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Detecting and monitoring emerald ash borer populations

INTRODUCTION

The emerald ash borer (EAB), first detected in Canada in 2002, is a highly destructive invasive beetle that has already caused significant mortality to North American ash trees and continues to pose a severe threat to most species of ash. In addition to the ecological consequences that may ensue, the loss of ash trees will have significant economic impacts on the hardwood forest industry, private woodlot owners and First Nations. Economic losses due to EAB in Ontario, Quebec and parts of the United States are estimated to be in the tens of millions of dollars. Municipalities have also incurred significant costs for the removal and replacement of urban trees, which in the north-eastern US is estimated to have already cost $3-10 billion.

It is difficult to detect new infestations of EAB, particularly in the early stages, because the insect spends most of its life cycle under the bark By the time adults emerge and trees exhibit symptoms of attack such as epicormic shoots, woodpecker damage or crown dieback, the tree may already be heavily infested and likely to soon die. For these reasons, forest managers need effective early detection and monitoring tools for EAB.

GREAT LAKES FORESTRY CENTRE ROLE

Scientists at GLFC have been conducting research on EAB to increase the knowledge on its biology as well as to develop tools to survey and control its populations. The development of an efficient and reliable early detection program is among the most important first steps in any management program, as it assists foresters in identifying and delimiting new outbreaks, evaluating potential damage and assessing control options. When EAB was first discovered in North America, survey techniques relied mainly on visual inspections of trees and destructive sampling that involved felling of entire trees. Since then, scientists at GLFC have been working on the development of effective, reliable and easy to use techniques for detecting infestations and determining the extent of infested areas.

Baited traps

Traps baited with an attractant can play an important role in insect monitoring programs because they can detect flying adults and provide evidence that a population is in the area. Considerable progress has been made in developing suitable traps baited with lures that can be used to monitor EAB population levels. The Canadian Food Inspection Agency (CFIA) used green traps baited with Z-3-hexenol, a mimic of the compound that is emitted by ash tree leaves, for the 2010 EAB monitoring program in Ontario because that colour-lure combination had proven to be the most effective by both Canadian and US researchers. Research has also indicated that traps work best when hung in the mid-upper canopy of trees in locations exposed to direct sunlight. Some limitations in the use of traps are that they can only be deployed during the summer flight period of the adults, they may not be effective at detecting low-density infestations and they do not provide a direct estimate of EAB population levels or of individual tree infestation.

Ongoing research is testing the efficacy of a pheromone-baited trap, one that emits the scent emitted by female EAB to attract a male, to see if that lure will increase detection rates, particularly when EAB densities are low. In addition, information on optimum trap number and spacing will be obtained.

Branch sampling

GLFC scientist Krista Ryall has been investigating branch sampling methods with the aim of determining the optimal sampling procedure to maximize detection, particularly in the early stages of infestation. The method involves carefully examining branches by peeling back the bark in thin layers to look for EAB galleries. Results demonstrated that the sampling method could detect numerous infested trees that initially appeared to be healthy, showing no signs or symptoms of attack. The recommended branch sampling procedure is described in further detail in Frontline Technical Note 111.

Baited traps versus branch sampling

Another goal of the research was to compare trap captures with infestation levels in trees as determined through branch sampling. This research was conducted in Oakville, Toronto and Sault Ste. Marie, where data on EAB density had already been obtained and where climatic conditions varied. Overall results showed a good correlation between trap captures and EAB densities based on branch sampling, although in some cases traps did not detect any EAB when the

density of galleries was very low. Ongoing research is determining the detection rate of both methods, along with the costs of each. It is likely that both trapping and branch sampling methods will be useful as part of an early detection plan for EAB. Traps can be deployed during the adult flight period, while branch sampling can be used at any time of the year to provide additional information with regard to density estimates, delimitation of infestations and assessing individual trees for treatment. Branch sampling could be used in combination with baited traps. For example, branch sampling could be used to identify the infested trees in areas where adult EAB have been found in baited traps.

Survey methods

A survey methodology for EAB detection and delimitation using branch sampling was designed and tested in Sault Ste. Marie, Toronto, Oakville, Burlington and Brampton. The procedure was employed in sample plots spaced 1 km apart. First, five trees per plot were examined for obvious visual signs of infestation such as exit holes, galleries, or woodpecker feeding. Then, if no signs were apparent, branches were whittled to search for galleries. If no EAB were detected, a further five trees were sampled to increase the chance of detecting low level populations. In addition, sampling was conducted up to a distance of 3-4 km from known infestations. This proposed sampling method will be helpful both in identifying areas with low-level and previously unknown infestations, as well as in areas with high EAB density.

Future work

In addition to refining these tools for characterizing EAB outbreaks across the landscape, scientists are evaluating EAB gallery density within a tree to determine when a tree can be treated by injection of a control product or when it should be removed. Such "action thresholds" will help determine costs and benefits of different management options. Other CFS researchers are striving to develop new direct control methods that could reduce the populations of EAB.

CONCLUSION

Surveys that are effective in the early detection of EAB infestations are an essential tool for timely pest management. Both branch sampling and trapping have been shown to be useful in such surveys. The usefulness of these tools will become evident when more control tools and options become available. The sooner detection occurs the more options can be employed to manage populations

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Canadian Food Inspection Agency

RECOMMENDED READING

Lyons, D.B. 2010. Emerald ash borer. Natural Resources Canada, Great Lakes Forestry Centre, Sault Ste Marie, Ontario. Frontline Technical Note 110. 4 p.

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