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

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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).

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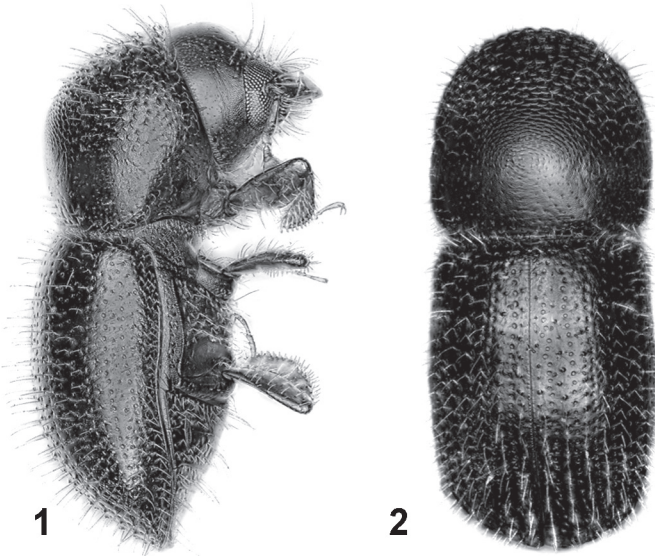


Fig. 1. Lateral (left) and dorsal (right) view of *Euwallacea* nr. *fornicatus* detected in Tijuana, Mexico.

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 mas 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

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