10-25-2024

First Record of *Molorchus minor* (Linnaeus, 1758) (Coleoptera: Cerambycidae) in North America

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A journal of world insect systematics

INSECTA MUNDI

1078

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Date of issue: October 25, 2024

Center for Systematic Entomology, Inc., Gainesville, FL

DiGirolomo MF, Bohne MJ. 2024. First record of *Molorchus minor* (Linnaeus, 1758) (Coleoptera: Cerambycidae) in North America. Insecta Mundi 1078: 1–7.

Published on October 25, 2024 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
http://centerforsystematicentomology.org/

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Electronic copies (online ISSN 1942-1354) in PDF format

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Abstract. We report the first documented occurrence of the Palaearctic longhorn beetle *Molorchus minor* (Linnaeus) (Coleoptera: Cerambycidae: Cerambycinae) based on specimens collected from bycatch of a bark and ambrosia beetle early detection trapping program in Massachusetts, USA. Diagnostic characters are discussed, and a modified key is presented to facilitate species identification of the genus in North America.

Key words. Adventive species, longhorn beetle, Palaearctic, Massachusetts, bycatch, Norway spruce.

ZooBank registration. urn:lsid:zoobank.org:pub:AB00D09B-5AEE-46B0-86B1-C26CED6E058A

Introduction

The genus *Molorchus* Fabricius (Coleoptera: Cerambycidae: Cerambycinae: Molorchini) is represented by 136 species worldwide (Bezark 2023a, b), the majority of which are of Palaearctic and Indomalayan origin, with three species native to the Nearctic. A recent discovery of a fourth, adventive, species in Massachusetts, USA, *Molorchus minor* (Linnaeus), is reported herein.

Materials and Methods

The USDA Forest Service's Early Detection Rapid Response (EDRR) program is a nationwide trapping effort aimed at detecting immigrant bark and ambrosia beetles (Coleoptera: Curculionidae: Scolytinae) in high risk forested sites using multiple-funnel traps and various host volatile and pheromone baits (Rabaglia et al. 2019). Through this multi-agency effort, several adventive scolytines have been discovered in the United States (Hoebeke and Acciavatti 2006; Rabaglia et al. 2006; LaBonte 2010; Hoebeke and Rabaglia 2008; Rabaglia et al. 2010; Cognato and Olson 2011) in addition to hundreds of new state records for native and non-native species already known to occur there. Although the target of this survey is Scolytinae, taxonomists often pay attention to bycatch and have made an occasional interesting discovery of something new to the continent (Hoebeke et al. 2019). During processing of 2022 EDRR samples, four specimens of an unfamiliar longhorn beetle were found in bycatch from a trap sample in central Massachusetts (Fig. 1). It appeared very similar to the California endemic *Molorchus eburneus* Linsley, however its presence in Massachusetts led us to believe it may be a non-native species instead. Comparing the specimen to images of *Molorchus* spp. on the website "A Photographic Catalog of the Cerambycidae of the World - Old World Cerambycidae Catalog" (Bezark 2023a), we determined that *Molorchus minor* was more likely the identity of the unknown beetles. Photos of a specimen were sent to Eugenio Nearns (USDA-APHIS) who agreed that *M. minor* was most likely the correct determination. Following the discovery, an informal survey of the area surrounding the trap location was carried out. Several *Picea abies* (L.) H. Karst. (Norway spruce) trees were in decline, exhibiting signs of infestation by numerous wood boring and other secondary insects. Material was collected from relatively healthy, declining, and predominantly dead branches and

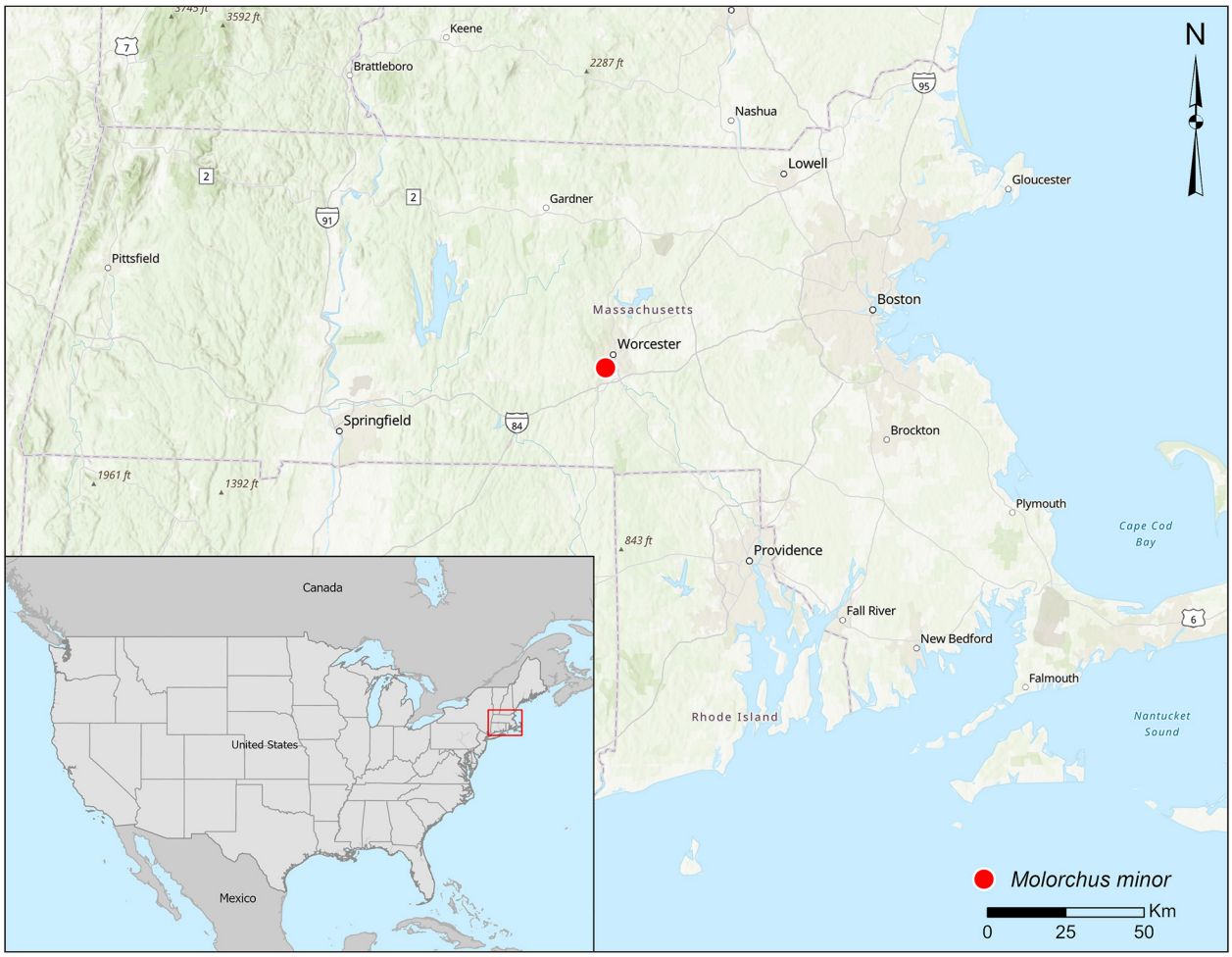

Figure 1. Location of *Molorchus minor* in Massachusetts, USA.

placed in separate emergence chambers. One chamber, containing predominantly dead branches, produced an adult of *M. minor* the following spring, confirming the host in Massachusetts. This specimen was placed in 95% ethanol. A hind leg from the specimen was used to extract DNA using a QIAGEN DNeasy® Blood & Tissue Kit following their standard protocol for insects (QIAGEN 2006). Amplification of the COI gene using the primers LCO1490 and HCO2198 (Folmer et al. 1994) was executed following Canadian Centre for DNA Barcoding protocols (Ivanova and Grainger 2023). Samples were sent to Genewiz (Azenta US, Inc., South Plainfield, NJ, USA) for Sanger sequencing. Sequences were aligned using the NCBI nucleotide BLAST and the BOLD Identification Engine. Trapping for the EDRR program was again conducted at the site in 2023, resulting in the capture of one additional specimen.

Specimens are deposited in the following institutions:

DFOC USDA Forest Service Durham Field Office Insect Collection, Durham, New Hampshire, USA
UNHC University of New Hampshire Insect Collection, Durham, New Hampshire, USA

Results

Results of the NCBI Nucleotide BLAST and BOLD Identification Engine search of the DNA sequence obtained from the leg of a specimen emerged from *Picea abies* showed a 100% species identity match to specimens of

Molorchus minor, thus confirming our initial species determination. The sample was uploaded to the NCBI GenBank database (accession number PP234645).

A total of six specimens of *M. minor* adults were collected from traps and reared from host material.

Molorchus (*Caenoptera*) *minor* (Linnaeus, 1758)

(Fig. 2, 3A)

New continental records. USA: MA: Worcester Co., Worcester, Hope Cemetery, 42.23582°, −71.82453°, 1 Jun 2022, N Keleher, multiple funnel trap, exotic Ips lure (3♂1♀, DFOC); Same locality, 7 Sep 2022 – 12 May 2023, MJ

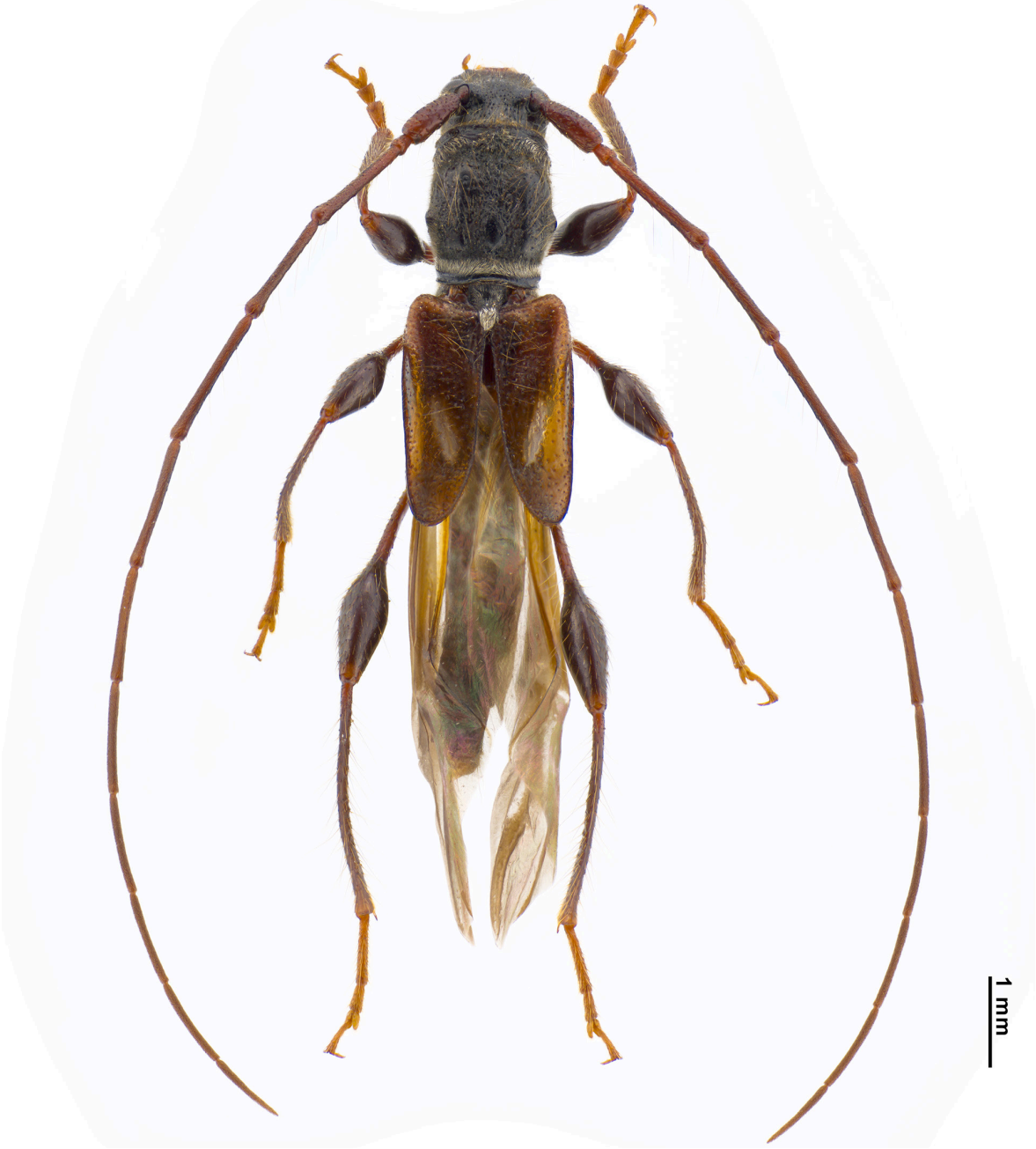

Figure 2. Dorsal habitus of *Molorchus minor*, male, collected in Massachusetts, USA.

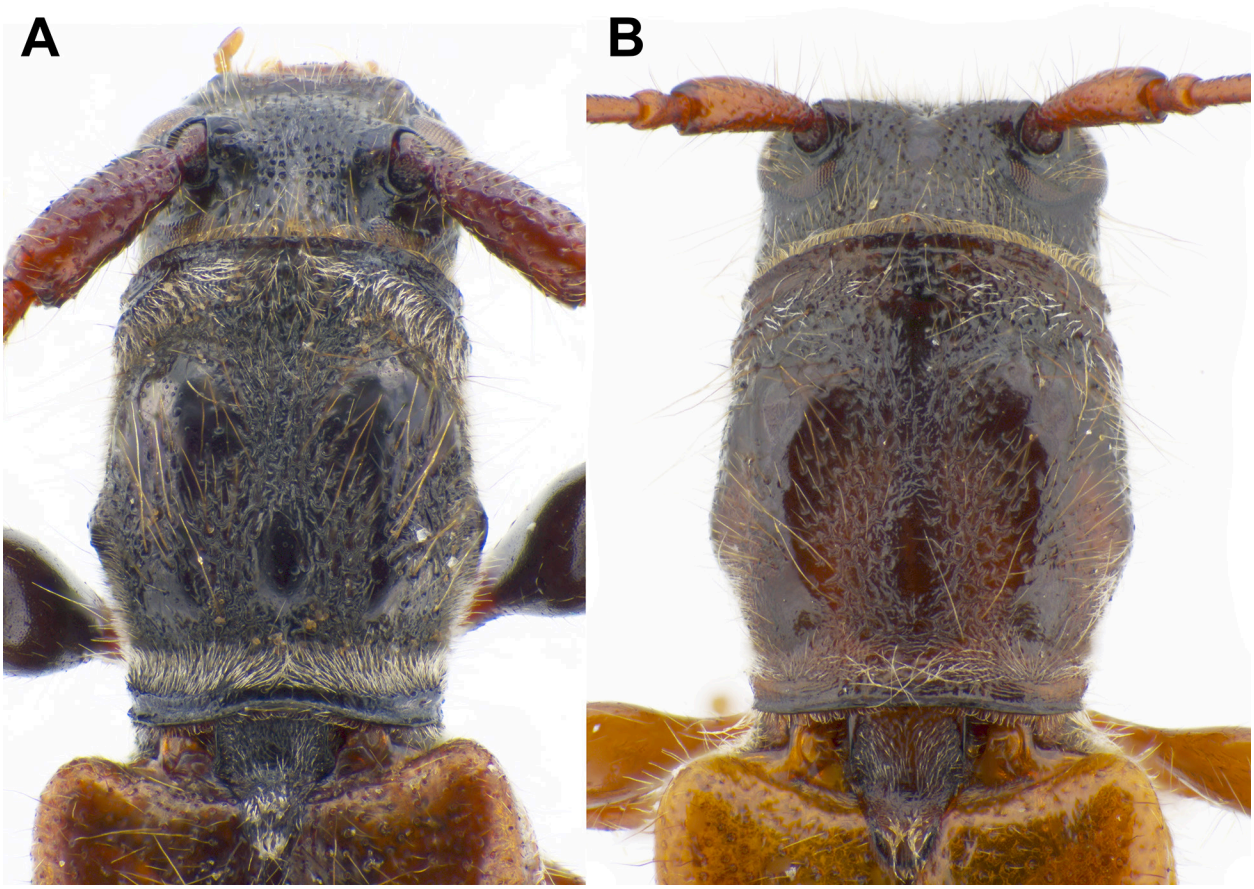

Figure 3. Head and pronotum of *Molorchus* spp. **A)** *Molorchus minor*. **B)** *Molorchus eburneus*.

Bohne, emergence chamber, ex *Picea abies*, dead branches, (1♂, DFOC); Same locality, 30 May 2023, F Hubacz, multiple funnel trap, exotic Ips lure (1♂, UNHC).

Diagnosis. *Molorchus minor* may be distinguished from the sole eastern North American member of the genus by the presence of a narrow, oblique, ivory colored, raised fascia on each elytron (Fig. 2). *Molorchus bimaculatus* Say usually have bicolored elytra, but the maculae are not raised, narrow and oblique. The California endemic *M. eburneus* is very closely related to *M. minor*, both sharing the oblique raised fasciae, and similar host preferences. They may be distinguished by differences in the shape, setation, and arrangement of calluses of the pronotum as described in the key below. Males of *M. minor* may be easily distinguished from females by the number of antennal segments (12 in male, 11 in female).

Biology. Duffy (1953) describes the larval biology in detail. A preference for twigs and branches has been observed. Eggs are oviposited in recently cut or damaged branches, and, seldomly, in exposed roots and boles. Galleries are predominantly subcortical and larvae subsequently bore into the outer sapwood where pupation occurs. Adults eclose in late summer but remain in their pupal cells until the following spring. The life cycle is two years.

Hosts. *Molorchus minor* is polyphagous in conifers and is known to infest *Pinus*, *Picea*, *Abies*, *Larix*, and *Pseudotsuga* (Bense 1995; Bringmann 2001). Reports of larval development in *Cupressus* and *Betula* are most likely erroneous (Vitali 2018). Duffy (1946) reported *M. minor* in *Betula* based on his own field observations and breeding experiments. Anisimov and Bezborodov (2021) reported larval development of *M. minor* in *Juglans*, *Carpinus*, *Ulmus*, *Crataegus*, and *Frangula*, however specimen records or references were not provided. It is likely these were taken from the Titan database (Tavakilian and Chevillotte 2018) which, although listed under larval host,

are probably referring to records of adults on flowers of these hardwood genera, or are misidentifications. Sama (1988) concluded that records of *M. minor* from broadleaf host trees are likely erroneous and should refer to other species. Softwood species records in literature include *Picea abies* (Doychev et al. 2009), *Picea pungens* Engelm. (Doychev and Georgiev 2004), *Picea sitchensis* (Bong.) Carr. (Bringmann 2001), *Pinus strobus* L. (Szczepański et al. 2022), *Pinus sylvestris* L. (Starzyk et al. 2008), *Pinus nigra* J.F.Arnold (Kovács and Hegyessy 1995), *Abies alba* Mill. (Pfeffer and Zumr 1983), *Larix decidua* Mill. (Kovács et al. 2000) and *Pseudotsuga menziesii* (Mirbel) Franco (Bringmann 2001). Additionally, the Titan database (Tavakilian and Chevillotte 2018) adds the following host species without specimen records or references: *Abies cephalonica* Loudon, *Abies cilicica* (Antoine & Kotschy) Carrière, *Abies sachalinensis* F.Schmidt, *Picea jezoensis* (Siebold & Zucc.) Carr., and *Picea orientalis* (L.) Link. Adults are often found feeding and copulating on flowers of various plants including *Crataegus* and the family Apiaceae (Bílý and Mehl 1989).

Key to North American species of *Molorchus* (Modified from Linsley 1931, 1963)

1. Pronotum entirely punctate, lacking smooth raised callused areas; elytra without oblique, white, elevated fasciae; antennae with fourth segment as long as third, much shorter than fifth segment **2**

— Pronotum with lateral and central raised longitudinal callused areas; elytra with oblique, elevated, ivory-white fasciae; antennae with fourth segment shorter than third, slightly shorter than fifth segment **3**

2(1). Elytra concolorous, testaceous or rufotestaceous; pronotum usually distinctly longer than broad with sides much narrower than base of elytra; length, 5–8 mm . . . . . ***M. longicollis* LeConte**

— Elytra rarely black or reddish, usually bicolored with base, apex, and lateral margin black; pronotum usually slightly longer than broad with the sides as wide or nearly as wide as base of elytra; length, 4–11.5 mm ***M. bimaculatus* Say**

3(1). Lateral pronotal calluses narrower, sub-parallel (Fig. 3A); bands of light-colored setae at anterior and posterior margins of pronotum shorter, finer, more dense and conspicuous; pronotum length to width ratio slightly larger (PL/PW = 1.37); length, 6–16 mm . . . . . ***M. minor* (Linnaeus)**

— Lateral pronotal calluses wider, distinctly arcuate (Fig. 3B); bands of light-colored setae at anterior and posterior margins of pronotum sparse, not conspicuous; pronotum length to width ratio slightly smaller (PL/PW = 1.24); length, 8.5–11 mm . . . . . ***M. eburneus* Linsley**

Discussion

Molorchus minor specimens were collected all from the same locality over two years, indicating that this is likely an established population and not simply a trap interception. This was corroborated by the rearing of infested host material showing that breeding was occurring in the environment with development to adults within open grown trees.

We feel that *M. minor* poses little threat to US forests economically due to its biology targeting dead branches. In northeastern US forests, *P. abies* is most commonly found in plantations, and is used for pulpwood, construction, furniture, and in musical instruments. It is a very common ornamental tree and is also frequently grown in Christmas tree farms. *Molorchus minor* could potentially be moved around through domestic trade of nursery stock. The reared spruce tree from which *M. minor* emerged was severely stressed and dying. Several other species of secondary phytophagous and predatory beetles also emerged from the same chamber of dead *Picea abies* branches that produced *M. minor*, including *Anthaxia quercata* (Fabricius) (Buprestidae), *Ernobius mollis* (Linnaeus) (Ptinidae), *Placopterus thoracicus* (Olivier), and *Madoniella dislocata* (Say) (Cleridae).

Two recorded hosts are native to North America, *Pseudotsuga menziesii* and *Pinus strobus*, the latter of which is common, widespread, and economically important in the northeastern United States. Now that *M. minor* is established in Massachusetts, we may expect that it could utilize *Pinus strobus* and/or some of the native spruces in the region as hosts, including *Picea glauca* (Moench) Voss, *Picea mariana* (Mill.) Britton, Sterns & Poggenburg, and *Picea rubens* Sarg.

This marks the second occurrence of *M. minor* being accidentally introduced outside of its native realm, as it was reported in Brazil from two female specimens collected in the wild in 2013 (Martins et al. 2015). An additional report of a single male specimen inside a warehouse in Spain (the species was not previously known from the Iberian Peninsula) on imported coniferous wood pallets (Franco et al. 2020) was likely an interception but suggests a possible pathway of introduction. It has been intercepted at ports of entry in Australia (Biosecurity Australia 2006). In North America, *M. minor* has been reared in quarantine out of intercepted spruce bolts used as dunnage in shipments of granite from Norway (Humble and Allen 2001).

Acknowledgments

We would like to thank Gino Nearns (APHIS-PPQ) for identification assistance, Matt Gimmel (Santa Barbara Museum of Natural History) for providing a loan of specimens of *M. eburneus* for imaging, and Nicole Keleher for organizing and executing EDRR trapping in Massachusetts. We would also like to thank E. Richard Hoebeke and H. E. James Hammond for their thoughtful and thorough reviews which improved the manuscript.

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Received June 28, 2024; accepted September 24, 2024.
Review editor Kyle Schnepp.