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Valentin Popa, Claude Guertin and Robert Werbiski

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Article abstract

Six species of the genus *Xyleborinus* (Reitter 1913) have been reported in North America. Five of these species were introduced, and one species is considered native to North and South America. *Xyleborinus attenuatus* (Blandford 1894), which was introduced into the Americas from Asia, was first recorded in 1995 in western Canada, in the province of British Columbia, and then in 2007 in the province of Nova Scotia, in eastern Canada. In Quebec, *X. attenuatus* was initially recorded in 2009 based on a single captured specimen. In this study, we present additional evidence of the presence of this alien ambrosia beetle in Quebec, Canada.

Evidence of *Xyleborinus attenuatus* (Blandford 1894) (Coleoptera: Curculionidae: Scolytinae: Xyleborini) populations in Quebec, Canada

Valentin Popa[1], Claude Guertin[1]✉ and Robert Werbiski[2]

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Six species of the genus *Xyleborinus* (Reitter 1913) have been reported in North America. Five of these species were introduced, and one species is considered native to North and South America. *Xyleborinus attenuatus* (Blandford 1894), which was introduced into the Americas from Asia, was first recorded in 1995 in western Canada, in the province of British Columbia, and then in 2007 in the province of Nova Scotia, in eastern Canada. In Quebec, *X. attenuatus* was initially recorded in 2009 based on a single captured specimen. In this study, we present additional evidence of the presence of this alien ambrosia beetle in Quebec, Canada.

Keywords: Alien species, ambrosia beetle, Canada, Quebec, records.

[Présence de populations de *Xyleborinus attenuatus* (Blandford 1894) (Coleoptera: Curculionidae: Scolytinae: Xyleborini) au Québec, Canada]

Six espèces du genre *Xyleborinus* (Reitter 1913) ont été rapportées en Amérique du Nord. Cinq de ces espèces ont été introduites et une espèce est considérée indigène en Amérique du Nord et du Sud. *Xyleborinus attenuatus* (Blandford 1894), qui a été introduit en Amérique depuis l'Asie, a été rapporté pour la première fois en 1995 dans l'ouest du Canada, en Colombie-Britannique, puis en 2007 dans l'est du pays, en Nouvelle-Écosse. Au Québec, *X. attenuatus* a été rapporté en 2009 à la suite de la capture d'un seul spécimen. Dans la présente étude, nous présentons des preuves supplémentaires de la présence de ce scolyte du bois exotique au Québec, Canada.

Mots-clés: Canada, espèce exotique, Québec, rapports, scolyte du bois.

INTRODUCTION

The ambrosia beetle genus *Xyleborinus* Reitter, 1913 (Xyleborini) comprises at least 84 recognized species worldwide (Cognato 2008). In North America, Rabaglia *et al.* (2006) listed only three species that belong to the genus *Xyleborinus*, including *X. gracilis* (Eichhoff 1868), *X. alni* (Niisima 1909) and *X. saxesenii* (Ratzeburg 1837). Of these, only *X. gracilis* is considered a native species to North and South America; *X. alni* and *X. saxesenii* were introduced into the Americas from Asia. Recently, Knížek (2011) proposed that *X. alni* (Niisima 1909) is synonymous with *X. attenuatus* (Blandford 1894). Furthermore, Cognato and Rubinoff (2008) identified *X. andrewesi* (Blandford 1896) in Hawaii. Okins and Thomas (2010) identified *X. andrewesi* for the first time in the eastern United States based on 24 specimens reared from branches of sugar apple (*Annona squamosa* L.) in North Fort Myers, Florida. Rabaglia *et al.* (2010) also recorded *X. octiesdentatus* (Murayama 1931) for the first time in North America following exotic beetle trapping surveys in Alabama and Louisiana. Rabaglia *et al.* (2010) provided identification keys for the five recorded species. Another recently identified alien ambrosia beetle, *X. artestriatus* (Eichhoff 1878), was first reported in Georgia and Texas (Cognato *et al.* 2013). Consequently, six *Xyleborinus* species have been identified in North America to date. All of these *Xyleborinus* species have been inventoried and included in a summary (Hulcr 2012).

In Canada, only two of these *Xyleborinus* species have been reported: *X. saxesenii* (Ratzeburg) and *X. attenuatus* (Blandford). *Xyleborinus saxesenii* was first recorded in North America in 1915 (Haack 2001). *Xyleborinus saxesenii* is considered a transcontinental species (Rabaglia *et al.* 2006) and is widely distributed in Europe (Kirkendall and Faccoli 2010; Knížek 2011). In Quebec, Canada, *X. saxesenii* was first recorded in 2003 by the Canadian Food Inspection Agency based on specimens recovered from hardwood (CFIA 2003).

1. INRS–Institut Armand-Frappier, Laval (Quebec), Canada H7V 1B7; ✉ claude.guertin@iaf.inrs.ca
2. Department of National Defence, Saint-Jean-sur-Richelieu (Quebec), Canada J0J 1R0

Xyleborinus attenuatus was first reported in western North America in 1996 in Washington and Oregon (Mudge *et al.* 2001). However, some evidence suggests that this species was first recorded in 1995 in four different locations in the Vancouver area of British Columbia, Canada (L.H. Humble, unpublished data cited by Mudge *et al.* (2001)). In Canada, *X. attenuatus* was first officially mentioned in 1996 from British Columbia in a report from the Canadian Food Inspection Agency (CFIA 1996). Later, in a publication by Humble and Allen (2006), *X. attenuatus* was cited as a relatively recent introduction into Canada. Hoebeke and Rabaglia (2007) mentioned for the first time the presence of *X. attenuatus* in the eastern United States following extensive trapping surveys of exotic bark beetles. *Xyleborinus attenuatus* was recorded in 2007 in Dartmouth and Debert (Nova Scotia, Canada) during exotic species trapping survey programs of the Canadian Food Inspection Agency (CFIA 2007). In Quebec, *X. attenuatus* was first recorded in 2009 in Sherbrooke, based on a single specimen captured in Lindgren traps set by the Canadian Food Inspection Agency (Douglas *et al.* 2013).

In this article, we present new records of *X. attenuatus* in Quebec, Canada, following a bark beetle survey program performed for the Canadian Department of National Defence.

MATERIAL AND METHODS

Xyleborinus attenuatus specimens were captured during a 3-yr (2011-2013) trapping survey of bark beetle populations at the Farnham Garrison located in Farnham, Quebec, Canada, about 55 km southeast of Montreal. In 2011 and 2012, 12-unit Lindgren multi-funnel traps (Synergy Semiochemicals Corp.®, Burnaby, BC) were used for the survey of bark beetle populations. Lindgren traps were equipped with plastic cups filled with 50 ml of propylene glycol to preserve the captured insects. The traps were baited with a complex of semiochemicals, such as low-release ethanol lure, seudenol lure, frontalin and exotic bark beetle lure (Synergy Semiochemicals Corp.®). In a 2013 survey, the Lindgren traps were baited with pine shoot beetle enhanced lures (Synergy Semiochemicals Corp.®). The field trapping period ranged from the beginning of March to the end of June. Trap cups were sampled weekly, and captured specimens were preserved in 70% alcohol and subsequently mounted and pinned. The identification of captured specimens was performed according to morphological features using a Discovery V20 stereomicroscope (Carl Zeiss Canada Ltd., Toronto, ON). One specimen was also identified from Claude Chantal's Collection (Varennes, QC). All captured specimens were deposited in the INRS-IAF entomological collection. A distribution map was drawn using ArcGIS and ArcMap 10.0 software.

RESULTS AND DISCUSSION

As a result of the 3-yr trapping survey of alien bark beetles, 16 specimens of *X. attenuatus* were captured as follows: 9-V-2011: three specimens at Farnham Garrison, Farnham, QC; 21-III-2012: one specimen in Varennes, QC (specimen found in Claude Chantal's Collection); 1-V-2012: two specimens at Farnham Garrison; 17-V-2012: one specimen at Farnham Garrison; 2-V-2013: nine specimens in Farnham Garrison. Considering the previous record by Douglas *et al.* (2013), *X. attenuatus* is presently found in three locations in Quebec, Canada: Sherbrooke (45.402406° N; -71.8822763° W), Farnham (45.302716°N; -73.001981W) and Varennes (45.678116° N; -73.418328° W) (Fig. 1). *Xyleborinus attenuatus* captures were improved in 2013 by using pine shoot beetle enhanced lure. The basic attractant of this lure type is α-pinene. At the Farnham military garrison, a mixture of coniferous and deciduous stands can be found. Specimens of *X. attenuatus* were captured mainly in young birch (*Betula* spp.) stands with a density of four trees per m². *Xyleborinus attenuatus* recently migrated to Quebec from the south, possibly from Vermont and Maine based on the actual distribution of *X. attenuatus* in the northern Unites States (Atkinson 2013).

Figure 1. Map of *Xyleborinus attenuatus* records in Quebec, Canada (gray square – previous record; red circle – new records).

Wood (2007) and Cognato (2008) have mentioned that species of the genus *Xyleborinus* (Reitter) are easily recognizable by the presence of a conical scutellum with the cavity surrounding this structure being abundantly filled with long hair-like setae (Fig. 2). Other related genera such as *Xyleborus* (Eichhoff) and *Anisandrus* Ferrari display a larger flat scutellum (Fig. 3) laying on the antero-medial (sutural) borders of both elytra (Holzschuh 1994; Cognato 2008). This species has been described by many authors starting with the original description reported by Blandford (1894) and a later description by Niisima (1909). More recent references regarding the morphological features of *X. attenuatus* have been provided by Rabaglia *et al.* (2006), Hoebeke and Rabaglia (2007), Cognato (2008) and Rabaglia *et al.* (2010). *Xyleborinus attenuatus* could be easily confused with the closely related species *X. saxesenii*. However, *X. attenuatus* has a longer body (2.5 to 3.0 mm) compared with *X. saxesenii* (1.9 to 2.4 mm), and the elytral declivity displays larger, pointed and hook-like denticles on the third interstriae (Figs. 4, 5).

The biology of *X. attenuatus* is largely unknown. Niisima (1909) provided the first data regarding the biology of this species. The insect bores oval-shaped galleries measuring about 2.4 cm in length and 1.3 cm

in width. In Japan, the host plant for *X. attenuatus* is the grey alder, *Alnus incana* (L.) Moench. In Japan, adult flight activity has been reported to begin in April or May. Bright and Skidmore (1997), Wood and Bright (1992) and Mudge *et al.* (2001) have suggested that *Alnus* Mill., *Betula* L., *Corylus* L., *Salix* L. and *Tilia* L. may act as hosts for *X. attenuatus* in the Palearctic region. LaBonte *et al.* (2005) reported the genus *Prunus* L. as host for *X. attenuatus* in North America based on specimens recovered from the trunk of a flowering cherry tree. The genus *Prunus* L. was first mentioned as host plant in the original habitat of *X. attenuatus* by Wood and Bright (1992). Additionally, Nikulina *et al.* (2007) mentioned *Populus* L., *Quercus* L. and *Fagus* L. as host plants for *X. attenuatus* in eastern Europe. In western Europe, Holzschuh (1994) mentioned the same host plants as for eastern Europe and suggested that *X. attenuatus* has a large host spectrum.

Like all xyleborines, *Xyleborinus* species are ambrosia beetles that bore into the xylem of host trees and cultivate fungal symbionts as food for adults and larvae (Biedermann *et al.* 2009). Fungal symbionts of ambrosia beetles are vertically transmitted supporting the hypothesis of coevolution between two partners (Six 2003). Biedermann *et al.* (2013) found *Raffaelea sulphurea* (Batra) T.C. Harrin. and *Fusicolla acetilerea* (Tubaki, C. Booth and T. Harada) Gräfenhan & Seifert as fungal associates with *X. saxesenii.* Fungal species associated with xyleborine ambrosia beetles may cause severe tree diseases such as oak dieback in Asia (Kamata *et al.* 2002) and laurel wilt disease in North America (Mayfield *et al.* 2008; Harrington and Fraedrich 2010). Moreover, xyleborine ambrosia beetles are the perfect candidates for the invasion of new habitats because of their large host plant spectrum and their ability to inbreed. Theoretically, a single fertilized female can potentially start an entirely new population (Kirkendall 1983; Jordal *et al.* 2001).

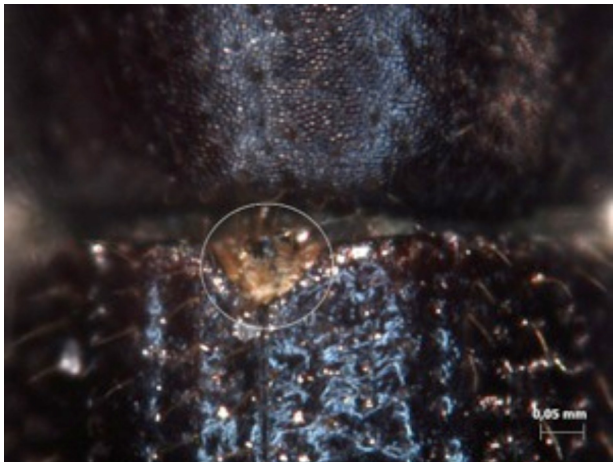

Figure 2. ***Xyleborinus attenuatus*** **– scutellum.**

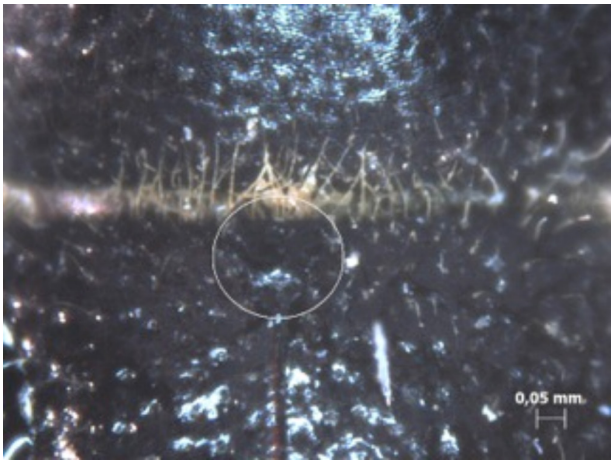

Figure 3. ***Anisandrus sayi*** **– scutellum.**

Figure 4. ***Xyleborinus attenuatus*** **– lateral view of elytral declivity.**

Figure 5. ***Xyleborinus attenuatus*** **– dorsal view.**

In conclusion, *X. attenuatus* has recently arrived in Quebec and continues to spread over the province's territory. To date, we have no information about the occurrence of this species in the neighbouring Canadian provinces of New Brunswick and Ontario. Further studies are required on the biology of this alien ambrosia beetle in order to assess the impact that this species could have on deciduous forests and ornamental trees in Quebec and eastern Canada, especially in the context of climate change.

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REFERENCES

Atkinson, T.H. 2013. Bark and ambrosia beetles of the US and Canada, http://barkbeetles.info/us_canada_chklist_target_species.php?lookUp=2023 (accessed on Jan 07, 2013).

Biedermann, P.H.W., K.D. Klepzig, and M. Taborsky. 2009. Fungus cultivation by ambrosia beetles: behavior and laboratory breeding success in three *Xyleborine* species. Environ. Entomol. 38: 1096-1105.

Biedermann, P.H.W., K.D. Klepzig, M. Taborsky, and D.L. Six. 2013. Abundance and dynamics of filamentous fungi in the complex ambrosia gardens of the primitively eusocial beetle *Xyleborinus saxesenii* Ratzeburg (Coleoptera: Curculionidae, Scolytinae). FEMS Microbiol. Ecol. 83: 711-723.

Blandford, W.F.H. 1894. The Rhynchophorous Coleoptera of Japan. Part III. Scolytidae. Trans. Entomol. Soc. Lond. 4: 53-141.

Bright, D.E., and R.E. Skidmore. 1997. A catalog of Scolytidae and Platypodidae (Coleoptera). Supplement 1 (1990-1994), National Research Council of Canada Press, Ottawa, ON.

CFIA. 1996. Summary of plant quarantine pest and disease situation in Canada. Government of Canada, Ottawa, ON. pp. 34-36.

CFIA. 2003. Summary of plant quarantine pest and disease situation in Canada. Available at http://www.inspection.gc.ca/english/sci/surv/sit2003e.shtml (Accessed on Jan. 07, 2013).

CFIA. 2007. Summary of plant quarantine pest and disease situation in Canada. Available at http://www.inspection.gc.ca/english/plaveg/pestrava/surv/sit2007e.shtml (Accessed on Jan. 07, 2013).

Cognato, A.I. 2008. Monographic research of tropical bark beetles (Scolytinae: Xyleborini). Preservation and modernisation of taxonomic expertise. Available at http://xyleborini.speciesfile.org (Accessed on Aug. 14, 2013).

Cognato, A.I., and D. Rubinoff. 2008. New exotic ambrosia beetles found in Hawaii (Curculionidae: Scolytinae: Xyleborina). Coleopt. Bull. 62: 421-424.

Cognato, A.I., R.J. Rabaglia, and N.J. Vandenberg. 2013. Another Asian ambrosia beetle, *Xyleborinus artestriatus* (Eichhoff 1878) (Coleoptera: Curculionidae: Scolytinae: Xyleborini), newly detected in North America. Pan-Pac. Entomol. 89: 27-31.

Douglas, H., P. Bouchard, R.S. Anderson, P. de Tonnancour, R. Vigneault, and R.P. Webster. 2013. New Curculionoidea (Coleoptera) records for Canada. Zookeys 309: 13-48.

Haack, R.A. 2001. Intercepted Scolytidae (Coleoptera) at U.S. ports of entry: 1985–2000. Integr. Pest Manag. Rev. 6: 253-282.

Harrington, T.C., and S.W. Fraedrich. 2010. Quantification of propagules of the laurel wilt fungus and other mycangial fungi from the redbay ambrosia beetle, *Xyleborus glabratus*. Phytopathology 100: 1118-1123.

Hoebeke, R.E., and R.J. Rabaglia. 2007. First reported occurrence of *Xyleborinus alni* (Coleoptera: Curculionidae: Scolytinae) in the eastern United States, with notes on its recognition and tree hosts. Proc. Entomol. Soc. Wash. 109: 240-248.

Holzschuh, C. 1994. Zur Unterscheidung von *Xyleborinus saxesenii* (Ratzeburg) und *X. alni* (Niisima) (Coleoptera, Scolytidae). Entomol. Brasil. 17: 311-318.

Hulcr, J. 2012. North American Xyleborini, http://www.ambrosiasymbiosis.org/northamericanxyleborini/index.html (Accessed on Jan. 7, 2013).

Humble, L., and E.A. Allen. 2006. Forest biosecurity: alien invasive species and vectored organisms. Can. J. Plant Pathol. 28: S256-S269.

Jordal, B.H., R.A. Beaver, and L.R. Kirkendall. 2001. Breaking taboos in the tropics: incest promotes colonization by wood-boring beetles. Glob. Ecol. Biogeogr. 10: 345-357.

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. Bull. Entomol. Res. 92: 119-126.

Kirkendall, L.W. 1983. The evolution of mating systems in bark and ambrosia beetles (Coleoptera: Scolytidae and Platypodidae). Zool. J. Linn. Soc. 77: 293-352.

Kirkendall, L.R., and M. Faccoli. 2010. Bark beetles and pinhole borers (Curculionidae, Scolytinae, Platypodinae) alien to Europe. Zookeys 56: 227-251.

Knížek, M. 2011. Scolytinae. Pages 204-251 *in* I. Löbl and A. Smetana (eds.), Catalog of Palaearctic Coleoptera, Vol. 7. Apollo Books, Stenstrup, Denmark.

LaBonte, J.R., A.D. Mudge, and K.J.R. Johnson. 2005. 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. Proc. Entomol. Soc. Wash. 107: 554-564.

Mayfield III, A.E., J.H. Crane, and J.A. Smith. 2008. Laurel wilt: a threat to redbay, avocado and related trees in urban and rural landscapes. Report No. HS 1137, Institute of Food and Agricultural Sciences (IFAS), University of Florida, USA.

Mudge, A.D., J.R. LaBonte, K.J.R. Johnson, and E.H. LaGasa. 2001. Exotic woodboring coleoptera (Micromalthidae, Scolytidae) and Hymenoptera (Xiphydriidae) new to Oregon and Washington. Proc. Entomol. Soc. Wash. 103: 1011-1019.

Niisima, Y. 1909. Die Scolytiden Hokkaidos unter Berücksichtigung ihrer Bedeutung für Forstschäden. J. Coll. Agric. 3: 109-179.

Nikulina, T.V., V.V. Martynov, and D.Y. Mandelshtam. 2007. The first record of the bark beetle *Xyleborinus alni* (Coleoptera, Scolytidae) in the faunas of Ukraine and European Russia. Vestn. Zool. 41: 542.

Okins, K.E., and M.C. Thomas. 2010. New North American record for *Xyleborinus andrewesi* (Coleoptera: Curculionidae: Scolytinae). Fl. Entomol. 93: 133-134.

Rabaglia, R.J., S.A. Dole, and A.I. Cognato. 2006. Review of American *Xyleborina* (Coleoptera: Curculionidae: Scolytinae) occurring north of Mexico, with an illustrated key. Ann. Entomol. Soc. Am. 99: 1034-1056.

Rabaglia, R.J., M. Knižek, and W. Johnson. 2010. First records of *Xyleborinus octiesdentatus* (Murayama) (Coleoptera, Curculionidae, Scolytinae) from North America. ZooKeys 56: 219-226.

Six, D.L. 2003. Bark beetle fungus symbioses. Pages 97-114 *in* K. Bourtzis and T.A. Miller (eds.), Insect Symbiosis, Vol. 1. CRC Press, Boca Raton, FL, USA.

Wood, S.L. 2007. Bark and ambrosia beetles of South America (Coleoptera: Scolytidae). M.L. Bean Museum, Brigham Young University, Provo, UT, USA.

Wood, S.L., and D.E. Bright. 1992. A Catalog of Scolytidae and Platypodidae (Coleoptera), Part 2: Taxonomic Index, Vol. A. Great Basin Nat. Mem. 13: 1-833.