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# Assessment of Biocontrol Possibilities for Japanese Beetle

## Animal and Plant Health Inspection Service

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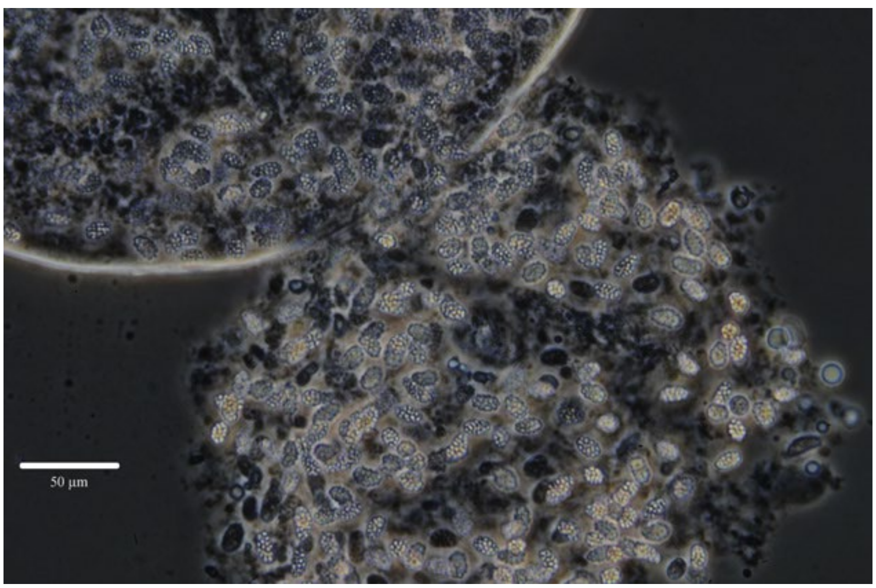

Petty et al., 2012.

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USDA has supported biocontrol efforts against Japanese beetle since 1920, importing 49 natural enemies of Japanese beetle and related scarabs in hopes of attaining long-term control of the pest (Clausen and King, 1927; Potter and Held, 2002). Of the nine insects selected for introduction from Japan and Korea in the 1920s (Clausen and King, 1927), three parasitoids– one fly and two wasps– have established in limited areas of the United States and received additional attention over the years (McDonald, 2020; Potter and Held, 2002). USDA's participation in programs to expand the ranges of these insects has been inconsistent and poorly documented, but we provide a brief summary below.

The winsome fly, *Istocheta aldrichi*[1], parasitizes Japanese beetle adults and was introduced to the Northeastern United States in 1922 (Cappaert and Smitley, 2000; Clausen and King, 1927; O'Hara, 2014). The winsome fly appears to have established in the Northeast after its introduction, but its life cycle is not well synchronized with Japanese beetle there (USDA-CPHST, 2005). The fly is also established in other infested states and has recently been introduced to Colorado (McDonald, 2020).

Two parasitoid *Tiphia* wasps– *T. vernalis* and *T. popilliavora*– that are established in the United States attack larvae (Potter and Held, 2002). *Tiphia vernalis* was introduced in 1925, and by 1953, it had established in 15 states (Cappaert and Smitley, 2000). Adults of these wasps require sources of pollen and nectar to thrive (McDonald, 2020). However, floral resources are uncommon and difficult to maintain on airport grounds at levels that can support local control of Japanese beetle (Lewis, 2020). Like the winsome fly, *T. vernalis* is currently being introduced to Colorado (McDonald, 2020).

USDA's use of insects for biological control of Japanese beetle has been largely unsuccessful. On the other hand, decades of research on a microsporidian pathogen, *Ovavesicula popilliae,* suggest that it would be an effective biological control organism for long-term population management of Japanese beetle on airport grounds.

*Ovavesicula popilliae* causes a chronic, debilitating disease in Japanese beetle hosts (Hanula and Andreadis, 1990). In areas with established populations of *O. popilliae,* adult females produce fewer eggs and larvae are less likely to survive through the winter (Smitley et al., 2011). Both grubs and adults can become infected, and if grubs survive, they can carry the pathogen into adulthood (Hanula and Andreadis, 1990). Once established in an area, *O. popilliae* is spread to new hosts by the beetles themselves, either by the release of spores from dead larvae in the soil or in excrement from adults (Petty, 2013).

[1] Clausen first reported this species as *Centeter cinerea* Aldrich (Clausen and King, 1927).

With the cooperation of local airport authorities, PPQ is currently seeding spores of the pathogen at airports across the regulated states and monitoring establishment. This effort started in 2017 with six airports in five states but has now expanded to 11 airports in eight states (**Figure**; Lewis, 2020). The pathogen has been recovered at some of these airport introduction sites (Rentschler, 2020; USDA-APHIS, 2018).
Japanese beetle CFWG continues to support research on developing this promising long-term management option, and further support is likely to be fruitful.

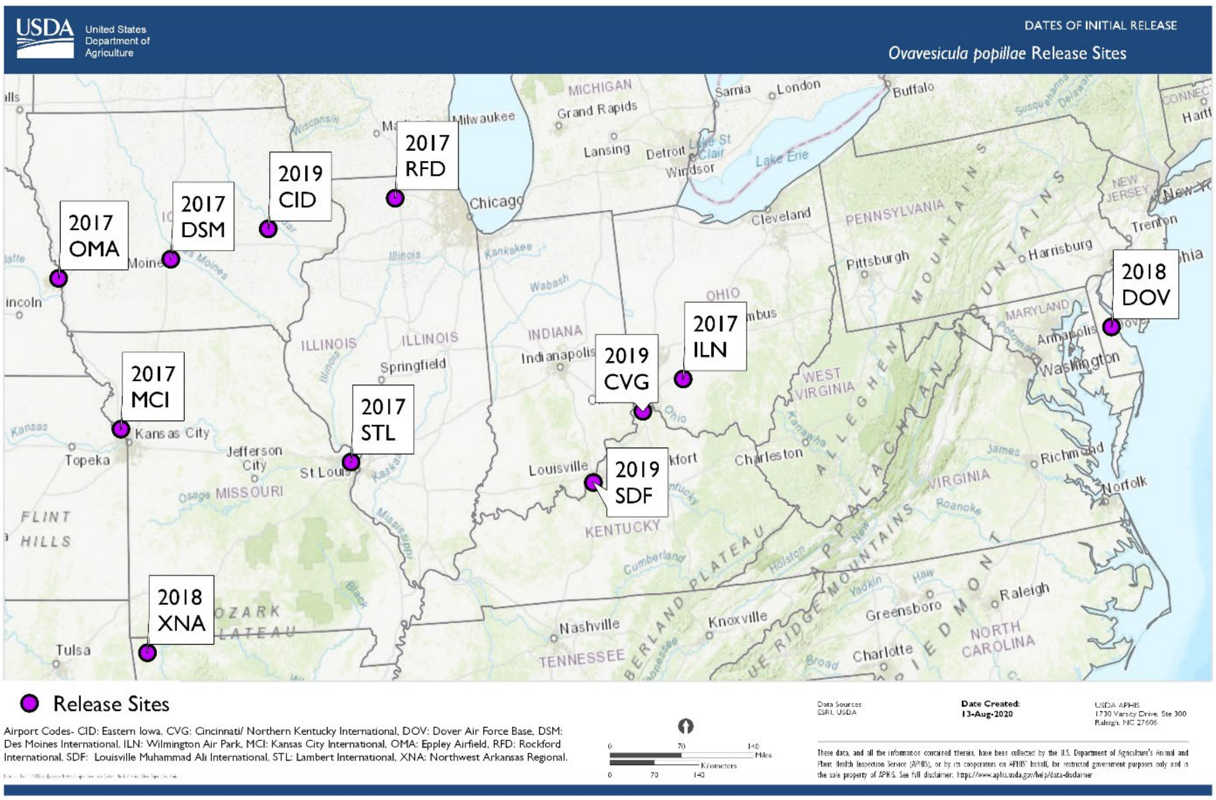


**Figure**. *Ovavesicula popillae* year of initial release at airport sites (data: Lewis, 2020).

Our review of the Japanese beetle program revealed that local beetle outbreaks can make safeguarding a challenge in some years (e.g., Moore, 2020; Simon and Johnson, 2020); therefore, keeping beetle abundances below outbreak numbers on airport grounds could be an effective way to safeguard flights over the long term. Biological control could potentially achieve this, but implementing a biological control program on airport grounds requires the cooperation of airport authorities or landscape managers who are not currently involved in the Japanese Beetle Program.

The pathogen *Ovavesicula popilliae* can effectively reduce Japanese beetle populations once it has established. Japanese beetle populations at early *O. popilliae* introduction sites in Michigan are now so low that trapping adult beetles is difficult (Lewis, 2020). At one Michigan field site where the pathogen has been well-established since 2008, at least 76.5 percent of infected larvae do not survive overwintering (Piombino et al., *In press*). The combined effects of larval mortality and reduced female egg production are estimated to reduce Japanese beetle populations by 40 percent each year (Piombino et al., *In press*). A successful biological control program could greatly reduce the risks of transporting Japanese beetles to the protected states. Establishment is a slow process but achieving this level of pest management is ideal.

PPQ has been releasing this pathogen at airports since 2017, and early results are promising (Lewis, 2020). However, seeding the pathogen requires burying infected beetle carcasses in grassy areas, which requires the cooperation of local airport authorities who manage airport grounds. Additionally, a formal environmental assessment of *O. popilliae* introduction has not yet been conducted, and some airport authorities might also be hesitant to participate in an experimental program (Lewis, 2020). Our interviews found that communication with landscape managers and obtaining permission from airport authorities can sometimes be an obstacle to implementing this program (Lewis, 2020; Simon and Johnson, 2020). Unlike carriers, airport authorities are not directly impacted by the Japanese beetle quarantine, and they may not consider beetle control a priority.

Airports that can successfully establish *O. popilliae* could potentially reduce their beetle numbers enough that annual regulation is no longer necessary. This can be a valuable safeguarding tool, as outbreaks seem to lead to increases in incursions. Creating outreach materials that can help convince airport authorities and landscape managers to participate in the program might help get more airports involved in the program.

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