

SPOTTED LANTERNFLY - BEST MANAGEMENT PRACTICES

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, there are no known established populations of Spotted Lanternfly (SLF) in Canada, however, there have been multiple reported sightings of adult SLF in numerous Canadian provinces. An updated list of SLF observations in Canada can be found here: [Spotted lanternfly observations in Canada - Canadian Food Inspection Agency](#). The first established population was in Pennsylvania, USA, in 2014, and since then, it has spread across mid-Atlantic states and to several Midwest states. 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 in Buffalo, NY, less than 12 km from the Canadian border and it is expected that infestations will likely appear in Ontario or Quebec due to natural or human-assisted spread at any point. This species has been listed as a regulated pest in Canada since 2018. As such, the Canadian Food Inspection Agency (CFIA) is mandated to initiate some control measures when the pest is discovered in Canada.

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 their 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 operation is one of the most critical steps 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

Spotted lanternfly feeds on a large variety of both woody and herbaceous plant species, including those in the agricultural and ornamental industries, as well as landscape plants. 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 it has access to this host. While SLF prefers Tree of Heaven for feeding, research has shown it is not critical for development and reproduction.

Nymphs and adults have piercing, sucking mouthparts. They are passive feeders relying on actively growing plants with high sap flow and turgor. Swarms of nymphs and adults damage plants directly by feeding on sap from the stems and trunks, and indirectly by excreting large amounts of sugary honeydew that promotes the development of sooty mould and interferes with photosynthesis. Once plants senesce or sap flow ceases, SLF moves on to other plants and trees that still have leaves. Young nymphs are highly polyphagous, prefer tender shoots and feed on a larger number of host plants than adults. Older nymphs and adults are more restrictive in their feeding and prefer fewer hosts than younger nymphs and therefore, scouting can generally be more targeted. Instars 1-3 feed on herbaceous material, including perennials and weeds, while instars 4 and adults feed on more woody plants, like grapevines and tree species like Tree of Heaven, walnut, maples, willows and more. 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.

In the US, adult SLF have shown a preference mainly for feeding on Tree of Heaven and wild or cultivated grapes. They also exhibit a preference for feeding on certain species of *Acer* (specifically *Acer saccharinum* and *Acer rubrum*), *Salix*, *Betula* (specifically *Betula nigra*), *Styrax japonicus*, and others. A detailed list of preferred plants for SLF feeding is available in the later sections of this document. If preferred host plants are not available, the highly mobile adults will feed on plants that are present (such as fruit trees, etc.) until they have the energy to move and seek out more preferred food sources.

Insect Biology 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 fall equinox in September until the first hard frost). Nymphs begin to appear in late spring and transition through four instar stages between May and September. Adults can be found as early as mid-July and are active until they are killed by a hard frost.
- Eggs are laid in parallel vertical rows about 2-3 cm long and have a mud-like protective coating that can crack and flake off over time. The egg mass coating starts off creamy white in colour and turns grey as it ages. Some egg masses can be laid without the protective coating. Females can lay multiple egg masses per year, each with 30-50 eggs.
- Eggs are resistant to cold conditions and are likely to survive winter in many parts of southern Canada.
- The first three nymphal instars are black with white spots. Early instar nymphs are small and resemble ticks. Nymphs cannot fly but can move easily by hopping and climbing. It is challenging to monitor for and control nymphs because they are generalist feeders and are constantly on the move between seasonal host plants.
- The fourth instars of SLF maintain the black and white spots but have distinct red patches. This is the last nymphal stage before they moult to adults.
- 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.
- Adults are the most reported stage because they are large and colourful and aggregate in swarms. The adults fold their wings together over their bodies in a triangular pattern and only reveal their colourful underwings when disturbed or in flight.
- Feeding by adults is the most damaging of the life stages. Adults have been reported to fly for hundreds of meters at a time and up to 11-16 km per year (Walsh, 2023 LO Nursery Short Course).

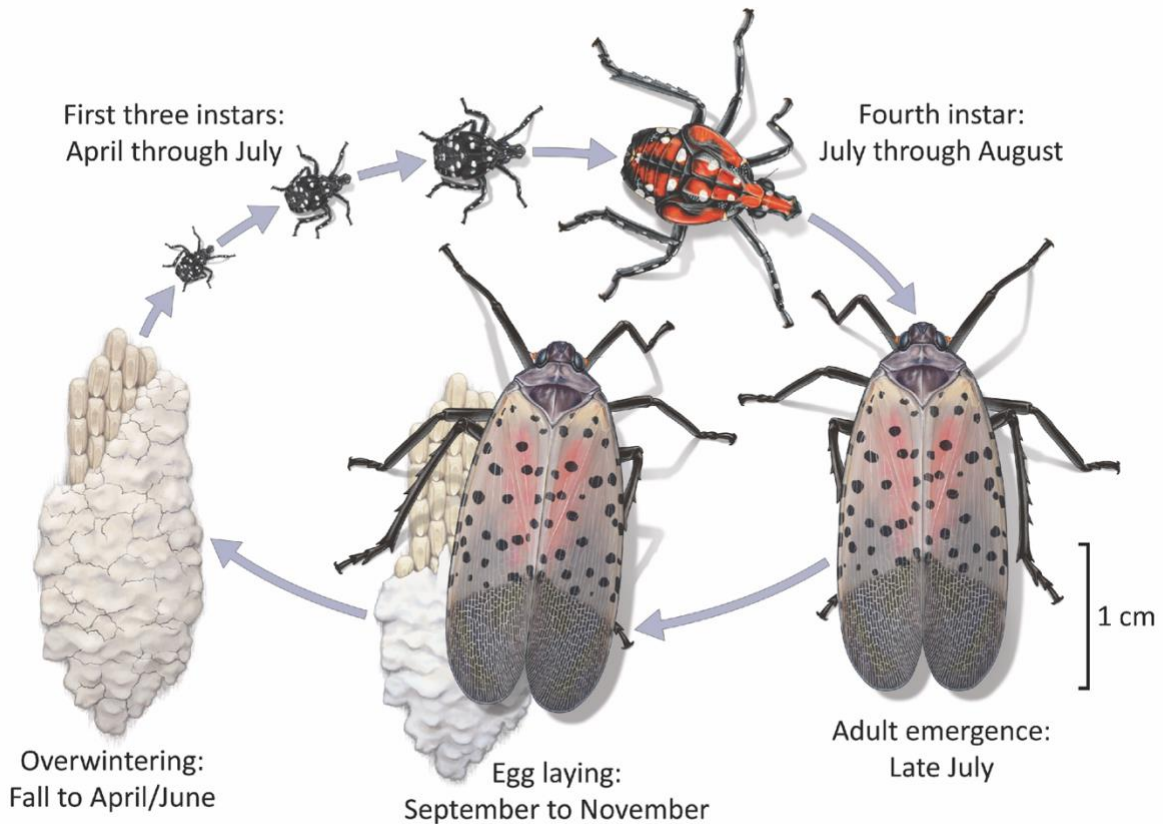


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Infestation Evidence & Diagnostics

- Egg masses can be laid on any host plant. On trees, most eggs will be laid in the top 2/3 of the tree on the branch crotches or the undersides of branches in protected areas.
- Egg masses can also be laid on any hard surface near where adults are feeding such as sides of pots, pallets, bricks, rocks, poles, stakes, dead plants, etc. Rough surfaces are preferred. Females will often oviposit near previously laid egg masses.
- 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.
- When actively feeding, adults can produce large amounts of honeydew that can resemble rain fall and commonly attracts other insects such as wasps.
- SLF feeding can also cause some plants to ooze and weep sap down the tree's exterior, resulting in stains on the bark.
- 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'

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plants. However, you may choose to remove/kill these plants since they are an invasive species and are the preferred host for SLF.

- Full removal of TOH is very challenging as they can spread by suckers or by samaras of female trees that are dispersed by wind. Once trees are established, they consistently produce suckers which can be seen over 15 meters away from a parent tree.
- With the ample supply of other host plants for SLF to feed on in the Canadian landscape, removing all TOH from areas surrounding a nursery is unlikely to be a reliable prevention tool. In the US, a common strategy is to remove female TOH to reduce the further spread via samaras (seeds) and only keep males as trap trees for both monitoring and control activities.

Tree Bands and Circle Traps

- SLF nymphs are in constant motion in the landscape as they search for suitable hosts. They will typically move up the trunks of trees and launch themselves from the canopy before moving to the next host. Adhesive bands (BugBarrier) or circle traps can be used to intercept nymphs during the spring and summer.
- These traps should be placed on trunks that are at least 15 cm wide, wrapped at chest height, with the adhesive portion of the band turned inward towards the trunk to avoid bycatch of other species.
- Tree bands should be placed around preferred tree hosts such as TOH, Acer, Juglans, or even poles next to preferred hosts such as wild grape. More details about tree bands are included later in this document.
- In the US, circle traps are used in some areas. These traps are more effective at capturing SLF adults 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 directs them into an enclosed container from which they cannot escape. The container can hold an insecticide strip to ensure the death of the insect. Large diameter trees may require more than one trap to cover the circumference, which optimizes capture rates.

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 host plants imported from areas in the US with established SLF populations should include the supplier source and information regarding the SLF compliance agreement under which the plants have been grown and shipped (infested and quarantined counties in the US use compliance agreements with state regulators to prevent movement of SLF out of those areas). Use the [SLF in the U.S.](#) map for details of quarantine counties and infested areas 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. Care should be taken to examine the incoming plants (especially near the top on taller specimens), pallets, shipping materials, and the transport vehicle itself for egg masses or other life stages relevant to the time of year. It is highly recommended to receive any incoming shipment in a quarantine area of the nursery where materials can be fully examined before being introduced to the rest of the nursery.

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:

Month	Possible life stage(s) present
January – March	Egg masses
April	Egg masses, possible early nymph hatch
May	Egg masses, early nymphs
June	Nymphs
July	Late instar nymphs, possible early adults
August	Late instar nymphs, adults
September	Adults, egg laying begins late September
October	Adults, Egg masses
November	Adults, Egg masses
December	Egg masses

- 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 adult life stages to prevent movement to the production areas. If a separate holding area is not feasible, then it is critical that host plants are inspected while on the truck with proper lighting and then again as they are being offloaded. 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 or other life stages could be underneath. SLF prefer to lay eggs on covered or protected areas so inspections should pay especially close attention to the undersides of branches, branch crotches or other cracks and crevasses.

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- Pay close attention to shipments of Acer, Juglans, Betula, Rhus, Salix, and StyraX as these have been noted as hosts where egg masses have been intercepted.
- The best opportunity to manage SLF with the least input is to remove egg masses (scrape and smash) found on incoming material.
- 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. If a separate holding area is not feasible, then it is critical that host plants are inspected while on the truck with proper lighting and then again as they are being offloaded and kept separate from the rest of your stock during this inspection.
- In the spring, look for egg masses on maple, black walnut, river birch, styrax, willow, dogwood or hard surfaces near where preferred host trees are growing
- 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, 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, black sooty mould, unusual wasp activity, or weeping on tree trunks and branches.
- Scouting and 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. Note that most egg masses occur in the upper canopy of trees, so make sure to direct scouting to these areas.
- Scouting areas should always include the edges of nursery production areas where host plants of SLF are known to occur. Check unmanaged host plants along woodlot edges, hedgerows, or in the landscape surrounding your operation for signs of infestation.
- In the natural environment, SLF commonly refuge on the edges of forests and woodlots or in the landscape where host plants are present. If Tree of Heaven or wild grape vines are on the nursery property or in the borders of your nursery, they can be flagged as indicators or ‘trap’ plants to closely monitor through the season.

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.

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- 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.
- Restrict traffic in/through the infested block or receiving area.
- 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 have shown to decrease the likelihood of eggs hatching. Applications can be made in the winter to target egg masses on tree trunks and nursery stock. A labeled use and rate of horticultural oil are pending PMRA approval.

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 as this product is not systemic.

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- 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 that may be higher in the canopy of trees and hard to target via direct contact sprays.
- ◆ Insecticidal applications can 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.
- ◆ It has been noted in the US that wheel bug eggs (Hemiptera), *Arilus cristatus*, can be commonly found near SLF egg masses and some predation of hatching nymphs is thought to be occurring. The impact of wheel bugs and other native biological controls requires more investigation.
- ◆ Researchers are investigating natural enemies of SLF from China, including *Anastatus orientalis*, an egg parasitoid, and *Dryinus* spp., which parasitize 2nd and 3rd instar nymphs. Non-native biological controls must be thoroughly screened for their suitability and host specificity prior to release and therefore, there are no viable solutions currently available.

Information on Traps

The BugBarrier tree band

Here is a [video link](#) for application instructions of the BugBarrier tree band. The product comes in either 30 or 250-foot roll kits comprised of the white batting with translucent heavy-duty sticky tape. OMAFRA currently recommends cutting the batting in half to allow for more exposure of the adhesive area. The BugBarrier can be purchased from [Vermeer Canada](#).



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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:

Primary hosts:

- Ailanthus
- Vitis (all wild and cultivated species)
- Acer (specifically *Acer saccharinum* and *Acer rubrum*)
- Juglans (specifically *Juglans nigra*)

Common Hosts:

- Betula (specifically *Betula nigra*)
- Rhus
- Salix
- Styrax (specifically *Styrax japonicus*)

Occasional:

- Cornus (specifically for young nymphs)

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
- 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.

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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.