Orthotomicus erosus (Wollaston)

Coleoptera: Curculionidae (Subfamily Scolytinae)

Mediterranean pine engraver

Host(s)	CAPS-Approved Survey Method
Major/Primary hosts* *Pinus* spp. (Pine), *Pinus armandii* (Armand pine), *Pinus brutia* (Calabrian pine), *Pinus canariensis* (Canary Island pine), *Pinus halepensis* (Aleppo pine), *Pinus kesiya* (Khasi pine), *Pinus maritima* (Maritime pine), *Pinus massoniana* (Masson pine), *Pinus mugo* subsp. *uncinata* (Mugo pine), *Pinus nigra* (Austrian pine) *Pinus pinaster* (Maritime pine), *Pinus pinea* (Italian stone pine), *Pinus radiata* (Radiata pine), *Pinus sylvestris* (Scots pine), *Pinus tabulaeformis* (Chinese pine), *Pinus yunnanensis* (Yunnan pine), **Minor hosts** *Abies* spp. (Fir), *Abies pinsapo* (Hedgehog fir), *Cedrus* spp. (Cedar), *Cedrus libani* (Cedar of Lebanon), *Picea* spp. (Spruce), *Picea orientalis*, *Pinus elliottii* (Slash pine), *Pinus patula* (Mexican weeping pine), *Pseudotsuga menziesii* (Douglas fir) **Other hosts** *Cedrus deodara* (Deodar cedar), *Cupressus* spp. (Cypress), *Larix laricina* (Eastern larch), *Picea glauca* (White spruce), *Picea mariana* (Black spruce), *Pinus caribaea* (Caribbean pine), *Pinus coulteri* (Coulter pine), *Pinus echinata* (Shortleaf pine), *Pinus leucodermis* (Bosnian pine), *Pinus nigricans* (Austrian pine),	EBB/ *Ips* lure: cis-verbenol, ipsdienol and 2-methyl-3-buten-2-ol lures in multi-funnel trap.

Pinus pithyusa, *Pinus strobus* (Eastern white pine), *Pinus taiwanensis* (Taiwan pine), *Pinus uncinata* (Mountain pine) (Wood and Bright, 1992; Eglitis, 2000; Devorshak and Hurt, 2005; Lee et al., 2008) **O. erosus* does not breed in hosts other than pines (Eglitis, 2000) In no choice laboratory tests, Lee et al. (2008) reported that *O. erosus* reproduced on four pines from its native Eurasian range: *Pinus canariensis* (Pine, Canary Island), *Pinus halepensis* (Pine, Aleppo), *Pinus pinea* (Pine, Italian stone), *Pinus sylvestris* (Pine, Scotch/Pine, Scots) 11 native North American pines: *Pinus banksiana* (Pine, Jack), *Pinus contorta murrayana* (Pine, Sierra lodgepole), *Pinus jeffreyi* (Pine, Jeffrey), *Pinus lamertiana* (Pine, Sugar), *Pinus radiata* (Pine, Monterey), *Pinus monophylla* (Pine, Singleleaf pinyon), *Pinus ponderosa* (Pine, Ponderosa), *Pinus resinosa* (Pine, Red), *Pinus sabiniana* (Pine, Grey), *Pinus strobus* (Pine, Eastern white), *Pinus taeda* (Pine, Loblolly), and four native [North American] nonpines: *Larix laricina* (Larch, Eastern/Tamarack), *Picea glauca* (Spruce, White) *Picea mariana* (Spruce, Black) *Pseudotsuga menziesii* (Fir, Douglas)	

Reason for Inclusion in Manual

Orthotomicus erosus was a target species in the original EWB/BB National Survey Manual.

Taxonomy

Orthotomicus erosus was originally placed in the genus *Ips* by Wood and Bright (1992) and was later moved to *Orthotomicus* by Bright and Skidmore (1997). Depending on interpretation of characters and the key used, *O. erosus* may still be identified as a member of the genus *Ips* (Cavey et al., 1994).

Pest Description

Eggs:

"Eggs are smooth, ovoid, white and translucent. The eggs of *O. erosus* are approximately 1 mm long and laid separately in niches along the egg gallery" (CAB, 2005).

Larvae:

"The larvae are white, legless, 'C' shaped grubs with an amber colored head capsule. Mature larvae are about 5 mm long [approx. $^{3}/_{16}$ in]" (Eglitis, 2000).

Pupae:

"The pupae are white, mummy-like, and have some adult features, including wings that are folded behind the abdomen" (Eglitis, 2000).

Adults:

"*Orthotomicus erosus* averages 3-3.8 mm [approx. $^{1}/_{8}$ in] length and is reddish brown in color. The adults are typical bark beetles of the subfamily Ipinae, family Scolytidae. The head is covered by a thoracic shield and is not visible when viewed dorsally and the declivity is concave, with each side armed by four spines, the second from the top being more conspicuous. The spines on the declivity of *O. erosus* are less conspicuous than on most North American species of *Ips*" (Eglitis 2000). "2nd elytral spine not broad; declivity with more than 3 spines or tubercles; 1 or 2 indentations between 3rd conical spine and post elytral margin; 1 tubercle between 2nd and 3rd spines; club round, with 2 slightly bowed sutures; 3 conical spines of lateral elytral declivity equidistant; male 2nd spine broad, nearly square; lateral margin of 2nd spine horizontal, tip perpendicular; 1st spine on 2nd interstria before declivity; 3rd interstria ends with granule before declivity; body black to reddish-brown, shiny, with grey filamentous setae; elytra reddish brown; 2.7-3.5 mm [approx. $^{1}/_{8}$ in]" (Grüne, 1979).

Adult, dorsal view (Jim Stimmel, Pennsylvania Department of Agriculture, Bugwood.org)

Head (Jim Stimmel, Pennsylvania Department of Agriculture, Bugwood.org)

Detail of elytron (Louis-Michel Nageleisen, Département de la Santé des Forêts, Bugwood.org)

For a more detailed description, as well as information on the pest's biology and ecology, see the Pine Commodity-based Survey Reference.

Biology and Ecology

The amount of generations per year is dependent on temperature, ranging from two to seven per year (reviewed in Eglitis, 2000). Turkey, France, and Morocco have two generations per year, whereas Israel has three to five generations per year with a generation taking 25 days in the summer and 76 days in the winter (Mendel, 1983; reviewed in Eglitis, 2000). In California, this species has 3 to 4 generations per year (Lee et al., 2007).

In California, this species is found on cut logs, stumps, declining branches of living trees, and on the trunk of dead standing trees (Lee et al., 2005). Males initiate host attacks when they bore through the bark and construct a nuptial chamber in the phloem and cambium layer. Once completed, one to three females will join and mate with the male. Mating generally occurs on the rough-barked sections of the main trunk or branches greater than 5 cm (approx. 2 in) in diameter. Females then construct individual egg galleries parallel to the wood grain, leading off of the nuptial chamber. Sometimes females will abandon their gallery and finish oviposition in another host tree (reviewed in Eglitis, 2000). Females lay between 26 to 75 eggs in niches along the gallery sides (Mendel and Halperin, 1982). In California, newly laid eggs have been found from early March until late of November (Lee et al., 2007).

Larvae mine at right angles to the parent gallery. Larvae have 3 instars (reviewed in Eglitis, 2000). Mature larvae tunnel towards the bark when ready to pupate. After pupation adults exit the host tree leaving a small round exit hole in the outer bark (1/16 in) (Lee et al., 2005).

O. erosus spends the winter in the adult stage. From mid-October to December, adults aggregate beneath host plant bark, up to several hundred individuals in the phloem and cambium region (Mendel, 1983). In California, this species overwinters as larvae, pupae, and adults beneath host tree bark (Lee et al., 2007). Maturation feeding is required for sexual maturity. This occurs

beneath the bark and may or may not occur on the tree in which they developed. Flight can occur from 14 to 38°C (52.7 to 100.4°F) ((reviewed in Eglitis, 2000). In California, this species has been found to fly in all months except late December and January (Lee et al., 2007).

Countries of Origin

This species is native to countries in the Mediterranean area (Karnavar, 1984).

Current Distribution

This species is present in: Algeria, Austria, Azores, Balearic Islands, Bulgaria, Chile, China, Corsica, Croatia, Cyprus, Egypt, England, Fiji, Finland, France, Greece, Iran, Israel, Italy, Jordan, Libya, Macedonia, Madeira Islands, Malta, Morocco, Norway, Poland, Portugal, Romania, Russia, Sardinia, Slovenia, South Africa, Spain, Swaziland, Switzerland, Syria, Tajikistan, Tunisia, Turkey, and Ukraine (Wood and Bright, 1992; Eglitis, 2000; Alonzo-Zarazaga, 2004; Global Invasive Species Database, 2005).

Distribution in United States

O. erosus was first detected in California in May 2005 (Lee et al., 2005).

From 2004 to 2006, California reported positive NAPIS survey data. California has not surveyed for this pest since 2006 (K. Handy, personal communication, 2009). This pest has not been found in NAPIS survey data for any other states (K. Handy, personal communication, 2009).

Pathway

Almost all interceptions of *O. erosus* have occurred in general cargo on wood products, including wood, crating and pallets (AQAS, accessed October 10, 2009). The population in California is thought to have arrived from solid wood packing material (Lee et al., 2005).

Pathogens Vectored

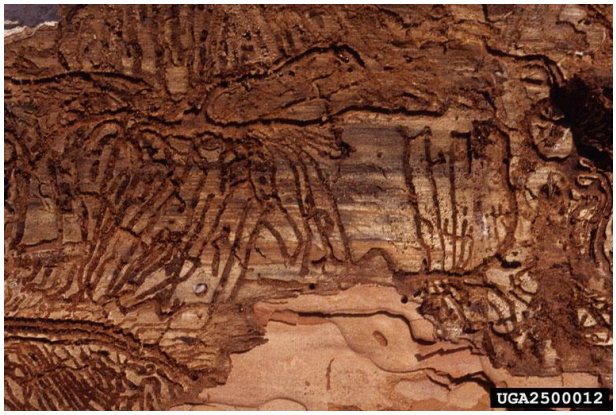
From "Suitability of Pines and Other Conifers as Hosts for the Invasive Mediterranean Pine Engraver (Coleoptera: Scolytidae) in North America" (Lee et al., 2008):

> *"O. erosus* can vector fungal pathogens. In South Africa, spores of *Ophiostoma ips* (Rumb.) Nannf., the causative agent of blue stain fungus, were found on 60% of 665 adult beetles or galleries on trap logs of *P. elliottii* and *P. patula;* spores of *Leptographium lundbergii* Lagerb. & Melin were also found on a few samples (Zhou et al. 2001). Spores of *Graphium pseudormiticum* Mouton & Wingfield have been found with *O. erosus* on unspecified pine logs (Mouton et al. 1994). In California, *O. erosus* overwintering in *P. canariensis* and *P. halepensis* carried spores of f *Ophiostoma ips* (T. Harrington, unpublished data)."

"Other organisms associated with *O. erosus* include the nematode *Bursaphelenchus fungivorus* (Arias et al., 2005)

Damage

Infestation by *O. erosus* may be difficult to detect until a tree exhibits signs of decline and dieback. As an attacked tree dies, the foliage fades from green to yellow to reddish-brown. Reddish-brown boring dust and frass expelled from galleries may be found on smooth bark surfaces of trees. If a healthy tree is attacked, pitch tubes may form on the bark. Adult and larval galleries can be viewed by peeling back the bark, though the appearance of the galleries may be disfigured by maturation feeding. Adult emergence holes are round and about 1.5 mm [1/16 in] in diameter. Sapwood may be discolored blue by staining fungi associated with *O. erosus* (reviewed in Eglitis 2000, Lee et al. 2005).



(Above) Gallery damage (William M. Ciesla, Forest Health Management International, Bugwood.org). (Right) Turkish pine damage by *O. erosus* (William M. Ciesla, Forest Health Management International, Bugwood.org)

Survey

1.1 Survey Site Selection

Identify known or prospective hosts of *O. erosus* and follow the general instructions on **General Site Considerations for Trap Placement** in the manual section **Planning a Survey**.

From "Mediterranean Pine Engraver. USDA-APHIS Pest Alert*"* (Lee et al., 2005):

"[*O. erosus*] are most likely to infest recently fallen trees, standing trees that are under stress, logging debris, and broken branches with rough bark that are at least two inches in diameter. In Israel, beetles are often found on the main stem and larger branches of stressed trees that are over 5 years old. In California, this species, or evidence of its past activity, has been found in cut logs from 6 inches to 3 feet in diameter, on stumps from 4

inches to 3 feet in diameter, on declining branches of live standing trees, and on the main stem of dead standing trees."

1.2 Trap and Lure

The CAPS-approved survey method for *O. erosus* is the Exotic Bark Beetle (EBB)/ *Ips* lure in a multi-funnel trap (Serez, 1987; Mendel et al., 1991). The EBB/ *Ips* lure is the synthetic aggregation pheromone for *Ips typographus*, which has also been found to be attractive to other species of bark beetles. The lure contains the following three components: 1) cis-verbenol, 2) ipsdienol, 3) 2-Methyl-3-buten-2-ol (MBO).

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.

IPHIS Survey Supply Ordering System Product Names:

1) *Ips* sp. Lure, 3 Dispenser
2) Multi-funnel Trap, 12 Funnel, Wet or
3) Multi-funnel Trap, 8 Funnel, Wet

1.3 Trap Placement

Follow the general instructions on **Trap Placement** and **Trap Setup** for multi-funnel traps in the manual section **Conducting a Survey**.

1.4 Time of year to survey

O. erosus "has two generations per year in Turkey, France and Morocco; 3-4 generations in Tunisia and South Africa; and 3-5 generations in Israel where adults are active from March to October" (Lee et al., 2005). "In California, [*O. erosus*] overwinters as larvae, pupae, and adults beneath the bark; adults fly during all months except late December and January; and the beetle has three to four generations per year" (Lee et al., 2007).

In Israel, flight occurs when the temperature exceeds 15°C [59°F], with a peak of activity between 25-26°C [77-79°F] (Mendel et al., 1991). Peak catch numbers occurred from early April through mid-August (Mendel et al., 1991). Beetles were caught in low numbers when the temperature reached 34°C [93°F] (Mendel et al., 1991).

Identification

CAPS-Approved Method

Morphological: Examine specimens under a good quality, high powered (preferably with up to 90X) dissecting microscope, with the help of a reference collection. Use the screening aid(s) for the relevant geographical area.

Mistaken Identities

With the naked eye, *O. erosus* could be confused with other families of small beetles. Upon magnification, *O. erosus* could be confused with other scolytids and other *Orthotomicus* and *Ips*

species. In the Northeastern United States, commonly confused species include: *Ips latidens*, *Ips pini*, and *Orthotomicus caelatus* (Cavey et al., 1994).

Resources and High Resolution Images

Images

http://www.forestryimages.org/browse/imagesthumb.cfm?sub=4071&area=5&start=1

Screening Aids

Cavey, J., S. Passoa, and D. Kucera D. 1994. Screening Aids for Exotic Bark Beetles in the Northeastern United States. NA-TP-11-94. Northeastern Area: U.S. Department of Agriculture, Forest Service.
http://caps.ceris.purdue.edu/screening/exotic_bark_beetles_of_northeast.

Lee, J. C., R. A. Haack, J. F. Negron, J. J. Witcosky, and S. J. Seybold. 2007. Invasive Bark Beetles. USDA-APHIS Forest Insect Disease Leaflet 176.
http://www.fs.fed.us/r6/nr/fid/fidls/fidl-176.pdf

References

Alonzo-Zarazaga, M. A. 2004. Fauna Europaea: *Orthotomicus erosus*. Fauna Europaea version 2.4, http://www.faunaeur.org

AQAS. 2009. Interception data for *Orthotomicus erosus*. Accessed October 10, 2009 from: https://mokcs14.aphis.usda.gov/aqas/HomePageInit.do.

CAB. 2005. Crop Protection Compendium. CAB International. Available on-line at: http://www.cabicompendium.org/cpc. Accessed 18 October 2006.

Cavey, J., S. Passoa, D. and Kucera. 1994. Screening Aids for Exotic Bark Beetles in the Northeastern United States. NA-TP-11-94. Northeastern Area: U.S. Department of Agriculture, Forest Service. http://caps.ceris.purdue.edu/screening/exotic_bark_beetles_of_northeast.

Devorshak, C. and C. Hurt. 2005. NPAG et Report, Orthotomicus erosus Wollaston: Mediterranean pine engraver beetle. USDA-APHIS-PPQ-CPHST-New Pest Advisory Group.

Eglitis, A. 2000. Exotic Forest Pest Information System for North America: *Orthotomicus erosus***.** North American Forest Commission.

Global Invasive Species Database. 2005. *Orthotomicus erosus*. Accessed May 20, 2011 from: www.issg.org/database/species/distribution.asp?si=787&fr=1&sts=sss&land=EN.

Grüne, S. 1979. Brief Illustrated Key to European Bark Beetles. M. & H. Schaper, Hannover.

Handy, K. J. 2009. NAPIS data for EWB/BB target species. Personal communication (email) to L. Jackson on 23 March 2009, from KJ Handy (USDA-APHIS-PPQ-EDP).

Karnavar, G. K. 1984. Preliminary studies on the use of 2-methyl-3-buten-2-ol as an attractant for the pine bark beetle, *Orthotomicus erosus*. J. Royal Swaziland Soc. Sci. & Techn. 5(3): 2-4.

Lee, J. C., M. L. Flint, and S. J. Seybold. 2008. Suitability of pines and other conifers as host for the invasive Mediterranean pine engraver (Coleoptera: Scolytidae) in North America. Journal of Economic Entomology 101(3): 829-837.

Lee, J. C., R. A. Haack, J. F. Negrón, J. J. Witcosky, and S. J. Seybold. 2007. Invasive bark beetles. Forest Insect and Disease Leaflet 176. United States Department of Agriculture and United States Forest Service. 12 pp.

Lee, J. C., S. L. Smith, and S. J. Seybold. 2005. Mediterranean Pine Engraver. USDA-APHIS Pest Alert R5-PR-016. 4 pp.

Mendel, Z. 1983. Seasonal history of *Orthotomicus erosus* (Coleoptera: Scolytidae) in Israel. Phytoparasitica 11(1): 13-24.

Mendel, Z. 1988. Attraction of *Orthotomicus erosus* and *Pityogenes calcaratus* to a synthetic aggregation pheromone of *Ips typographus*. Phytoparasitica. 16: 109-117.

Mendel, Z. and J. Halperin. 1982. The biology and behavior of *Orthotomicus erosus* in Israel. Phytoparasitica 10(2): 169-181.

Mendel, Z., O. Boneh, Y. Shenhar, and J. Riov. 1991. Diurnal flight patterns of *Orthotomicus erosus* and *Pityogenes calcaratus* in Israel. Phytoparasitica 19: 23-31.

Serez, M. 1987. Use of the aggregation pheromone preparation 'Ipslure' against the Mediterranean pine bark-beetle Ips (Orthotomicus) erosus (Woll.) (Col., Scolytidae). [Verwendung des Aggregationspheromon-Praparats 'Ipslure' gegen den mediterranen Kiefernborkenkafer, Ips (Orthotomicus) erosus (Woll.) (Col., Scolytidae).] *Anzeiger fur Schadlingskunde, Pflanzenschutz, Umweltschutz*, 60(5):94-95.

Wood, S. L. and D. E. Bright. 1992. A catalog of Scolytidae and Platypodidae (Coleoptera), part 2: taxonomic index. Brigham Young University, Provo, Utah.