Tomicus piniperda (Linnaeus)

Coleoptera: Curculionidae (Subfamily Scolytinae)
Pine shoot beetle

Host(s)	CAPS-Approved Survey Method
Main *Pinus ponderosa* (Ponderosa pine), *Pinus resinosa* (Red pine), *Pinus sylvestris* (Scots pine), and (Humphreys and Allen, 1998; APHIS, 2000). **Other** *Abies* spp. (Fir), *Abies balsamea* (Balsam fir), *Abies pectinata*, *Larix* spp. (Larch), *Larix decidua* (European larch), *Larix europea*, *Picea* spp. (Spruce), *Picea abies* (Common spruce), *Picea excelsa*, *Picea obovata* (Spruce of Siberia), *Picea smithiana* (Himalayan spruce), *Pinus* spp. (Pine), *Pinus armandii* (Armand pine), *Pinus banksiana* (Jack pine), *Pinus brutia* (Brutian pine), *Pinus cembra* (Swiss stone pine), *Pinus contorta* (Lodgepole pine), *Pinus densiflora* (Japanese umbrella pine), *Pinus halepensis* (Aleppo pine), *Pinus koraiensis* (Korean pine), *Pinus leucodermis* (Bosnian pine), *Pinus massoniana* (Masson pine), *Pinus mugo* (Mugo pine) (=*Pinus montana*), *Pinus nigra* (Black pine), *Pinus nigra austriaca*, *Pinus nigra cevennensis*, *Pinus nigra nigra*, *Pinus pentaphylla* (Japanese white pine), *Pinus peuce* (Balkan pine), *Pinus pinaster* (Maritime pine), *Pinus pinea* (Italian stone pine), *Pinus radiata* (Monterey pine), *Pinus strobus* (Eastern white pine),	The CAPS-approved survey method for *Tomicus piniperda* is alpha-pinene in a multi-funnel trap.

Pinus thunbergii (Japanese black pine), *Pinus uncinata* (Mountain pine), *Pinus yunnanensis* (Yunnan pine), *Pseudotsuga* spp. (Douglas-fir), and *Pseudotsuga menziesii* (Douglas-fir). (Browne, 1968; USDA, 1972; Grüne, 1979; Wood and Bright, 1992; Haack and Kucera, 1993; Bright and Skidmore, 1997; Humphreys and Allen, 1998; Bright and Skidmore, 2002; Thomas et al., 2006; CABI, 2011). Humphreys and Allen (1998) state that all native pine species may be potential hosts.	

Reason for Inclusion

PPQ Program Pest

Pest Description

Eggs:

"Eggs are 1 mm [approx. $^{1}/_{16}$ in] long, oval, smooth, and shiny white" (Haack and Kucera, 1993).

Larvae:

"Larvae are legless, slightly curved, have a white body and brown head, and can reach $^{1}/_{4}$ inch (5 mm) in length when fully grown" (Haack and Kucera, 1993).

Dorsal view of adult *Tomicus piniperda* (Maja Jurc, University of Ljubljana, Bugwood.org).

Pupae:

"The pupae are white, mummy-like and have some adult features including wings that are folded behind the abdomen" (Ciesla, 2001).

Adults:

"The adults are brown to black, 3.5 to 4.8 mm [approx. $^{1}/_{8}$ to $^{3}/_{16}$ in] long, and somewhat resemble individuals of *Dendroctonus* (southern pine beetle and black turpentine beetle) in general appearance, but the funicle of the antenna is composed of six antennomeres. *Tomicus piniperda* can be distinguished from other members of the genus by the smooth second elytral interval on the declivity" (Thomas et al., 2006).

Biology and Ecology

Adults overwinter in galleries beneath the bark on trees they shoot-fed on. Overwintering ends when ambient temperatures are approximately 11°C (51.8°F) with no snow cover. Females colonize host plant material which can include stumps, logs, and dead or dying pines. Females tunnel to the xylem where they are joined by a male (Nielsen, 1997). Adults find host material through host volatiles (Ciesla, 2001). The female will begin constructing the egg gallery (10–15 cm (approx. 3 $^{15}/_{16}$ to5 $^{15}/_{16}$ in) long) while the male removes the frass and sawdust (Nielsen, 1997). Galleries are constructed within the inner bark and outer sapwood (Ciesla, 2001). Females lay up to 100 eggs singly in notches along both sides. Once finished in the gallery, a female can move to additional host material and complete and lay eggs in a second gallery (Nielsen, 1997).

Once larvae hatch, they construct horizontal feeding galleries 4–9 cm (approx. 1 $^{9}/_{16}$–3 $^{9}/_{16}$ in) in length (Ciesla, 2001). In Ohio, larvae mature and emerge as adults around mid June to August (Nielsen, 1997) through 2 mm (approx. $^{1}/_{16}$ in) diameter exit holes (Ciesla, 2001).

Recently emerged adults fly to new pine shoots for maturation feeding (Nielsen, 1997). Adults prefer either the one year old or current year's growth (Ciesla, 2001). Adults enter the shoots and feed in the pith toward distal buds. If the terminal bud is reached, adults will exit from their entrance hole and attack another shoot. Tunnels do not have frass or sawdust present. Once temperatures reach about 0°C (32°F) adults will leave the shoots and move to the tree trunk (at a height of approximately 20 cm (approx. 7 $^{7}/_{8}$ in) from the ground) (Nielsen, 1997).

Countries of Origin

This species is native to Europe, North Africa, and Asia (Humphreys and Allen, 1998).

Current Distribution

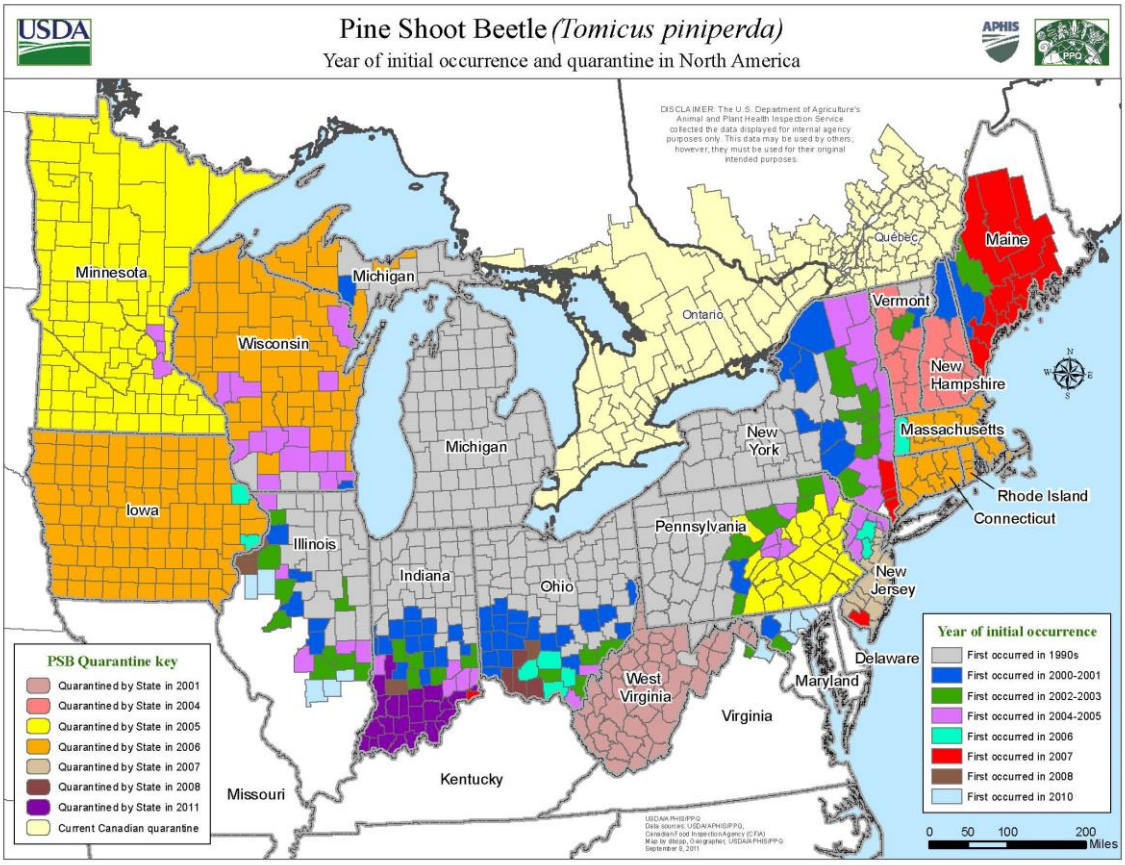
This species is found in Algeria, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Canary Islands, China, Croatia, Cyprus, Czech Republic, Korea, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hong Kong, Hungary, India, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Macedonia, Madeira Islands, Mongolia, Morocco, Netherlands, Norway, Philippines (Basilan Island), Poland, Portugal, Romania, Russia (including Sakhalin Island), Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, Tunisia, Turkey, Ukraine, Vietnam, and the United Kingdom (England and Scotland) (Browne, 1968; Wood and Bright, 1992; Bright and Skidmore, 1997; Bright and Skidmore, 2002; Alonso-Zarazaga, 2004; CABI, 2011).

Distribution in United States

T. piniperda, has been found in at least 19 states in the Northeast and Midwest United States and is a PPQ program pest. *T. piniperda* was first found in the United States in 1992 on a Christmas tree farm in Ohio (Haack, 1997). It has since been found in several other states including Connecticut, Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, and Wisconsin.

A previous infestation was reported in New Jersey in 1913, but this was eradicated (APHIS, 2002).

DNA results suggest that the population in the United States most likely resulted from at least two separate introductions (Haack and Lawrence, 1997). This species causes similar damage as several native insects and diseases, likely leading to the extended lag time between its introduction and discovery (Haack, 1997).



Year of initial occurrence and quarantine in North America for *T. piniperda*. USDA-APHIS-PPQ.

Pathway

This species likely entered the United States on solid wood packing material (APHIS, 2000). This species moves easily in international trade and was one of the most commonly intercepted bark beetles from 1985 to 1996 (Haack and Cavey, 1997).

This pest can also move naturally through adult flight. Studies have shown dispersal of 2 km (1.2 miles) when wind is present (APHIS, 2002).

To slow the spread of this pest in the United States, restrictions are in place on several materials that may help move the pest including pine Christmas trees, pine nursery stock, and unprocessed pine bark and forest products coming from infested areas (Humphreys and Allen, 1998). A list of regulated articles and quarantine areas can be found in the Code of Federal Regulations (Title 7, part 301.50) which can be found online at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr;sid=ce593b15d033bd6c58410d1b27317838;rgn=div6;view=text;node=7%3A5.1.1.1.2.7;idno=7;cc=ecfr.

Pathogens Vectored

This species can vector a variety of plant pathogens and other organisms including: *Ambrosiella* spp., *Aurebasidium pullulans, Bursaphelenchus sexdentati, Hormonema dematioides, Ophiostoma* spp. (blue-stain fungus), *O. minus*, and *Leptographium* spp., *L. wingfieldii* (Solheim and Långström, 1991; Humble and Allen, 2006; Kirisits, 2004). Humble et al. (2006) lists other *Ophiostoma* and *Leptographium* spp. as well.

T. piniperda has also been found to vector bluestain fungi that are native to North America, including *Ophiostoma ips, O. nigrocarpa, O. piceae, Leptographium terebrantis*, and *L. procerum* (Haack and Lawrence, 1997).

Crown damage on pine trees caused by *Tomicus piniperda*. The thinning of the crown is due to fallen terminals (E. Richard Hoebeke, Cornell University, Bugwood.org).

Damage caused by *Tomicus piniperda* (Gyorgy Csoka, Hungary Forest Research Institute, Bugwood.org).

Damage

This species is considered a serious pest of pines in Europe, attacking both trunks and growing shoots of pines (Thomas et al., 2006). This species has caused serious damage to commercial pine tree plantations in North America. Damage caused by *T. piniperda* can lead to shoot and branch mortality which may affect growth and appearance of the host plant (Humphreys and Allen, 1998).

Different life stages can be found in galleries under the bark of dead or dying trees during different times in spring. Exit holes are approximately 2 mm ($^{1}/_{16}$ in) in diameter while entrance holes on new shoots are circular and approximately 2–3 mm ($^{1}/_{8}$ in). Tunnels can be 2 to 10 cm in length ($^{13}/_{16}$ to3 $^{15}/_{16}$ in). Attacked first- and second-year shoots will wilt and yellow or redden in early summer (Humphreys and Allen, 1998). Shoots may bend near the point of entrance (Ciesla, 2001). Dead shoots may be found on the ground (Humphreys and Allen, 1998). Entrance holes caused by maturation feeding may also have resin present (Nielsen, 1997).

The most damage is due to maturation feeding by adults which destroys shoots. Shoot injuries are usually limited to the top third of the tree. Severe shoot feeding can reduce needle mass, height, and diameter increment (Humphreys and Allen, 1998). Mortality of the tree may occur when populations are high (APHIS, 2002).

Damage may look similar to damage caused by *Ips* spp. or by *Rhyacionia* spp. (pine tip moths), so shoot damage should be examined carefully (Thomas et al., 2006).

Survey

The CAPS-approved survey method for *Tomicus piniperda* is the alpha-pinene lure in a multi-funnel trap; however, always defer to the Pine Shoot Beetle Plant Pest Program regarding any survey instructions.

IPHIS Survey Supply Ordering System Product Names:

1) Alpha Pinene Lure (two bottles are needed per trap)
2) Multi-funnel Trap, 12 Funnel, Wet or
3) Multi-funnel Trap, 8 Funnel, Wet

In the past, there were two approved lures for *Tomicus piniperda* listed in the CAPS approved methods. The two lures were the 1) Alpha Pinene Lure and 2) Alpha Pinene UHR Lure. The Alpha Pinene Lure is an un-gelled lure in a bottle dispenser that has been used by the PPQ Program for *Tomicus piniperda* (pine shoot beetle). The Alpha Pinene UHR Lure is a polysleeve, ultra-high release dispenser used for other EWB/BB targets.

For the 2013 survey season and beyond, only the Alpha Pinene Lure (the un-gelled lure in a bottle dispenser) should be used for *Tomicus piniperda* surveys. Negative data will not be accepted from the Alpha Pinene UHR Lure. The scientific literature supports the use of lower release alpha pinene lures for *Tomicus piniperda*, which is achieved by the bottle dispensers.

1.1 Survey Site Selection

This species could potentially infest all native pine species, so areas with high concentrations of pine species should be targeted. Good survey sites could include pine plantations, nurseries, and natural and managed forest stands. In the United States, this species is found attacking *P. sylvestris* (Scots pine) the most, but it also attacks *P. nigra* (Austrian pine) and *P. strobus* (eastern white pine) (Thomas et al., 2006).

1.2 Trap and Lure

This species is not known to produce pheromones but it is attracted to host volatiles. A multi-funnel trap should be used and baited with alpha-pinene. The release rate of this lure is highly temperature-dependent. However, CAPS has listed a conservative length of effectiveness (8 weeks) that will be effective for even the warmest climates in the CAPS community. Lures for other target species should not be combined with the *T. piniperda* trap and lure combination.

1.3 Trap Placement

Traps should be placed at least 10 m (32.8 ft) from the edge of the stand and away from competing host material (Humphreys and Allen, 1998).

1.4 Time of year to survey

Adults can be found in the springtime (Humphreys and Allen, 1998). Adults leave their overwintering site when temperatures reach 12°C (54°F) (APHIS, 2002). Beetle flight is most common on sunny, calm days (Haack and Lawrence, 1997). In summer and fall, adults feed in pine shoots (APHIS, 2002).

Identification

CAPS-Approved Method

Morphological. Examination by a taxonomist with expertise in the weevil subfamily Scolytinae is required for identification. Examine specimens under a microscope with 70–110x magnifications and gooseneck lighting sources.

1. To determine if the specimen is *Tomicus*, use Passoa and Cavey (1994) followed by Brodel (2005--rev. 2009).

2. To determine the species of *Tomicus (destruens, minor,* or *piniperda)*, use Brodel (2005--rev. 2009) with Brodel (2000).

3. To separate *T. minor* from *T. piniperda*, use Brodel (2000).

Mistaken Identities

Tomicus piniperda can be mistaken for other families and genera of small beetles with the naked eye. Upon magnification, *T. piniperda* can be mistaken for other Scolytinae and *Tomicus* spp., including *Tomicus minor* and *T. destruens*. Neither *T. minor* or *T. destruens* have been found in the United States.

Resources and High Resolution Images

See the *T. piniperda* Plant Pest Program website for more information, including:

- **Fact Sheet:** Biology and survey information http://www.aphis.usda.gov/publications/plant_health/content/printable_version/fs_phpsb.pdf.

- **Pest Risk Assessment** http://www.aphis.usda.gov/plant_health/plant_pest_info/psb/pra.shtml.

Tomicus piniperda Plant Pest Program website: http://www.aphis.usda.gov/plant_health/plant_pest_info/psb/index.shtml.

Screening Aids

Brodel, C. F. 2000. Distinguishing *Tomicus minor* from *T. piniperda.* http://caps.ceris.purdue.edu/dmm/125.

Brodel, C. F. 2005 (rev. 2009). *Tomicus* Bark Beetles: A Key for Separating Program Species *piniperda* from European Exotics *destruens* and *minor.* http://caps.ceris.purdue.edu/dmm/126.

Passoa, S. and J. Cavey. 1994. Key to help screen *Tomicus piniperda* (L.) from other North American Scolytidae (Coleoptera). NA-TP-06-93. USDA, APHIS, PPQ. http://www.barkbeetles.org/exotic/tmcspnpe.html.

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Images

http://www.forestpests.org/hungary/weevilstp.html.

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