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NONINDIGENOUS WOODBORING COLEOPTERA (CERAMBYCIDAE, CURCULIONIDAE: SCOLYTINAE) NEW TO OREGON AND WASHINGTON, 1999–2002: CONSEQUENCES OF THE INTRACONTINENTAL MOVEMENT OF RAW WOOD PRODUCTS AND SOLID WOOD PACKING MATERIALS

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Abstract.—Urban forests, port areas, mills and businesses known to have received or handled imported wood or wood products were surveyed for nonindigenous woodboring insects in Oregon and southernmost western Washington from 1999–2002, predominantly using Lindgren funnel traps, Intercept™ panel traps and/or Scots pine bait logs. Several other woodborer surveys or projects, using various traps and lures, also took place concurrently. Eight species of nonindigenous woodboring beetles new to Oregon, Washington, the western U.S., western North America, or North America are recorded for the first time: *Phymatodes testaceus* (L.), *Tetropium castaneum* L., *Xylotrechus hircus* (Gebler), and *X. sagittatus sagittatus* (Germar) (Cerambycidae), *Monarthrum fasciatum* (Say), *Xylosandrus crassiusculus* (Motschulsky), *X. germanus* (Blandford), and an undetermined species of *Xyleborus* (Curculionidae: Scolytinae). Additional records are included for the following nonindigenous woodborers detected in 1997–1998 and reported in an earlier paper: *Gnathotrichus materiarius* (Fitch), *Hylastes opacus* Erichson, *Xyleborinus alni* (Niisima), *Xyleborus californicus* Wood, *X. pfeili* (Ratzeburg) (Scolytinae), and *Xiphydria prolongata* (Geoffroy) (Hymenoptera: Xiphydriidae). Seventy-five percent of the nonindigenous woodborers treated in this and our earlier paper are known from both eastern and western North America. We believe these western records of five eastern indigenous species and eight extracontinental exotic species established in the East are evidence of the intracontinental movement of untreated domestic solid wood packing material and other raw woods as the probable pathways for these species to the West.

Key Words: nonindigenous, woodborers, Cerambycidae, Scolytinae, Xiphydriidae

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Nonindigenous woodboring and wood-associated insects (NIWBI) introduced and established in North America and the United States continue to be found at an alarming rate (Atkinson et al. 1990, Hoebeke 1994, Humble 2001, Mudge et al. 2001, Rabaglia and Valenti 2003). While the effects of many of these species are unknown, several have already had significant economic impacts through damage to trees and shrubs, quarantines of wood products and nursery stock, implementation of integrated pest management programs, and continuing survey, eradication, and research efforts (e.g., Haack et al. 1996, Haack et al. 1997, Oliver and Mannion 2001, Poland et al. 1998, McCullough and Roberts 2002). Such organisms threaten the health of North American forests, as well as other urban, rural, and natural environments (U.S. Con-

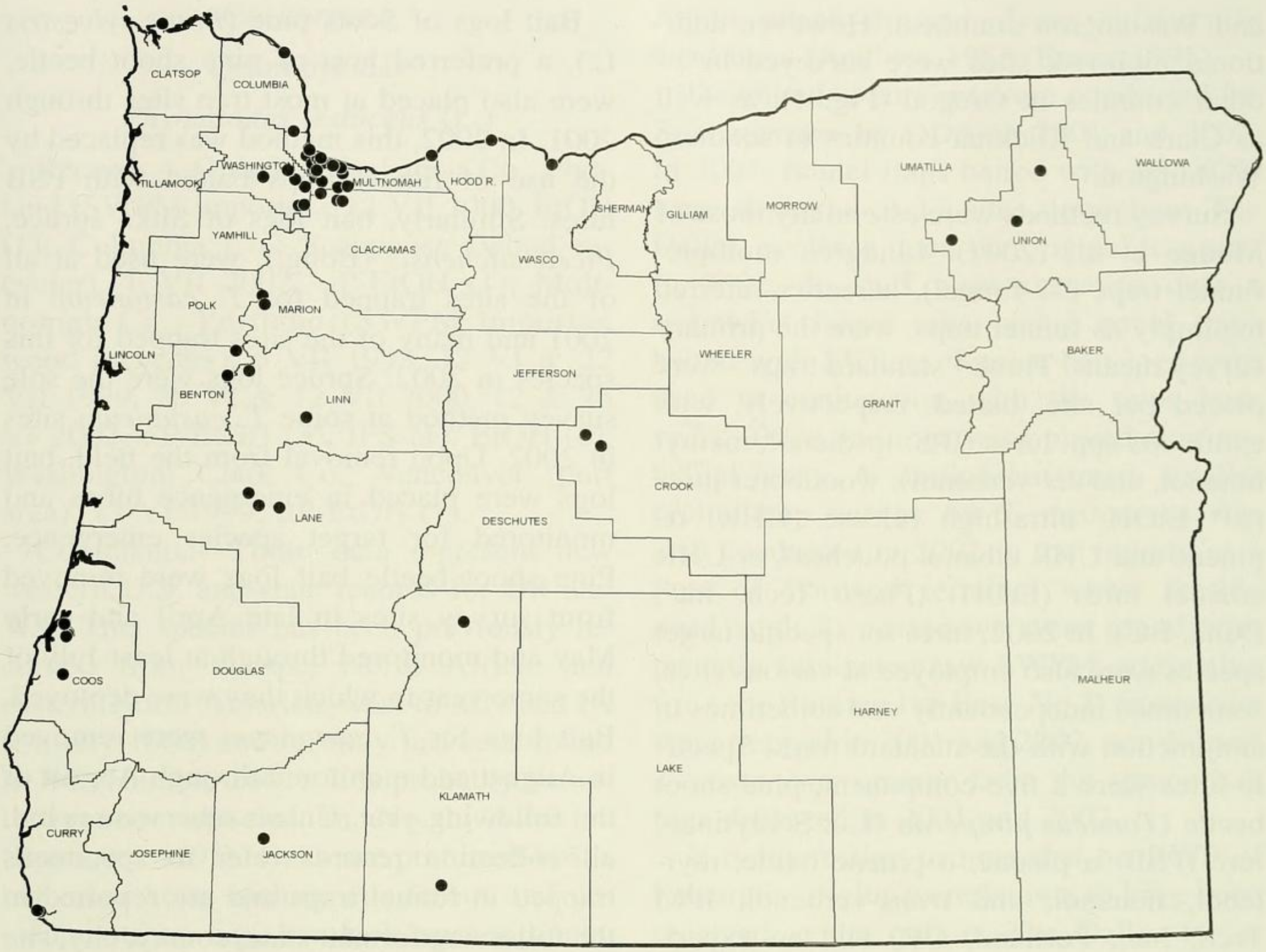

Fig. 1. Survey sites for nonindigenous woodboring insects in Oregon 1997–2002.

gress, OTA 1993, Liebhold et al. 1995, Campbell and Schlarbaum 2002).

As part of the USDA's Cooperative Agricultural Pest Survey (CAPS) program, the Oregon Department of Agriculture (ODA) has conducted surveys since 1997 at sites at risk for the introduction of NIWBI. The results of the first two years (1997 and 1998) were reported in Mudge et al. (2001), where eight species of NIWBI were documented from Oregon, Washington, the western United States, or North America for the first time. Surveys of high-risk sites continued in Oregon and southernmost western Washington from 1999 through 2002. In addition, a research project was initiated in 2002 by the USDA Forest Service (USFS) in cooperation with ODA to develop more effective monitoring methods for ambrosia beetles (Curculionidae: Scolytinae). New state, regional, or continental records from these projects reported here include eight species of nonindigenous woodboring Coleoptera (Cerambycidae and Scolytinae). Additional distributional records for most of the species treated in Mudge et al. (2001) are included. Our belief that these records are evidence of the movement of nonindigenous woodboring insects throughout North America via the intracontinental movement of untreated solid wood packing material (SWPM) and raw wood products (RWP) is discussed.

High-risk sites surveyed included warehouses and businesses importing commodities with SWPM (this refers to all types of solid wood packing material, including crating, dunnage, pallets, etc.), mills importing RWP, wood recyclers, port and industrial areas, and urban forests. Of the sites surveyed, 57% were in the Portland metropolitan area (Clackamas, Multnomah,

and Washington counties). However, additional high-risk sites were surveyed in 14 other counties in Oregon (Fig. 1), as well as Clark and Klickitat counties in southern Washington.

Survey methods were essentially those of Mudge et al. (2001). Lindgren multiple-funnel traps (12-funnel), hereafter referred to simply as funnel traps, were the primary survey means. Three "standard traps" were placed per site, baited, respectively, with exotic *Ips* spp. lures (IPS: ipsdienol, methyl butenol, and *cis*-verbenol), woodborer lures (αP−EtOH: ultra-high release [UHR] α-pinene and UHR ethanol pouches), or UHR ethanol lures (EtOH) (Phero Tech, Inc., Delta, BC). In 2002, lures for specific target species were also employed at various sites, sometimes independently and sometimes in conjunction with the standard traps. Specific lures were a five-component, pine shoot beetle (*Tomicus piniperda* (L.): Scolytinae) lure (PSB: α-pinene, α-pinene oxide, myrtenol, nonanol, and *trans*-verbenol, IPM Tech, Inc., Portland, OR) and an experimental blend of spruce volatiles (SV: α-pinene, 3-carene, limonene, and turpinolene, Phero Tech) for *Tetropium castaneum* (F.) (Cerambycidae).

The standard traps were deployed from February through mid-October. Traps targeting specific taxa were deployed and maintained over different periods, based upon the target taxa life histories, i.e., February through late May for pine shoot beetle and mid-April through mid-October for *T. castaneum*. All traps were monitored bi-weekly.

Intercept™ panel traps (IPM Tech) (hereafter referred to as panel traps) were used in 2000 in a survey for nonindigenous wood-associated insects that could vector exotic plant pathogens as well as at all sites trapped for *T. castaneum* in 2002. The USFS and ODA cooperative ambrosia beetle monitoring project utilized funnel traps, panel traps, and Japanese beetle traps (Trece, Inc., Salinas, CA) baited with αP-EtOH lures.

Bait logs of Scots pine (*Pinus sylvestris* L.), a preferred host of pine shoot beetle, were also placed at most trap sites through 2001. In 2002, this method was replaced by the use of funnel traps baited with PSB lures. Similarly, bait logs of Sitka spruce, *Picea sitchensis* (Bong.), were used at all of the sites trapped for *T. castaneum* in 2001 and many of the sites trapped for this species in 2002. Spruce logs were the sole survey method at some *T. castaneum* sites in 2002. Upon removal from the field, bait logs were placed in emergence tubes and monitored for target species emergence. Pine shoot beetle bait logs were removed from survey sites in late April and early May and monitored through at least July of the same year in which they were deployed. Bait logs for *T. castaneum* were removed in August and monitored through August of the following year. Unless otherwise noted, all collection records refer to specimens trapped in funnel traps and are reported in the following format: state, county, city, site type (in parentheses), collection date, lure. The number of specimens collected, by lure type, are in parentheses.

Target taxa were initially identified by LaBonte, based upon available literature and comparison with identified material in the insect collections of the ODA (ODAC), Salem, OR, or the Oregon State Arthropod Collection (OSAC), Oregon State University, Corvallis, OR. Cerambycidae and Scolytinae identifications were also provided or confirmed by several taxonomic authorities (see Acknowledgments). Unless otherwise stated, specimens collected in the Oregon surveys are housed in the ODAC.

New Records

The following data represent, to the best of our knowledge, the first published records of these species from the specified region.

COLEOPTERA

Cerambycidae

Phymatodes testaceus (L.)

Records.—Oregon: Clackamas Co., Portland (SWPM importer), 12 VII 2000, EtOH (1); Columbia Co., Scappoose (wood recycler), 1 VII 2002, αP-EtOH (1); Multnomah Co., Portland (SWPM importer, wood recyclers), 6 VII 1998, 17 VI & 22 VII 1999, 26 VI & 12 VII 2000, 12 & 26 VI 2002, αP-EtOH (3), IPS (1), EtOH (6). Washington: Clark Co., Vancouver (port area), 17 VI 1999, αP-EtOH (1).

Comments.—These data represent new western U.S. and state records for OR and WA. This species has been previously recorded from Europe, North Africa, and eastern North America, west to MN and IA (Linsley 1964) and recently has been found in BC (Humble 2001). It is probably a non-indigenous species in North America (Bousquet 1991). Oaks are preferred hosts, but other hosts include coniferous and deciduous trees, e.g., hemlock, spruce, apple, beech, cherry, chestnut, hickory, and willow (Linsley 1964). Our surveys suggest *P. testaceous* is widespread throughout the Portland-Vancouver metropolitan area. The 1998 specimen was not determined until after publication of Mudge et al. (2001).

Tetropium castaneum L.

Records.—Oregon, Wasco Co., The Dalles (mill site), 5 VI & 5 VII 2000, αP-EtOH (2).

Comments.—These are the first records of this species being trapped in North America and OR. This species has previously been intercepted in dunnage and SWPM entering the United States (including OR) and Canada (Humble et al. 2002, USDA APHIS PPQ, Port Interception Network). It is a Palearctic species known from most of Europe, northeastern Asia, China, and Japan (Bense 1995; M. Rejzek, unpublished data). Hosts are conifers, primarily spruce, but also include fir, larch, and pine (Bense 1995, Rejzek and Rebl 1999). Adults attack stressed, dying, or recently dead trees (Juutinen 1955, Bense 1995).

Delimitation surveys were conducted for *T. castaneum* by ODA in 2001 and 2002. In 2001, funnel traps baited with αP-EtOH were deployed at 17 sites throughout The Dalles, centered upon the original trap site. In 2002, 46 sites were surveyed over a somewhat larger area, using panel traps baited with SV lure. Spruce bait logs were used in conjunction with the traps both years. Traps and logs were placed near potential hosts. A similar, but much smaller preliminary survey for *T. castaneum* was also conducted in 2002 in the vicinity of a Port of Portland terminal where freshly dead adult *T. castaneum* were found with recently fumigated raw SWPM originating from the Russian Far East. No *T. castaneum* were trapped in 2001 and 2002, nor did any *T. castaneum* emerge from the spruce bait logs deployed in 2001 and 2002.

It is interesting to note that no RWP of Palearctic origins were known to have been received at the mill in The Dalles for at least a year prior to the trapping of *T. castaneum.* The mill's records for 1999 and 2000 indicated raw railroad ties from ID, MO, TX, WA, and Canada were received, raising the possibility of an undetected population of *T. castaneum* in one of those regions.

Xylotrechus hircus (Gebler)

Records.—Oregon, Multnomah Co., Portland, (wood recycler), 22 VII 1999, EtOH (1).

Comments.—This is the first record of this species from North America and OR. This Palearctic species is recorded from northern China, Japan, Korea, northern Mongolia, eastern Siberia, Kazakhstan, and the Sakhalin and Kurile Islands (Svacha and Danilevsky 1987; M. Rejzek, unpublished data). Larvae feed in the dead wood of birch (Svacha and Danilevsky 1987) and possibly other deciduous trees. This species has been rarely collected in its native haunts (M. Rejzek, personal communication). In

2000, additional traps were placed in the vicinity of the original trap site and the site was trapped via the standard ODA protocols in 2001. No further specimens have been trapped.

Xylotrechus sagittatus sagittatus (Germar)

Records.—Oregon, Wasco Co., The Dalles (residential area), 25 IX 2001, αP-EtOH (1).

Comments.—This is a new western North American and OR record. This beetle is native to eastern North America, from eastern Canada south to FL and west to NM (Linsley 1964). Hosts are conifers, including fir, pine, and spruce (Linsley 1964).

The specimen was trapped in a 2001 *T. castaneum* delimitation trap. No additional specimens have been trapped, despite the numerous *T. castaneum* delimitation traps in The Dalles in 2002.

CURCULIONIDAE: SCOLYTINAE

Monarthrum fasciatum (Say)

Records.—Oregon, Wasco Co., The Dalles (mill site), 23 IV 1999 & 1 V 2000, αP-EtOH, (1; panel trap, 1).

Comments.—These data represent the first western North American and OR records for *M. fasciatum.* This species is a native of eastern North America, west to TX, WI, and ON (Wood and Bright 1992, Bright and Skidmore 1997). Typical hosts are deciduous hardwoods, but it has also been recorded from pine (Wood and Bright 1992, Solomon 1995) and grape (Bright and Skidmore 1997). Despite further trapping in The Dalles, this species was not collected in 2001 or 2002.

Xylosandrus crassiusculus (Motschulsky)

Records.—Oregon, Wasco Co., The Dalles (mill site), all sampling periods from 18 VIII–8 X 1999, 5 VI & 19 VI 2000, αP-EtOH (13), EtOH (17).

Comments.—These data represent the first western North American records from traps outside of warehouses (*X. crassiusculus* has been intercepted in SWPM and trapped near SWPM in warehouses in British Columbia—see Humble 2001) and the first OR records. This African and Asian species was first documented from SC in 1974 and is also known from FL, GA, LA, MS, NC, TN, and TX (Solomon 1995, Oliver and Mannion 2001). While hosts include over 200 woody angiosperms, this species shows some preference for sweetgum (Solomon 1995). It is one of the two major ambrosia beetle species attacking chestnut in TN (Oliver and Mannion 2001). It has also been recorded as attacking at least one species of pine (Wood and Bright 1992). Both healthy and stressed hosts, as well as freshly cut material, are attacked (Solomon 1995). Despite the placement of traps at prior positive sites, as well as numerous *T. castaneum* delimitation traps in the general vicinity, this species was not collected in 2001 or 2002.

Xylosandrus germanus (Blandford)

Records.—Oregon, Multnomah Co., Portland (SWPM importer, urban forest, wood recycler), 4 VI & 22 VII 1999, 24 IV 2000, 29 V & 17 VI 2002, αP-EtOH (4), EtOH (2); Washington Co., Hillsboro (SWPM importer), 27 IV 2001, αP-EtOH (1).

Comments.—These data represent new western U.S. and OR records. This Asian species has been introduced into Europe and eastern North America (Wood and Bright 1992), as well as British Columbia (Bright and Skidmore 1997, Humble 2001). First documented from NY in 1932, it has since been recorded as far west as MI in the U.S. (Solomon 1995). Over 200 species of broadleafed and coniferous trees and shrubs are hosts, although angiosperms are preferred (Solomon 1995). Along with *X. crassiusculus,* this is one of the two major ambrosia beetles attacking chestnut in TN (Oliver and Mannion 2001). As with the preceding species, this species attacks vigorous as well as stressed hosts and recently cut material (Solomon 1995).

Xyleborus sp. undetermined

Records.—Oregon, Washington Co., Hillsboro (SWPM importer), 28 VI 2000, αP-EtOH (1).

Comments.—This specimen was sent to Lawrence Kirkendall and Stephen Wood for identification. Both concluded it was an exotic species with which they were unfamiliar and ultimately decided that no species determination could be made at this time. However, they stated that it was apparently related to *X. volvulus* (L.), suggesting that it may have tropical or subtropical origins. Traps placed at the trap site in 2001 and 2002 yielded no additional specimens.

Additional Records

The following data represent additional records for nonindigenous species previously reported in Mudge et al. (2001). An abbreviated format is used for the numerous records of *Xyleborinus alni, Xyleborus californicus,* and *X. pfeili.*

Coleoptera

Curculionidae: Scolytinae

Gnathotrichus materiarius (Fitch)

Records.—Oregon, Wasco Co., The Dalles (mill site), all sampling periods from 23 III–22 VII 1999, 31 V 2002, αP-EtOH (41), IPS (167), EtOH (1).

Comments.—These specimens were trapped from the same locality where this species was first found in OR in 1998. No *G. materiarius* were collected when the same sites were trapped in 2000 and 2001, although a single specimen was trapped in 2002.

Hylastes opacus Erichson

Records.—Oregon: Clackamas Co., Portland (SWPM importers), 6 IV–9 V 2000, αP-EtOH (6), IPS (1); Marion Co., Salem (wood recycler), 1 V 2001, αP-EtOH (1); Multnomah Co., Portland (port vicinity, wood recyclers), 24 IV 2000, 29 III 2001, bait log (1), αP-EtOH (2; panel trap, 1), EtOH (1); Washington Co., Tualatin (SWPM importer), 12 IV 2001, αP-EtOH (1).

Comments.—These data include three new OR county records: Clackamas, Marion, and Washington. Initial OR detections of this species were from bait logs of *Pinus sylvestris* placed in early 1997. No specimens were found in bait logs or traps in 1998, 1999, or 2002.

Xyleborinus alni (Niisima)

Records.—Oregon: Benton Co., Adair (wood recycler), 1 III 2002, EtOH (1); Clackamas Co., Portland (SWPM importers), 23 III & 6 IV 2000, αP-EtOH (2), IPS (1); Columbia Co., Scappoose (wood recycler), 25 IV 2000, αP-EtOH (1), IPS (2); Linn Co., Sweet Home (mill site), 23 III & 9 IV 2001, EtOH (7); Marion Co., Salem (wood recycler), 26 III 2001, αP-EtOH (1), EtOH (1); Multnomah Co., Portland (SWPM importers, urban forests, warehouses, wood recyclers), 27 II–20 V, 20 IX & 16 X, 1999–2002, αP-EtOH (45), IPS (8), EtOH (109); Polk Co., Salem (nursery), 10 V 2001, in the trunk of flowering cherry *Prunus* "Canada Red" (1); Washington Co., Portland and surrounding areas (SWPM importers, urban forest, wood recyclers), 13 III–20 V & 24 VII, 1999–2002, αP-EtOH (16), IPS (7), EtOH (17), PSB (8); Yamhill Co., Newberg (wood recycler vic.), 28 III 2002, PSB (1). Washington: Clark Co., Vancouver (port area), 24 III 1999 & 6 IV 2000, IPS (1), EtOH (2).

Comments.—These data include seven new OR county records (Benton, Clackamas, Linn, Marion, Polk, Washington, and Yamhill) and a new WA county record (Clark Co.). Formerly thought to be restricted to a relatively modest area in Portland and vicinity, this species now appears to be widespread throughout much of the Willamette Valley of northwestern OR. The specimen extracted from a nursery's flowering cherry is the first record of *X. alni* from a species of *Prunus* in North America.

Xyleborus californicus Wood

Records.—Oregon: Benton Co., Adair (wood recycler), 4 VI 2002, EtOH (2); Clackamas Co., Portland (SWPM importers), 24 IV–12 VI 2000, 26 VII & 23 VIII 2000, αP-EtOH (3), IPS (3), EtOH (10); Columbia Co., Scappoose (wood recycler), 8 IV–28 VI 2000, αP-EtOH (1), IPS (24), EtOH (24); Hood River Co., Hood River (rural forest), 31 V & 12 VII 2002, EtOH (5); Lane Co., Eugene (industrial area/urban forest), 30 V 2000, αP-EtOH (1); Jasper (mill site and vicinity), 21 IV–21 VII 1999, αP-EtOH (1), EtOH (30); Linn Co., Albany (SWPM importer), 25 V & 8 VI 1999, EtOH (6); Sweet Home (mill site), 20 IV 2001, EtOH (1); Multnomah Co., Portland (customs warehouse, SWPM importers, wood recyclers), 11 IV–26 V & 9–28 VIII, 1999–2002, αP-EtOH (1), IPS (4), EtOH (14), PSB (1); Washington Co., Portland and surrounding areas (SWPM importers, urban forest, wood recyclers), 15 III–22 VIII, 1999–2002, αP-EtOH (16), IPS (5), EtOH (25), PSB (1).

Comments.—These data include six new OR county records: Benton, Clackamas, Columbia, Hood River, Linn, and Washington. First recorded from OR based upon a specimen collected in Marion Co. in 1980 (Wood 1982), this species now appears to be widely distributed in northwestern OR.

Xyleborus pfeili (Ratzeburg)

Records.—Oregon: Lane Co., Jasper (mill site and vicinity), 2 VI–7 X 1999, 30 V 2000, αP-EtOH (panel trap, 1), EtOH (25); Linn Co., Sweet Home (mill site), 26 VII 2001, EtOH (1); Marion Co., Salem (SWPM importer), 4 VI–28 IX 2001, αP-EtOH (4), IPS (2), EtOH (40); Multnomah Co., Portland (exotic woods importer, port vicinity, SWPM importers, urban forests, wood recycler), 26 V–3 VI, 23 VIII–19 IX & 19 X 1999–2002, αP-EtOH (2), EtOH (5), SV (1); Washington Co., Tualatin (SWPM importer), 24 V 2001, EtOH (1). Washington, Clark Co., Vancouver (wood recycler), 7 VI & 3 VIII–1 X 2001, αP-EtOH (1), EtOH (5).

Comments.—These data include four new OR county records (Linn, Marion, Multnomah, and Washington) and a new WA state record. In an effort to delimit the extent of the populations of *X. pfeili* and *X. xylographus* (Say) detected in 1997 and 1998, additional funnel traps were placed in 1999 near the Jasper, Lane Co. (OR) sites where these species were originally detected. Four additional traps, one at each cardinal point, were placed approximately 2 km from the original sites. *Xyleborus pfeili* was found in all four delimitation traps in the Jasper vicinity, indicating it is well established in that area and has perhaps been present for some time. The large numbers from the Portland metropolitan area (including the Newberg and the Vancouver sites), as well as the Salem records, also suggest that *X. pfeili* has been established in the northern Willamette Valley for a considerable period.

Xyleborus xylographus (Say)

Records.—Oregon: Lane Co., Goshen (mill site), 9 & 24 VI 1999, EtOH (8); Marion Co., Salem (wood recycler), 6 VI 2001, αP-EtOH (1); Washington Co., Tualatin (SWPM importer), 24 V 2001, αP-EtOH (2).

Comments.—These data include a new OR record for Washington County. In 1999, this species was only found at the original site, not in any of the delimitation traps placed in that vicinity subsequent to its detection in 1998, suggesting this population stemmed from a recent introduction. No specimens were trapped in 2000 or 2002.

HYMENOPTERA

Xiphydriidae

Xiphydria prolongata (Geoffroy)

Records.—Oregon, Multnomah Co., Portland (wood recyclers), 6–18 VIII 1999, 2 VIII 2001, 27 VI 2002, αP-EtOH (3), IPS (2), EtOH (1).

Comments.—No specimens were trapped in 2000, despite trapping at the same sites where this species was found in 1999. Efforts to find infested host material in 2000 were also unsuccessful.

Discussion

Eight species of NIWBI trapped in 1999–2002 at various high-risk sites in northwestern Oregon and southwestern Washington represent new Oregon, Washington, Pacific Northwest, western U.S., or North American records. Most of the species of NIWBI found in 1997 and 1998 (documented in Mudge et al. 2001) were trapped again in 1999–2002. There were no further records of *Micromalthis debilis* LeConte (Coleoptera: Micromalthidae) or *Xyloterinus politus* (Say) (Scolytinae). Trapping only one or a few specimens of a species, e.g., *Tetropium castaneum, Xylotrechus hircus,* and *Monarthrum fasciatum,* may indicate possible interceptions rather than established populations.

Twelve of the sixteen species (75%) of NIWBI treated in this paper and Mudge et al. (2001) are now known from both eastern and western North America. *Gnathotrichus materiarius, M. debilis, Monarthrum fasciatum, X. politus,* and *Xylotrechus sagitattus sagittatus* are indigenous to eastern North America (Linsley 1964, Wood 1982, Wood and Bright 1992, Phillips and Young 2001). *Hylastes opacus, Phymatodes testaceus, Xiphydria prolongata, Xyleborus californicus, X. pfeili, Xylosandrus crassiusculus,* and *X. germanus* are nonindigenous species from other continents that have been established in the East for varying periods (Smith 1983, Hoebeke 1994, Solomon 1995, Vandenberg et al. 2000).

SWPM/RWP from foreign (extracontinental) sources is subject to regulation, certification, and inspection at ports of entry into the U.S., although only a small percentage is actually inspected (USDA 2003). With few exceptions, there are virtually no restrictions on the transport of domestic SWPM/RWP across Canadian and state borders. Consequently, potentially infested SWPM/RWP, which is not inspected or treated, travels through and into the West from eastern North America daily. It seems likely that at least some of the Oregon and Washington records for nonindigenous species previously known from eastern North America were the result of SWPM/RWP infested in the East. This was almost certainly the case for the records of eastern indigenous species.

The "sharing" of NIWBI among North American regions has not been unidirectional. Three western scolytine species have recently been detected in the central and eastern United States: *Dendroctonus pseudotsugae* Hopkins in Minnesota (Dziuk 2003) and *Hylesinus californicus* Swaine and *H. criddlei* (Swaine) in Maryland (Rabaglia and Williams 2002). These records were most likely due to infested SWPM/RWP received from the West. This may also have been the case for populations of several of the exotic NIWBI species recently detected in the East, e.g., *Xyleborus californicus* and *X. pfeili* (Vandenburg et al. 2000).

These data underscore the potential for and the risks associated with introducing NIWBI from one region of North America to another. The introduction of exotic forest pests established elsewhere in North America (see below) or forest pests indigenous to other regions of the U.S. (e.g., southern pine beetle, *Dendroctonus frontalis* Zimmerman (Scolytinae)) into the West could, in some instances, profoundly affect western urban environments, forests, and associated resources. The daunting list of NIWBI species in eastern North America compounds these concerns. Recent NIWBI species established outside of western North America include the emerald ash borer, *Agrilus planipennis* Fairmaire (Buprestidae), the Asian longhorned beetle, *Anoplophora glabripennis* (Motschulsky), the smaller Japanese cedar longhorned beetle, *Callidiellum rufipenne* (Motschulsky), and the brown spruce longhorned beetle, *Tetro-*

pium fuscum (F.) (Cerambycidae), as well as myriad bark and ambrosia beetles (Scolytinae), e.g., the red-haired pine bark beetle, *Hylurgus ligniperda* (F.), the pine shoot beetle, *T. piniperda, Pityogenes bidentatus* (Herbst), *Xyleborus similis* Ferrari, and *Xylosandrus mutilatus* (Blandford) (Hoebeke 1994, Hoebeke 1999, Hoebeke et al. in prep., Maier and Lemmon 2000, CFIA 2002, McCullough and Roberts 2002, USDA Pest Alert—*Hylurgus ligniperda*), Schieffer and Bright 2004). Woodborers indigenous to or established in the West could also have severe effects should they be introduced elsewhere in North America, including species that are benign or economically insignificant in the West. An analogous example would be the current impacts of the hemlock woolly adelgid (Hemiptera: Sternorhyncha: Adelgidae: *Adelges tsugae* Annand) on eastern forests.

NIWBI could be transported intracontinentally by infested nursery stock and household plants, infested SWPM or RWP (including firewood), or hitchhiking on vehicles or other transportation. Untreated hardwood SWPM is strongly implicated as one likely pathway since 79% of NIWBI species documented in this paper and in Mudge et al. (2001) are known predominantly or exclusively from hardwoods. To the best of our knowledge, relatively little hardwood RWP are imported into Oregon and Washington from the East. In contrast, ODA staff have often observed substantial volumes of hardwood SWPM received in Oregon that clearly originated in the East. Further support for this possibility is provided by the frequent interceptions of woodboring insects in foreign SWPM (USDA/APHIS/FS 2000, Haack 2001). Records of NIWBI species with conifer hosts could stem from either SWPM or RWP. For instance, there is a much greater volume of eastern RWP versus SWPM received at one of the mill sites where several conifer-attacking NIWBI species have been detected. There is also evidence that nonwoodboring insects may be transported among North American regions via SWPM/RWP (e.g., Lattin and LaBonte 2002; ODA, unpublished data).

The movement of unregulated, untreated SWPM/RWP within North America poses a major threat to the health of our forests and shrublands, nursery industry, and ornamental plantings. Combined with the ongoing risks of the introduction of new woodboring insect pests from foreign sources, the potential for substantial economic and environmental disruption is great. The challenges associated with regulation and treatment of domestic SWPM/RWP are daunting. However, if the current situation persists, it is only a matter of time until a woodboring or wood-associated insect pest established in or indigenous to one North American region becomes a devastating new addition to another region.

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NONINDIGENOUS WOODBORING COLEOPTERA (CERAMBYCIDAE, CURCULIONIDAE: SCOLYTINAE) NEW TO OREGON AND WASHINGTON, 1999-2002: CONSEQUENCES OF THE INTRACONTINENTAL MOVEMENT OF RAW WOOD PRODUCTS AND SOLID WOOD PACKING MATERIALS

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Abstract. — Urban forests, port areas, mills and businesses known to have received or handled imported wood or wood products were surveyed for nonindigenous woodboring insects in Oregon and southernmost western Washington from 1999-2002, predominantly using Lindgren funnel traps. Intercept® panel traps and/or Scots pine bait logs. Several other woodborer surveys or projects, using various traps and lures, also took place concurrently. Eight species of nonindigenous woodboring beetles new to Oregon, Washington,

the western U.S., western North America, or North America are recorded for the first time: Phymatodes testaceus (L.), Tetropium castaneum L., Xylotrechus hircus (Gebler), and X. sagittatus sagittatus (Germar) (Cerambycidae), Monarthrum fasciatum (Say), Xylosandrus crassiusculus (Motschulsky), X. germanus (Blandford), and an undetermined species of Xyleborus (Curculionidae: Scolytinae). Additional records are included for the following nonindigenous woodborers detected in 1997-1998 and reported in an earlier paper: Gnathotrichus materiarius (Fitch), Hylastes opacus Erichson, Xyleborinus alni (Niisima), Xyleborus californicus Wood, X. pfeili (Ratzeburg) (Scolytinae), and Xiphydria prolongata (Geoffroy) (Hymenoptera: Xiphydriidae). Seventy-five percent of the nonindigenous woodborers treated in this and our earlier paper are known from both eastern and western North America. We believe these western records of five eastern indigenous species and eight extracontinental exotic species established in the East are evidence of the intracontinental movement of untreated domestic solid wood packing material and other raw woods as the probable pathways for these species to the West.

Key Words: nonindigenous, woodborers, Cerambycidae, Scolytinae, Xiphydriidae

Nonindigenous woodboring and wood- shrubs, quarantines of wood products and

associated insects (NIWBI) introduced and nursery stock, implementation of integrated

established in North America and the Unit- pest management programs, and continuing

ed States continue to be found at an alarm- survey, eradication, and research efforts

ing rate (Atkinson et al. 1990, Hoebeke (e.g., Haack et al. 1996, Haack et al. 1997,

1994, Humble 2001, Mudge et al. 2001, Oliver and Mannion 2001, Poland et al.

Rabagha and Valenti 2003). While the ef- 1998, McCullough and Roberts 2002).

fects of many of these species are unknown. Such organisms threaten the health of North

several have already had significant eco- American forests, as well as other urban,

nomic impacts through damage to trees and rural, and natural environments (U.S. Con-

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Fig. 1. Survey sites for nonindigenous woodboring insects in Oregon 1997-2002.

gress, OTA 1993, Liebhold et al. 1995,
Campbell and Schlarbaum 2002).

As part of the USDA's Cooperative Agricultural Pest Survey (CAPS) program, the Oregon Department of Agriculture (ODA) has conducted surveys since 1997 at sites at risk for the introduction of NIWBI. The results of the first two years (1 997 and 1998) were reported in Mudge et al. (2001),

where eight species of NIWBI were documented from Oregon, Washington, the western United States, or North America for the first time. Surveys of high-risk sites continued in Oregon and southernmost western Washington from 1999 through 2002. In addition, a research project was initiated in 2002 by the USDA Forest Service (USPS) in cooperation with ODA to develop more effective monitoring methods for ambrosia beetles (Curculionidae: Scolytinae). New state, regional, or continental

records from these projects reported here include eight species of nonindigenous woodboring Coleoptera (Cerambycidae and Scolytinae). Additional distributional records for most of the species treated in Mudge et al. (2001) are included. Our belief that these records are evidence of the movement of nonindigenous woodboring insects throughout North America via the intracontinental movement of untreated solid wnod packing material (SWPM) and raw wood products (RWP) is discussed.

High-risk sites surveyed included warehouses and businesses impt^rting comnu)dities with SWPM (this refers to all types of

solid wood packing material, including crating, dunnage, pallets, etc.). mills iiu-porting RWP. wood recyclers, port and in-dustrial areas, and urban forests. Of the sites surveyed. 579<- were in the Portland metropolitan area (Clackamas. Multnomah,

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and Washington counties). However, addi-tional high-risk sites were surveyed in 14 other counties in Oregon (Fig. 1), as well as Clark and Klickitat counties in southern Washington.

Survey methods were essentially those of Mudge et al. (2001). Lindgren multiple-funnel traps (12-funnel), hereafter referred to simply as funnel traps, were the primary survey means. Three "standard traps" were placed per site, baited, respectively, with exotic Ips spp. lures (IPS: ipsdienol, methyl butenol, and c/5-verbenol), woodborer lures

(aP-EtOH: ultra-high release [UHR] a-pinene and UHR ethanol pouches), or UHR ethanol lures (EtOH) (Phero Tech, Inc., Delta, BC). In 2002, lures for specific target species were also employed at various sites, sometimes independently and sometimes in conjunction with the standard traps. Specific lures were a five-component, pine shoot beetle (Tomicus piniperda (L.): Scolytinae) lure (PSB: a-pinene, a-pinene oxide, myrtenol, nonanol, and trans-y crb^noX, IPM Tech, Inc., Portland, OR) and an experimental blend of spruce volatiles (SV: a-pinene, 3-carene, limonene, and turpinolene, Phero Tech) for Tetropium castaneum (F.) (Cerambycidae).

The standard traps were deployed from February through mid-October. Traps targeting specific taxa were deployed and maintained over different periods, based upon the target taxa life histories, i.e., February through late May for pine shoot beetle and mid-April through mid-October for T. castaneum. All traps were monitored bi-weekly.

Intercept® panel traps (IPM Tech) (here-

after referred to as panel traps) were used in 2000 in a survey for nonindigenous wood-associated insects that could vector exotic plant pathogens as well as at all sites trapped for T. castaneum in 2002. The USES and ODA cooperative ambrosia beetle monitoring project utilized funnel traps, panel traps, and Japanese beetle traps (Trece. Inc., Salinas, CA) baited with aP-EtOH lures.

Bait logs of Scots pine (Pinus sylvestris L.), a preferred host of pine shoot beetle, were also placed at most trap sites through 2001. In 2002, this method was replaced by the use of funnel traps baited with PSB lures. Similarly, bait logs of Sitka spruce, Picea sitchensis (Bong.), were used at all of the sites trapped for T. castaneum in 2001 and many of the sites trapped for this species in 2002. Spruce logs were the sole survey method at some T. castaneum sites in 2002. Upon removal from the field, bait logs were placed in emergence tubes and monitored for target species emergence. Pine shoot beetle bait logs were removed from survey sites in late April and early May and monitored through at least July of the same year in which they were deployed.

Bait logs for T. castaneum were removed in August and monitored through August of the following year. Unless otherwise noted, all collection records refer to specimens trapped in funnel traps and are reported in the following format: state, county, city, site type (in parentheses), collection date, lure. The number of specimens collected, by lure type, are in parentheses.

Target taxa were initially identified by LaBonte, based upon available literature and comparison with identified material in the insect collections of the ODA (ODAC), Salem, OR, or the Oregon State Arthropod Collection (OSAC), Oregon State University, Corvallis, OR. Cerambycidae and Scolytinae identifications were also provided or confirmed by several taxonomic authorities (see Acknowledgments). Unless otherwise stated, specimens collected in the Oregon surveys are housed in the ODAC.

New Records

The following data represent, to the best of our knowledge, the first published records of these species from the specified re-

gion.

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COLEOPTERA

Cerambycidae

Phymatodes testaceus (L.)

Records. — Oregon: Clackamas Co., Portland (SWPM importer), 12 VII 2000, EtOH (1); Columbia Co., Scappoose (wood recycler), 1 VII 2002, aP-EtOH (1); Multnomah Co., Portland (SWPM importer, wood recyclers), 6 VII 1998, 17 VI & 22 VII 1999, 26 VI & 12 VII 2000, 12 & 26 VI 2002, aP-EtOH (3), IPS (1), EtOH (6). Washington: Clark Co., Vancouver (port area), 17 VI 1999, aP-EtOH (1).

Comments. — These data represent new western U.S. and state records for OR and WA. This species has been previously re-

corded from Europe, North Africa, and eastern North America, west to MN and lA (Linsley 1964) and recently has been found in BC (Humble 2001). It is probably a non-indigenous species in North America (Bousquet 1991). Oaks are preferred hosts, but other hosts include coniferous and deciduous trees, e.g., hemlock, spruce, apple, beech, cherry, chestnut, hickory, and willow (Linsley 1964). Our surveys suggest P. testaceous is widespread throughout the Portland- Vancouver metropolitan area. The 1998 specimen was not determined until after publication of Mudge et al. (2001).

Tetropiuin castaneum L.

Records. — Oregon, Wasco Co., The Dalles (mill site), 5 VI & 5 VII 2000, aP-EtOH (2).

Comments. — These are the first records of this species being trapped in North America and OR. This species has previously been intercepted in dunnage and SWPM entering the United States (including OR) and Canada (Humble et al. 2002, USDA APHIS PPQ, Port Interception Network). It is a Palearctic species known from

most of Europe, northeastern Asia, China, and Japan (Bense 1995; M. Rejzek, unpublished data). Hosts are conifers, primarily spruce, but also include fir, larch, and pine (Bense 1995, Rejzek and Rebl 1999).

Adults attack stressed, dying, or recently dead trees (Juutinen 1955, Bense 1995).

Delimitation surveys were conducted for T. castaneum by ODA in 2001 and 2002. In 2001, funnel traps baited with aP-EtOH were deployed at 17 sites throughout The Dalles, centered upon the original trap site. In 2002, 46 sites were surveyed over a somewhat larger area, using panel traps baited with SV lure. Spruce bait logs were used in conjunction with the traps both years. Traps and logs were placed near potential hosts. A similar, but much smaller preliminary survey for T. castaneum was also conducted in 2002 in the vicinity of a Port of Portland terminal where freshly dead adult T. castaneum were found with recently fumigated raw SWPM originating from the Russian Far East. No T. castaneum were trapped in 2001 and 2002, nor did any T. castaneum emerge from the spruce bait

logs deployed in 2001 and 2002.

It is interesting to note that no RWP of Palearctic origins were known to have been received at the mill in The Dalles for at least a year prior to the trapping of T. castaneum. The mill's records for 1999 and 2000 indicated raw railroad ties from ID, MO, TX, WA, and Canada were received, raising the possibility of an undetected population of T. castaneum in one of those regions.

Xylotrechus hircus (Gebler)

Records. — Oregon, Multnomah Co., Portland, (wood recycler), 22 VII 1999, EtOH (1).

Comments. — This is the first record of this species from North America and OR. This Palearctic species is recorded from northern China, Japan, Korea, nortlieni Mongolia, eastern Siberia, Kazakhstan, and the Sakhalin and Kurile Islands (S\acha and Danilevsky 1987; M. Rejzek, unpublished data). Larvae feed in the dead wood of birch (Svacha and Danilevsky 1987) and possibly other deciduous trees. This species

has been rarely collccled in its native haunts (M. Rejzek, personal communication). In

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2000, additional traps were placed in the vicinity of the original trap site and the site was trapped via the standard ODA protocols in 200 1 . No further specimens have been trapped.

Xvlotrechus sagittatus sagittatus (Germar)

Records. — Oregon, Wasco Co., The Dalles (residential area), 25 IX 2001, aP-EtOH (1).

Comments. — This is a new western North American and OR record. This beetle is native to eastern North America, from eastern Canada south to FL and west to NM (Linsley 1964). Hosts are conifers, including fir, pine, and spruce (Linsley 1964).

The specimen was trapped in a 2001 T. castaneum delimitation trap. No additional specimens have been trapped, despite the numerous T. castaneum delimitation traps in The Dalles in 2002.

Curculionidae: Scolytinae

Monarthrum fasciatum (Say)

Records. — Oregon, Wasco Co., The Dalles (mill site), 23 IV 1999 & 1 V 2000, aP-EtOH, (1; panel trap, 1).

Comments. — These data represent the first western North American and OR records for M. fasciatum. This species is a native of eastern North America, west to TX, WI, and ON (Wood and Bright 1992, Bright and Skidmore 1997). Typical hosts are deciduous hardwoods, but it has also been recorded from pine (Wood and Bright 1992, Solomon 1995) and grape (Bright and Skidmore 1997). Despite further trapping in The Dalles, this species was not collected in 2001 or 2002.

Xylosandrus crassiusculus (Motschulsky)

Records. — Oregon, Wasco Co., The Dalles (mill site), all sampling periods from 18 VIII-8 X 1999, 5 VI & 19 VI 2000, aP-EtOH (13), EtOH (17).

Comments. — These data represent the first western North American records from traps outside of warehouses (X. crassiusculus has been intercepted in SWPM and

trapped near SWPM in warehouses in British Columbia — see Humble 2001) and the first OR records. This African and Asian species was first documented from SC in 1974 and is also known from FL, GA, LA, MS, NC, TN, and TX (Solomon 1995, Oliver and Mannion 2001). While hosts include over 200 woody angiosperms, this species shows some preference for sweetgum (Solomon 1995). It is one of the two major ambrosia beetle species attacking chestnut in TN (Oliver and Mannion 2001). It has also been recorded as attacking at least one species of pine (Wood and Bright 1992). Both healthy and stressed hosts, as well as freshly cut material, are attacked (Solomon 1995). Despite the placement of traps at prior positive sites, as well as nu-

merous T. castaneum delimitation traps in the general vicinity, this species was not collected in 2001 or 2002.

Xylosandrus germanus (Blandford)

Records. — Oregon, Multnomah Co., Portland (SWPM importer, urban forest, wood recycler), 4 VI & 22 VII 1999, 24 IV 2000, 29 V & 17 VI 2002, aP-EtOH (4), EtOH (2); Washington Co., Hillsboro (SWPM importer), 27 IV 2001, aP-EtOH (1).

Comments. — These data represent new western U.S. and OR records. This Asian species has been introduced into Europe and eastern North America (Wood and Bright 1992), as well as British Columbia (Bright and Skidmore 1997, Humble 2001). First documented from NY in 1932, it has since been recorded as far west as MI in the U.S. (Solomon 1995). Over 200 species of broadleafed and coniferous trees and shrubs are hosts, although angiosperms are pre-fen^ed (Solomon 1995). Along with X crassiusculus, this is one of the two major am-

brosia beetles attacking chestnut in TN (Oliver and Mannion 2001). As with the preceding species, this species attacks vigorous as well as stressed hosts and recently cut material (Solomon 1995).

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Xyleborus sp. undetermined

Records. — Oregon, Washington Co., Hillsboro (SWPM importer), 28 VI 2000, aP-EtOH (1).

Comments. — This specimen was sent to Lawrence Kirkendall and Stephen Wood for identification. Both concluded it was an exotic species with which they were unfamiliar and ultimately decided that no species determination could be made at this time. However, they stated that it was apparently related to X. volvulus (L.), suggesting that it may have tropical or subtropical origins.

Traps placed at the trap site in 2001 and 2002 yielded no additional specimens.

Additional Records

The following data represent additional records for nonindigenous species previously reported in Mudge et al. (2001). An abbreviated format is used for the numerous records of Xyleborinus alni, Xyleborus californicus, and X. pfeili.

COLEOPTERA

Curculionidae: Scolytinae

Gnathotrichus materiarius (Fitch)

Records. — Oregon, Wasco Co., The Dalles (mill site), all sampling periods from 23 III-22 VII 1999, 31 V 2002, aP-EtOH (41), IPS (167), EtOH (1).

Comments. — These specimens were trapped from the same locality where this species was first found in OR in 1998. No G. materiarius were collected when the same sites were trapped in 2000 and 2001, although a single specimen was trapped in 2002.

Hylastes opacus Erichson

Records. — Oregon: Clackamas Co., Portland (SWPM importers), 6 IV-9 V 2000, aP-EtOH (6), IPS (1); Marion Co., Salem (wood recycler), 1 V 2001, aP-EtOH (1); Multnomah Co., Portland (port vicinity, wood recyclers), 24 IV 2000, 29 III 2001, bait log (1), aP-EtOH (2; panel trap, I), EtOH (1); Washington Co.. Tualatin

(SWPM importer), 12 IV 2001, aP-EtOH (1).

Comments. — These data include three new OR county records: Clackamas, Marion, and Washington. Initial OR detections of this species were from bait logs of Pinus sylvestris placed in early 1997. No specimens were found in bait logs or traps in 1998, 1999, or 2002.

Xyleborinus alni (Niisima)

Records. — Oregon: Benton Co., Adair (wood recycler), 1 III 2002, EtOH (1); Clackamas Co., Portland (SWPM import-

ers), 23 III & 6 IV 2000, aP-EtOH (2), IPS (1); Columbia Co., Scappoose (wood recycler), 25 IV 2000, aP-EtOH (1), IPS (2): Linn Co., Sweet Home (mill site), 23 III &

9 IV 2001, EtOH (7); Marion Co., Salem (wood recycler), 26 III 2001, aP-EtOH (1), EtOH (1); Multnomah Co., Portland (SWPM importers, urban forests, warehouses, wood recyclers), 27 11-20 V, 20 IX & 16 X, 1999-2002, aP-EtOH (45), IPS (8), EtOH (109); Polk Co., Salem (nursery),

10 V 2001, in the trunk of flowering cherry Prunus "Canada Red" (1); Washington Co., Portland and surrounding areas (SWPM importers, urban forest, wood recyclers), 13 III-20 V «& 24 VII, 1999-2002. aP-EtOH (16), IPS (7), EtOH (17). PSB (8); Yamhill Co.. Newberg (wood recycler vie), 28 III 2002, PSB (1). Washington: Clark Co., Vancouver (port area). 24 111 1999 & 6 IV 2000, IPS (1), EtOH (2).

Comments. — These data include se\cn new OR county records (Benton. Clackamas. Linn, Marion. Polk. Washington, and Yamhill) and a new WA county record (Clark Co.). Formerly thought to be restrict-

ed to a relatively modest area in Portland and vicinity, this species now appears to be widespread throughout much of the Willamette Valley of northwestern OR. The specimen extracted from a nursery's flowering cheny is the first record of X. alni from a species of Prunus in North America.

[Begin Page: Page 560]

Xyleborus calif ornicus Wood

Records. — Oregon: Benton Co., Adair (wood recycler), 4 VI 2002, EtOH (2); Clackamas Co., Portland (SWPM importers), 24 IV- 12 VI 2000, 26 VII & 23 VIII 2000, aP-EtOH (3), IPS (3), EtOH (10); Columbia Co., Scappoose (wood recycler), 8 IV-28 VI 2000, aP-EtOH (1), IPS (24), EtOH (24); Hood River Co., Hood River (rural forest), 31 V & 12 VII 2002, EtOH (5); Lane Co., Eugene (industrial area/urban

forest), 30 V 2000, aP-EtOH (1); Jasper (mill site and vicinity), 21 IV-21 VII 1999, aP-EtOH (1), EtOH (30); Linn Co., Albany (SWPM importer), 25 V & 8 VI 1999, EtOH (6); Sweet Home (mill site), 20 IV 2001, EtOH (1); Multnomah Co., Portland (customs warehouse, SWPM importers, wood recyclers), 1 1 IV-26 V & 9-28 VIII, 1999-2002, aP-EtOH (1), IPS (4), EtOH (14), PSB (1); Washington Co., Portland and surrounding areas (SWPM importers, urban forest, wood recyclers), 15 III-22 VIII, 1999-2002, aP-EtOH (16), IPS (5), EtOH (25), PSB (1).

Comments. — These data include six new OR county records: Benton, Clackamas, Columbia, Hood River, Linn, and Washington. First recorded from OR based upon a specimen collected in Marion Co. in 1980 (Wood 1982), this species now appears to be widely distributed in northwestern OR.

Xyleborus pfeili (Ratzeburg)

Records. — Oregon: Lane Co., Jasper (mill site and vicinity), 2 VI-7 X 1999, 30

V 2000, aP-EtOH (panel trap, 1), EtOH (25); Linn Co., Sweet Home (mill site), 26 VII 2001, EtOH (I); Marion Co., Salem (SWPM importer), 4 VI-28 IX 2001, aP-EtOH (4), IPS (2), EtOH (40); Multnomah Co., Portland (exotic woods importer, port vicinity, SWPM importers, urban forests, wood recycler), 26 V-3 VI, 23 VIII- 19 IX & 19 X 1999-2002, aP-EtOH (2), EtOH (5), SV (1); Washington Co., Tualatin (SWPM importer), 24 V 2001, EtOH (1). Washington, Clark Co., Vancouver (wood recycler), 7 VI & 3 VIII- 1 X 2001, aP-EtOH (1), EtOH (5).

Comments. — These data include four new OR county records (Linn, Marion, Multnomah, and Washington) and a new WA state record. In an effort to delimit the extent of the populations of X. pfeili and X. xylographus (Say) detected in 1997 and 1998, additional funnel traps were placed in 1999 near the Jasper, Lane Co. (OR) sites where these species were originally detected. Four additional traps, one at each cardinal point, were placed approximately 2 km from the original sites. Xyleborus pfeili was found in all four delimitation traps in

the Jasper vicinity, indicating it is well established in that area and has perhaps been present for some time. The large numbers from the Portland metropolitan area (including the Newberg and the Vancouver sites), as well as the Salem records, also suggest that X. pfeili has been established in the northern Willamette Valley for a considerable period.

Xyleborus xylographus (Say)

Records. — Oregon: Lane Co., Goshen (mill site), 9 & 24 VI 1999, EtOH (8); Marion Co., Salem (wood recycler), 6 VI 2001, aP-EtOH (1); Washington Co., Tualatin (SWPM importer), 24 V 2001, aP-EtOH (2).

Comments. — These data include a new OR record for Washington County. In 1999, this species was only found at the original site, not in any of the delimitation traps placed in that vicinity subsequent to its detection in 1998, suggesting this population stemmed from a recent introduction. No specimens were trapped in 2000 or 2002.

Hymenoptera

Xiphydriidae

Xiphydria prolongata (Geoffroy)

Records. — Oregon, Multnomah Co., Portland (wood recyclers), 6-18 VIII 1999, 2 VIII 2001, 27 VI 2002, aP-EtOH (3), IPS (2), EtOH (l).

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Comments. — No specimens were trapped in 2000, despite trapping at the same sites where this species was found in 1999. Efforts to find infested host material in 2000 were also unsuccessful.

Discussion

Eight species of NIWBI trapped in 1999-2002 at various high-risk sites in

northwestern Oregon and southwestern Washington represent new Oregon, Washington, Pacific Northwest, western U.S., or North American records. Most of the species of NIWBI found in 1997 and 1998 (documented in Mudge et al. 2001) were trapped again in 1999-2002. There were no further records of Micromalthis debilis LeConte (Coleoptera: Micromalthidae) or Xyloterinus politus (Say) (Scolytinae). Trapping only one or a few specimens of a species, e.g., Tetropium castaneum, Xylotrechus hircus, and Monarthrum fasciatum, may indicate possible interceptions rather than established populations.

Twelve of the sixteen species (75%) of NIWBI treated in this paper and Mudge et al. (200 1) are now known from both eastern and western North America. Gnathotrichus materiarius, M. debilis, Monarthrum fasciatum, X. politus, and Xylotrechus sagitattus sagittatus are indigenous to eastern North America (Linsley 1964, Wood 1982, Wood and Bright 1992, Phillips and Young 2001). Hylastes opacus, Phymatodes testaceus, Xiphydria prolongata, Xyleborus californicus, X. pfeili, Xylosandrus crassiusculus, and X. germanus are nonindigenous

species from other continents that have been established in the East for varying periods (Smith 1983, Hoebeke 1994, Solomon 1995, Vandenberg et al. 2000).

SWPM/RWP from foreign (extracontinental) sources is subject to regulation, certification, and inspection at ports of entry into the U.S., although only a small percentage is actually inspected (USDA 2003). With few exceptions, there are virtually no restrictions on the transport of domestic SWPM/RWP across Canadian and state

borders. Consequently, potentially infested SWPM/RWP, which is not inspected or treated, travels through and into the West from eastern North America daily. It seems likely that at least some of the Oregon and Washington records for nonindigenous species previously known from eastern North America were the result of SWPM/RWP infested in the East. This was almost certainly the case for the records of eastern indigenous species.

The "sharing" of NIWBI among North American regions has not been unidirec-

tional. Three western scolytine species have recently been detected in the central and eastern United States: Dendroctonus pseudotsugae Hopkins in Minnesota (Dziuk 2003) and Hylesinus californicus Swaine and H. criddlei (Swaine) in Maryland (Rabaglia and Williams 2002). These records were most likely due to infested SWPM/RWP received from the West. This may also have been the case for populations of several of the exotic NIWBI species recently detected in the East, e.g., Xyleborus californicus and X. pfeili (Vandenburg et al. 2000).

These data underscore the potential for and the risks associated with introducing NIWBI from one region of North America to another. The introduction of exotic forest pests established elsewhere in North America (see below) or forest pests indigenous to other regions of the U.S. (e.g.. southern pine beetle, Dendroctonus frontalis Zimmerman (Scolytinae)) into the West could, in some instances, profoundly affect western urban environments, forests, and associated resources. The daunting list of NIWBI species in eastern North America compounds these concerns. Recent NIWBI

species established outside of western North America include the emerald ash hover, Agrilus planipennis Fairmairc (Buprestidae), the Asian longhorned beetle, Anoplophora glabripennis (Molschulsky), the smaller Japanese cedar longhorned beetle. Callidielluni rujipcniic (Motschulsky). and the brown spruce longhorned beetle. Tclropium fuscum (F.) (Cerambycidae), as well as myriad bark and ambrosia beetles (Scolytinae), e.g., the red-haired pine bark beetle, Hylurgus ligniperda (E), the pine shoot beetle, T. piniperda, Pityogenes bidentatus (Herbst), Xyleborus similis Ferrari, and Xylosandriis miitilatus (Blandford) (Hoebeke 1994, Hoebeke 1999, Hoebeke et al. in prep., Maier and Lemmon 2000, CFIA 2002, McCullough and Roberts 2002, USDA Pest Alert — Hylurgus ligniperda), Schieffer and Bright 2004). Woodborers in-

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digenous to or established in the West could also have severe effects should they be introduced elsewhere in North America, including species that are benign or economically insignificant in the West. An analogous example would be the current impacts of the hemlock woolly adelgid (Hemiptera: Sternorhyncha: Adelgidae: Adelges tsugae Annand) on eastern forests.

NIWBI could be transported intracontinentally by infested nursery stock and household plants, infested SWPM or RWP (including firewood), or hitchhiking on vehicles or other transportation. Untreated hardwood SWPM is strongly implicated as one likely pathway since 79% of NIWBI species documented in this paper and in Mudge et al. (2001) are known predominantly or exclusively from hardwoods. To the best of our knowledge, relatively little hardwood RWP are imported into Oregon and Washington from the East. In contrast, ODA staff have often observed substantial volumes of hardwood SWPM received in Oregon that clearly originated in the East. Further support for this possibility is provided by the frequent interceptions of

woodboring insects in foreign SWPM (USDA/APHIS/FS 2000, Haack 2001). Records of NIWBI species with conifer hosts could stem from either SWPM or RWP. For instance, there is a much greater volume of eastern RWP versus SWPM received at one of the mill sites where several conifer-attacking NIWBI species have been detected. There is also evidence that nonwoodboring insects may be transported among North American regions via SWPM/RWP (e.g., Lattin and LaBonte 2002; ODA, unpublished data).

The movement of unregulated, untreated SWPM/RWP within North America poses a major threat to the health of our forests and shrublands, nursery industry, and ornamental plantings. Combined with the ongoing risks of the introduction of new woodboring insect pests from foreign sources, the potential for substantial economic and environmental disruption is great. The challenges associated with regulation and treatment of domestic SWPM/RWP are daunting. However, if the current situation persists, it is only a matter of time until a woodboring or wood-associated in-

sect pest established in or indigenous to one North American region becomes a devastating new addition to another region.

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