

# SPOTTED LANTERNFLY - BEST MANAGEMENT PRACTICES

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Spotted Lanternfly (*Lycorma delicatula*) is an invasive sap-feeding planthopper native to Asia. It is a generalist feeder and feeds on more than 70 species of trees and plants. To date, Spotted Lanternfly (SLF) has only ever been detected in Canada as dead adults on conveyances in Manitoba and Quebec. The first established population was in Pennsylvania, USA, in 2014, and since then, it has spread to several states, including New Jersey, Delaware, and northern Virginia. In 2022, established populations were discovered in Pontiac, Michigan, and it is reported that SLF spread to that area on nursery stock. SLF populations are also present near Buffalo, NY, and it is expected that infestations will likely appear in Ontario or Quebec due to natural or human-assisted spread in 2023. The planthopper has been a regulated pest in Canada since 2018. As such, the Canadian Food Inspection Agency (CFIA) is mandated to contain or eradicate the pest when it is discovered in Canada for the first time.

Spotted Lanternfly can walk, jump or fly short distances, but their long-distance spread is facilitated by the movement of infested plant material or other items carrying SLF egg masses. Adult females can lay their egg masses on a multitude of surfaces, such as tree bark, landscaping stones, patio furniture, shipping materials and vehicles. Nymphs and adults have special structures on their feet that allow them to stick firmly to surfaces, even during transport. In the US, SLF is moving on nursery stock, so preventing the introduction of SLF to your nursery is the most critical step you can take. The following information and best management practices (BMPs) are provided to reduce the risk of importing and spreading SLF through the nursery pathway.

## Host Plants

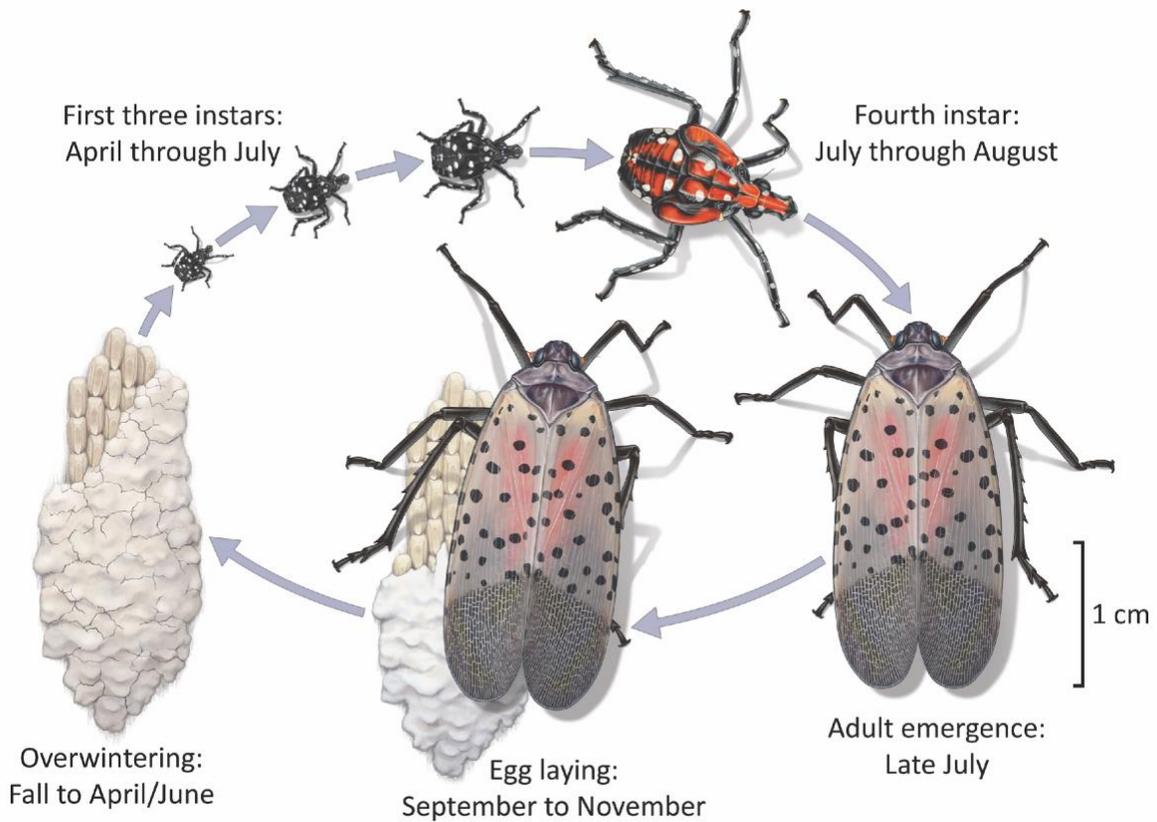
There are over 70 documented host plants for SLF in North America, including hardwoods such as black walnut and maple, fruit trees, hops and grapevines. The Tree of Heaven (*Ailanthus altissima*) is an important host of late-instar nymphs and adults and increases the survivorship of nymphs to adults, resulting in more clutches of eggs where this host is present. SLF prefers Tree of Heaven for feeding, overwintering and egg laying, but it is not critical to the pest's life cycle.

Nymphs and adults have piercing, sucking mouthparts. They are passive feeders relying on actively growing plants with high sap flow and turgor. These stages of SLF damage host plants when they feed by sucking sap from plant tissue. Once plants senesce or sap flow ceases, SLF moves on to other plants and trees that still have leaves. Young nymphs are highly polyphagous and feed on a larger number of host plants than adults. They have smaller mouth parts, so need tender shoots and leaves to feed on. Older nymphs and adults are more restrictive in their feeding and prefer fewer hosts than younger nymphs therefore, scouting can generally be more targeted. Instars 1-3 feed on herbaceous material, including weeds, while instars 4 and adults feed on more woody plants, like grapevines, stone fruits (apricot, cherry, nectarine, peach and plum) and other tree species like Tree of Heaven, apple, oak, pine, poplar, and walnut. SLFs are not known to feed on conifers but can lay their eggs on them. While SLF nymphs do not fly, they are 'hoppers' and are able to move to nearby plants in search of a preferred food supply.

## Insect Epidemiology and Diagnosis

### Life Cycle

- There is one generation of SLF per year in the states where it has been established. Overwintering egg masses are laid through the fall, after the full equinox (September to the first hard frost). Nymphs begin to appear in late spring. The first three instars are black with white spots, and the fourth instars have distinct red patches. Adults can be found as early as mid-July and are active until they are killed by cold temperatures.
- Nymphs transition through four instars between May and September. Early instar nymphs resemble ticks, can move easily by hopping and climbing and are difficult to detect. They are transitory in the environment because they are moving from plant to plant for feeding. Nymphs are challenging to control because they are generalist feeders and incredibly mobile.
- Adults are large (25mm long) and have uniquely coloured wings that make them easy to identify - front wings are pale with black spots at the front and dark net-like bands at the tip, while rear wings have bands of red, black and white.



- Egg masses are yellowish-brown in colour and covered with a gray, waxy coating. Females lay up to two egg masses per year, each with 30-50 eggs. Eggs are laid in parallel vertical rows about 1" long and have a mud-like coating that can crack and flake off over time. It takes temperatures of -23°F(-30C) over many hours for egg mortality to occur.

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- Adults are the most reported stage because they are large and colourful and aggregate in swarms. Feeding by adults is the most damaging of the life stages. Adults have been reported to fly for half a mile at a time and may fly up to 10 miles per year (Walsh, 2023 LO Nursery Short Course).

### **Infestation Evidence & Diagnostics**

- Egg masses can be laid on any host plant or flat surface (e.g. bricks, stones, dead plants). On trees, most eggs will be laid in the top 2/3 of the tree.
- Aggregations (swarms) of nymphs and adults damage plants directly by feeding on plant sap and causing plant stress, and indirectly by excreting large amounts of honeydew that promotes the development of sooty mold and interferes with photosynthesis.
- SLF feeding can cause the plant to ooze and weep sap down the tree's exterior, resulting in stains on the bark.
- The sap and honeydew promote mold and fungi growth, which attracts other insects like wasps.
- The CFIA must be contacted if any life stage of SLF is detected at your operation.

### **Prevention**

#### **Tree of Heaven Control**

- In the natural environment, SLF prefers the edges of forests. If Tree of Heaven are on the nursery property or in the borders of your nursery, they can be used as indicators or 'trap' plants. However, you may choose to remove/kill these plants since they are an invasive species and are the preferred host for SLF.

#### **Tree Bands and Circle Traps**

- When instars emerge from egg masses in May, the four nymph stages crawl up and down trees to feed each day. Banding trees from the end of April to November with adhesive traps (Bug barriers tree band) is effective in capturing the first three instar stages.
- These traps should be at least 6 inches wide, wrapped at chest height, with the adhesive portion of the band turned inward towards the trunk to avoid bycatch of other species.
- In the US, tree bands have mostly been replaced by circle traps, which are more effective at capturing SLF and are reusable. These are made of mesh wrapped around the trunk of trees. SLFs crawl up the tree into a funnel of mesh, and the mesh funnels them into an enclosed container from which they cannot escape. The container holds an insecticide strip to ensure the death of the insect.

#### **Traceability and Documentation**

For traceability, records should be maintained for at least three years. Addresses and maps of all production facilities should indicate where activities associated with host plants received from infested areas (e.g., receiving, shipping, propagation, potting, etc.) take place. A modified Google map can be used. Other records include receiving, movement, shipping documents, scouting & trapping, pest management, and control/eradication activities.

#### **Incoming Plants**

The history of received host plants from areas in the US with an established SLF population should include the supplier source and information regarding the SLF compliance agreement under which the plants have been grown and shipped (e.g., infested and quarantined counties in the US use compliance

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agreements with state regulators to prevent movement of SLF out of those areas.). Use the [SLF Quarantine Map](#) for details of quarantine counties across the United States. This information should be included on or with the receiving documentation. Select suppliers located in areas where SLF is not known to occur or where facilities are pest-free production sites. Particular care should be taken to examine the incoming plants (especially near the top on taller specimens) and the transport vehicle itself for egg masses or other life stages relevant to the time of year.

### **Training**

- Preventing the introduction of SLF is the most critical step you can take. Early pest detection by nursery staff is critical to minimize spread before infested plant hosts are moved around the production facility areas.
- Train appropriate staff regarding SLF pest biology, identification & detection, including the risk of pest spread by natural means, staff, equipment, plants, and plant debris.
- Useful resources for training staff include [SLF - Monitoring and identification for nurseries](#) and the [Penn State Extension SLF Website](#). Check with your local association for additional training opportunities.
- As SLF detection is primarily by visual scouting, ensure staff can identify life stages and know the seasonality of SLF.
- Ensure staff know who to contact in the case of a suspected SLF find.

## **SLF Management at Nurseries Outside of Infested Areas**

### **Receiving Host Plants**

- If possible, do not receive host plants originating from infested areas or delay plant shipments from infested areas until June to allow SLF eggs to hatch in the infested area before arriving at your nursery.
- A separate holding area should be prepared to receive host plants originating from infested areas. The area should be separated from the production facility or within a pest exclusion barrier during nymph and larval life stages to prevent movement to the production areas. Host plants from different suppliers/sources should be separated from each other until thorough inspections are completed and documented to verify the plants are SLF-free.
- Incoming plants, trucks and hardgoods from infested areas should be visually scouted for signs of SLF or for symptoms of pest damage (e.g., sooty mould) under adequate light levels and scouting conditions before moving the plants into the main production area.
- Remove any trunk wrap and inspect as SLF egg masses could be underneath.
- The inspection of incoming host plants should be recorded.
- Maintain purchasing records.

### **Returns**

- Any plants returned to the nursery should be visually scouted for SLF in the same manner as described in Receiving Host Plants

### **Production Practices**

- Identify a SLF nursery stock inspection area to keep newly arrived plants and trucks from an infested area separate from the rest of your stock.
- In the spring, look for egg masses on maple, river birch, styrax, willow and dogwood.

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- In mid-August – October, scout for adults: scout the tree line around your farm, concentrating on Tree of Heaven, wild grape, black walnut, maple, willow, birch, dogwood and sumac.
- If infested plants are suspected even in just one block, manage all production blocks as if they were infested until pest presence can be determined and delineated or absence confirmed.

### **Pest Monitoring**

- Scout for SLF regularly as part of your plant care activities. Early detection is critical. Inspect plants for life stages of SLF and signs of SLF infestation like the presence of egg masses and black sooty moulds, unusual wasp activity, or weeping on tree trunks and branches.
- The best opportunity to manage SLF with the least input is to remove egg masses (scrape and smash) found on incoming material, which significantly reduces the reproductive potential.
- Practise regular and thorough inspections by trained staff of host plants (production and stock blocks) throughout production; keep records of damage, sightings and resulting actions.
- Inspection frequency should be every week during the anticipated nymphal and adult stages (May – November). For egg masses, a thorough inspection of all plants and surrounding edges of the farm should be completed at least once between November – May.
- Maintain monitoring records, trap inspections, diagnostic reports, pest management records and any follow-up details for at least three years.

### **Biosecurity**

- Have all visitors to your facility sign in and out of a visitor log and prohibit visitors' vehicles from entering production areas. Alternatively, thoroughly inspect vehicles for SLF and only allow them entry to production areas if they are SLF-free.
- Prepare a protocol for handling SLF-infested material, including containment of suspected infested material, notification of CFIA, pest identification, confirmation, and treatment or disposal activities.
- Maintain areas relatively free of leaf litter and other host plant debris (e.g., production & shipping areas, delivery trucks) to reduce habitat that could harbour pests.

### **Movement and Shipping of Host Plants**

- Inspections prior to shipping should be within two days of the expected ship date.
- Maintain records of the outbound visual inspection and relevant shipping documents.
- Clean all plant debris from trailers before loading host plants.

### **Procedures After a Suspected and/or Positive SLF Find**

In the event of a suspected SLF find, assume the pest is SLF and follow these recommendations:

- Reporting SLF provides the greatest opportunity for a successful response in mitigating the risk of introduction.
- The CFIA must be notified of any suspected and/or positive SLF find, whether on nursery stock or in Canada's environment. Call your local CFIA office or report [on-line](#).
- If SLF is discovered during an inspection of incoming host plants, collect a sample (store in a sealed bag or container) and take clear pictures for identification/verification. If living life stages are discovered, immediately seal the load to prevent escape and spread.
- Cease shipping of host plants and obtain CFIA guidance prior to resumption.
- Assess the severity or extent of infestation.
- Restrict traffic in/through the infested block or receiving area.

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- In consultation with CFIA, determine the scope of actions required (treatment, eradication, etc.).
- Ensure complete cleanup and containment of plant debris.
- Compile all relevant trace forward/back records, inspections, scouting records, etc.
- Keep a record of the actions taken.

### Treatment suggestions:

At this point, CFIA will provide instructions on responding to and treating any positive finds. The following treatment suggestions are provided here to help develop a response plan for your farm.

#### Egg mass treatment

- Scrape egg masses from plants or surfaces with a stiff plastic card, smash the egg mass and place in a container with an alcohol solution to cause mortality.
- Dormant oil treatments prevent eggs from hatching. Applications can be made in the winter to target egg masses on tree trunks and nursery stock.

#### Nymph and adult treatment

- Systemic insecticides are taken up by the root system, foliage, or through the bark and translocated upward through the plant. When feeding, nymphs and adults ingest the insecticide within the plant sap. The habit of SLF is to climb higher on structures, including trees, so contact sprays may be less effective.
- For outdoor ornamentals in Canada
  - KOPA® insecticidal soap is registered for suppression of SLF nymphs. Nymphs need to be contacted with spray solution to be effective.
  - ALTUS® insecticide is registered for Emergency Use to control SLF. ALTUS® moves in a translaminar manner through the leaf tissue in the case of foliar applications and can provide control of pests on the undersides of leaves.
- Applications would be made from May to first freeze, depending on pest presence and label directions.

#### Biological controls

- To date, natural predation is not high enough in the US for dependable SLF control. It is higher in China, where SLF is only occasionally a problem during years that favour an SLF boom.
- *Anastus orientalis* is an egg parasitoid, and *Dyminus sinicus* attacks the 2<sup>nd</sup> and 3<sup>rd</sup> instar nymphs of SLF. Research is ongoing, but these cannot be considered viable options at this time.

### Information on Traps

#### The BugBarrier tree band

Here is a video link [https://www.youtube.com/watch?v=2ip\\_DGdc2XU](https://www.youtube.com/watch?v=2ip_DGdc2XU) for application instructions of the BugBarrier tree band. The product comes in either 30 or 250-foot roll kits comprised of the white foam with green heavy-duty tape. As per the video, a clear film could be added to the top to prevent the pest from going up the tree. The BugBarrier can be purchased from [Vermeer Canada](#).



### List of Host Plants

The Pennsylvania Department of Agriculture's [Spotted Lanternfly Research](#) webpage has a few recent research papers investigating host plants and is a good resource for a comprehensive review of the host plants identified from various sources.

Observations from jurisdictions where SLF exist indicate that these hosts are ones that should be monitored more closely:

- Acer
- Ailanthus
- Betula
- Cornus
- Juglans
- Rhus
- Salix
- Styrax
- Vitis

### List of Regulated Articles in Pennsylvania

This list is provided to give an indication of the breadth of products that are hosts or egg-laying sites for SLF. The Pennsylvania State Department of Agriculture lists these as regulated articles:

- Any living stage of SLF
- Brush, debris, bark or yard waste
- Landscaping, remodelling or construction waste
- Logs, stumps or any tree parts
- Firewood of any species
- Packing materials, such as wood crates or boxes

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- All plants and plant parts. This shall include, but is not limited to, all live, dead, infected or non-infected trees, nursery stock, budwood, scionwood, green lumber, firewood, perennial plants, garden plants and produce, and other material living, dead, cut, fallen, including stumps, roots, branches, mulch and composted or uncomposted chips.
- Outdoor household articles, including recreational vehicles, lawn tractors and mowers, mower decks, grills, grill and furniture covers, tarps, mobile homes, tile stone, deck boards, mobile fire pits, any associated equipment and trucks or vehicles not stored indoors.
- Grapevines for decorative purposes or as nursery stock.
- Any other article or means of conveyance when it is determined by an inspector to present a risk of spread of SLF in any life stage, is in proximity to such articles, the articles present a high risk of artificial spread, and the person in possession of them has been notified.

### **Disclaimer:**

These BMPs are recommendations for nursery growers to enable rapid identification, prevention, and management of SLF finds in wholesale nursery production facilities. Implementation of these measures cannot guarantee that nurseries will remain free of SLF. This document is based on the most current information available. As the science of spotted lanternfly management evolves and new control measures are introduced, these BMPs will change.

For further information about SLF in your area, contact your provincial government agricultural ministry office, your regional office of the Canadian Food Inspection Agency, or your local nursery growers' association.