

Tom

### ASSESSMENT OF POTENTIAL IMPACTS OF TOMICUS PINIPERDA IN THE UNITED STATES

**Scientific Name of Pest:**

*Tomicus piniperda* L. (Syn. *Myelophila*, *Blastophagus*)

**Scientific Name of Host(s):**

*Pinus* species, especially *Pinus sylvestris*. Adult beetles can also breed in felled *Picea abies*, *Picea obovata*, *Larix decidua* and *Larix europaea*.

**Distribution:**

Algeria, Austria, Belgium, Bulgaria, Canary Islands, China, Cyprus, Czechoslovakia, Finland, France, Germany, Great Britain, Greece, Hungary, Italy, Japan, Korea, Madeira, Netherlands, Norway, Poland, Portugal, Rumania, Russia, Spain, Sweden, Switzerland, and Turkey.

**Summary of Natural History and Basic Biology of the Pest:**

Adults of the common pine shoot beetle (*Tomicus piniperda*) are small (3 to 5 mm in length) beetles with a black head and thorax and reddish-brown to brownish-black wing covers. Scotch pine (*Pinus sylvestris*) is the principal host, but other pines and occasionally larch and spruce are used for breeding purposes. It breeds in trees weakened by fire, disease, windthrow or prior attack by defoliating insects or in felled logs. The adult beetles overwinter in hollowed-out pine shoots or in short tunnels in and under the bark at the base of trees. In spring, the beetles emerge from these sites and commence breeding. There is no known aggregation or sex pheromone but *T. piniperda* adults are attracted by (-) alpha pinene, (+) 3 carene and terpinolene or by a mixture of these terpenes; it is also attracted to pruning wounds. Upon locating suitable breeding material, each pair of beetles tunnels out a gallery in the bark and sapwood. The female beetle excavates the gallery while the male ejects the boring material and blocks the entrance with his body. The gallery, which may be up to 25 cm long, consists of a club shaped nuptial chamber at the entrance and a tunnel following the grain of the wood. The female beetle cuts niches at regular intervals into the walls at either side of the egg gallery and deposits an oval, pearly white egg into each niche. There may be several "ventilation holes" cut at intervals along the gallery through the bark. The eggs hatch into white, wrinkled, legless grubs with a well developed brown head. They burrow in the bark and cambial layer, at first at right angles to the egg gallery, but later more haphazardly. They pass through four instars and then pupate in chambers hollowed out of the bark or sapwood. Adult beetles emerge by chewing round holes through the bark. Adults generally feed in lateral twigs from May through October. This so called "maturation feeding" takes the form of boring up the center of pine shoots, usually those of the current year's growth. Maturation feeding in pine shoots is the primary cause of damage to pines in Europe and Great Britain; this results in reduced radial and height growth. Some of the parent beetles may produce a second brood and undergo a second feeding period known as "regeneration feeding". Usually there is one generation per year with adult beetles breeding the following spring after they emerge. In some parts of its range, there may be two generations per year. Recent observations by Forest Service entomologists visiting China indicate that *T. piniperda* is able to successfully attack and kill apparently healthy, but probably drought stressed, *Pinus yunnanensis* in commercial plantations.

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**FAX TRANSMITTAL**

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To Bill Leuschner  
Dept./Agency

From Tom Hofacker  
Phone #

Fax # 803-656-3304

Fax #

## Specific Information Relating to Risk Elements:

### A. Probability of Pest Establishment

1. **Pest with Host at Origin:** High

*T. piniperda* adults infest cut logs and are commonly found in crating and dunnage with bark.

2. **Entry Potential:** High

Entry potential for *T. piniperda* is high. Numerous interceptions are made at U.S. ports annually (although most are found in dunnage rather than in commercial wood products).

3. **Colonization Potential:** High

An infestation currently exists in Ohio, Indiana, Michigan and Pennsylvania.

4. **Spread Potential:** High

Once established, these beetles have great potential to spread. Adult beetles can fly at least 1 km and infested logs, nursery stock and Christmas trees can be transported long distances.

5. **Control Options:** High in Christmas tree farms & nurseries; low in forests.

Pre-infestation (preventive) treatments of lindane have been successfully used in Great Britain and Europe so it is likely that treatments with chlorpyrifos, or carbaryl would be similarly effective. Cygon may be effective in killing beetles during maturation feeding. Beetles in logs or downed timber can also be controlled by debarking or burning the infested material. In forest situations, where the use of insecticides is not practical, build-up of beetle populations during thinning or logging operations can be reduced by denying or removing suitable breeding material during the months of breeding activity (March through July in Great Britain and March to April in Germany). Trap trees, put out at six-week intervals during the period of beetle flight, can be used to reduce beetle populations.

### B. Consequences of Establishment

6. **Economic Damage Potential:** High

Establishment of *T. piniperda* in the U.S. has the potential to impact urban trees, and the timber, Christmas tree and nursery industries. The estimated economic impacts of *T. piniperda* on Christmas tree and commercial timber production and on trees in urban areas is discussed below. These impacts are based on the assumption that *T. piniperda* requires felled, dead or dying trees to breed in. Should *T. piniperda* be able to breed in and kill healthy living pines, as recent observations in China suggest, potential impacts would be significantly greater.

Potential losses to Christmas trees growers in the United States are based on the following information and assumptions.

- \* Christmas trees will be treated with an insecticide before attack to prevent damage.(G)
- \* There are one million acres of Christmas tree plantations in the United States. (Geiger, 1992)
- \* Each year 25% of the total Christmas tree acreage will be sprayed.(J)
- \* All Christmas tree plantation acreage are included because the plantations are 80% Scotch pine (Koelling, 1992) and because the other pines grown for Christmas trees may also be affected.
- \* The cost of preventive treatment is \$15.00 per acre. The cost included chemicals and application costs. (Koelling, 1992)
- \* The annual cost (\$3.75 million) of preventive treatments is accumulated for the 1994-2024 (30 years) period and discounted at a 4% discount rate to 1993.

The 1993 present value of preventive treatment of the Christmas trees in the United States over the next 30 years is \$62 million.

The potential losses to owners of pines in urban areas of the United States are estimated in terms damaged trees that are removed and replaced.

Potential losses are based on the following information and assumptions.

- \* Urban trees are trees for landscapes and yards, ornamentals, including golf courses and parks, and residential areas.
- \* Damaged trees will be removed and replaced for the next 16 years, after 16 years T.Piniperda damaged trees will have been replaced with resistant pine trees or with hardwoods.(J)
- \* It cost \$125 to remove damaged tree and \$275 to replace with a 2 inch balled and burlaped tree. (Neely, D. 1988).
- \* Twenty-five percent of the pines will be attacked and of those 10 percent will be sufficiently deformed or killed and will require removal and replacement.
- \* A discount rate of 4% is used to compute the present value of losses over the 16 years period (1994-2010).
  
- \* For the New England and North Central (21 states) there are:
  - 20,784,000 acres of urban and built up area (Sampson, ) of which 48 % is residential with 39 trees per acre and 3 % are pine; institutional/parks are 15% of area with 45 trees per acre and 3% pine; commercial and industry are 18 % of the area with 4 trees per acre and 3% pine. (Rowntree, 1984) (also Richards, 1978).For New England and North Central the present cost in 1993 of removal and replacement for 16 years is \$119 million.
  
- \* For the South there are:
  - 21 million acres of urban areas (Sampson, ) of which residential is 56% with 39 trees per acre and 6% pines;
  - commercial/industry is 13% with 4 trees per acre and 6% pines;
  - institutional/parks is 7% with 45 trees per acre and 6% pines.(Rowntree, R.A. 1984).For the South the present cost in 1993 of removal and replacement for 16 years is \$237 million.
  
- \* For the West there are:
  - 8,288,000 acres of urban area (Sampson, ) of which residential is 44 % with 39 trees per acre and 8% pines;

commercial/industry is 12 % with 4 trees per acre and 8% pines;  
institutional/parks is 10% with 45 trees per acre and 8% pines. (Nowak, D. 1991).  
For the West the present value in 1993 of removal and replacement for 16 years is \$108 million.

For the United States the present value of potential losses to urban areas from *T. piniperda* over 16 years is \$464 million.

The potential losses to producers of commercial timber from the affects of *T. piniperda* are based on the following information and assumptions.

- \* In addition to Scotch pine, eastern white pine (*P. strobus*), loblolly pine (*P. taeda*), shortleaf pine (*P. echinata*) and slash pine (*P. elliottii*) will also be affected by *T. piniperda*.
  - \* All pines attacked by *T. piniperda* will have a growth loss of 39%. (US Department of Agriculture, 1972).
  - \* 10% of the Scotch pine will be attacked. (J)
  - \* 1% of the other pines will be attacked. (J)
- Damage to Scotch Pine for commercial purposes is based on assumptions of 5,693 MBF volume in inventory in 1993 with an annual growth of 2 percent. (Gansner, 1992)
  - *T. piniperda* spreads into Scotch pine in northeastern United States over a 30 year period.
  - 1990 price of \$60 per MBF.

The present value of losses to Scotch pine for the 30 year period are \$1.865 million.

- Damage to eastern white pine in the northeastern United States for commercial purposes is based on assumption of 43,764 MBF volume in inventory in 1993 with an annual growth rate of 4 percent per year. (Gansner, 1992).
- *T. piniperda* spreads into white pine over a 30 year period.
- 1990 price of \$70 per MBF.

The present value of losses to white pine for the 30 year period are \$3.345 million.

- Damage to other pine in commercial uses are based on all southern softwoods.
- Forest Service projected harvest volumes and prices of 1993 5,605 million board feet to 7160 million board feet harvested in 2023, and prices increase from \$199 per 1000 board feet in 1993 to \$374 in 2023. (U.S. Department of Agriculture, 1990, page 161).
- 1 percent of trees affected with 39 percent reduction in growth which is directly reflected in harvest.

The present value of potential losses by *T. piniperda* to southern softwoods are \$211 million.

In summary, the estimate of the present value of potential losses and increased production costs in the United States over the next 30 years due to the effects of *T. piniperda* is:

| Category Millions of dollars<br>-----    | (present value)<br>----- |
|--|--------------------------|
| Christmas trees (preventive)-----        | 62                       |
| Urban trees (removal and replacement)--  | 464                      |
| Scotch pine (timber growth loss)-----    | 2                        |
| Eastern white pine (timber growth loss)- | 3                        |
| Southern pines (harvest loss)-----       | 211                      |
| <b>TOTAL POTENTIAL LOSSES -----</b>      | <b>\$742</b>             |

**7. Environmental Damage Potential: Low**

*T. piniperda* has killed trees on afforestation sites in sand dune areas of Great Britain. Thus, *T. piniperda* may be able to kill pine trees on mine reclamation sites where trees are being grown under similarly harsh conditions. This may affect our ability to use pines to reclaim sites damaged by mining or other activities. The primary host of *T. piniperda* is *Pinus sylvestris*, a non-native species.

**8. Perceived Damage (Social and Political Influences): Moderate**

Discoloration and death of pine shoots would be readily visible to the public and may cause public concern. The Christmas tree, nursery and forest industries can be expected to lobby for aggressive action.

**Estimated Risk for Pest: High**

**Prepared By:**

This paper was prepared by Forest Pest Management and State and Private Forestry of the USDA Forest Service, P.O. Box 96090, Washington, D.C. 20090-6090 for the USDA Animal and Plant Health Inspection Service, Federal Building, Hyattsville, MD 20782.

**References:**

Beran, D. 1987. Forestry Commission Handbook 1 - Forest Insects. U.K. Forestry Commission.

Davies, J.M., and King, C.J. 1977. Forestry Commission Leaflet 3 - Pine Shoot Beetles

Gansner, David. 1992. Personal communication. Forestry Inventory and Analysis, Northeastern Forest Experiment Station, USDA Forest Service.

Geiger, Joan. 1992. Personal communication as representative of the National Christmas Tree Association.

Koelling, Mel. 1992. Personal communication. Dept. of Forestry, Michigan State University

Neely, D. (ed.). 1988. Valuation of Landscape Trees, Shrubs, and other Plants. Washington, D.C. Council on Tree and Landscape Appraisers.

Nettleton, W.A. 1992. Personal communication on attack of *P. yunnanensis* in China.

Nowak, D.D. 1991. "Urban Forest Development and Structure: Analysis of Oakland, California," doctoral dissertation, University of California, Berkeley, California, 1991.

Richards, N.A. and Stevens, J.C. 1978. Streetside Trees and Street Trees. SUNY-CESF. 1978.

Rowntree, R.A. 1984. Forest Canopy Cover and Land Use in Four Eastern United States Cities. Urban Ecology, August 1984, pp. 55 - 57.

Sampson, N., Moll, G. and Kielbaso, J.J. Urban Forests, Carbon Storage and Energy Conservation. American Forestry Association.

Schwenke. 1974. Die Forstschadlinge Europas, Bd. 2. Kafer.

Schroeder. 1987. J. Chem. Ecol. 13: 1591-1599.

U.S. Department of Agriculture. 1972. Coop. Econ. Ins. Report 22(12): 234-236

U.S. Department of Agriculture, 1990. An Analysis of the Timber Situation in the United States: 1989 - 2040. Forest Service Gen. Tech. Rpt. RM-199.

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*Reference Codes in Text*

G  
J  
E

*Description*

General knowledge, no specific source.  
Judgement.  
Extrapolation from limited data.