EFFICACY OF LAMBDA-CYHALOTHRIN FOR CONTROL OF THE ASIAN LONGHORNED BEETLE

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ABSTRACT

The Asian longhorned beetle (ALB) (*Anoplophora glabripennis*) is among the high-risk invasive species that recently invaded the U.S. from China. The methods used to eradicate ALB within North American infestations have thus far included visual survey for ALB-infested trees, removal of ALB-infested trees, removal of all host trees within a given radius (i.e., 400 m) of known ALB-infested trees, and/or treatment, with a systemic insecticide (e.g., trunk injection, soil injection), of all host trees within a given radius (i.e., 400 m) of known ALB-infested trees. To date, over 32,000 and 23,000 high-value shade trees have been removed in the U.S. and Canada, respectively, in an effort to eradicate ALB and prevent its permanent establishment.

The objective of the research reported here was to investigate the potential development of an alternative control method based upon selective application of the pyrethroid, Lambda-Cyhalothrin, as an encapsulated insecticide under the trade names of Demand® CS or Scimitar® CS. More specifically, the objectives of the initial studies were to determine (1) the lethal dose (24 hour) and knockdown time of Lambda-Cyhalothrin, the active ingredient of Demand® and Scimitar®, applied topically to adult ALB; and (2) the residual activity of Demand® by exposing adult ALB to treated bands (Band Size: 12 x 22.5 cm^2; Material: 600 X 300 Denier, 7 Mil. PVC backed polyester fabric; Source: American Home and Habitat, Inc.; Product # FPV600B; Contact www.ahh.biz). The objectives of the subsequent studies were to determine (1) the residual activity of Demand® by exposing adult ALB to treated caged *Acer mono* trees and (2) the efficacy of Demand® and Scimitar® by spraying ALB-infested *Acer negundo* street trees.

Lethal Dose and Knockdown Time of Lambda-Cyhalothrin

Results from the lethal dose studies showed that the: (a) LD_{50} = 0.13639µg/beetle (CI = 0.04717, 0.21372), and (b) LD_{90} = 0.78461µg/beetle (CI = 0.47376, 3.03056). Results from the knockdown time studies showed that the: (a) KT_{50} = 69.28298 sec (CI = 58.87043 84.27864), and (b) KT_{90} =282.78445 sec (CI = 187.77320 624.53467).

Residual Activity of Demand® Treated Denier Bands

Demand® CS provided 100% mortality for 90 days when applied to bands at 450 mg a.i./L and 600 mg a.i./L. Additional field studies where Demand® CS is applied to bands are needed. Exposure of adult *A. glabripennis* to a lethal dose of Demand® CS is based upon several factors, including: (1) the willingness of adult beetles to walk onto and across treated bands, and (2) the number and position of bands wrapped around branches in trees at risk. We recently evaluated the willingness of adult beetles to walk onto and across different materials. Results showed that adult *A. glabripennis* most readily walked onto and across Denier, but they hesitated to walk onto burlap. We have been evaluating where adult *A. glabripennis* most commonly reside within different tree species, particularly adult female *A. glabripennis* as they lay eggs during the first year of colonization. These studies will pinpoint where bands should be placed within trees so they have the highest probability of killing adult beetles and preventing colonization.

Residual Activity of Demand® Treated Potted *Acer mono* Trees

Demand® CS, prepared in tap water at dosages of 94.0mg a.i./L, 204.24mg a.i./L, and 315.19 mg a.i./L, was applied to each of 10 potted Acer mono trees. Tap water was applied to 10 control trees. Each tree was then individually caged using hardware cloth. On the 1st, 8th, 15th, 22nd, 29th, and 36th day post treatment (DPT), two male and two female field-collected ALB were randomly introduced into each of the 40 cages. Adult beetle mortality was assessed after 24 hours. Beetles failing to exhibit leg movement when prodded with a fine brush were scored as dead. Results from the cage study indicate that Demand® CS can provide 95% and 90% 24 hour mortality for 29 days when applied to potted trees at 204.24 mg a.i./L and 315.19 mg a.i./L, respectively. However, since adult beetles were commonly found seeking refuge in cooler areas of the cage (e.g., holes or cracking in the soil surface; underneath the lip of the pots) that had not been treated with Demand® CS, these results likely underestimate the mortality that would occur on large landscape treated trees and on treated potted trees that are adequately shaded and/or where all surfaces are treated.

Efficacy of Demand® CS and Scimitar® CS Treated *Acer negundo* Urban-landscape Trees

Results showed that exposure to 300 mg a.i./L and 600 mg a.i./L Demand® CS provided overall population control of 99.0% [2765 dead/(27 live +2765 dead)] and 98.4% [2717 dead/(43 live + 2717 dead)], respectively, over the 58-day test period in 2005 (14 July to 9 September). Results also showed that exposure to 300 mg a.i./L and 600 mg a.i./L Scimitar® CS provided overall population control of 98.4% [926 dead/(15 live +926 dead)] and 98.4% [791 dead/(13 live +791 dead)], respectively, over the 67-day test period in 2006 (13 July to 17 September). This shows that Demand and Scimitar are highly effective at controlling adult ALB. However, it is important to note that the treated and check (control) plots were spatially very close to one another, and as such, the live ALB that continued to be found within the treated trees were largely due to immigration from the untreated check plots. We are confident that had the treated and check plots been farther apart and/or a treated buffer been included between the treated and check plots, it is highly probable that percent control would have been consistently maintained at ca. 100%. To obtain a direct measure of immigration, additional data analysis is currently in progress at this time: # 2005 and 2006 exit holes/tree. This will aid in determining the relative proportion of ALB within trees that resulted from emergence versus immigration. Furthermore, because our goal is to prevent oviposition by live female ALB and because ALB in Yanji, Jilin, China, have a 24- month life cycle, exit holes/tree will be evaluated in 2007 and 2008. This data will provide a measure of the efficacy of Demand® CS and Scimitar® CS to prevent attack by ALB.

Closing Remarks

Additional field studies were initiated in 2006 where Scimitar® CS is applied to potted *Acer mono* sentinel trees for detection and monitoring of adult *A. glabripennis*. Most importantly, these additional studies will determine if Demand® CS or Scimitar® CS alters the attractiveness of *A. mono* sentinel trees. For details, refer to Smith et al. on page 66 in this volume.

Literature Cited

Smith, Michael T.; Fuester, Roger W.; Tropp, Joseph M.; Aparicio, Ellen M.; Tatman, Daria; Wildonger, Jeff A. [In this proceedings]. **Native natural enemies of native woodborers: Potential as biological control agents for the Asian longhorned beetle, *Anoplophora glabripennis***. In: Fosbroke, S.L.C; Gottschalk, K.W., eds. Proceedings of the U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species; 2007 January 9-12; Annapolis, MD. Gen. Tech. Rep. NRS-P-28. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.