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Japanese Maple Scale Biological Control

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Japanese Maple Scale

Japanese Maple Scale (JMS) *Lopholeucaspis japonica* is a serious pest throughout Asia, Eastern Europe, and North and South America (EPPO 2016). It was first reported in the United States in Connecticut in 1914 (Miller et al. 2005). It has since spread to Alabama, Connecticut, Delaware, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Tennessee, Texas, Virginia, and Washington DC (Frank et al. 2013, García Morales et al. 2016, Gilder et al. 2020, Jeger et al. 2018 and).

Japanese Maple Scale has a wide host range, with a preference for smooth-barked trees and shrubs. It has been reported on 97 plant species from 35 different families (Miller et al. 2005, Shrewsbury et al. 2020, Harsur et al. 2018, and Jeger et al. 2018). The most common hosts include dogwood, elm, flowering fruit trees, maple, magnolia, lilac and rose.

In the eastern United States, this scale has been identified as a nursery pest in

woody ornamental production areas (Fulcher et al. 2012, Addesso et al. 2014). There were 26 recorded shipment rejections of nursery trees originating in Tennessee from 2021-2023 due to the presence of JMS, posing an economic threat to growers (pers. comm, Tennessee Plant Certification Administrator). The small size of the insect (1-2 mm), its waxy covering, and its bark-like coloration make it challenging to identify and manage **(Fig. 1)**. The wax covering repels water and so the scale is protected from insecticide formulations applied in water unless the wax cover is disrupted **(Fig. 2)**. With two generations per year, the reproductive potential of this pest is high. A single male and female scale have the potential to reproduce millions of new scales in a few years' time. Under natural conditions, predators, parasitoids, and diseases prevent scale numbers from reaching outbreak levels. However, broad-spectrum pesticide use in nursery systems significantly reduces the population of natural enemies, leading to scale outbreaks.

Fig. 1. Japanese maple scale infestation on hornbeam.

Fig. 2. Japanese maple scale female with eggs under wax covering.

These complex factors necessitate selection and timing of chemical management tools wisely to manage this pest while promoting the “free” control provided by parasitoids, predators, and pathogens.

What is Biological Control?

It is important to understand that all insect species populations are kept in balance by naturally occurring organisms and environmental factors with no human interaction and is referred to as natural control. Biological control, more specifically, is a component of an integrated pest management strategy. It can be defined as the reduction of pest populations by natural enemies with the involvement of an active human role. Biological control programs involve the intentional incorporation of predators, parasitoids, and/or pathogens to suppress the population of the targeted pest. There are three approaches by which we can practice biological control: a) by conserving the existing natural enemies in the field, b) by introducing a new natural enemy that is specific to the targeted pest, and c) by increasing the population of a natural enemy in the field when and where it is needed so as to manage the targeted pest.

Predators

In general, scales are preyed upon by many predators, including certain beetles, bugs, lacewings, and predatory mites. Predatory lady beetle belonging to the genus, *Chilocorus*, *Hyperaspis*, and *Rhyzobius*, can easily go unnoticed because the adults of many species are tiny (2-3 mm), and their color and shape blend in with scale-infested areas. Predatory lady bird beetle larvae may feed hidden beneath scale covers. *Hyperaspis* species are tiny, shiny, black lady beetles with several red, orange, or yellow spots on the back. *Rhyzobius* has a reddish head and underside and a grayish

back densely covered with tiny hairs (Kabashima, 2023). The twice-stabbed lady beetle, *Chilocorus stigma* **(Fig 3),** is a larger, shiny black beetle with two red spots on its back. Previous studies conducted by Addesso et al. (2016) observed twice-stabbed lady beetles feeding on JMS in Tennessee nurseries.

Fig. 3. *Chilocorus stigma* – twice-stabbed lady beetle adult

Parasitoids

Diaspidid scales are parasitized by several microscopic parasitic Chalcidoidea wasps, including species in the genera *Aphytis*, *Coccophagus*, *Encarsia*, and *Metaphycus*. Members of the family Aphelinidae, namely *Pteroptrix chinensis* **(Fig. 4a)**, *Aphytis hispanicus* **(Fig. 4b)**, and *Marlattiella prima* **(Fig. 4c)** are the only three species of reported parasitoids in the United States for JMS (Krombein et al. 1979; Gilder et al., 2020) and all three species have been recovered from Tennessee nurseries (Daniel et al., 2024).

Female parasitoid wasps lay one or several eggs in or on each scale and the wasp larva then feeds on the scale. Parasitized scales may become puffy or darken in comparison with unparasitized scales. After completing development, the emerging adult wasps typically leave a round exit hole in the scale it killed. Preliminary studies conducted by Daniel et al. (2024) in middle Tennessee found the percentage of parasitized scale in infested container production averaged 7.0% and 7.9% in privet and euonymus shrubs, respectively. Additional research is needed to understand how these parasitoids contribute to the control of JMS in the

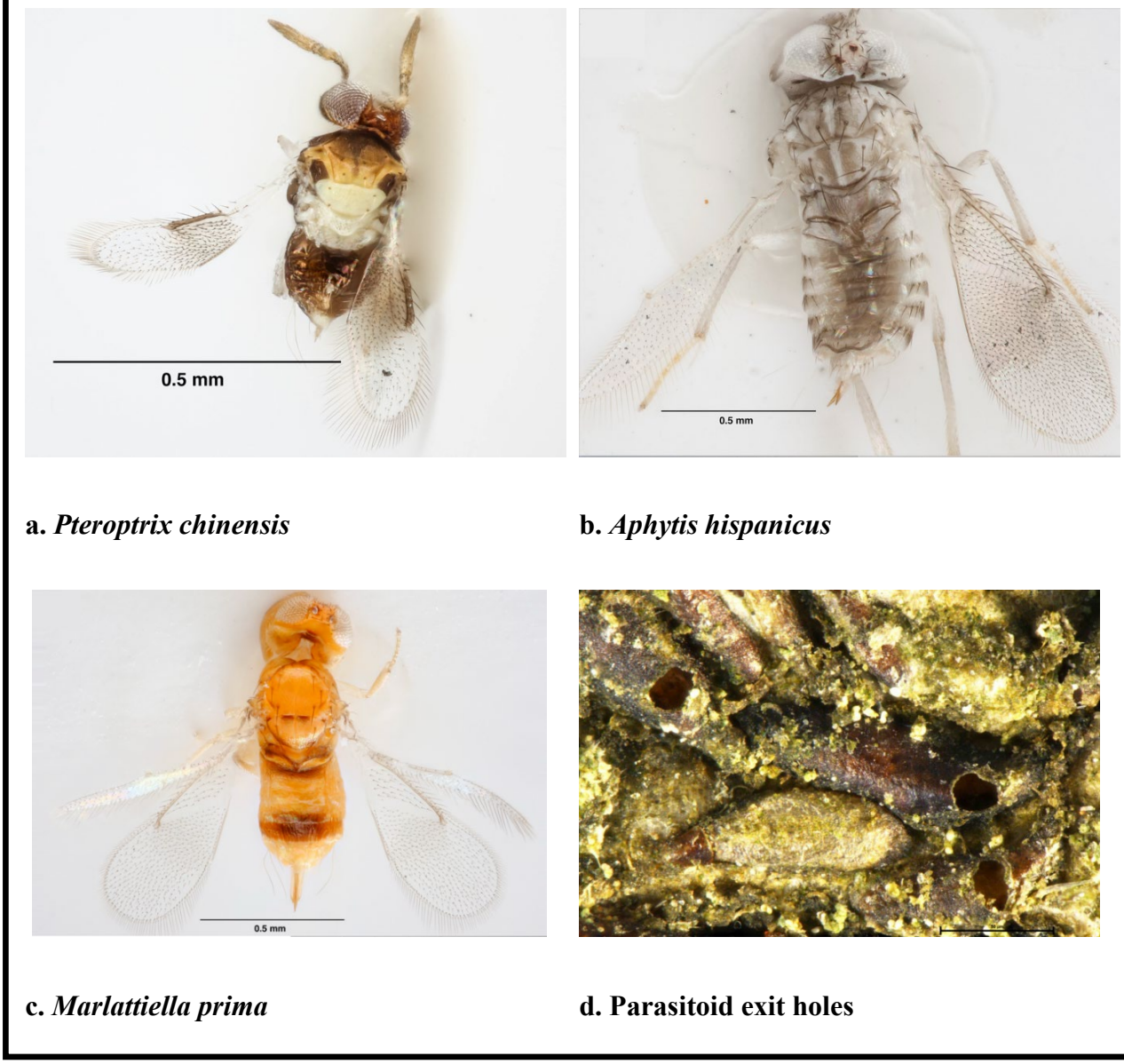
landscape and how nursery production practices can be modified to better promote parasitoid populations.

Pathogens

Entomopathogens – organisms which cause disease in insects – can penetrate through the insect's body surface and around the wax cover of armored scales to attack them directly. However, our knowledge of naturally occurring pathogens in JMS populations is limited. Tabatadze & Yasnosh (1999) found a significant population reduction of JMS by the fungus *Aschersonia* in the Republic of Georgia. However, detailed studies are necessary to assess the potential of this group of entomopathogenic fungi as commercial biological control agents. There is no data available on the efficacy of current commercially available entomopathogens on JMS survival. This is an area of research that requires further study.

Conserving Natural Enemies of JMS In Nursery Production and Landscapes

The conservation of natural enemies is the most important and readily available biological control practice available to nursery growers. Natural enemies occur everywhere, from backyard gardens to commercial fields. Conservation can be a simple and cost-effective management tool. To determine if natural enemies are already present in the field, workers should scout infestations and look for the presence of small ladybeetles feeding on the scales. Adult twice-stabbed ladybeetles will be the most obvious. Their larvae, however, are odd-looking, resembling fast-moving mealybugs. Other species of ladybeetles potentially feeding on scales are harder to spot as they are small (around 2 mm) and black. Tapping branches onto white paper or cloth may aid in scouting for them. To determine whether parasitoids are present in



a. ***Pteroptrix chinensis***

b. ***Aphytis hispanicus***

c. ***Marlattiella prima***

d. Parasitoid exit holes

Fig 4. Parasitoids of Japanese maple scale recovered from Tennessee nurseries. Photos and Identification Courtesy (Fig a-c): James B. Woolley, Texas A&M University, College Station, TX, United States of America.

the field, look for exit holes in scale covers under 10× magnification.

The presence of holes indicates previous parasitic wasp activity (**Fig. 4d**). Yellow sticky cards placed in infested plant canopies can capture small wasps and be evaluated under microscope.

If your aim is to preserve natural enemy populations, it is essential to avoid spraying broad-spectrum insecticides in the scale-infested areas. Instead, choose products that target the scale crawlers and apply products during optimal application times. Addesso et al. (2021) recommended applying a tank-mix of horticultural oil (up to 3%) and pyriproxyfen growth regulator from mid-March through mid-May (~250-1,000 growing degree days). This product combination can be applied to manage JMS efficiently while limiting negative impacts to the natural enemy populations.

To promote beneficial insects in fields or container production, it is also essential to provide them with alternative habitat and nectar sources. Field margins can be planted with a variety of native flowering cover crops or wildflower blends to provide nectar sources to beneficial insects. Native populations of golden rod and Queen Anne's lace in and around the nursery will also attract and maintain natural enemies in the area.

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For additional information, contact your local nursery specialist at:

Tennessee State University, Otis L. Floyd Nursery Research Center
472 Cadillac Lane McMinnville, TN 37110
http://www.tnstate.edu/agriculture/nrc/
931-668-3023

Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.

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