Platypus quercivorus (Murayama)

Coleoptera: Curculionidae

Oak ambrosia beetle

Host(s)	CAPS-Approved Survey Method
Major hosts *Quercus* spp. (Oak), *Quercus acuta* (Japanese evergreen oak), *Quercus acutissima* (Sawtooth oak), *Quercus gilva* (Ichii-gashi), *Quercus glauca* (Japanese white oak), *Quercus mongolica* (Mongolian oak), *Quercus phillyraeoides* (Ubame oak), *Quercus salicina* (Urazirogashi), *Quercus serrata* (Konara oak), *Quercus sessilifolia* (Tsukabanegashi) **Other hosts** *Castanopsis cuspidata* (Japanese chinkapin), *Castanopsis sieboldii* (Sudajii), *Cryptomeria japonica* (Japanese Cedar)*, *Ilex chinensis* (Chinese holly)*, *Lindera erythrocarpa* (Spice bush)*, *Lithocarpus edulis* (Japanese tanbark oak), *Lithocarpus glaber* (Japanese-oak), *Prunus* spp. (Stone fruit)*, *Quercus myrsinaefolia* (Japanese white oak) *Some trees in the families Cupressaceae, Aquifoliaceae, Lauraceae, and Rosaceae may be attacked, but will not support reproduction (Davis et al., 2006). (Hijii et al., 1991; Wood and Bright, 1992; Bright and Skidmore, 2002; Kamata et al., 2002; Ciesla, 2003; Esaki et al., 2004)	Quercivoral in a multi-funnel trap.

Reason for Inclusion in Manual

Platypus quercivorus was added to the manual in 2010. *Platypus quercivorus* is on the AHP Prioritized Pest List for FY2012.

Pest Description

Eggs:
Eggs of *P. quercivorus* are elongated and cylindrical (Ciesla, 2003).

Larvae:
At maturity, larvae of *P. quercivorus* vary in length from 2-6 mm (approx. $^{1}/_{16}$ to ¼ in) (Ciesla, 2003). Larvae are legless and creamy white with an amber to light brown head capsule (Ciesla, 2003). The last abdominal segment is flat to slightly concavely sloped at the end (Ciesla, 2003).

Pupae:
Pupae of *P. quercivorus* are creamy white with partially developed wings and appendages (Ciesla, 2003).

Adults:
Murayama (1925) describes *P. quercivorus* as ferruginous brown with a darker head and elytra apex and a yellowish-brown underside.

> **Adult females:**
> "Front and vertex the same as in the male. Prothorax subquadrate, shining, with fine punctures and median sulcus, as in the male, on each side of the sulcus with 3-5 large round touched depressions in two rows, each depression being surrounded by a black bar. ... Elytra as in the male, excepting in the more gently rounded sides and declivity...underside a little paler than in the male, with stronger convexity on each abdominal segment" (Murayama, 1925).
>
> **Adult male:**
> "Head with front flat, covered with an irregular rugose reticulation, a short depressed median line between the bases of the antennae; vertex rather abruptly separated from the front, with a narrow black median line, sparse rugose punctures, and long aureous hair" (Murayama, 1925).
>
> "Elytra elongate, with sides parallel in the anterior two thirds and gradually diminished about one third of the breadth towards the apex; upper surface with a slight declivity in the posterior third, with the apex abruptly truncated…underside with scanty long yellow hair and large porelike punctures, abdominal segments convex, the 7th with a large transversal shallow oval depression" (Murayama, 1925).

Biology and Ecology

Adults mate at the entrance hole. Once mated, females build on the horizontal gallery, branching both laterally and vertically, and lay eggs along the wall. As the female extends the gallery, she inoculates it with mycangial fungi (Kinuura, 2002). Males plug the entrance with their body to prevent predators and parasites from entering (Kinuura, 1995) and remove dust and frass from the gallery (Soné et al., 1998). Eggs hatch in approximately one week (Kinuura, 1995).

Larvae eat the fungi from the gallery walls and when they reach the final instar, vertical cradles are formed in which the larvae pupate (Kinuura, 2002). Reproductive potential for this species is high. A proportion of the brood will reach the adult stage before winter. Many new adults leave the maternal galleries to form their own, but some remain in their maternal gallery (Soné et al., 1998). Soné et al. (1998) found that these adults did not seem to lay their own eggs, suggesting that this species shows some eusocial characteristics. The larvae that do not mature overwinter at the fifth larval stage and emerge in mid-June of the following year (Soné et al., 1998).

Pupation can occur either before or after hibernation (Kinuura, 2002). Newly emerged adults will stay in the cradle until sclerotization takes place (Kinuura, 2002).

The *Platypus* genus has mutualistic associations with ambrosia fungi, which are moved from old to new galleries by mycangia organs (Kinuura, 2002). *Platypus quercivorus* is usually univoltine but adults can emerge in the same year around late spring and autumn (Kinuura, 2002; Soné et al., 1998; Kinuura, 1995). In Japan, Soné et al. (1998) found that adults who emerged from their maternal gallery in autumn were not successful in reproducing in their own galleries. Emergence typically occurs from late June to early October or November (Kinuura, 2002; Soné et al., 1998). Adults are monogamous, making only one gallery system in their life. Males initiate host attacks in both living and cut trees, but prefer stressed or downed trees (Soné et al., 1998). Males can attract other adults; possible plant attractants include wounded host volatiles, aggregation pheromones and sound produced by male beetles (Davis et al., 2006; Ohya and Kinuura, 2001). More than one gallery can be present on cut trees making density levels high (Soné et al., 1998).

Countries of Origin

This species is native to Asia and is found in temperate, subtropical and tropical ecosystems within the current distribution (Ciesla, 2003).

Current Distribution

P. quercivorus is currently distributed in India, Indonesia (Java), Japan, Papua New Guinea and Taiwan (Wood and Bright, 1992).

Distribution in United States

P. quercivorus is not known to occur in the United States.

Pathway

Wood packing material made of host material such as oak may serve as a pathway for this pest. Localized spread may occur through movement of logs and firewood.

Pathogens Vectored

P. quercivorus vectors the ambrosia fungus *Raffaelea quercivora* which may be the causal agent of Japanese oak disease (Davis et al., 2006, Kubono and Ito, 2002).

Damage

In Asia, stands suspected of *P. quercivorus* infestations often have wilted canopies during summer when there is no drought and/or reddish-brown discoloration of leaves (Ciesla, 2003; Davis et al., 2006). Formation of tyloses (growths in woody tissue that block surrounding xylem cells) in the tree may be triggered by infestations of this pest (Manion, 1991). Tyloses may account for the rapid wilting of hosts, especially those found in the white oak group (Davis et al., 2006). Additional signs of *P. quercivorus* include frass tubes projecting from the tree and sawdust near the base of the tree (see images below). These signs of damage are not specific to *P. quercivorus* and may be caused by other insects.

Platypus spp. damage. (James Solomon, USDA-APHIS, Bugwood.org)

Platypus spp. damage. (Andrew J. Boone, South Carolina Forestry Commission, Bugwood.org)

Survey

1.1 Survey Site Selection

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

1.2 Trap and Lure

The CAPS-approved survey method for *P. quercivorus* is the synthetic aggregation pheromone for *P. quercivorus* (called quercivoral) in a multi-funnel trap. The pheromone is referred to as (1S,4R)-4-isopropyl-1-methyl-2-cyclohexen-1-ol and abbreviated as (-)-IMCH (Kamata et al., 2008; Mori, 2006).

The same pheromone is also referred to as (1S,4R)-*p*-Menth-2-en-1-ol or quercivorol (Kashiwagi et al., 2006; Masahiko, et al., 2007). (1S,4R)-4-isopropyl-1-methyl-2-cyclohexen-1-ol is the International Union of Pure and Applied Chemistry (IUPAC) name; IUPAC chemical names are regarded as the standard in chemical nomenclature.

The lure is effective for 28 days (4 weeks).

IPHIS Survey Supply Ordering System Product Names:

1) *Platypus quercivorus* Lure
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**. Traps should be placed at the forest edge (Kamata et al., 2008), where the increase in light attracts adults, (Igeta et al., 2003).

1.4 Time of year to survey

In Japan, *P. quercivorus* usually has one generation (Esaki et al., 2004). Adult emergence of the main overwintering generation occurs from May through September, with occasional second generations observed from late August to early December (Esaki et al., 2004). Peak adult emergence is reported to be in early July in central Japan (Kamata et al., 2008).

Identification

CAPS-Approved Method

Morphological. Positive identification of adults can be achieved through examination of morphological characters by a well-trained taxonomist.

Mistaken Identities

Platypus quercivorus may be mistaken for morphologically similar wood-boring relatives. Seven *Platypus* species are found in the United States, including *Euplatypus compositus* (=*Platypus compositus*), *Euplatypus parallelus* (=*P. parallelus*), *Myoplatypus flavicornis* (=*P. flavicornis*), *Oxoplatypus quadridentatus* (=*P. quadridentatus*), *Platypus abietis, P. pini, P. quadridentatus, and P. wilsoni* (Wood, 1979). Both *O. quadridentatus* and *M. flavicornis* attack pines and oaks while *E. compositus* and *E. parallelus* are polyphagous (Atkinson, 2008).

Resources and High Resolution Images

Oak Commodity-based Survey Reference:
http://caps.ceris.purdue.edu/survey_manuals

References

Atkinson, T. H. 2008. Ambrosia beetles, *Platypus* spp. (Insecta: Coleoptera: Platypodidae). EENY-174. Featured Creatures series of the Entomology and Nematology Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Bright, D. E. and R. E. Skidmore. 2002. A Catalog of Scolytidae and Platypodidae (Coleoptera), Supplement 2 (1995-1999). NRC Research Press, Ottawa, Ontario, Canada. 523 pp.

Carnegie, A. J., M. Matsuki, D. A. Haugen, B. P. Hurley, R. Ahumada, P. Klasmer, J. Sun, and E. T. Iede. 2006. Predicting the potential distribution of *Sirex noctilio* (Hymenoptera: Siricidae), a significant exotic pest of *Pinus* plantations. Annals of Forest Science 63: 119-128.

Ciesla, W. M. 2003. Exotic Forest Pest Information System for North America: *Platypus quercivorus***.** North American Forest Commission.

Davis, E.E., R.C. Venette and E.M. Albrecht. 2006. CAPS Oak Commodity Survey Reference. United States Department of Agriculture.

Esaki, K., K. Kato, and N. Kamata. 2004. Stand-level distribution and movement of Platypus quercivorus adults and patterns of incidence of new infestation. Agricultural and Forest Entomology 6:71-82.

Hijii, N., H. Kajimura, T. Urano, H. Kinuura, H. Itami. 1991. The mass mortality of oak trees induced by *Platypus quercivorus* (Murayama) and *Platypus calamus* Blandford (Coleoptera: Platypodidae)- the density and spatial distribution of attack by the beetles. Journal of Japanese Forestry Society 73: 471-476.

Igeta, Y., K. Esaki, K. Kato and N. Kamata. 2003. Influence of light condition on the stand-level distribution and movement of the ambrosia beetle *Platypus quercivorus* (Coleoptera: Platypodidae). Applied Entomology and Zoology 38(2): 167-175.

Kamata, N., K. Esaki, K. Mori, H. Takemoto, T. Mitsunaga, H. Honda. 2008. Field trap test for bioassay of synthetic (1S,4R)-4-isopropyl-1-methyl-2-cyclohexen-1-ol as an aggregation pheromone of *Platypus quercivorus* (Coleoptera: Platipodidae). Journal of Forest Research 13: 122-126.

Kamata, N., K. Esaki, K. Kato, Y. Igeta, and K. Wada. 2002. Potential impact of global warming on deciduous oak dieback caused by ambrosia fungus *Raffaelea* sp. carried by ambrosia beetle *Platypus quercivorus* (Coleoptera: Platypodidae) in Japan. Bulletin of Entomological Research 92: 119-126.

Kashiwagi, T., Nakashima, T., Tebayashi, S. and Kim, C-S. 2006. Determination of the absolute configuration of quercivorol, (1*S*,4*R*)-*p*-menth-2-en-1-ol, an aggregation pheromone of the ambrosia beetle, *Platypus quercivorus* (Coleoptera: Platypodidae), Biosci. Biotechnol. Biochem. 70: 2544-2546.

Kinuura, H. 2002. Relative dominance of the mold fungus, *Raffaelea* sp., in the mycangium and proventriculus in relation to adult stages of the oak platypodid beetle, *Platypus quercivorus* (Coleoptera: Platypodidae). Journal of Forest Research 7:7–12.

Kinuura, H. 1995. Life history of *Platypus quercivorus* (Murayama) (Coleoptera: Platypodidae). In Behavior, population dynamics and control of forest insects. F. P. Hain, S. M. Salom, W. F. Ravlin, T. L. Payne, and K. F. Raffa (eds.) In Proceedings of the IUFRO Joint Conference.

Kubono, T. and S. Ito. 2002. *Raffaelea quercivora* sp. nov. associated with mass mortality of Japanese oak, and the ambrosia beetle (*Platypus quercivorus*) Mycoscience 43: 255-260.

Manion, P. D. 1991. Tree Disease Concepts, Second edition. Prentice-Hall, Inc. Englewood Cliffs, New Jersey.

Masahiko, T., M. Kobayashi, S. Saito, H. Kinuura, T. Nakashima, E. Shoda-Kagaya, T. Kashiwagi, S. Tebayashi, C. Kim, and K. Mori. 2007. Novel aggregation pheromone, (1S,4*R*)-*p*-meth-2-en-1-ol, of the ambrosia beetle, *Platypus quercivorus* (Coleoptera: Platypodidae). Bulletin of FFPRI 6(1): 49-57.

Mori, K. 2006. Synthesis of (1S,4R)-4-isopropyl-1-methyl-2-cyclohexen-1-ol, the aggregation pheromone of the ambrosia beetle *Platypus quercivorus*, its racemate, (1R,4R)- and (1S,4S)-isomers. Tetrahedron 17: 2133-2142.

Murayama, J. 1925. Supplementary notes on "The Platypodidae of Formosa". Journal of the College of Agriculture, Hokkaido Imperial University 15: 229-235.

Ohya, E. and H. Kinuura. 2001. Close range sound communications of the oak platypodid beetle *Platypus quercivorus* (Murayama) (Coleoptera: Platypodidae). Applied Entomology and Zoology 36: 317–321.

Soné, K., T. Mori and M. Ide. 1998. Life history of the oak borer, *Platypus quercivorus* (Murayama) (Coleoptera: Platypodidae). Applied Entomology and Zoology 33(1): 67–75.

Wood, S. L. 1979. A catalog of the Coleoptera of America North of Mexico, Family: Platypodidae. United States Department of Agriculture, Agricultural Handbook Number 529-141.

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