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NEW RECORDS OF TWO *XYLEBORUS* (COLEOPTERA: SCOLYTIDAE) IN NORTH AMERICA

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Abstract.—New American locality records are given for two exotic ambrosia beetles (Coleoptera: Scolytidae) in the genus *Xyleborus*. *Xyleborus pfeili* (Ratzeburg), a widely distributed Old World species, is reported for the first time in North America, from three counties in Maryland. *Xyleborus californicus* Wood, of northern Palearctic origin, but previously established in the western United States, is reported for the first time from Maryland, Delaware, South Carolina and Arkansas. Diagnoses and descriptions are given for the two species, along with scanning electron micrographs of key characters. Modifications are made to a previous key to include these new additions to the eastern North American ambrosia beetle fauna.

Key Words: *Xyleborus,* Scolytidae, eastern North America, introductions

The introduction through commerce of exotic bark and ambrosia beetles (Coleoptera: Scolytidae) poses a threat to our native forests and urban plantings. The adult beetles damage trees by tunneling and feeding in the cambium region just beneath the bark's surface (true bark beetles), or by drilling into the sapwood and feeding on introduced fungal symbiotes (ambrosia beetles). Although scolytid beetles may promote the general health of a stand by culling overly mature or damaged trees (Atkinson et al. 1990), the effect of foreign species, released from controlling factors of their native environment, can be unpredictable or even devastating (U.S. Congress, Office of Technology Assessment 1993).

Within the past decade, scolytid introductions and interceptions have increased concern over the effects of exotic species in North America. Recently, several economically important bark beetles have become established on this continent (e.g., *Tomicus piniperda* (L.) (Haack and Kucera 1993) and *Hylastes opacus* Erichson (Hoebeke 1994, Rabaglia and Cavey 1994)), or been collected at or near United States and Canadian ports-of-entry (e.g, *Ips typographus* (L.), Cavey and Passoa 1993). Eight species of exotic ambrosia beetles have been established in eastern North America within this century (Wood 1977, 1982, Atkinson et al. 1990, Hoebeke 1991), and some of these have become significant pests. We report the occurrence of two additional exotic ambrosia beetles new to eastern North America: *Xyleborus pfeili* (Ratzeburg) and *X. californicus* Wood.

Xyleborus pfeili was first detected in North America in a mixed sample of Xy-

leborine ambrosia beetles submitted to one of us (NJV) at the USDA Systematic Entomology Laboratory, Washington, D.C. The specimens were included along with a sample of frass collected from branch/stump of paw paw, *Asimina triloba* (Annonaccac), at the Wye Research and Education Center, Carmichael, Maryland, and were reported to have emerged from the host in June and July 1992. The lot consisted of 2 specimens of *Xyleborinus saxeseni* (Ratzeburg), 3 specimens of *Xyleborus affinis* Eichhoff, and 5 specimens of another species which could not be identified using the keys to exotic and native North American fauna in Wood (1982) or Atkinson et al. (1990). The 5 unknowns were recognized (DEB) as a new record for the Old World species, *X. pfeili.* Additional specimens were found (RJR) during bark beetle trapping surveys in Maryland from 1994–1997, where yet another exotic species, *Xyleborus californicus,* was detected for the first time. During manuscript preparation, the latter species was also found in Arkansas and South Carolina. Although it was first described from a population in California (Wood 1982), it is now known to be a northern Palearctic species (Siberia (S.L.Wood, pers. comm.), China, new interception in British Columbia (DEB)). Descriptions, diagnoses, revised keys and scanning electron micrographs are provided for each of the newly reported exotic species to aid in identification. Material from the trapping survey has been deposited in the National Museum of Natural History, Washington, D.C.

Xyleborus pfeili (Ratzeburg)
(Figs. 2, 4–6)

Distribution.—This species is native to Europe (Austria, Belgium, Bulgaria, former Czechoslovakia, France, Germany, Greece, Hungary, Italy, Poland, Romania, Spain, Switzerland, and former western USSR), Asia (China, Japan, Korea and Turkey) and Africa (Algeria and Morocco), and has been introduced into New Zealand (Wood and Bright 1992).

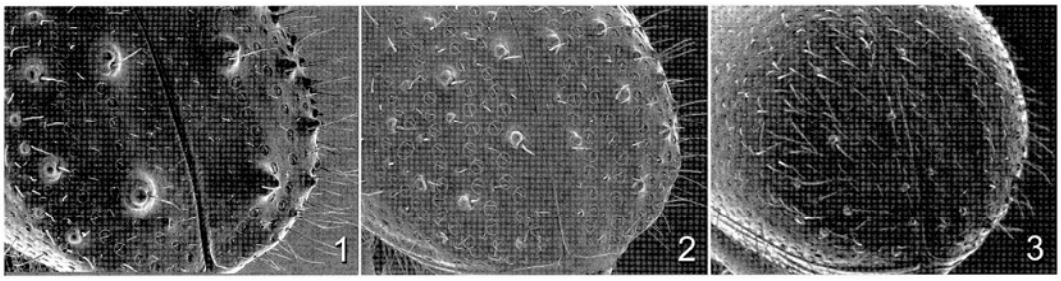
Diagnosis.—Among eastern North American *Xyleborus,* specimens of *X. pfeili* with well-developed declivital tubercles are most likely to be confused with *X. celsus* Eichhoff and *X. ferrugineus* (F.). *Xyleborus pfeili* (Fig. 2) differs from *X. celsus* (Fig. 1) in its more gradual declivity with greater consistancy in the size of interstrial tubercles, and the straighter declivital striae 1. It differs from *X. ferrugineus* by the presence of tubercles on declivital interstriae 1. Specimens of *X. pfeili* with less developed declivital tubercles are most likely to be confused with *X. volvulus* (F.). They can be distinguished by the larger size (*X. volvulus* females are generally less than 2.8 mm), the weakly sulcate elytra with distinctly raised interstriae 1 (Fig. 2), and the more abruptly formed declivity (Figs. 4–5).

Description.—*Female:* Length 3–3.6 mm, cylindrical, reddish brown, with legs paler yellowish.

Frons minutely reticulate, weakly shining, coarsely shallowly punctate; longitudinal carina weak to obsolete.

Pronotum 1.2 times as long as wide, sides roughly parallel, summit near middle; anterior margin of pronotum arcuate, unarmed; anterior and posterolateral areas weakly reticulate and faintly shining, with moderate to weakly developed asperities and moderately long setae; median area posterior to summit devoid of asperities, more polished, with fewer setae and sparse scattered punctures.

Elytra about 1.8 times as long as wide; strial punctures on disc moderately large, each with very short recumbent seta, separated within row by approximate diameter of a puncture; interstrial discal punctures minute, more widely and less regularly spaced, each with stouter, longer, erect to semirecumbant seta; interstriae 1 with granules sometimes developed in posterior half before declivity. Elytral declivity steep, oblique, linear in profile, occupying approximately posterior 30% of elytra, weak-



Figs. 1–3. Posterolateral views of elytral declivity. 1, *Xyleborus celsus*. 2, *X. pfeili*. 3, *X. californicus*.

ly sulcate, highly polished except for duller patches in depressed areas; rows of strial punctures less regular than on disc, deviating around larger tubercles; 2 or 3 larger conical tubercles often present on interstriae 1 and 3; scattered smaller tubercles or granules often occurring on some or all interstriae; interstriae 1 slightly elevated.

Male: Not seen. Males of *Xyleborus* spp. are "exceedingly rare and flightless" (Wood 1982). Described and illustrated by Balachowsky (1949). Apparently similar to female, except for smaller size (2.1–2.6 mm long) and pronotal shape which is ogival in outline and concave in anterior ⅓.

Variation.—Specimens vary in development and position of declivital armature, although specimens from the introduced population (Figs. 2, 4–5) thus far show less variation than some of the Old World specimens examined. Specimens with reduced declivital tubercles show less variation in the relative size of these structures, and some specimens in a series from Brout-Vernet, France, entirely lack declivital tubercles except at base.

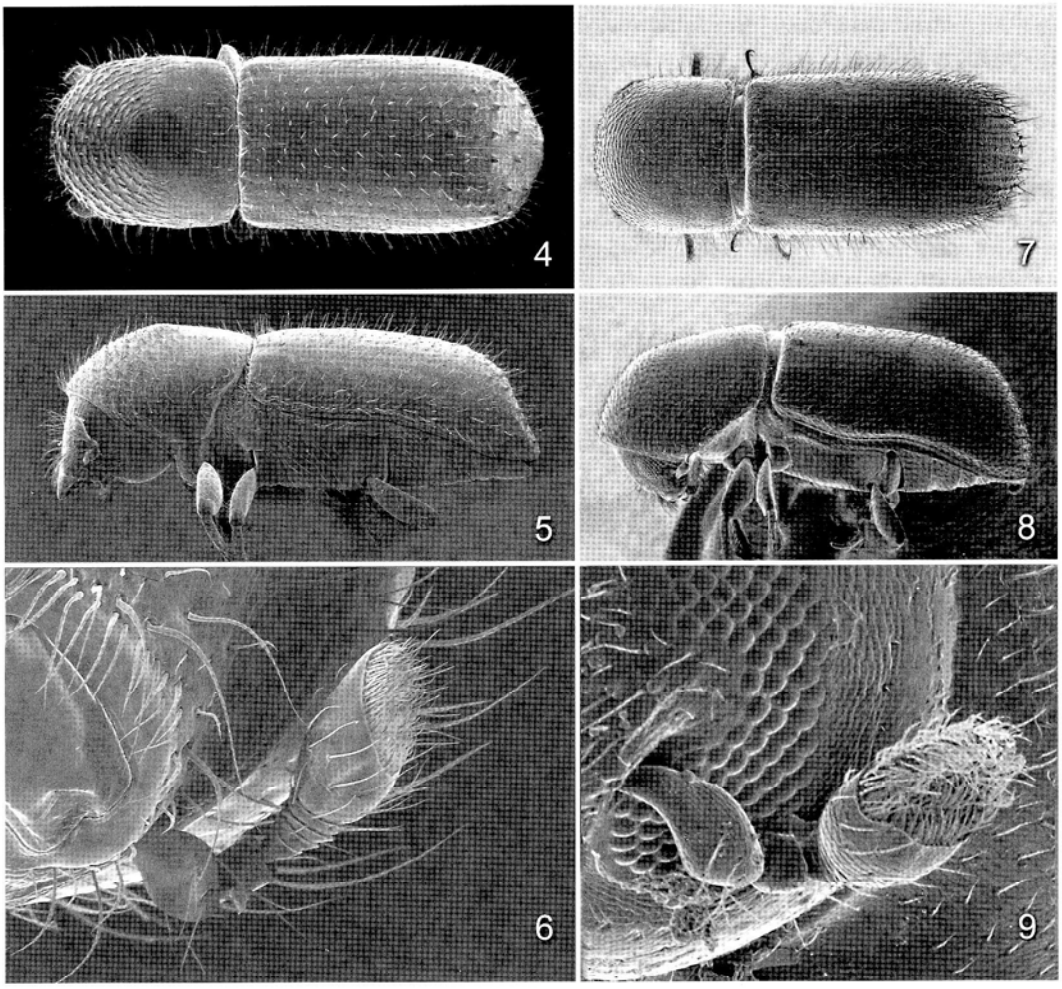
Specimens examined (all ♀, introduced population).—UNITED STATES: MARYLAND: *Cecil Co.*: Elk Neck State Forest, 4 June 1997, *ex* Chalcoprax-baited funnel trap, R.J. Rabaglia. *Kent Co.*: Coleman, 4 June 1997, *ex* Chalcoprax-baited funnel trap, R.J. Rabaglia. *Queen Anne's Co.*: Carmichael, Wye Research and Education Center, June–July 1992, R.N.Peterson, *ex* branch/stump of paw paw, *Asimina triloba*; Wye, 5 May 1995, *ex* ethanol-baited funnel trap, R.J. Rabaglia; Wye, 26 September 1996, *ex* ethanol-baited funnel trap, R.J. Rabaglia.

Xyleborus californicus Wood
(Fig. 3, 7–9)

Distribution.—According to Wood (pers. comm.) this species belongs to a complex indigenous to Siberia and neighboring parts of northern Asia. Recently a specimen from China was intercepted in Vancouver, B.C. The species was originally described from a population established in California and Oregon, but its exotic status was never seriously in dispute (Wood 1982). The sudden occurrence of *X. californicus* in the Mid-Atlantic region and southeastern United States further supports the exotic origin of this species. Each year its numbers and distribution have increased.

Diagnosis.—Wood (1982) states that this species might be confused with *pubescens* Zimmermann. It can be distinguished by the more abundant pubescence, the smaller size and the lighter coloration. We found *X. californicus* to be most similar to *X. pelliculosus* Eichhoff except for the much smaller size and paler color. Both of the latter species have the same structure of the antennal club and similar body proportions, punctation and vestiture. *Xyleborus pelliculosus* was not included in Wood's key because its presence in the United States was reported subsequently (Atkinson et al. 1990).

Description.—The following description is from Wood (1982) with the addition of a phrase (in **bold face**) to describe the antennal club:



Figs. 4–9. 4–6, *Xyleborus pfeili.* 4, Dorsal view. 5, Lateral view. 6, Detail of head showing left antenna. 7–9, *X. californicus.* 7, Dorsal view. 8, Lateral view. 9, Detail of head showing left antenna.

Female: Length 2.0–2.2 mm, 2.9 times as long as wide; yellowish brown.

Frons rather strongly convex; surface strongly reticulate, a few small granules from epistoma to upper level of eyes. Vestiture of fine, sparse hair. **Antennal club (Fig. 9) flattened, subcircular, posterior face solid or with a subapical suture and rows of setae visible on apical third.**

Pronotum 1.2 times as long as wide; sides almost straight and parallel on basal two-thirds, rather broadly rounded in front; anterior margin unarmed; summit in front of middle; anterior slope steep, rather coarsely asperate; posterior areas strongly reticulate, punctures small, shallow, rather close. Vestiture of fine, short rather abundant hair.

Elytra 1.7 times as long as wide, 1.4 times as long as pronotum; sides almost straight and parallel on basal two-thirds, broadly rounded behind; disc occupying basal three-fourths; striae not impressed, punctures small, shallow, distinct, in rows, spaced by diameter of a puncture; interstriae three to four times as wide as striae, almost smooth, shining, punctures fine, in indefinite rows in some specimens, distinctly confused on basal half in others. Declivity steep, convex, general contours as in *pu-*

bescens; strial punctures large, shallow, distinct, their interior surfaces reticulate-granulate; interstriae only slightly wider than striae, their punctures mostly replaced by minute granules on all interstriae, a few granules on 1, 3 and lateral areas; posterolateral margin rounded, with an indefinite row of scattered granules. Vestiture of rather abundant, short, fine hair, distinctly longer on margins of declivity.

Specimens examined (all ♀).—UNITED STATES: DELAWARE: *New Castle Co.*: Wilmington, 21 August 1997, Delaware Dept of Agric. Coll. *Sussex Co.*: Redden State Forest HQ Tract, 18 May 1997, Michael A. Valenti; Redden State Forest Appenzellar Tract, 23 May 1997, Michael A. Valenti. MARYLAND: *Anne Arundel Co.*: Odenton, 18 April 1994, R. J. Rabaglia; *Somerset Co.*: Wellington, 27 April 1994, R. J. Rabaglia. *Calvert Co.*: Lusby, 11 April 1995, *ex* Ipslure-baited funnel trap, R. J. Rabaglia. *Caroline Co.*: Idylwilde Wildlife Management Area, 12 May 1994, R. J. Rabaglia. *Cecil Co.*: Elk Neck State Forest, 9 April 1997, *ex* Lineatin-baited funnel trap, R. J. Rabaglia. *Charles Co.*: Indian Head, 11 April 1995, *ex* Ipslure baited-funnel trap, R. J. Rabaglia. *Harford Co.*: Upper Crossroads, 3 May 1994, R. J. Rabaglia. *Kent Co.*: Sandy Bottom, 9 April 1997, *ex* ethanol-baited funnel trap, R. J. Rabaglia. *Queen Anne's Co.*: Matapeake, 8 April 1997, *ex* Chalcoprax-baited funnel trap, R. J. Rabaglia; Wye Mills, 23 April 1997, *ex* ethanol-baited funnel trap, R. J. Rabaglia; Romancoke, 5 May 1997, *ex* Ipslure-baited funnel trap, R. J. Rabaglia. *St.Mary's Co.*: Mechanicsville, 11 April 1995, *ex* Ipslure baited-funnel trap, R. J. Rabaglia. *Talbot Co.*: Longwoods, 12 May 1997, *ex* ethanol-baited funnel trap, R. J. Rabaglia. *Worcester Co.*: Pocomoke State Forest, 27 April 1994, R. J. Rabaglia. SOUTH CAROLINA: *Aiken Co.*: Savannah River Site, 7 July 1993, *ex* turpentine-baited bumper trap, R. D. Klaper Coll. *Stephen Co.*: Chattahoochee National Forest, 10 July 1996, *ex* loblolly-baited tent trap, C. A. H. Flechtmann Coll. ARKANSAS: *Pulaski Co.*: Little Rock, 21 March 1997, *ex* oak stump, B. Baldwin Coll.

Discussion.—Atkinson et al. (1990) published a key to females of the eastern North American *Xyleborus*. The key is modified below in order to accomodate the newly recorded species. Figure captions in italics refer to figures in the original publication. Note that *X. validus* Eichhoff in Atkinson et al (1990) has been removed from *Xyleborus*; it is now placed in *Euwallacea* (see Wood & Bright 1992) and is not included in the modified key.

1. Anterior margin of pronotum usually armed by several coarse serrations (*Fig. 8*), however serrations absent or reduced in *atratus* (*Fig. 2*); body stout, less than 2.2 times as long as wide; mature color black 2
– Anterior margin of pronotum unarmed by large serrations (*Fig. 10*); body slender, greater than 2.5 times as long as wide; mature color usually yellowish or reddish brown 5

2(1) Posterolateral costa on declivity armed by 3–5 distinct tubercles. North-central United States and Canada, south to Virginia. 2.8–3.5 mm . . . . . *obesus* LeConte
– Posterolateral costa on declivity of uniform height, may appear slightly undulating, but without denticles (*Fig. 9*) 3

3(2) Anterior margin of pronotum armed by numerous small subequal serrations (*Fig. 8*); declivital striae impressed, declivital interstriae less than 2 times as wide as striae (*Figs. 4, 9*) 4
– Anterior margin of pronotum armed by 2–6 serrations, median pair conspicuously larger than others; declivital interstriae at least twice as wide as striae. North-central United States and Canada. 2.3–2.6 mm . . . . . *sayi* (Hopkins)

4(3) Anterior margin of pronotum armed by 6–8 subequal serrations (*Fig. 8*); declivity flattened, interstrial setae subequal in length to width of interstriae (*Fig. 9*). North-central United States and Canada, Pacific Northwest of United States and Canada. 2.8–3.5 mm . . . . . *dispar* (F.)
– Anterior margin of pronotum with weakly developed serrations (*Fig. 2*); declivital interstriae 2 impressed, declivity slightly bisulcate; interstrial setae twice as long as width of interstriae (*Fig. 4*). Asian exotic,

Tennessee, Georgia, Maryland, West Virginia. 3.0 mm . . . . . *atratus* Eichhoff

5(1) Declivity strongly concave with obtusely elevated margins on posterolateral areas (*Fig. 14*); sutural interstriae of declivity armed by 2–4 stout tubercles. Southern Texas to Central America. 3.8–4.2 mm . . . . . *horridus* Eichhoff

– Declivity convex, flattened, or somewhat impressed near midline, but not concave 6

6(5) Denticles on some interstriae much larger than on others (Fig. 1) (*Figs. 16–17*) . . . 7

– Denticles on all interstriae (where present) more uniform in size (Fig. 2, 3) (*Figs. 18–20*) 9

7(6) Declivity steep, flat, surface dull; stria 1 on declivity strongly curved away from midline, with 2 large, pointed, widely spaced tubercles almost on striae; smaller granules on all interstriae only at base or lateral areas of declivity, not on face, forming a circumdeclivital ring (Fig. 1) (*Fig. 16*). Eastern North America. 3.6–4.5 mm . . . . . *celsus* Eichhoff

– Declivity less steep, slightly impressed along midline, surface shining; interstriae 1 and 2 armed only at base by small tubercles; interstria 3 with 3 widely spaced denticles, the middle one conspicuously larger than others (*Fig. 17*) 8

8(7) Anterior portion of pronotum of female impressed, weakly sulcate. Southeastern United States 2.0–2.5 mm . . . . . *viduus* Eichhoff

– Anterior portion of pronotum of female convex, normal (*Figs. 10–11*), impressed and sulcate in males (*Figs. 11, 13*). Eastern North America, Neotropics. 2.0–2.3 mm . . . . . *ferrugineus* (F.)

9(6) Surface of declivity opaque, dull (*Figs. 19, 20, 21*) 10

– Surface of declivity shining (Figs. 2–3) (*Figs. 18, 22*) except for duller patches in depressed areas 12

10(9) Declivity broadly sloping, occupying posterior 30–40% of elytra (*Fig. 23*), declivity slightly tapered posteriorly; tubercles of interstriae 1 and 3 small but conspicuous (*Fig. 20*). Eastern North America, Neotropics. 2.0–2.7 mm . . . *affinis* Eichhoff

– Declivity steep, occupying posterior 15% of elytra, apex blunt, not tapered; tubercles of interstriae 1 and 3 very small (*Fig. 19*) 11

11(10) Anterior portion of pronotum of female impressed, weakly sulcate. Eastern North America. 2.3–2.4 mm . . . . . *planicollis* Zimmermann

– Anterior portion of pronotum of female convex, normal (impressed and sulcate in males). Eastern North America. 2.3–2.7 mm . . . . . *xylographus* (Say)

12(9) Interstrial setae on elytra and declivity placed in a single median row (Figs. 2, 4) 13

– Interstrial setae on elytra and declivity in 2 or 3 randomly placed rows (Figs. 3, 7) 16

13(12) Elytral declivity convex, posterolateral areas not subacutely elevated (*Figs. 22, 24*) 14

– Elytral declivity flattened, sloping, posterolateral areas subacutely margined (Fig. 5) (*Figs. 18*) 15

14(13) Discal interstriae 2 times as wide as striae; some declivital tubercles with height and basal width greater than the diameter of strial punctures. Western North America to Honduras, New York to Georgia. 2.2–2.7 mm . . . . . *intrusus* Blandford

– Discal interstriae less than 1.5 times as wide as striae; some declivital tubercles with height and basal width less than the diameter of strial punctures (*Fig. 22*). Eastern North America. 2.3–2.7 mm . . . . . *pubescens* Zimmermann

15(13) Length 2.1–2.8 mm; eye with upper part above emargination wider than antennal club; southern Florida, Texas, widespread in Neotropical region . . *volvulus* (Fabricius)

– Length 3.0–3.6 mm; eye with upper part above emargination narrower than antennal club; introduced, Maryland . . . . . *pfeili* (Ratzeburg)

16(12) Length 2.0–2.2 mm; color yellowish-brown; introduced, California, Oregon, Arkansas, Delaware, Maryland, and South Carolina . . . . . *californicus* Wood

– Length 3.2 mm; color dark brown; introduced, Maryland, Pennsylvania . . . . . *pelliculosus* Eichhoff

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