



## Release of parasitic wasps for biological control of the emerald ash borer in Canada

### INTRODUCTION

The emerald ash borer (EAB), *Agrilus planipennis* (Coleoptera: Buprestidae), is a devastating invasive beetle that has killed tens of millions of ash trees across Canada and the United States. Few management or control options are available, particularly in natural forest habitats. The economic and ecological impacts of damage by EAB are of serious concern, and will only worsen as the insect continues to spread across the native range of ash in North America.

The use of introduced biological control agents is one method being explored to help reduce the spread and growth of EAB populations. Two species of parasitic wasps (parasitoids) from the native range of EAB are currently being evaluated in Canada. The wasps were originally collected in China by US researchers as part of their classical biological control program for EAB and they have generously provided the insects for the Canadian trials. These wasps are highly specific to EAB and studies have demonstrated high parasitism levels in their native range. Permission to begin field trials with the parasitoids in Canada was granted by the Plant Biosecurity and Forestry Division of the Canadian Food Inspection Agency (CFIA), after review by the Biological Control Review Committee.

### GREAT LAKES FORESTRY CENTRE (GLFC) ROLE Protocols

Parasitoid release in test plots began in Canada in 2013, in an attempt to establish populations of the wasps in the region infested with EAB. Wasps were obtained from the Biocontrol Production Laboratory in Brighton, Michigan, where wasps have been reared since 2009. Emerald Ash Borer Biological Control Release and Recovery Guidelines, developed by the United States Department of Agriculture - Animal and Plant Health Inspection Service (USDA-APHIS), are being followed in Canada.

#### Site and plot selection

Forest stands with a high ash component and moderate populations of EAB were selected, based on guidelines set out by the USDA-APHIS. Suitable locations were found on various Conservation Authority properties and lands managed by the National Capital Commission. Following site selection, 12 ash trees within the interior of the stand were selected as release trees. Data on each of the trees, as well as surrounding ash trees were recorded, including signs and symptoms of EAB attack (i.e., woodpecker feeding holes, bark

deformities, epicormic shoots and EAB exit holes). All data to date has been uploaded to the EAB Parasitoid Release and Recovery Database ([www.mapbiocontrol.org](http://www.mapbiocontrol.org)) to make it available for analysis in the future to determine optimum release strategies.



Small log bolts containing EAB larvae infested with *T. planipennis* (on right, as seen through a microscope)



#### Parasitoid release

The first species released in 2013, *Tetrastichus planipennis*, is a species that attacks EAB larvae as they feed under the bark. Adults emerge in late May and produce multiple generations per year. Females parasitize late instar EAB larvae, with up to 57 wasps produced per EAB larva. This species can attack up to 50% of EAB larvae in its native range in China. For the field trials, small log bolts containing EAB larvae infested with the parasitic wasps are prepared in the lab. They are given time to develop until they are almost ready to emerge, at which time the bolts are placed in the field. The parasitoids finish development and begin emergence soon after deployment. To date, over 60,000 *T. planipennis* have been released in total over the past four years at 12 sites across southern Ontario and Quebec.

In 2015, tests began with a second species, *Oobius agrili*, an egg parasitoid with two generations per year. Up to 80 EAB eggs are attacked per female with one egg laid per EAB egg. This species has up to 60% parasitism in its native range. Parasitized eggs are placed in small containers with mesh screening that allows the wasps to exit, then suspended on the release trees. Over 25,000 *O. agrili* have been released at nine sites since 2015.

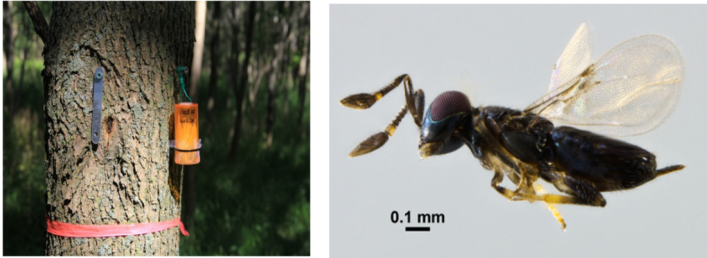
#### Post-release assessment

Following release of the parasitoids, overwintering survival and establishment are assessed. One year later, a number of ash trees within the release area were felled, cut into bolts and transported to GLFC laboratories where they were put into rearing containers to observe parasitoid emergence. Initial

follow-up sampling to evaluate if the parasitoids can be recovered has been conducted in six sites so far. Initial follow-up sampling to evaluate if the parasitoids can be recovered has been conducted in six sites so far. Early establishment of *T. planipennisi* appears to be quite high, with wasps recovered at all six sites. Of those trees sampled, approximately 64% contained at least one brood of *T. planipennisi*, indicating that the wasps are dispersing throughout the site and locating additional trees infested by EAB. It is too early yet to conduct recovery sampling for the egg parasitoid, *O. agrili*; this sampling will commence in 2017. Additional sampling of trees infested with EAB will be necessary over the next several years to determine if one or both parasitoids have become permanently established (typically requiring at least three consecutive years of recovery following releases).

#### Future work

A rearing initiative has been started with the Insect



Container holding EAB eggs with *O. agrili* (on right, as seen through a microscope)

Production and Quarantine Laboratory at the Great Lakes Forestry Centre, in collaboration with Dr. Amanda Roe and John Dedes as well as the USDA-APHIS rearing facility in Brighton, Michigan. Rearing of *T. planipennisi* has recently begun (Dec 2016) to augment numbers of parasitoids available for release within Canada.

Additional releases in new sites will be conducted in future years. Further research is necessary to continue to evaluate initial and permanent establishment of one or both parasitoids. In addition, releases of one or more additional parasitoid species will be conducted as permission is obtained to import them into Canada. It would be of interest to test the effectiveness of parasitoids in an urban area and to learn more about biology and habitat requirements to see what they need to establish and persist.

#### CONCLUSION

It is still very early in the development of the biological control program for EAB in Canada; no results on any potential impact of the parasitoids on EAB populations are yet available, but this will be evaluated in the future. Preliminary studies in the US demonstrate increasing parasitism levels over time and some reduction in the rate of growth of EAB populations. In the long term, establishment of these parasitoids is intended to assist in regulating EAB at lower population levels.

#### ACKNOWLEDGEMENTS

United States Department of Agriculture - Animal and Plant Health Inspection Service (USDA-APHIS), Ontario Ministry of Natural Resources and Forestry, Quebec Ministry of Natural Resources and Energy, Conservations Authorities of Ausable Bayfield, Long Point Region, Upper Thames River and the Credit Valley, National Capital Commission, Ville de Montréal – Environnement, York Region, BioForest Technologies Inc.

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#### POLICY PERSPECTIVE

The Canadian Forest Service (CFS) has a mandate to conduct research relating to the protection of the forest resources of Canada under the Forestry Act. As described in the CFS Strategic Framework, “Growth and Innovation Rooted in Sustainable Forests,” the CFS conducts research on native and alien forest pests, working with key partners to develop management and mitigation strategies. The EAB biocontrol program is supported through CFS’ partnership in SERG (Spray Efficacy Research Group)-International – a collaboration in forest pest research among Canadian provinces, federal agencies, and the U.S. Forest Service. The Ontario portion of the program is under the aegis of the Canada-Ontario Memorandum of Understanding for Cooperation in Forestry. The EAB biocontrol program is conducted under a permit issued by the CFIA, which oversees the release of biocontrol agents in Canada.