Black stem borer control in apple nurseries and tall spindle plantings

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Background and Justification: The ambrosia beetle, *Xylosandrus germanus* (Blandford) (Coleoptera: Curculionidae: Scolytinae), also known as the black stem borer, is a serious pest in ornamental tree nurseries and landscapes in North America. This tiny beetle which is about 2 mm in length, attacks and bores holes 1 mm in diameter to form galleries into the wood of trunks or limbs of apparently healthy trees and those that are stressed, dying or recently dead. Brood channels are excavated by the females with entrance tunnels, brood chambers containing eggs, and branch tunnels where the young develop. This arrangement accommodates all life stages and developmental processes of the insect's life history.

The term "ambrosia beetle" refers to species that derive nourishment during the larval and adult stages from a mutualistic "ambrosia" fungus carried by the adult female in mycangia (internal pouches) and introduced into host plants during gallery excavation. The ambrosia fungus associated with *X. germanus* is *Ambrosiella hartigii* Batra, visible in the galleries as an abundant grayish-white mycelium growth. It is this fungal growth that the insects feed on, and not the host plant tissue. However, its presence signals the tree that it is under attack, and as the tree walls off its vascular system in response, symptoms develop including wilting, dieback, tree decline and death. But other pathogenic fungi such as *Fusarium solani* and the oak wilt fungus have also been isolated from the beetles.

In 2013, infestations of *X. germanus* were seen for the first time in commercial apple trees, in multiple western NY sites. In these sites, growers were seeing 30% of trees in parts of their orchards collapsing. To date, at least 30 additional infestation sites have been documented, extending as far as to Long Island, and it appears that these ambrosia beetles may have been present in the area for some years before first being detected, as they are now able to be found in nearly every orchard showing these types of tree decline symptoms; hundreds of trees have already been destroyed.

Methods: Since apple nursery producers have been struggling with this pest as well as many tall spindle apple producers, we set up trials for testing controls using various insecticide treatments as the first line of defense. But to encourage attraction of beetles to the trees, we used a potted tree approach and bagged the trees to flood them and induce them to emit ethanol from the stress (Ranger).

Nursery Tree Trial: We potted sleeping eye trees on B9, and applied 8 treatments, 4 reps, 4 trees per rep on 2 sites, Roberts Farm Market and Wafler Nursery. The trees were lined along a woods edge near an infested site, placing them in larger plant containers lined with plastic bags and filled with water to simulate flooding stress. Treatments were applied using a CO2 sprayer wand with a full cone nozzle to cover the bark of the tiny nursery trees. We evaluated the trees for holes by pulling potted trees and scraping bark to find the holes, and cut cross-sections to determine the success of BSB rearing brood for each hole.

Preliminary results :

Table 1 shows nursery trees that had no stress were not infested, but Lorsban was effective at reducing the pressure in the Wafler nursery site. The pyrethroids did not show very promising control. The Metarhizium, biological control fungus, appeared to be effective but all the green tissue on the tree was severely burned. The Roberts nursery tree test was not as clear with no damage in the untreated flooded trees. This site was adjacent to larger established trees in a wet area in the orchard that were infested and likely more attractive to BSB than the tiny nursery trees. We need to continue to work on the methods to get clearer results.

Table 1. Nursery Trial for control of 1st generation BSB at Wafler - 2015

Stress	Treatment	% Infested	# Holes	Gallery	Adults	Brood	Adult dead
No flood	**untreated**	**0**	**0**	**0**	**0**	**0**	**0**
Flooding	**untreated**	**38**	**14**	**3**	**3**	**2**	**2**
Flooding	**Lorsban**	**13**	**2**	**0**	**0**	**0**	**0**
Flooding	**Lorsban then Permup**	**13**	**2**	**0**	**0**	**0**	**0**
Flooding	**Permup x2**	**38**	**10**	**0**	**3**	**0**	**4**
Flooding	**Warrior x2**	**56**	**16**	**1**	**3**	**0**	**2**
Flooding	**Warrior then Keyplex**	**25**	**6**	**2**	**7**	**1**	**3**
Flooding	**Metarhizium**	**6**	**1**	**0**	**0**	**0**	**0**

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Christopher M. Ranger, Michael E. Reding, Peter B. Schultz and Jason B. Oliver. Influence of flood-stress on ambrosia beetle host-selection and implications for their management in a changing climate. Agricultural and Forest Entomology (2013), 15, 56–64.