

First Report of *Euwallacea nr. fornicatus* (Coleoptera: Curculionidae) in Mexico

Authors: Clemente De Jesus García-Avila, Francisco Javier Trujillo-Arriaga, José Abel López-Buenfil, Rigoberto González-Gómez, Daniel Carrillo, et. al.

Source: Florida Entomologist, 99(3) : 555-556

Published By: Florida Entomological Society

URL: <https://doi.org/10.1653/024.099.0335>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-o-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

First report of *Euwallacea* nr. *forficatus* (Coleoptera: Curculionidae) in Mexico

Clemente De Jesús García-Avila^{1,*}, Francisco Javier Trujillo-Arriaga², José Abel López-Buenfil¹, Rigoberto González-Gómez¹, Daniel Carrillo³, Luisa F. Cruz³, Isabel Ruiz-Galván¹, Andrés Quezada-Salinas¹, and Nallely Acevedo-Reyes²

Two undescribed species of beetles in the genus *Euwallacea* (Coleoptera: Curculionidae: Scolytinae), the polyphagous shot hole borer and the kuroshio shot hole borer, have been reported in California, attacking more than 300 host plants in 58 plant families; agricultural crops include avocado (*Persea americana* Mill.; Lauraceae), orange (*Citrus sinensis* [L.] Osbeck; Rutaceae), loquat (*Eriobotrya japonica* Lindley; Rosaceae), macadamia (*Macadamia integrifolia* Maiden & Betche; Proteaceae), olive (*Olea europaea* L.; Oleaceae), pear (*Prunus persica* [L.] Stokes; Rosaceae), and grapes (*Vitis vinifera* L.; Vitaceae) (Eskalen 2013, 2016). Polyphagous shot hole borer and kuroshio shot hole borer are part of a group of cryptic species that correspond morphologically to the Asian ambrosia beetle *Euwallacea forficatus* (Eichhof) (O'Donnell et al. 2015). Other species of the complex have been introduced into Florida (Carrillo et al. 2012), Costa Rica and Panama (Atkinson 2015; CABI 2015), and Israel (Mendel et al. 2014), the latter matching polyphagous shot hole borer from California. The species within this complex have not received new species names and are treated here as *Euwallacea* nr. *forficatus*. In 2003, polyphagous shot hole borer was collected for the first time in southern California (Rabaglia et al. 2006) but has spread into at least the following counties: Los Angeles, Orange, San Bernardino, and Riverside. More recently, kuroshio shot hole borer was found in San Diego County (Eskalen 2014). Polyphagous shot hole borer and kuroshio shot hole borer attack the main trunk and branches larger than 2.5 cm diameter. The symptoms vary by host plant species (Mendel et al. 2014); in avocado, "sugar volcanos" surround the beetle entry holes (Coleman et al. 2013) and branches can break due to weakness caused by the beetle galleries (Walgama 2014).

Euwallacea species form symbiotic associations with plant pathogenic fungi, including *Fusarium euwallaceae*, *Graphium euwallaceae*, *Acremonium pembeum* for polyphagous shot hole borer, and *Fusarium* sp. and *Graphium* sp. for kuroshio shot hole borer (Eskalen 2013; Freeman et al. 2013; Lynch et al. 2016; O'Donnell et al. 2015). Female beetles transport fungal spores from their natal host in specialized structures called mycangia. As females construct breeding galleries, they inoculate the host with fungi, which results in wilting and in some cases tree death, a disease known as "fusarium dieback" in avocado and other hosts (Eskalen 2013; Freeman et al. 2013). Polyphagous shot

hole borer has been reported to cause up to 60% reduction in avocado production in Israel (Freeman et al. 2014).

Euwallacea species are regulated pests in Mexico (International Plant Protection Convention 2011). The introduction and spread of this pest represents a significant threat for trees in urban landscapes and natural, agricultural, and riparian areas. Moreover, it poses a risk for the 176,000 ha of avocado grown in Mexico, with an economic value of 1.2 billion US dollars. In 2013, the "Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria, Dirección General de Sanidad Vegetal (DGSV)" began surveying commercial avocado orchards and high risk areas (ports, airports, and international borders) using Lindgren traps baited with querciverol and serviced weekly (Carrillo et al. 2015). Visual surveys for damage and symptoms of ambrosia beetle infestations in areas with potential hosts on roadways or tourist areas were also conducted weekly. Surveys have been implemented in the states of Baja California, Colima, Guanajuato, Guerrero, Hidalgo, Jalisco, Estado de México, Michoacán, Morelos, Nayarit, Nuevo León, Puebla, Querétaro, San Luis Potosí, Sonora, Tamaulipas, and Veracruz.

During 2015, an ambrosia beetle was captured in a trap located in Tijuana, Baja California (32.536667°N, 117.076944°W; 128 m asl), 200 m from the U.S. border in a tourist area. The specimen (Fig. 1) was preserved in 70% ethanol and sent to the "Laboratorio de Entomología y Acarología del Centro Nacional de Referencia Fitosanitaria," where it was identified as *Euwallacea* nr. *forficatus* based on morphological characters using the taxonomic keys by Wood (1982) and Rabaglia et al. (2006), and deposited in the DGSV Entomological Collection. An additional sample was sent to the University of Florida/Institute of Food and Agricultural Sciences/Tropical Fruit Entomology Laboratory for molecular identification. Total genomic DNA was extracted from an individual beetle and portions of the cytochrome oxidase subunit I and the nuclear ribosomal 28S D2/D3 regions were amplified using oligonucleotide primers LCO1490 and HCO2198, and D2F1 and D3R2 (Folmer et al. 1994; Jordal et al. 2008). The National Center for Biotechnology Information's Basic Local Alignment Search Tool (BLAST) was used to identify the nucleotide sequences resulting in 100% match with *Euwallacea* sp. # 5 KO-2014 strain PN Sy reported by O'Donnell et al. (2015), which is a population from San Diego, California, referred to as kuroshio shot hole borer ("KSHB") by Eskalen (2016).

¹Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria. Unidad Integral de Diagnóstico, Servicios y Constatación, Tecámac, Estado de México 55740, México; E-mail: clemente.garcia@senasica.gob.mx (C. J. G.-A.), abel.lopez@senasica.gob.mx (J. A. L.-B.), dgsv.iica027@senasica.gob.mx (R. G.-G.), ruizg.isabel@gmail.com (I. R.-G.), andresqs@colpos.mx (A. Q.-S.),

²Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria. Dirección General, Coyoacán, Distrito Federal 04530, México; E-mail: trujillo@senasica.gob.mx (F. J. T.-A.), nallely.acevedo@hotmail.com (N. A.-R.)

³University of Florida, IFAS-Tropical Research and Education Center, Homestead, Florida 33031, USA; E-mail: dancar@ufl.edu (D. C.), luisafacruz@ufl.edu (L. F. C.)

*Corresponding author; E-mail: clemente.garcia@senasica.gob.mx (C. J. G.-A.)

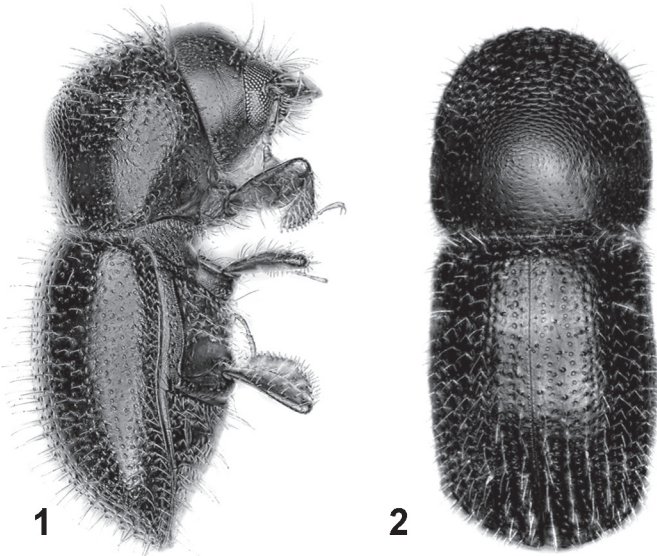


Fig. 1. Lateral (left) and dorsal (right) view of *Euwallacea nr. fornicatus* detected in Tijuana, Mexico.

This is the first collection of a *Euwallacea nr. fornicatus* in Mexico. Potential hosts are present in the 1,600 ha surrounding the detection site, including maple, avocado, ash, guava, castor bean, orange castor bean, orange, olive, Washingtonia palm, Brazilian pepper tree, and grapes, but none showed evidence of damage or symptoms of ambrosia beetle infestation.

Summary

The 2 cryptic species of *Euwallacea nr. fornicatus* (Coleoptera: Curculionidae: Scolytinae) have more than 300 known hosts, of which avocado is the most important. Fusarium dieback, the fungal disease associated with these beetles, has killed some host plant species in Israel and the USA. Kuroshio shot hole borer, one of the 2 cryptic species, is reported for the first time in Baja California, Mexico, and represents a new threat to avocado and other potential hosts in urban and natural areas.

Key Words: cryptic species; Kuroshio shoot hole borer; avocado

Sumario

Las 2 especies crípticas de *Euwallacea nr. fornicatus* (Coleoptera: Curculionidae: Scolytinae), tienen más de 300 hospederos conocidos, de los cuales el aguacate es el más importante. La muerte regresiva por *Fusarium*, una enfermedad de un hongo asociada con estos escarabajos, ha ocasionado la muerte de algunos de las plantas hospederas en Israel y los EE.UU. El barrenador de agujero del brote Kuroshio, una de las especies crípticas, se reporta por primera vez en Baja California, México y representa una amenaza para el aguacate y otros hospederos potenciales en áreas urbanas y naturales.

Palabras Clave: especies crípticas; barrenador agujero del brote Kuroshio; aguacate

References Cited

Atkinson RT. 2015. *Euwallacea fornicatus* (Eichhoff 1868). Bark and Ambrosia Beetles of North and Central America. On-line via: http://www.barkbeetles.info/regional_chklist_target_species.php?lookUp=1964 (last accessed 25 May 2016).

- CABI 2015. *Euwallacea fornicatus* (tea shot-hole borer). Invasive Species Compendium. On-line via: <http://www.cabi.org/isc/datasheet/57163> (last accessed 25 May 2016).
- Carrillo D, Duncan R, Peña JE. 2012. Ambrosia beetles (Curculionidae: Scolytinae) that breed in avocado wood in Florida. *Florida Entomologist* 95: 573–579.
- Carrillo D, Narvaez T, Cossé AA, Stouthamer R, Cooperband M. 2015. Attraction of *Euwallacea nr. fornicatus* (Coleoptera: Curculionidae: Scolytinae) to lures containing quercivorol. *Florida Entomologist* 98: 780–782.
- Coleman TW, Eskalen A, Stouthamer R. 2013. New pest complex in California: The polyphagous shot hole borer, *Euwallacea sp.*, and fusarium dieback, *Fusarium euwallaceae*. United States Department of Agriculture. On-line via: https://cirs.ucr.edu/pdf/pest_alert_pshb_and_fd.pdf (last accessed 25 May 2016).
- Eskalen A. 2013. Host range of fusarium dieback and its ambrosia beetle (Coleoptera: Scolytinae) vector in southern California. *Plant Disease* 97: 938–951.
- Eskalen A. 2014. Polyphagous shot hole borer (*Euwallacea sp.*) and fusarium dieback (*Fusarium sp.*). University of California, Riverside. Center for Invasive Species Research. On-line: http://cirs.ucr.edu/polyphagous_shot_hole_borer.html (last accessed Nov 2015).
- Eskalen A. 2016. Fusarium Dieback / PSHB & KSHB Distribution Map. University of California, Riverside On-line via: <http://eskalenlab.ucr.edu/distribution.html> (last accessed 25 May 2016).
- Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R. 1994. DNA primers for amplification of mitochondrial cytochrome C oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* 3: 294–299.
- Freeman S, Sharon M, Maymon M, Mendel Z, Protasov A, Aoki T, Eskalen A, O'Donnell K. 2013. *Fusarium euwallaceae* sp. nov.—a symbiotic fungus of *Euwallacea sp.*, an invasive ambrosia beetle in Israel and California. *Mycologia* 105: 1595–1606.
- Freeman S, Sharon M, Protasov A, Margalit O, Mohotti K, O'Donnell K, Mendel Z. 2014. Occurrence of *Fusarium euwallaceae* and *Graphium sp.* symbiotic fungi within their host trees and their association with their symbiotic beetle, *Euwallacea nr. fornicatus*. Topic: Phylogeny, Phylogeography, Biogeography and Epidemiology, p. 51 *In Academic and Technical Workshop on Xyleborus glabratus and Euwallacea sp.* Simposio Internacional sobre manejo y control de plagas cuarentenarias en el aguacatero. Xalapa, Veracruz, Mexico, Nov 3–7.
- International Plant Protection Convention (CIPF). 2011. List of regulated pests (Art. VII.2i). On-line via: https://www.ippc.int/en/IPP/Es/default_es.jsp?language=es (last accessed 27 Nov 2015).
- Jordal B, Gillespie JJ, Cognato AI. 2008. Secondary structure alignment and direct optimization of 28S rDNA sequences provide limited phylogenetic resolution in bark and ambrosia beetles (Curculionidae: Scolytinae). *Zoologica Scripta* 37: 43–56.
- Lynch SC, Twizeyimana M, Mayorquin JS, Wang DH, Na F, Kayim M, Kasson MT, Thu PQ, Bateman C, Rugman-Jones P, Hucr J, Stouthamer R, Eskalen A. 2016. Identification, pathogenicity and abundance of *Paracremonium pembeum* sp. nov. and *Graphium euwallaceae* sp. nov.—two newly discovered mycangial associates of the polyphagous shot hole borer (*Euwallacea sp.*) in California. *Mycologia* DOI:10.3852/15-1063.
- Mendel Z, Portasov A, Margalit O, Sharon M, Maoz Y, O'Donnell K, Freeman S. 2014. Tree colonization behavior as a basis for management of *Euwallacea nr. fornicatus* populations in avocado plantations and ornamentals. Topic: Phylogeny, Phylogeography, Biogeography and Epidemiology, p. 51 *In Academic and Technical Workshop on Xyleborus glabratus and Euwallacea sp.* Simposio Internacional sobre manejo y control de plagas cuarentenarias en el aguacatero. Xalapa, Veracruz, México, Nov 3–7.
- O'Donnell K, Sink S, Ran LHR, Hulcr J, Kasson MT, Ploetz CR, Konkol JL, Ploetz JN, Carrillo D, Campbell A, Duncan, ER, Liyanage NHP, Eskalen A, Na F, David M, Geiser MD, Bateman C, Freeman S, Mendel Z, Sharon M, Aoki T, Cossé AA, Rooney PA. 2015. Discordant phylogenies suggest repeated host shifts in the *Fusarium–Euwallacea* ambrosia beetle mutualism. *Fungal Genetics and Biology* 82: 277–290.
- Rabaglia RJ, Dole SA, Cognato A. 2006. Review of American Xyleborina (Coleoptera: Curculionidae: Scolytinae) occurring north of Mexico, with an illustrated key. *Annals of the Entomological Society of America* 99: 1034–1055.
- Walgama S. 2014. Symbiotic relationship in the tea ecosystem: tea shot-hole borer of Sri Lanka. Topic: Phylogeny, Phylogeography, Biogeography and Epidemiology, p. 51 *In Academic and Technical Workshop on Xyleborus glabratus and Euwallacea sp.* Simposio Internacional sobre manejo y control de plagas cuarentenarias en el aguacatero. Xalapa, Veracruz, Mexico, Nov 3–7.
- Wood SL. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph. *Great Basin Naturalist Memoirs* 6: 1–1356.