



## The Pine Shoot Beetle

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The pine shoot beetle, (*Tomicus piniperda* (L.), Coleoptera: Scolytidae), a native of Europe, North Africa and Asia, is established throughout the Great Lakes region of Canada and the northeastern United States. This beetle is one of the most destructive shoot feeding species of pines in Europe. First discovered in 1992 in a Christmas tree plantation in Ohio, it probably entered North America in wooden packing material aboard ships from Europe in the 1980s. By 1994, it was established in ten Ontario counties and has subsequently spread to other areas of Ontario and the United States.

### The Threat

- In North America, the most serious damage has been found in commercial pine tree plantations.
- Damage by adult beetles results in shoot and branch mortality that affects growth and appearance.
- Quarantine restrictions on the movement of logs and Christmas trees from infested areas will have serious economic implications.
- Stressed trees and natural pine stands growing in drier regions of Canada may be more susceptible to attack.
- Pine shoot beetle is a vector of three species of damaging blue-stain fungi in Europe.

### Hosts

In North America all native pine species are potential hosts of the pine shoot beetle. The preferred species are red pine, Scots pine, and ponderosa pine. When beetle populations are high, balsam fir, eastern white pine, Norway spruce, and larch are also attacked.

### Recognition

- Larvae, pupae and adults can be found at different times in galleries under the bark of dead or stressed trees in spring, usually before native bark beetles. Young adults are 3 to 5 mm long, brownish black, darkening with maturity.
- Adults create 2-mm holes when exiting tree stems and 2-mm to 3-mm entrance holes when attacking new shoots (Fig. 1).
- First and second year shoots droop and become yellow or red in early summer.



Eric Allen, CFS.

Figure 1. Entrance hole on new pine shoot.





*Figure 2. Damaged shoots beneath pine tree.*

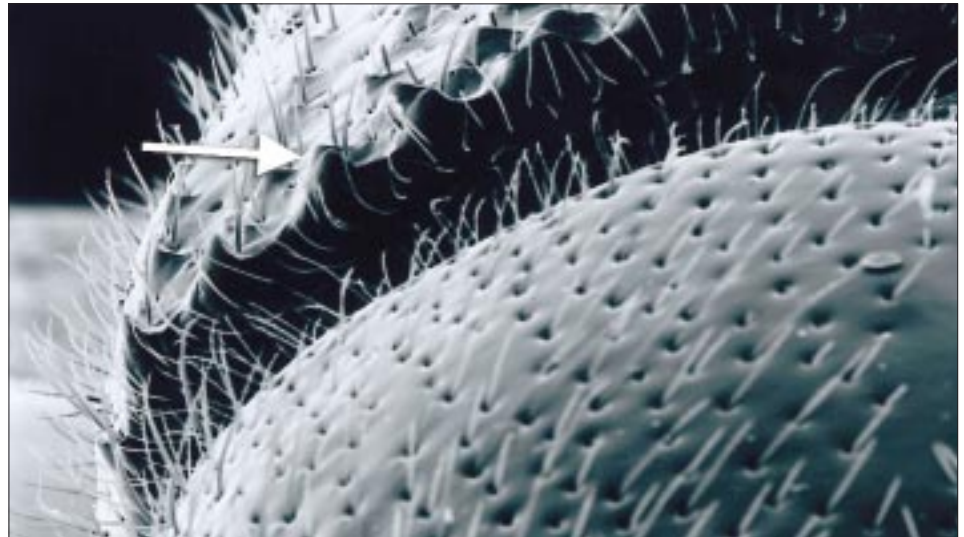
- Dead shoots from current or previous years may be evident on the ground (Fig. 2).
- Shoots damaged by the pine shoot beetle will have 2-cm to 10-cm tunnels and may have circular entrance holes near the broken end (Fig. 3).
- Microscopic features of the pine shoot beetle include:
  - clubbed antennae with a 6-segmented funicle (Fig. 4);
  - tooth-like projections on front edge of elytra (Fig. 5);
  - on the elytra, rows of pits alternate with rows of setae on raised bases (Fig. 6); and
  - second row on the declivity has no setae on raised bases.



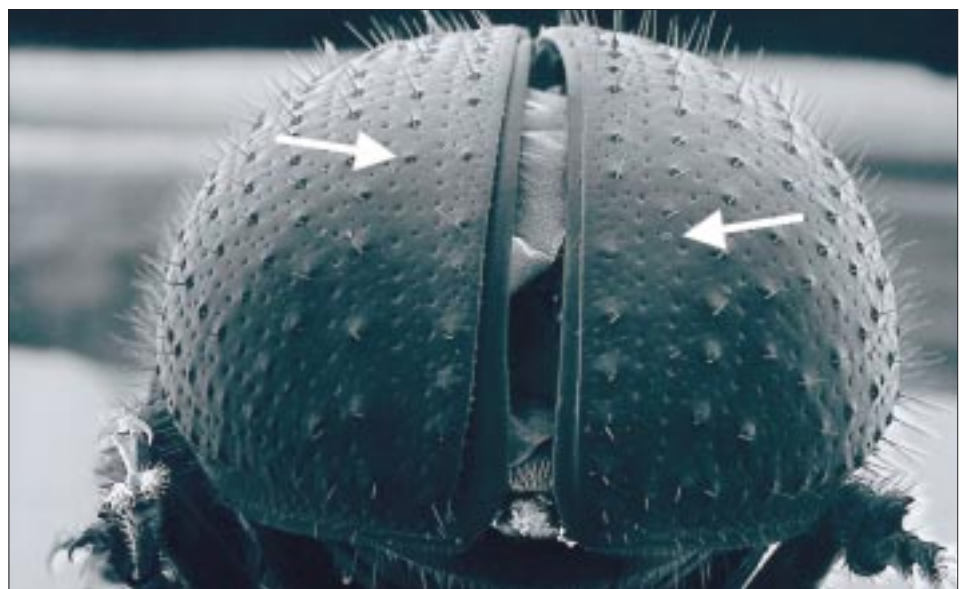
*Figure 3. Adult beetles mining shoot.*



*Figure 4. Six-segmented funicle on clubbed antenna.*



*Figure 5. Tooth-like projections on elytra.*



*Figure 6. Lack of setae on raised bases along second row.*

## Life Cycle

The pine shoot beetle completes one generation per year. Overwintering adults initiate flight on the first warm days of March in the Great Lakes area, when daily maximum temperatures reach 10 to 12°C and the daily mean temperature is 7 to 8°C. Adults can fly for several kilometres searching for a suitable host. The adult beetles usually colonize freshly cut stumps and slash but can attack stressed living trees.

Females excavate galleries, 10 to 25 cm long, under the bark to lay eggs (Fig. 7). Galleries are more numerous on the sides of logs and trees that are warmed by the sun. After the adult beetles finish laying eggs, they emerge and die.



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*Figure 7. Egg galleries under bark.*

From April to June, larvae feed in separate galleries 2.5 to 10 cm long. The larvae finish feeding in May or June, pupate and transform into adults at the end of their feeding gallery.

The new adults emerge through the bark and attack new shoots on pine trees of all ages. The beetles burrow up to 10 cm into the pith of the current year's twigs. During October the adults exit the twigs and move

into the soil or the base of pine trees to overwinter. The timing of the life cycle of the pine shoot beetle is very dependent on the local climate.

Adults can overwinter in shoots in warmer climates but move under the bark at the base of trees or the soil in colder weather. Snow pack adds insulation in most areas of Canada. Larvae are killed by temperatures below -12°C. Pupae and the adults die at temperatures below -18°C.

## Damage to Trees

The destruction of shoots by adult maturation feeding causes the most significant damage. Approximately 10 to 20 cm of the shoots become bent over, turn yellow-red (Fig. 8), and often break near the entrance hole. Each adult can destroy between two and six shoots. Shoot injuries are mainly limited to the top third of the tree. Severe shoot feeding reduces needle mass and leads to reductions in height and diameter increment. Growth will start to diminish if the number of infested shoots is more than 20 in young pines or more than 50 in older pines.



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*Figure 8. Infested shoots bent over in the tree crown.*

## Management

### Quarantine

Restrictions on the movement of pine Christmas trees, pine nursery stock, unprocessed pine bark and pine forest products with bark from known areas of infestation help prevent the spread of the pine shoot beetle.

### Detection

Plantations within known areas of infestation should be surveyed annually for the pine shoot beetle. A preferred monitoring program would include a combination of sentinel (trap) logs and funnel traps. Sentinel logs must be pine (preferably Scots, jack or red pine), at least 1 m long, and more than 10 cm in diameter (Fig. 9). Sentinel logs should be set out by February or March, depending on the climate, with a minimum of five logs per hectare. Logs must not be cut earlier than November of the previous year. After daytime temperatures reach 10°C, trap logs should be checked every two weeks for evidence of attack (boring dust or galleries). The frass is a multi-colored, white-brown dust. Adults usually fly in the afternoons with the peak period between 1500 and 1800 hrs. If beetle attack is detected, then additional trap logs should be deployed immediately, up to 25 per hectare. Sentinel logs should be destroyed between May 1 and May 20 either by burning them or burying them at least 30 cm deep. If logs are chipped, the chips must be smaller than 5 cm in any dimension.

The pine shoot beetle produces no pheromone but is attracted to host scents. Lindgren® funnel traps baited with  $\alpha$ -pinene lures can be used to detect the pine shoot beetle. Traps should be 8 to 12 funnel units with an insect killing strip in the collection cup. Funnel traps and sentinel logs should be placed



Figure 9. Sentinel (trap) logs.

together in the stand, at least 10 m from the edge of the stand and away from any competing host material.

### Sanitation

In infested areas, potential host material including recently cut stumps, branches over 5 cm in diameter, and culled trees should be destroyed by burning, burying or chipping by May 20. Christmas trees in infested areas should be cut at the root collar and the bottom 30 cm of trunk should be removed and destroyed.

### Chemical control

To obtain a phytosanitary certificate, trees in infested areas must be inspected, and if found to be infested, fumigated with methyl bromide. Application of an approved pesticide foliar cover spray and a trunk spray can be effective in deterring attack. The foliar sprays should be applied just before new adult beetles emerge from brood material to infest the new pine shoots. The best time to spray depends on the microclimate of the site but is usually in early May. If feeding of new shoots is evident then a trunk spray with an approved pesticide may be desirable.

Spraying an exposed stump with an approved pesticide just before the

flight of the adults in February or March and again before the flight of the new adults in April or May should provide an effective control against emergence.

### What to Look For

- Eggs, larvae and pupae under the bark of logs, stumps or stressed standing trees in the spring. Pine shoot beetle attack will be evident earlier in the year than native bark beetle species.
- Bent over yellow-red shoots or dead shoots on the ground with hollow pith.
- Entrance and exit holes and mining evidence (boring dust) on the stem.

### Additional Information

For further information regarding import and export regulations see the Canadian Food Inspection Agency Directive D-94-22, available on the WWW at <http://www.cfia-acia.agr.ca/english/plant/protect/d-94-22e.html>.

### Acknowledgements

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