New Records and Accounts

Occurrence of the Ambrosia Beetle *Xyleborinus exiguus* (Walker) (Curculionidae: Scolytinae: Xyleborini) on the Island of O‘ahu, Hawai‘i, USA

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We report the first record of an ambrosia beetle, *Xyleborinus exiguus* (Walker 1859) (Curculionidae: Scolytinae: Xyleborini) in the USA found on the island of O‘ahu, Hawai‘i. Twenty-five specimens are vouchered in the University of Hawai‘i Insect Museum, Honolulu, Hawai‘i (15) and The A.J. Cook Arthropod Research Collection, Michigan State University, East Lansing, Michigan (10). They were labeled with the following collection details: USA: Hawai‘i, O‘ahu, Kahana Bay, 21.5573N, –157.8783E, 15m, ex. *Schefflera actinophylla* branches, 24.vii.2018, D. Honsberger Coll. Additional collections from the same host species and location occurred periodically from 2018 to 2023 and often produced *X. exiguus*, occasionally in large numbers. Immature stages were also found in the wood upon dissection.

Xyleborine ambrosia beetles include the most invasive scolytine species; approximately 45 species have been introduced worldwide (Osborn et al. 2023). Currently 12 suspected human-introduced species have been documented in the Hawaiian Islands: *Euwallacea fornicatus* (Eichhoff, 1868), *E. perbrevis* (Schedl, 1951), *E. interjectus* (Blandford, 1894), *E. similis* (Ferrari, 1867), *Xyleborinus andrewesi* (Blandford, 1896), *X. exiguus, X. saxesenii* (Ratzeburg, 1837), *Xyleborus spinulosus* Blandford, 1898, *Xylosandrus compactus* (Eichhoff ,1875), *X. crassiusculus* (Motschulsky, 1866), *X. germanus* (Blandford, 1894), and *X. morigerus* (Blandford, 1894) (Samuelson 1981, Cognato and Rubinoff 2008, Bernard et al. 2018, Rugman-Jones et al. 2020). In addition, the global species, *Xyleborus affinis* Eichhoff, 1868, *X. ferrugineus* (Fabricius, 1801), and *X. perforans* (Wollaston, 1857) occur in the Hawaiian Islands but it is less certain that they arrived through human activities (Gohli et al. 2016). A radiation of endemic *Xyleborus* occur in the Hawaiian Islands which began approximately 13 million years ago and resulted in 21 known species which almost exclusively utilize native trees as hosts (Samuelson 1981, Cognato et al. 2018).

Xyleborinus exiguus is likely native from China to India east to the Philippines, and south through Malaysia and New

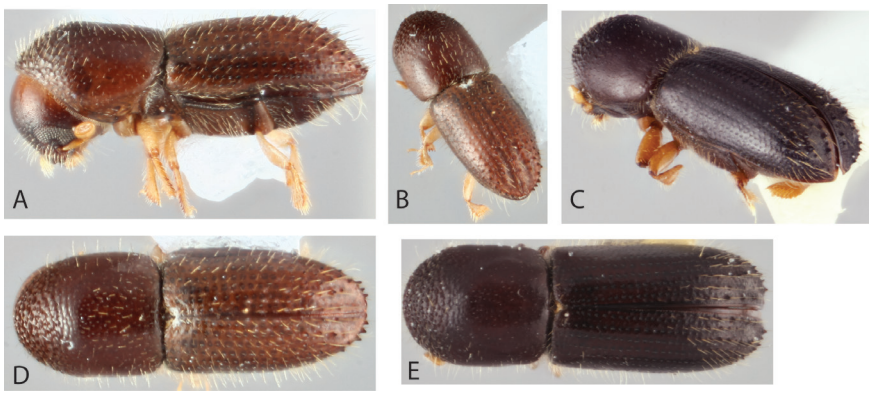

Figure 1. Habitus of *Xyleborinus exiguus* female, from Hawai'i, A. lateral, B. declivity, D. dorsal; and *X. saxesenii* female, C. declivity, E. dorsal.

Guinea and Oceania including Mariana Is., Niue I., Samoa, Solomon Is., and Tahiti (Smith et al. 2020). It has been introduced to West Africa (Beaver 2005) and Central America (Kirkendall and Ødegaard 2007). The beetle is considered polyphagous and has been collected from a wide range of plant families, such as Combretaceae, Euphorbiaceae, and Moraceae (Ohno 1990), however this is the first host record for octopus tree (*Schefflera actinophylla* (Endl.) Harms) (Araliaceae). It is not known to transmit plant pathogens.

Xyleborinus exiguus is morphologically similar to *X. saxesenii* (Fig. 1). It is distinguished by its smaller size (< 2.0 mm), with denticles on interstriae 3 larger than those on interstriae 1 and the elytral apex with three (usually) pairs of large flattened tubercles. We further confirmed the species identification with partial COI and CAD DNA sequences obtained from one specimen (DNA voucher SAX538) following the protocol of Smith and Cognato (2022). These sequences along with published *Xyleborinus* spp. sequences (Table 1) were used in a parsimony analysis (Swofford 2002). An exhaustive search resulted in five most parsimonious trees that differed only in the arrangement of the individuals from Hawai'i and Papua New Guinea (PNG) (Fig. 2). Two well-supported clades were found: one included specimens from PNG and Hawai'i, which have dull elytral declivities and slightly smaller sharp granules and the other clade included specimens from Vietnam and Africa, which have shiny elytral declivities and larger sharp granules. Individuals of the PNG + Hawai'i clade appear most similar to the type specimen of *X. exiguus* (as figured in Hulcr and Cognato 2013 and Eliasson and Jordal 2021). The COI and CAD "p" sequence differences between these clades ranged 12–13% and 3.7–4.7% respectively. These values exceed the 10% (COI) and 2% (CAD) guidelines for recognizing Xyleborini species boundaries (Cognato et al. 2020). Evidence of reciprocal well-supported clades, high sequence differences, and associated morphological diagnostic characters suggests these clades are separate species. Evaluation of morphological variation observed across the geographic range of *X. exiguus* (Hulcr and Cognato 2013) in light of these results is necessary before further taxonomic action is taken.

It is likely that *X. exiguus* is established on O'ahu given that it has been consis-

Table 1. GenBank numbers. N/A = not available

Species	Locality	COI	CAD
Xyleborinus andrewesi	India	MN620011	MN620281
Xyleborinus saxesenii	Vietnam	MN620028	MN620296
Xyleborinus exiguus	Cameroon	MW617412	MW656531
Xyleborinus exiguus	Gabon	MW617391	MW656510
Xyleborinus exiguus	Papua New Guinea	MW617392	MW656511
Xyleborinus exiguus	Papua New Guinea	HM064109	N/A
Xyleborinus exiguus	Papua New Guinea	MN620021	MN620288
Xyleborinus exiguus	Vietnam	MN620022	MN620289
Xyleborinus exiguus	USA, Hawai‘i	OQ589851	OQ594825

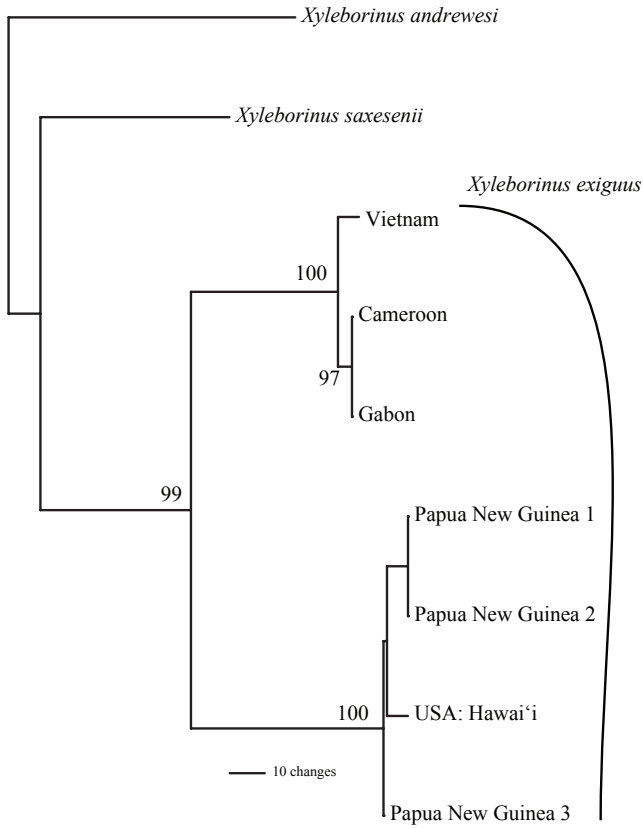

Figure 2. One of five most parsimonious trees found in an exhaustive search. The clade comprising individuals from Hawai‘i and Papua New Guinea was unresolved in the strict consensus of the five most parsimonious trees. Numbers at nodes are bootstrap values (>90%) determined with 500 pseudo-replicates using branch and bound searches.

tently collected since 2018 from the same locality. The extent of its distribution and host use on the island is currently unknown. It was likely introduced within the past 11 years given it was not found in periodic surveys for scolytines on O'ahu and other islands (Cognato and Rubinoff 2008; Gillett et al. 2019a, 2019b) or in the scolytine collections in the University of Hawai'i Insect Museum and Bishop Museum (AIC and SMS, personal observations). The collection of *X. exiguus* and other non-endemic xyleborines from octopus tree (Honsberger and Wright 2022) causes concern of the possibility of overlap in host use with endemic *Xyleborus* on other aromatic species of Araliaceae (such as, *Cheirodendron trigynum* (Gaudich.) Heller) which are the hosts utilized by many of the endemic species (Samuelson 1981, Gillett et al. 2020). Octopus tree, which was introduced to the Hawaiian Islands circa 1900 (Little and Skolmen 1989), has not been recorded as a host for the endemic *Xyleborus* species thus direct interaction with non-endemic xyleborines on this tree is not expected. It is of no surprise that *X. exiguus* was found in Hawai'i given the beetle's extensive distribution; however, it is a little surprising that it was not previously recorded or introduced decades earlier like the other adventive xyleborine ambrosia beetles (Cognato and Rubinoff 2008).

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