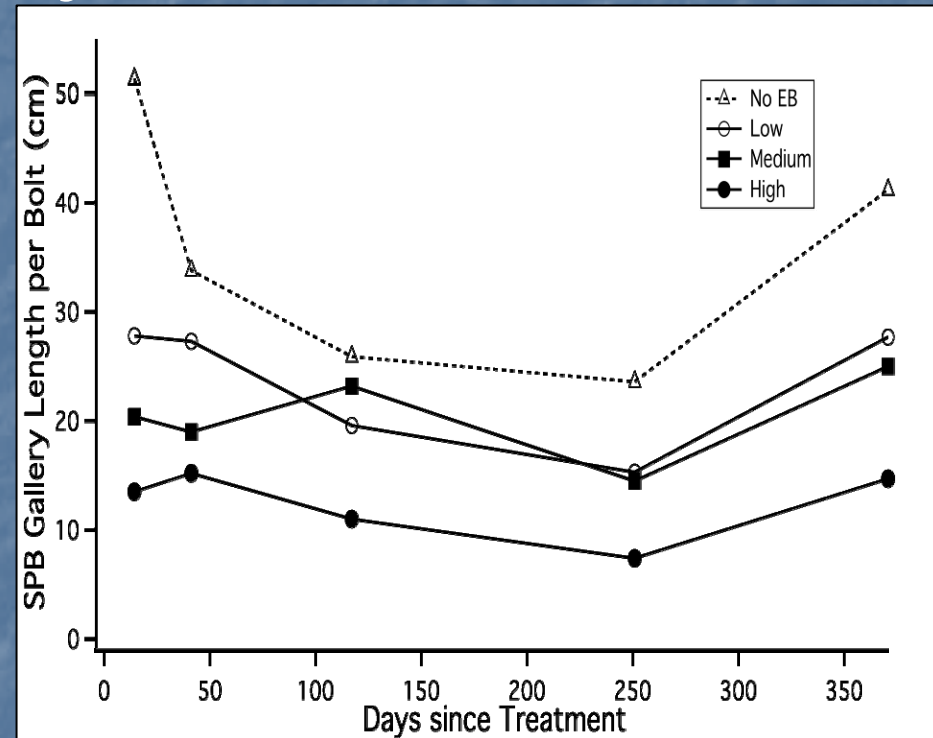
Total: 100.0%

TREE-äge™ appears to be effective against both larval and adult stages of Emerald Ash Borer.

- being evaluated in Hawaii against erythrina gall wasp.
- being evaluated in the south against seed and cone insects
- will evaluate in 2009 against GSOB in So Cal with Tom

Louisiana

Evaluations (bioassays) were completed using the southern pine beetle and a small-bolt laboratory assay, which exposed 75 beetles to individual bolts (11 cm long) in polystyrene containers for 48 hours.

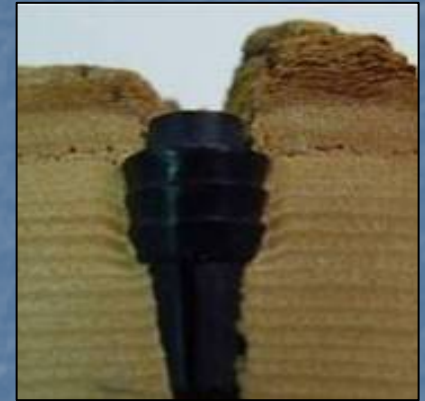


Southern pine beetle produced significantly shorter galleries in EB treated bolts, particularly in the highest dosage treatment.

California EB injection treatments

Location	Species	n	Treatment period	Evaluate
Tahoe NF	Sugar pine	30	Spring 2007	Summer 2008
Tahoe NF	Sugar pine	30	Fall 2007	Fall 2008, Spring 2009
Modoc NF	Western white pine	24	Fall 2007	Fall 2008, Spring 2009

EB injection treatments using ARBORjet Tree I.V.



EB injection treatments using ARBORjet Tree I.V.



Challenge by mountain pine beetle was promoted by attaching attractive lures to tree boles at breast height. Treatments are being evaluated by a combination of biological and chemical assays.

Trees will be checked for pitch tubes, crown fading and ultimately, mortality. Amount of gallery formation and adult emergence will also be determined. In addition, phloem tissue was collected from injected trees for chemical analysis.



California

Injected tree evaluations

- **Spring-injected 2007, sugar pines:** none of the treated trees died; 4 control trees died. Control tree mortality was insufficient to meet the treatment evaluation standard.
- **Fall-injected 2007, sugar pines:** trees were baited 31 July through 10 October 2008. As of October 10, most trees have high numbers of MPB attacks. Several trees sustained fire injuries in 2008. Tree status will be evaluated again in 2009.
- **Fall-injected 2007, western white pines:** trees were baited from 1 July through 4 Sept. 2008. As of October, all of the control trees and all but two of the injected trees have high numbers of MPB attacks. Tree status will be evaluated again in 2009.

UNTREATED

TREATED



Western white pines

Both trees are heavily attacked by mountain pine beetle: treated tree will likely die due to numerous attacks, however, there is a difference in degree of fading between treated and untreated trees. May indicate some level of toxicity of EB to mountain pine beetle.

Higher doses of EB may be effective and a new study may be initiated in 2009 after we have determined EB residue levels in the phloem.

Disruptant Semiochemicals

- have been used for decades to manipulate the behavior of a wide range of bark beetle species.
- Verbenone has been used to aid in the management of many western bark beetle species.
- More recently there have been additions from a class of chemicals known as green leaf or non-host volatiles.
- There is some evidence that these compounds synergize with verbenone to improve disruption effects toward bark beetles.
- Large reductions in the number of beetles caught in traps might indicate that the application of disruptant semiochemicals to individual Jeffrey pine trees could be a useful management tool for tree protection.

Jeffrey pine beetle verbenone/GLVs 2007

- Location: Luther Pass (LTBMU and Toiyabe NF), elevation 7,735 ft.
- Trapping period: 19 July 07 – 16 Aug 07
- Replicates: 12 / treatment
- Traps – 12 unit funnel
- Collections: weekly



Photo by Erich Vallery

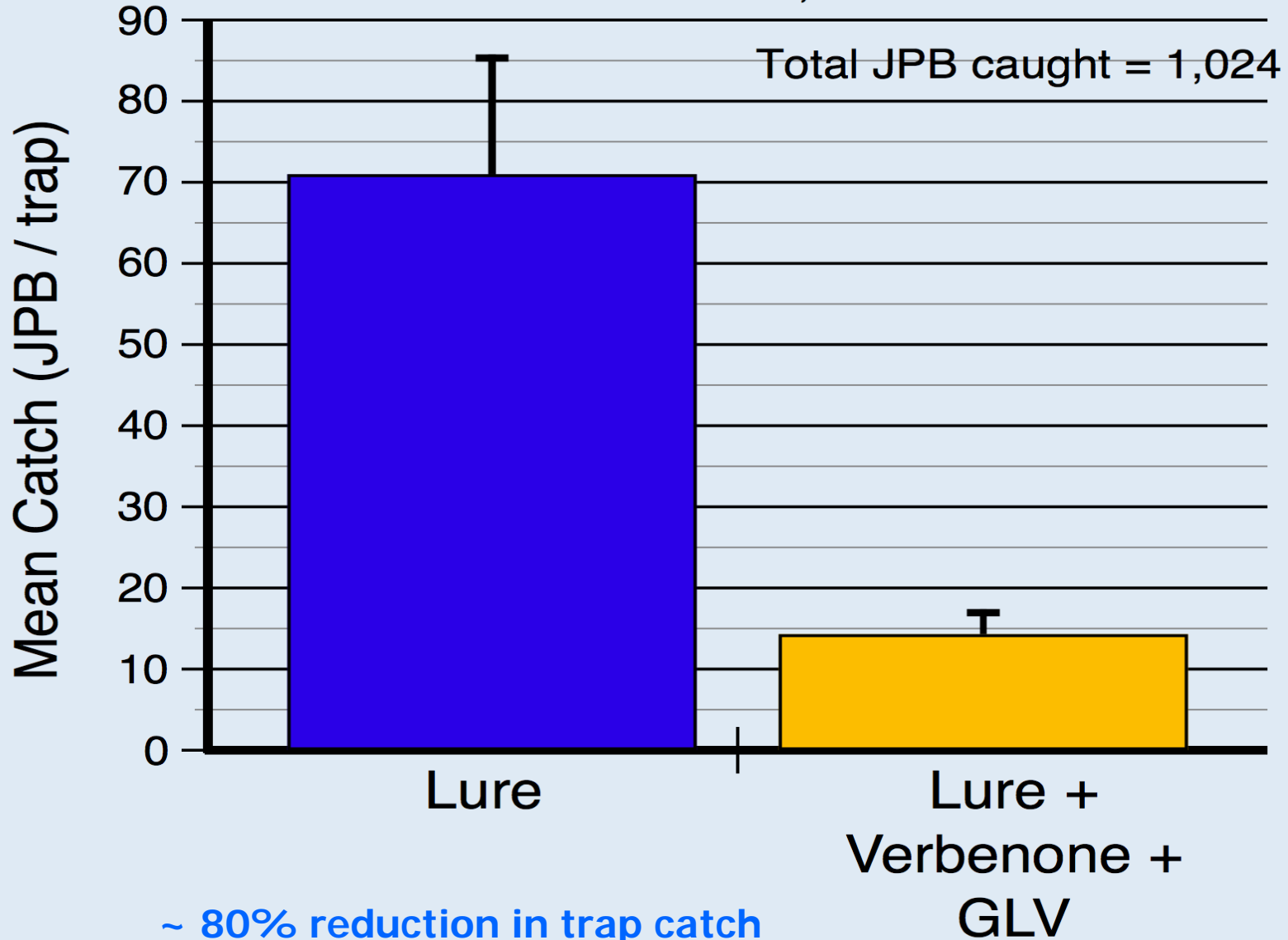
Treatments

- Blend of 95% n-heptane and 5% 1-heptanol in 250 ml bottle with hole drilled in cap (no wick).
- Blend of 95% n-heptane and 5% 1-heptanol in bottle, with verbenone (Synergy) and GLV (Synergy).

- **verbenone: disruptant pheromone that is an oxidized terpene; important in the chemical communication system of several economically important bark beetle species.**
- **green leaf volatiles (GLV, Synergy Semiochemicals Corp.): 1:1 mix of Z-3-hexenol (aka cis-3-hexenol, or leaf alcohol) and 1-hexanol.**

Jeffrey Pine Beetle 2007

Luther Pass, CA



Jeffrey pine beetle Verbenone/GLV/Frontalin 2008

- Location: Luther Pass (LTBMU and Toiyabe NF), elevation 7,735 ft.
- Trapping period: 24 June 08 – 6 Aug 08
- Replicates: 5 / treatment
- Traps – 12 unit funnel
- Collections: weekly

Treatments

- Blend of 95% n-heptane and 5% 1-heptanol in 250 ml bottle with hole drilled in cap (no wick)
- Blend of 95% n-heptane and 5% 1-heptanol in bottle, with verbenone (Synergy), glv (Synergy) and frontalin (Synergy).

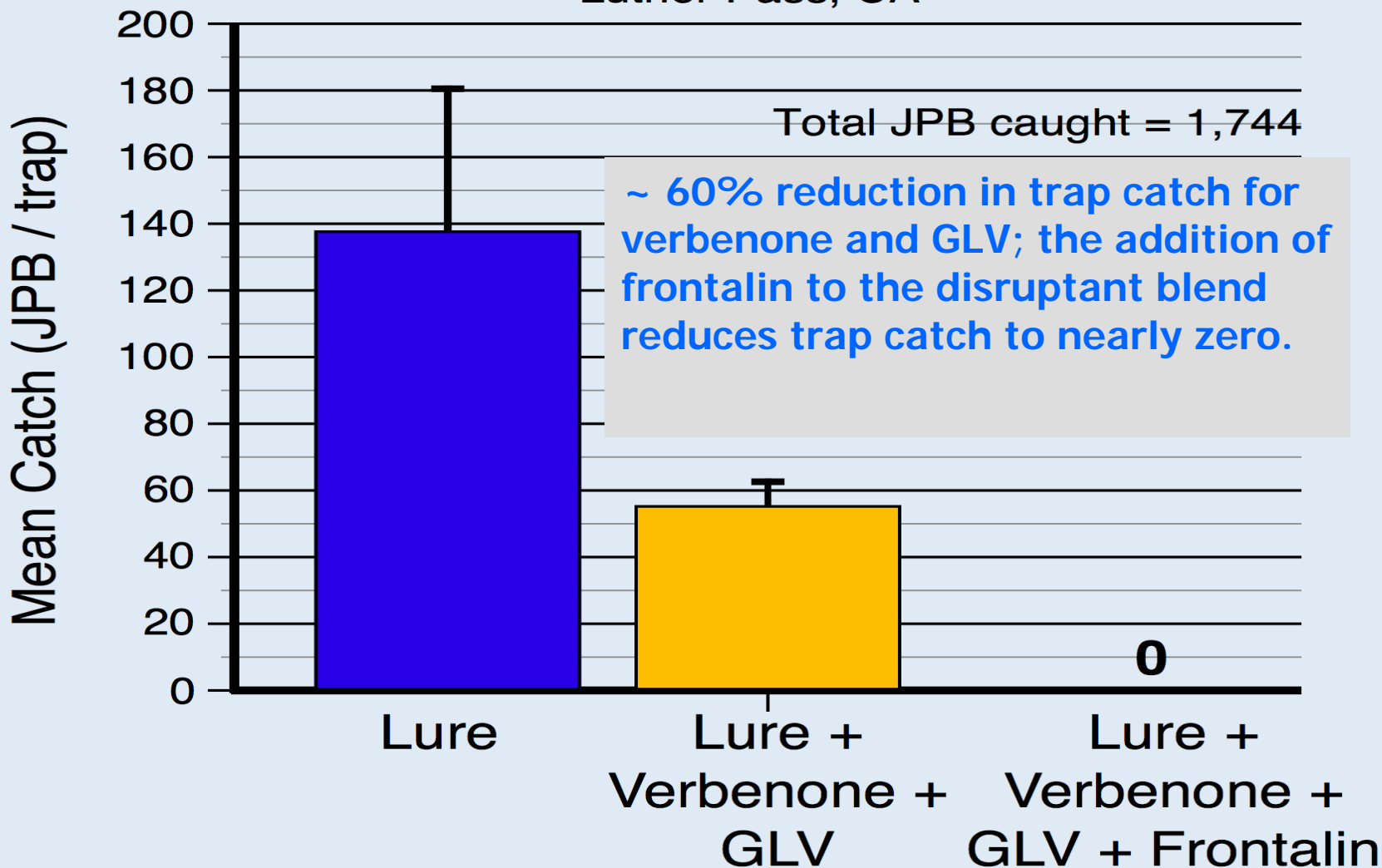
2008 treatments added frontalin

frontalin: a Jeffrey pine beetle (and other Scolytids) pheromone component produced by males (Paine et al. 1999; Hall et al. 2002); Paine reported inhibition of female JPBs to traps baited with frontalin)

Only first two weeks of collection counted and displayed in graph.

Jeffrey Pine Beetle 2008

Luther Pass, CA



2009

we plan to test the disruptant combination of verbenone, green leaf volatiles and frontalin for protection of individual Jeffrey pine trees.

Thanks

Tree injections:

this work has been supported by the Southern Research Station, Pineville, LA, Forest Health Protection, R5 and Harold Thistle, FHTET. The cooperation of Karen Jones, Tahoe National Forest, Anne Mileck, Modoc National Forest, Kisatchie National Forest personnel and Joe Doccola, ARBORJet, are greatly appreciated. Danny Cluck, Erin Frolli and Sherry Muse assisted with injections.

Semiochemical work:

this work has been supported by Forest Health Protection, R5 and the Southern Research Station, Pineville, LA. The cooperation of the Lake Tahoe Basin Management Unit and the Humboldt-Toiyabe National Forest are greatly appreciated. The Forest Health Protection (Susanville, CA) summer field crew assisted with beetle collections.

Danny Cluck for presenting.