Establishing *Oobius agrili* (Hymenoptera: Encyrtidae), the introduced egg parasitoid of emerald ash borer, in Michigan ash stands

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The egg parasitoid *Oobius agrili* Zhang and Huang (Hymenoptera: Encyrtidae) is one of four parasitoid species from northeast Asia being released in regions of North America as part of a biological control program to manage the invasive emerald ash borer (EAB), *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae) (Bauer et al. 2015). To date, *O. agrili* has been released in 23 U.S. states and two Canadian provinces. At Michigan study sites where *O. agrili* was released starting in 2007, average egg parasitism reached up to 40% over a five-year period (Abell et al. 2014). From 2007 to 2011, *O. agrili* were released into the field as live adults after they were allowed to feed on honey for at least 24 hrs (USDA–APHIS/ARS/FS 2016). In the laboratory, unfed *O. agrili* adults died within 24 hrs (unpublished data). In 2012, release methods transitioned from the release of parasitoids as adults to the deployment of parasitoids as pupae which completed development and emerged as adults in the field. This new method includes using EAB eggs that were laid on filter paper and presented to *O. agrili* in the laboratory. *Oobius agrili* parasitize and develop inside the EAB eggs and when they reach the pupal stage, small pieces of the filter paper with parasitized eggs are placed in small plastic containers referred to as "oobinators" that have an open end covered with screening (USDA–APHIS/ARS/FS 2016). After placement of the oobinators on EAB-infested ash trees in the field, *O. agrili* complete development and adults chew round exit holes in the EAB eggs and then crawl through the oobinator screening to disperse. Streaks of honey are placed inside the oobinators for emerging *O. agrili* to feed upon. Utilizing oobinators has greatly eased handling efforts given that adult *O. agrili* are only 1-mm long, making them difficult to count and transfer between containers. This release method has also simplified releases in the field, where oobinators can be placed in the field regardless of current weather conditions, which is important when releasing *O. agrili* as adults, i.e., heavy winds and rain should be avoided (USDA–APHIS/ARS/FS 2016).

There is some concern by researchers and managers that releasing *O. agrili* using oobinators is not as effective for establishment of *O. agrili* when compared to releasing live adults fed honey. However, these claims are based primarily on anecdotal observations. Releasing egg parasitoids as pupae within host eggs has been used successfully for inundative releases of various Trichogrammatidae (Hymenoptera) species, however, only two papers evaluating releases of adults versus pupae were found in the literature (Saavedra et al. 1997, Chowdhury et al. 2016).

In 2015, we initiated a study to compare the establishment success of *O. agrili* released as adults fed honey to those released as pupae in oobinators. We selected 16 sites (8 for each treatment) in the lower peninsula of Michigan where *O. agrili* was not previously released. For each site, variables such as basal area of live and dead ash, percent canopy dieback of live ash trees, and basal area of all live non-ash trees were recorded. To monitor EAB adult flight and abundance, we placed three green funnel traps baited with *cis-3*-hexenol in the lower to mid canopy of live ash trees at each site and collected captured insects at 1-2 week intervals.

Preliminary results demonstrate that overall EAB egg densities, EAB adult densities, and percent canopy dieback of ash trees increased from 2015 to 2106 at most sites. We followed parasitoid release guidelines (USDA–APHIS/ARS/FS 2016) for timing releases of *O. agrili* in 2015, and these coincided with peak EAB adult flight and oviposition, as determined by trapping EAB adults and estimation of initial oviposition beginning approximately two weeks after initial adult emergence. For samples sorted to date, EAB eggs with the signs and symptoms of parasitism by *O. agrili* were recovered from bark samples collected after releases were made at two sites that received adults and two sites that received oobinators, confirming *O. agrili* reproduction at 4 of the 16 sites. Successful establishment of *O. agrili* will again be assessed at all sites in 2017. We will also continue to monitor EAB adult flight, EAB egg densities, and ash canopy condition at all sites in 2017.

References

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