

Attract and Kill technology for management of European pine shoot moth (*Rhyacionia buoliana*) and Western pine shoot borer (*Eucosma sonomana*)

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ABSTRACT: An attract and kill bait matrix was deployed for management of European pine shoot moth (*Rhyacionia buoliana*), and Western pine shoot borer (*Eucosma sonomana*) in pine plantations and tree nurseries. *R. buoliana* is an introduced pest of native and ornamental pines throughout the Northeastern and Northwestern United States and adjacent Canadian provinces, and a serious pest of pine plantations in South America. *E. sonomana* causes substantial economic losses in ponderosa, lodgepole, and Jeffrey pine in the Western United States. Due to the cryptic larval habits of these shoot borers, conventionally sprayed insecticides are not very effective. A&K technology very selectively removes male moths of the target species from the ecosystem with negligible impact on non-target organisms. Baits combine the selectivity of pheromone (only 0.21 g/ha, compared to 3.5 to 20 g/ha for mating disruption) with rapid toxicity of insecticides (only 7.92 g/ha, compared to 500–800 g/ha for conventional sprays). This bait retains the insecticide within a hydrophobic matrix that precludes run-off or drift, thus preventing ecosystem contamination and damage. Trap catch data indicated that in comparison to number of male *R. buoliana* captured on untreated plots male moth population on plots treated with formulation containing 0.16% (w/w) of pheromone was reduced by 86.6% to 100%. Trap captures of male *E. sonomana* in A&K treated blocks were reduced more than 80% in comparison to untreated blocks.

An attract and kill bait matrix was deployed for management of European pine shoot moth (*Rhyacionia buoliana*), and shoot borer (*Eucosma sonomana*) in pine plantations and tree nurseries. Due to the cryptic larval habits of these shoot borers, conventionally sprayed insecticides are not very effective. A&K technology very selectively removes male moths of the target species from the ecosystem with negligible impact on non-target organisms. Baits combine the selectivity of pheromone (only 0.21 g/ha, compared to 3.5–20 g/ha for mating, disruption) with rapid toxicity of insecticides (only 7.92 g/ha, compared to 500–800 g/ha for conventional sprays). This bait retains the insecticide within a hydrophobic matrix that precludes run-off or drift, thus preventing ecosystem contamination and damage.

OBJECTIVES

- To determine 1) treatment efficacy, optimal formulation, and application rate, and 2) placement of Last Call formulation in the field;
- To test 3) biological and 4) chemical properties of aged and fresh droplets.

MATERIAL AND METHODS

1. Field application of two Last Call formulations, 0.016% and 0.16% pheromone content (w/w): *R. buoliana* – 50 droplets/tree on small groups of trees or 1,200 droplets/acre on plantations; *E. sonomana* – at a rate of 600 and 1,200 droplets/acre, respectively. Moth populations were monitored with A-traps baited w/rubber septa pheromone lures. Damage by *E. sonomana* was estimated at the end of the growth season. Damage by *R. buoliana* will be determined in May 2001.
2. Male moths of both species were trapped at three different heights of the same trees.
3. Male moths of both species were monitored with A-traps baited with 5-week-old and fresh Last Call droplets.
4. Fresh and laboratory aged Last Call droplets were analyzed for residual pheromone content over time.

RESULTS AND DISCUSSION

1. Trap catches of *R. buoliana* were reduced 56–95% and 83–100% on plots treated with 0.016% and 0.16% formulation (respectively) when compared to untreated plots

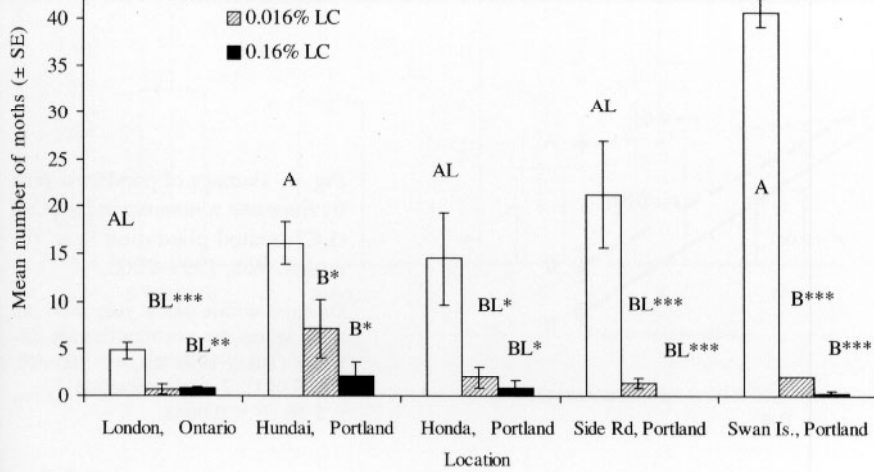


Fig. 1. Trap catches of *Rhyacionia buoliana* in Last Call (LC) treated pine blocks, Portland, OR, USA and London, ON, Canada, May 23–July 20, 2000

Bars within same location with the same letters are not significantly different (Tukey HSD test, $n = 3-6$, $*P < 0.01$, $**P < 0.005$, $***P < 0.001$, L – analysis performed on log-transformed data)

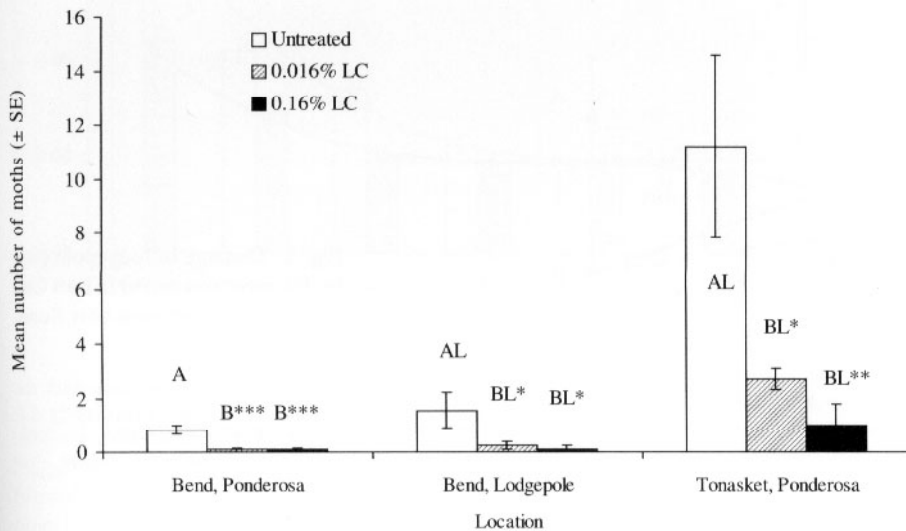


Fig. 2. Trap catches of *Eucosma sonomana* in Last Call (LC) treated pine plantations near Bend, OR, and Tonasket, WA, May 10–June 20, 2000

Bars within same location with the same letters are not significantly different (Tukey HSD test, $n = 9-20$, $*P < 0.05$, $**P < 0.005$, $***P < 0.001$, L – analysis performed on log-transformed data)

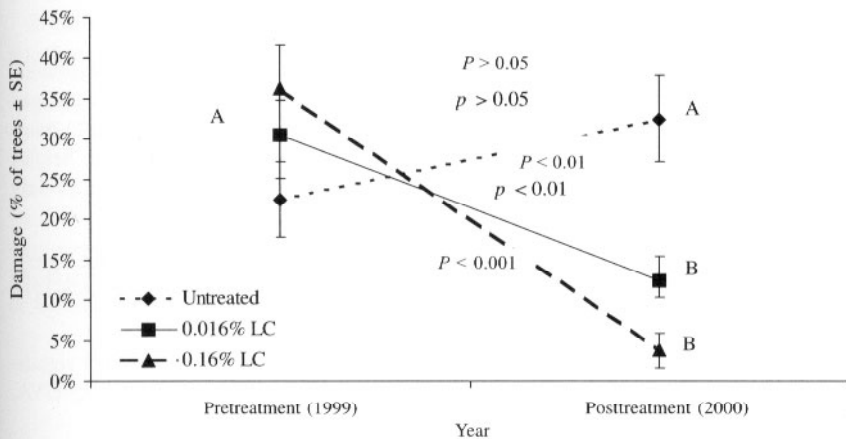


Fig. 3. Damage of ponderosa pine by *Eucosma sonomana* in Last Call (LC) treated plantation near Bend, OR, 1999–2000

Damage within same year with the same letters are not significantly different (Tukey HSD test, $n = 80$, $P < 0.001$). 2-way interaction $F_{(2,556)} = 11.45$, $P < 0.001$

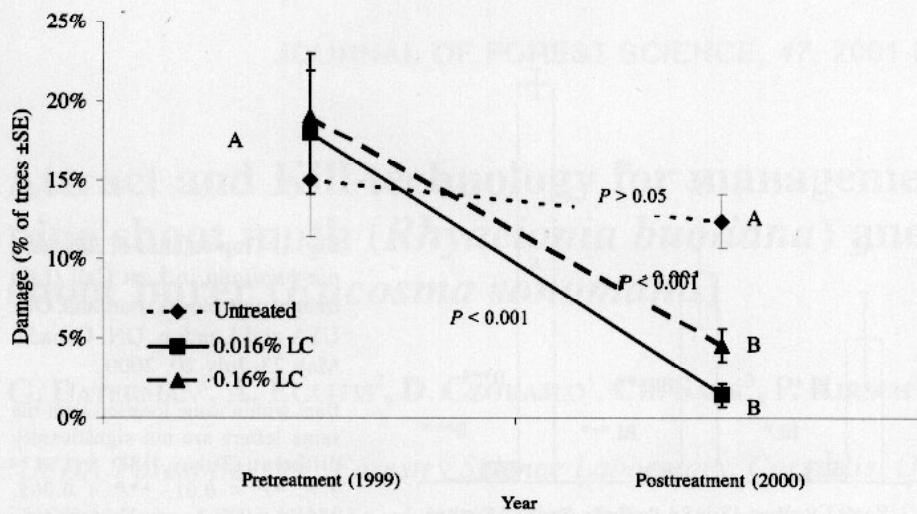


Fig. 4. Damage of ponderosa pine by *Eucosma sonomana* in Last Call (LC) treated plantation near Tonasket, WA, 1999–2000

Damage within same year with the same letters are not significantly different (Tukey HSD test, $n = 100-400$, $P < 0.001$). 2-way interaction $F_{(2,1476)} = 5.36$, $P < 0.0048$

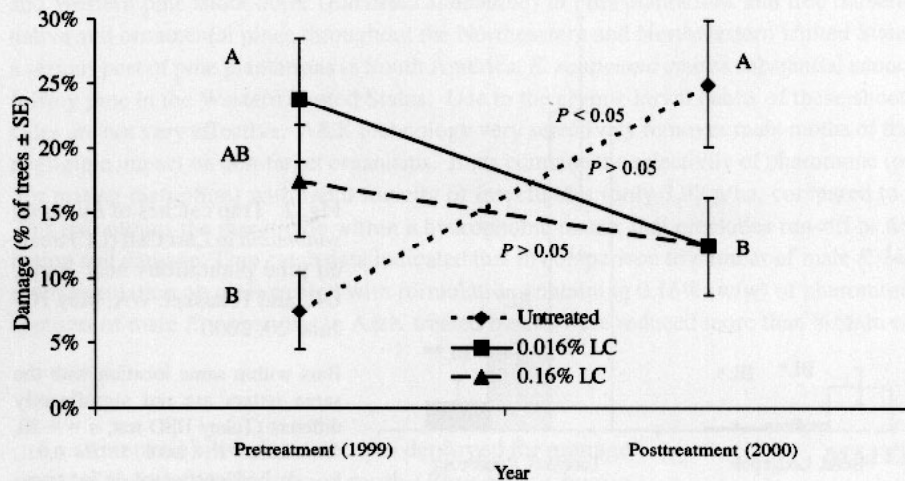


Fig. 5. Damage of lodgepole pine by *Eucosma sonomana* in Last Call (LC) treated plantation near Bend, OR, 1999–2000

Damage within same year with the same letters are not significantly different (Tukey HSD test, $n = 80$, $P < 0.05$). 2-way interaction $F_{(2,474)} = 6.76$, $P < 0.0013$

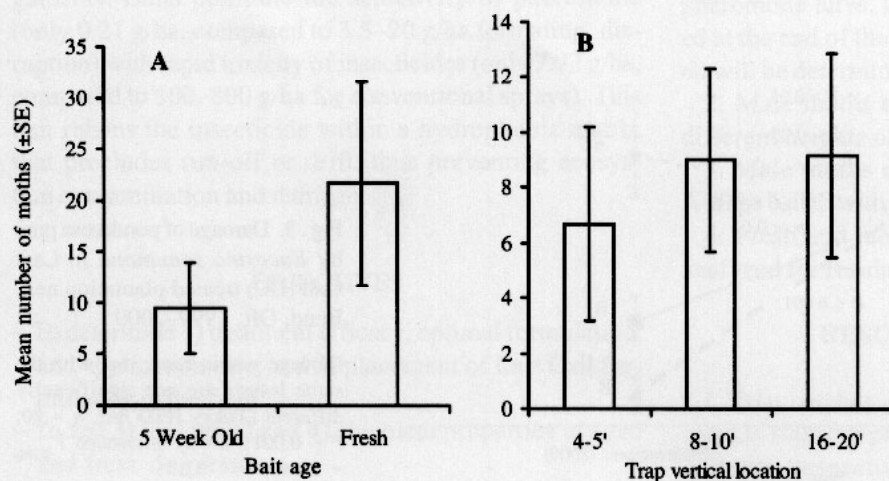


Fig. 6. Trap catches of *Rhyacionia buoliana* in traps baited with aged and fresh Last Call (0.16%) drops (A) and traps at different heights (B). Portland, OR. June 23–July 10, 2000

A – Trap catches were not significantly different (1-way ANOVA, $n = 6$, $P > 0.05$)

B – Trap catches were not significantly different (1-way ANOVA, $n = 6$, $P > 0.05$)

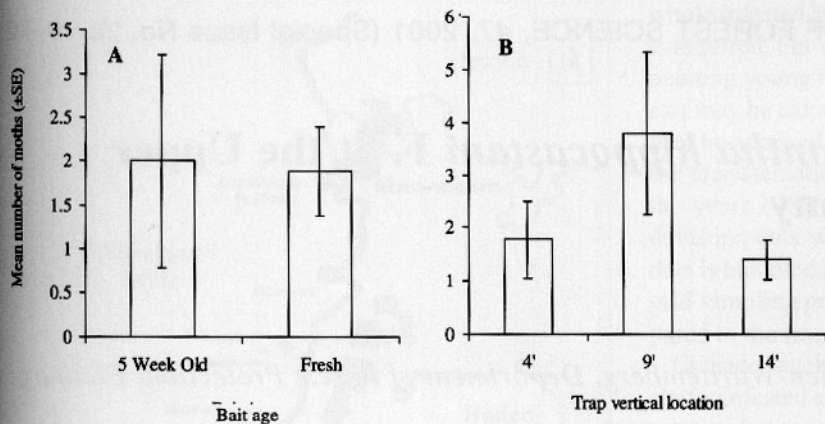


Fig. 7. Trap catches of *Eucosma sonorensis* in traps baited with aged and fresh Last Call (0.16%) drops (A) and traps at different heights (B). Bend, OR. June 6-18, 2000

A - Trap catches were not significantly different (1-way ANOVA, $n = 10$, $P > 0.05$)

B - Trap catches were not significantly different (1-way ANOVA, $n = 9$, $P > 0.05$)

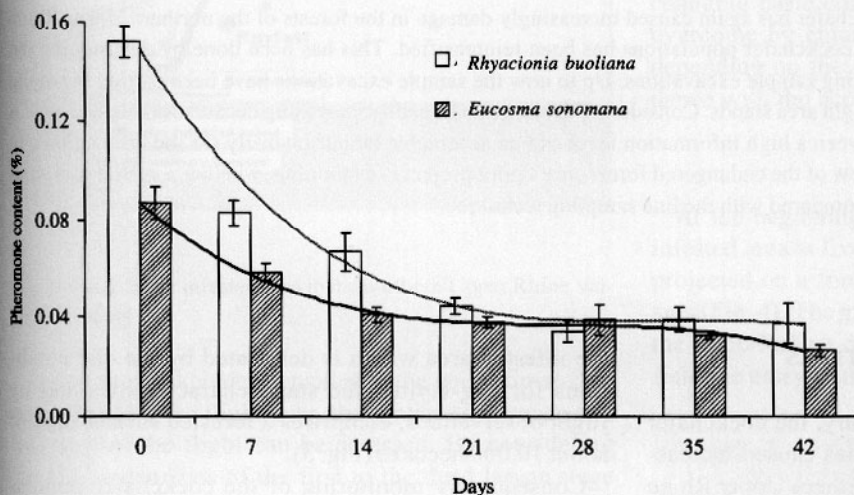


Fig. 8. Pheromone content in Last Call droplet over 42 days in the laboratory

Standard Last Call pheromone load = 0.16%

(Fig. 1). Trap catches of *E. sonorensis* were reduced 76-90% and 90-93% on plots treated with 0.016% and 0.16% formulation (respectively) when compared to untreated plots (Fig. 2).

Damage by *E. sonorensis* in two plantations was significantly reduced on plots treated with either Last Call formulation while moth populations did not change in the untreated plots (Figs. 3, 4). Damage on Last Call treated plots in the third plantation was not significantly reduced while moth populations significantly increased in the untreated plot (Fig. 5).

2. Catches of both moth species were independent of trap height in the tree (Figs. 6, 7, right). However, the

majority of *E. sonorensis* were captured in traps placed nine feet above the ground.

3. Trap catches of both moth species did not differ significantly between traps baited with 5-week old and fresh Last Call droplets (Figs. 6, 7 left).

4. The Last Call formulation retains and protects the integrity of both *R. buoliana* and *E. sonorensis* pheromone for at least 42 days (Fig. 8).

CONCLUSIONS

Last Call technology is an effective, alternative method for management of *R. buoliana* and *E. sonorensis*.

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