



SURVEY GUIDELINES FOR ASIAN LONGHORNED BEETLE

AT A GLANCE

- Prioritize inspection of maples on dry days, after leaf drop.
- Focus on street trees and trees along forest edges.
- In pairs, inspect 30 trees for signs and symptoms of attack at each grid point.
- Examine each tree for 60 s per inspector.
- Scan each tree from a distance, then examine the bole and the crown with binoculars.
- Complete the survey form for each grid point, photograph and GPS suspect trees.
- Insects must be placed in 70% non-denatured ethanol for lab submission.
- Asian longhorned beetle (ALHB) Infested Places Order repealed and ALHB declared eradicated from Canada in 2020.
- Inspect elm, *Ulmus* spp. when other high risk hosts are not abundant or absent at a given grid point.

1. Background and Objectives

In China, the Asian longhorned beetle (ALHB, *Anoplophora glabripennis*) is known as the “starry sky beetle” and is considered a major pest of hardwood trees in many parts of the country. In North America, this invasive alien insect attacks and kills a wide range of deciduous trees and, therefore, poses a high risk to urban and natural forests.

The first report that this beetle was established outside of its native range was from the cities of Brooklyn and Amityville, NY, in 1996. Many trees, particularly maples, were found to be heavily attacked. Quarantine and eradication procedures were quickly implemented to prevent further spread and to eliminate the population. To date, ALHB infestations have been discovered in the following North American cities: New York, NY (1996), Chicago, IL (1998), Jersey City, NJ (2002), Carteret, NJ (2004), Staten Island, NY (2007), Worcester, MA (2008), Boston, MA (2010), Bethel, OH (2011), on the border between Toronto and Vaughan, ON (2003), Mississauga, ON (2013) and Charleston, South Carolina (2020). All of these infestations are either under quarantine and eradication or have been eradicated.

This survey is being conducted in support of CFIA policy directive [D-11-01: Phytosanitary Requirements for Plants for Planting and Fresh Branches to Prevent the Entry and Spread of *Anoplophora* spp.](#) The primary goal of this survey is to ensure there are no ALHB infestations with a radius of 750 m or greater in the target urban centres.

Citrus longhorned beetle (CLB, *Anoplophora chinensis*) is a serious pest with a host range of more than 85 genera of plants. It feeds on and damages a wide variety of hardwood trees, including many important species found in Canada. The citrus long-horned beetle is very similar in biology and appearance to ALHB but differ in that signs such as their T-shaped oviposition pits and exit holes are typically concentrated on the bark of the lower part of the bole/trunk and on exposed roots of host trees.

Spotted lanternfly (SLF, *Lycorma delicatula*) is a non-native pest regulated by the CFIA. It can feed on more than 100 species of trees and plants and while it is not known to be present in Canada, it poses a significant threat to grape production. The Plant Health Survey Unit (PHSU) has developed protocols for an SLF-specific survey to be delivered at high-risk areas. As some SLF infestations are close to the Canadian border, there is still an urgent need to conduct additional SLF surveys in order to protect Canada’s agriculture, viticulture and forestry sectors.

At each survey site established across Canada, visual inspection of host material will target signs and symptoms of ALHB, CLB, and SLF.

2. Target Life Stages

Currently there is no attractant or lure available to effectively detect adult ALHB populations. Furthermore, no sampling methods targeting any life stage have been developed. This insect spends most of its life cycle in the wood of the tree; thus, the only active techniques to detect its presence

are to search for adults during the flight period or to search for visible signs and symptoms of its attack on trees. Although the adult flight period is from July to October, it is considered more effective to scan trees for signs and symptoms, as those can be seen throughout the year.

Asian longhorned beetle requires 1 to 2 years to complete its development from egg to adult. Eggs are laid under the bark between early July and mid-October. Larvae hatch and begin feeding on the outer surface of the sapwood, creating feeding galleries under the bark. After feeding for several weeks or months, larvae bore a tunnel into the heartwood. Upon reaching maturity, larvae create a pupal chamber near or in the sapwood, near the terminal end of the feeding tunnel. Larvae of all ages can be found throughout the year. Pupation occurs from early June to mid-August and adults emerge from the tree, creating a round exit hole between late June and late August. Mated females chew irregular oval-shaped oviposition pits into the bark, in which they inject their eggs.

3. Target Hosts

All species of maple (*Acer* spp.). When there are less than 30 maples present at a given grid point, inspection can be supplemented with willow (*Salix* spp.), poplar (*Populus* spp.), birch (*Betula* spp.) and elm (*Ulmus* spp.).

4. Timing and Duration

The likelihood of detecting an infestation is greatest under dry weather conditions, when leaves are absent (spring and fall). Therefore, the survey should not be conducted when conditions are wet and/or overcast. Visual surveys for signs and symptoms can also be conducted during the adult mating and egg-laying period (June–September); however, the goal is to complete the surveys between September and December.

5. Target Areas and Site Selection

Trees infested by ALHB can be found in a variety of landscapes. For example, in the Greater Toronto Area, infested trees were found in residential, commercial and industrial areas, as well as in transportation/utility corridors, forested land, and green spaces. Each year, triangular grid surveys will be conducted in pre-selected urban centres.

6. Survey Methodology

In the absence of an effective trapping system and pheromone, the survey consists of a visual inspection of target hosts.

6.1. Visual Survey

As stated above, the objective is to determine whether there is an infestation with a radius of 750 m or larger in any of the target areas. This size of infestation was chosen because it corresponds to the approximate size of the core infestation in the Greater Toronto Area when it was discovered in 2003. A triangular grid of survey points spaced 1301 metres apart is

generated for each of the target areas. Using such a grid ensures that at least one survey point will fall within any circular infestation of 750 m or greater in radius, anywhere in the survey area. The methodology used by the surveyors is designed to ensure an extremely high probability of detecting an advanced infestation at each survey point.

Maps will be provided showing all grid points to be surveyed in a given target area. At each target grid point, thirty (30) maple trees are to be inspected for signs and symptoms of ALHB. If there are fewer than 30 maple trees present within a **200 m** radius of the survey point, surveyors should inspect all suitable maple present and then proceed to inspect any alternate host genera (willow, poplar, birch and elm) falling within the survey radius. Surveyors should continue inspection of the alternate host genera until a total of 30 trees have been inspected, or no alternate host genera remain.

Inspection should begin by assessing the area around the grid point to ensure the survey is biased to maples in proximity to risk sites with emphasis on host trees near facilities dealing with wood packaging material when possible. In residential areas where access to backyards may be limited, inspection should focus on street trees (boulevard or front of property); however, the back yard should be surveyed if it contains wood packaging. Trees growing singly or in open areas are generally attacked first, followed by trees situated on the edges of stands. Thus, when a grid point falls within a forested area, inspection should focus on trees at the edge of the woodlot and on those surrounding parking areas or trail access points.

Signs and symptoms of attack made by either adults or larvae of this species can be found on any visible part of the tree. On large trees attacked by ALHB for the first time, oviposition pits are found predominantly on the branches of the upper canopy. In small trees (less than 16 cm diameter at breast height), pits are usually found lower on the trunk.

Inspection of each tree will be conducted in pairs, where both inspectors examine the target host at the same time:

- Inspection should focus on target hosts with a diameter at breast height of about 10 cm or greater.
- Start the inspection of the selected tree by scanning the entire tree as you approach from a distance.
- Move around the tree to inspect the main stem and lower main branches for any apparent signs or symptoms of ALHB. The bole and crown should then be examined using binoculars.
- Given that the biology, signs and symptoms of this pest are very similar to those of the citrus longhorned beetle (CLHB), inspectors should also scan each tree for signs and symptoms of CLHB. Pay close attention to the lower 50 cm of the bole, root collar and roots, where exit holes and T-shaped oviposition scars are typically found.
- Inspection of each tree should not last much more than 60 s per surveyor when inspecting in pairs. If inspecting individually, this time should be increased to 2 minutes.

While conducting this survey, keep an eye open for SLF life stages at each ALHB grid point. Dead nymphs and adults may be present on the ground or at the base of trees/plants and egg masses may be present on plants as well as man-made structures.

Try to conduct the ALHB survey before snowfall to increase the likelihood of detecting a SLF population and to decrease the likelihood of false negatives because the snow has covered dead SLF stages.

Suspect egg masses can be removed by prying a pocket knife under it.



Figure 1. The four nymphal instars of SLF. Photo credit: Tea-Kesting-Handly, Pennsylvania Department of Agriculture.

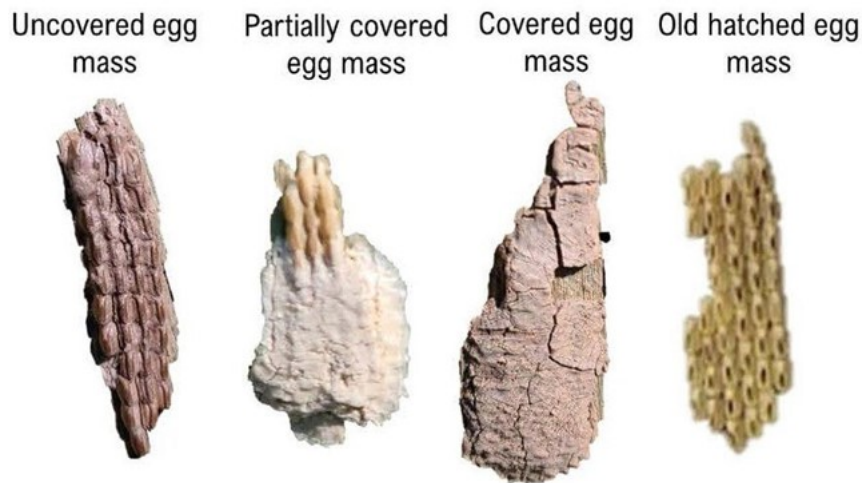


Figure 2. Various states of SLF egg masses.



Figure 3. Live and dead adult SLF on the ground.

While surveying a grid point, if Tree-of-Heaven (*Ailanthus altissima*) is present, record this observation [in iNaturalist](#). This data will assist in determining where to survey for SLF. Examine Tree-of-Heaven for SLF but only examine those within the radius of that particular ALHB grid point; you don't have to examine all Tree-of-Heaven within 200m of the grid point, just those while conducting the ALHB survey.

Complete the Asian Longhorned Beetle Area-Wide Ground Survey Form (Appendix 1) for each survey site. The survey site address should coincide with the street address closest to the survey point, although the survey at a given point shall not be limited to that address. The type and quantity of host genera inspected should be noted on the survey form before proceeding to the next site. Additionally, if access to a given site is restricted, inspectors should note this on the survey form and proceed to the next site.

Note: The objective of the survey is to ensure that no large infestation exists in the area surveyed, rather than to uncover any single sign or symptom of the ALHB.

6.2. Signs and Symptoms of Attack

Before conducting visual surveys for ALHB, *Detecting Signs and Symptoms of Asian Longhorned Beetle Injury Training Guide* should be reviewed.

6.2.1. Signs of ALHB

- **Exit Holes:** Large round holes (6–14 mm) where the adults leave the tree may be found anywhere, including branches, trunk, and exposed roots. These exit holes can number in the hundreds per tree.
- **Oviposition Scars:** Oval to round, darkened wounds in the bark, about 10 mm in diameter, may be observed. These are oviposition sites, where adult females chew out a cavity to lay their eggs. Current-year oviposition pits are light-brown (or often reddish on maples), and can be seen from mid-summer through fall. Oviposition can take place along the entire trunk and on exposed roots; however, adults tend to first lay eggs along the main branches where the bark is smooth.
- **Frass:** Sawdust and wood shavings may collect in branch axils or at the base of the tree as a result of larval tunnelling.
- **Adults:** On sunny days, adult beetles are most active from 10:00 AM to 2:00 PM. They can be seen crawling on the tree surface or making short flights. Males may be looking for mates, females may be chewing oviposition sites or laying eggs, alone or accompanied by a male. They usually rest in the canopy on cloudy days.
- **Galleries and Tunnels:** Young larvae feed at the interface between wood and bark, making flat galleries (which lead to cracks and large patches of missing bark). Intermediate and mature larvae chew oval tunnels into the wood. These galleries interrupt the flow of water from the roots to the leaves. Galleries are not visible unless the bark has fallen (in which case the galleries are already several years old) or has been removed.

6.2.2. Symptoms of ALHB

- **Sap:** During the tree's active growing season, foamy or frothy sap may be seen running from oviposition sites. Wasps and hornets are attracted to the flowing sap.
- **Thinning Crowns / Dead Branches:** Adults feed on the bark of small branches in the upper crown, resulting in crown thinning and dead branches.
- **Callus Tissue around Injuries:** Callus tissue appears around oviposition pits, feeding galleries, and exit holes several months after the injury.
- **Cracked or Missing Bark:** This symptom is a response to larval feeding on the surface of the sapwood under the bark, resulting in bark cracking or falling a year or more after the attack has begun.
- **Tree death:** Trees killed by ALHB exhibit readily apparent signs and symptoms of attack.

7. Biosecurity Precautions

When visiting areas that are, or could be infested with pests of significance, staff must take the necessary precautions to ensure that the risk of spread is mitigated. During the adult flight period, vehicles should be inspected before leaving a site to ensure there are no hitchhiking beetles.

8. Coordinating with the CFIA

8.1. Target Locations

To ensure that your efforts compliment the regulatory survey being conducted by the CFIA, it is highly recommended that you contact your Area Survey Biologist or local Inspection Advisor to obtain the current survey plan for your specific area.

8.2. Collaborative Data Management

Survey activities conducted for a regulated pest in accordance with the established CFIA survey protocol should be captured so that all collaborative efforts can be reported. An Excel spreadsheet containing latitude and longitude coordinates and address for the site surveyed, organization details and coordinates for any suspect trees can be submitted to the CFIA cfia.surveillance-surveillance.acia@inspection.gc.ca by no later than November 1st of each year so that all efforts can be mapped and reported Nationally. Possible suspects should always be reported in real time.

8.3. Suspect Finds

All suspect findings must be communicated to your [local CFIA office](#) as soon as possible.

Suspect longhorned beetles must be submitted to your local CFIA office with the Asian Longhorned Beetle Area-wide Ground Survey Form (Appendix 1) for official lab analysis.

- The survey form (Appendix 1) must be completed for all suspect locations including address and GPS coordinates for all suspect trees to facilitate follow-up inspection activities.
- Upon submission to your local CFIA office, relevant data will be entered into the CFIA's Lab Sample Tracking System prior to shipment to the lab for official identification.

8.4. Sample Preparation

Any suspect ALHB larvae, pupae, or adults must be verified by the entomology lab in Ottawa. See fact sheet for description of adults, larvae, and pupae.

- All suspect specimens should be secured in a collection jar to ensure safety during transport. Specimens should be kept cool until they can be preserved accordingly.
- Adults and pupae should be placed into a vial of 70% non-denatured ethanol prior to being shipped to the lab. Larvae should first be killed by placing them into near-boiling water. Heat about 125 mL (½ cup) water (using a gas-burner, microwave oven or kettle) until the first signs of boiling. Add the larvae to this water and let sit for at least 30 seconds (or up to 3 minutes for large larvae). Remove from water and place into vials with a 70% non-denatured ethanol.

- Insert in the collection jar a paper label indicating the date of collection (e.g., 11 Oct 2016), the location specimen was collected (longitude/latitude coordinates in decimal degrees, NAD83), the street address, the tree genus or species on which the specimen was collected, and your name.

All SLF stages (egg masses, nymphs, adults) can be immediately placed in vials with 70% non-denatured ethanol **or 70% specially denatured ethanol**. There is **no** need to boil any SLF life stage. As per the above procedures, ensure the vial label contains pertinent information for proper sample submission.

Contact should be made with a CFIA Inspector or cfia.surveillance-surveillance.acia@inspection.gc.ca as soon as possible to arrange to have the specimen(s) safely transported to the nearest CFIA office.

9. Equipment and Supplies

- Binoculars
- Digital camera
- Tree identification guide
- 70% non-denatured ethanol (**see note below**)
- Collection jar or vials
- Vials with leakproof stoppers
- Utility knife, chisel, and hatchet
- Pruning shears and sanitizer
- Disposable latex gloves
- HB pencils
- Permanent markers
- Paper labels that contain cotton (25-30% is ideal but any percentage is good)
- GPS unit
- Maps
- Field book with waterproof paper
- Tweezers
- Flagging tape
- Blank LSTS Report for Submission forms
- Measuring tape
- Protective footwear (Safety boots)
- Reflective vest
- Sunglasses
- Hat
- Sunscreen
- Tick Removal Kit (e.g., <https://canlyme.com/product/tick-removal-kit/>)

Inspectors should have at least a 10% surplus of supplies (e.g., vials, ethanol, gloves, etc.) on hand.

Note: Denatured ethanol contains toxic chemicals (e.g. kerosene, methyl isobutyl ketone, ethyl acetate, etc. to render it undrinkable) that can cause adverse health effects to our laboratory staff and negatively affects the specimens being submitted.

10. Supporting Documents and Additional Information

Detecting Signs and Symptoms of Asian Longhorned Beetle Injury Training Guide:

http://www.glfc.forestry.ca/VLF/invasives/alhbdetecguide_e.pdf

Asian Longhorned Beetle news, information and policy documents:

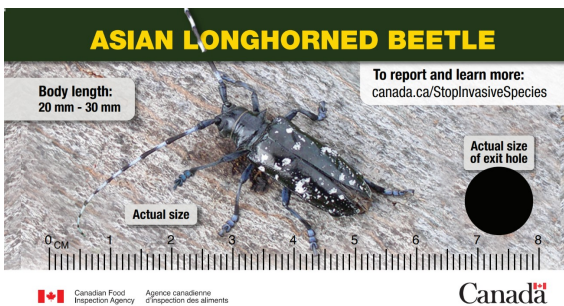
<http://www.inspection.gc.ca/plants/plant-protection/insects/asian-long-horned-beetle/eng/1337792721926/1337792820836>

Asian Longhorned Beetle - Signs of Infestation:

<http://www.inspection.gc.ca/plants/plant-protection/insects/asian-longhorned-beetle/signs-of-infestation/eng/1395272842057/1395273052449>

Asian Longhorned Beetle Area-Wide Ground Survey Form (Appendix 1)

Asian Longhorned Beetle Detection Card



Appendix 1: Asian Longhorned Beetle Area-Wide Ground Survey Form

ASIAN LONGHORNED BEETLE AREA-WIDE GROUND SURVEY FORM

1. Survey date:				Y	Y	Y	Y	M	M	D	D	2. Survey team members:											
3. City:												8. Land use category: <input type="checkbox"/> Residential <input type="checkbox"/> Forested area (1, Ravine; 2, Woodlot) <input type="checkbox"/> Commercial (1, Mall; 2, other) <input type="checkbox"/> Green space (1, Cemetery; 2, Park; 3, golf) <input type="checkbox"/> Industrial (1, Light; 2, Heavy) Other: _____ <input type="checkbox"/> Transportation/utility corridor (1, Rail; 2, Powerline; 3, Highway, 4 Pipeline)											
4. Grid ID number:																							
5. Datum:	N	A	D	8	3																		
6. Latitude:			.																				
7. Longitude:	-			.																			
9. Address:																							
				Number				Street name (no abbreviation)				Property name											
Access to property restricted?				<input type="checkbox"/> Yes		<input type="checkbox"/> No		Follow up survey required?				<input type="checkbox"/> Yes		<input type="checkbox"/> No									
10. Maple species present:						Maples absent: <input type="checkbox"/>						11. If no maples, # of alternate high risk hosts inspected:											
<input type="checkbox"/> Amur		<input type="checkbox"/> Norway		<input type="checkbox"/> Sugar		<input type="checkbox"/> Sorbus		<input type="checkbox"/> Celtis		<input type="checkbox"/> Betula		<input type="checkbox"/> Ulmus		<input type="checkbox"/> Platanus									
<input type="checkbox"/> Black		<input type="checkbox"/> Red		Others (if known): _____		<input type="checkbox"/> Salix		<input type="checkbox"/> Aesculus		<input type="checkbox"/> Populus													
12. Suspect tree found:				<input type="checkbox"/> Yes		<input type="checkbox"/> No		13. Specialist follow up required?				<input type="checkbox"/> Yes		<input type="checkbox"/> No		14. Picture taken?				<input type="checkbox"/> Yes		<input type="checkbox"/> No	
Suspect tree site:		15. Latitude:		.									16. Longitude:		-	.							
17. Type of sign:				<input type="checkbox"/> Oviposition pit		<input type="checkbox"/> Exit hole		<input type="checkbox"/> Frass		<input type="checkbox"/> Feeding gallery		Other: _____											
18. Type of symptom:				<input type="checkbox"/> Sap		<input type="checkbox"/> Thin crown		<input type="checkbox"/> Callus tissue		<input type="checkbox"/> Cracks in bark		Other: _____											
19. Specimen collected?				<input type="checkbox"/> Yes		<input type="checkbox"/> No		20. How many? _____				21. LSTS System ID#: _____											
22. Notes:																							