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FIRST RECORD OF *RETICULITERMES FLAVIPES* (ISOPTERA:
RHINOTERMITIDAE) FROM TERCEIRA ISLAND (AZORES, PORTUGAL)

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Reticulitermes Holmgren is a Holarctic genus of subterranean termites indigenous to North America, the Mediterranean and Black Sea regions, and eastern Asia (Emerson 1971). It is unequivocally the most important economic termite genus to North America. Although *Reticulitermes* spp. constitute the dominant complex of subterranean termite pests of structures in most of these areas (Edwards & Mill 1986), records of emigrations to non-indigenous locations are remarkably less common compared to pest species of *Coptotermes* Wasmann and *Cryptotermes* Banks (Gay 1967). The involvement of military operations as a progenitor for anthropogenic sourcing of exotic insect establishments is well-known. For example, the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, was brought to the continental USA after World War II via military retrograde from the Pacific Theater (La Fage 1987), and associated with military ports receiving and storing equipment (Spink 1967; Scott & Scott 1996; Austin 2006). Another important subterranean species, *Reticulitermes flavipes* (Kollar), has been identified in several areas throughout the world (Austin et al. 2005a, 2005b; Su et al. 2006), where introductions to both hemispheres have been reported. Due to its establishment capability, *R. flavipes* occupies the largest geographic distribution of any subterranean termite within the genus. Establishment and subsequent spread of *R. flavipes* throughout the Palearctic—recently confirmed by its establishment in northern Italy—also implicates human aided dispersal (Ghesini et al. 2010; Ghesini et al. 2011) from areas where

earlier introductions are known (e.g., southwestern France and northern Germany).

We herein report the discovery of established *R. flavipes* populations on Terceira Island, Azores, Portugal (Fig. 1A, 1B). The sample was subjected to mtDNA testing according to methods outlined in Austin et al. (2005a), and the GenBank submission is available as accession number DQ001964. The samples were provided as part of an ongoing survey of the phylogeography of *Reticulitermes* throughout the world. Samples were procured by PAVB and TGM near the Lajes Air Force Base (38.75413-27.06872) (see Fig. 1C). The samples were vouchered in RHS's collection at the University of Florida, Fort Lauderdale Research and Education Center, Fort Lauderdale, Florida, as (EUR22). The mtDNA 16S rRNA haplotype was identified by our database of termite sequences as haplotype LL, an identified haplotype that has been previously described as an eastern nearctic introduction to Sacramento, California (on McClellan Air Force Base) (Austin et al. 2005a). Also this haplotype has been identified from Key West, Florida from the Naval Air Station Key West (NAS Key West, Florida sample number 2290) (Szalanski et al. 2008). This particular group of termites must be relatively adept to establishment, and the influence of human aided dispersal (particularly from military transport opportunities) is clearly implicated.

This is the second subterranean termite to be established in Azores, after the European subterranean termite of the same genus, *Reticulitermes grassei* Clément in Faial Island (Nunes & Nobre



Fig. 1. (A) Map of the Azores; (B) Location of Lajes Field, Azores – Portugal, as denoted by “A”, and (C) an aerial view of Lajes AFB with *Reticulitermes flavipes* collection site (38.75413–27.06872) denoted by “.” on the island of Terceira, Azores.

2007). In both cases the distribution is quite restricted, the European species occurring only in the small town of Horta and the American species occurring in a small section of the US military base at Praia da Vitória. The distribution of *R. flavipes* is not only restricted to locations near the houses, as some specimens have been found almost 100 m away from houses associated with dead tree trunks.

It is clear that *R. flavipes* has an establishment capability unlike many of its endemic congeners, and thus its movement to new global regions, often facilitated by anthropogenic sources, will only increase in frequency. In the United States, recent records of this have been documented in

California, Nevada, Utah, Arizona (Austin et al. 2005a), Oregon (McKern et al. 2006), far west of the established, endemic range of *R. flavipes*, which occupies most of the eastern half of the United States. The trajectory of introduction of *R. flavipes* to Terceira Island, in the Azores, Portugal may have its origins from the US, facilitated by military shipping and transport, but it may well also be from a European introduction of a yet unidentified population (populations of *R. flavipes* that may reside elsewhere in Europe or in other ‘unidentified’ locations) that has established there (Austin et al. 2005b).

The collection from the Terceira Island site is from the location of a US military base (“Bairro de Santa Rita”). The historical involvement of the US military in the Azores is well known. In 1944, American forces constructed a small and short-lived air base on the island of Santa Maria. In 1945, a new base was constructed on the island of Terceira and is currently known as Lajes Field (Fig. 1C), home of the 65th Air Base Wing and is presently the only U.S. military organization in the Azores. The wing serves as the U.S. Air Force’s pre-eminent, en-route, expeditionary-focused, combat support organization, whose mission is to enable expeditionary movement of war fighters, warplanes and global communications to Combatant Commanders, to support Joint, Coalition and NATO operations, and to promote regional partnerships (Anonymous 2011).

Termites collected from Terceira Island, Azores were acquired by RHS on 14 September 2010 near Lajes AFB (“Bairro de Santa Rita”) (38.75413, -27.06872 at 88 masl) from pressboard in a yard. Morphological measurements were taken in accordance with Scheffrahn & Su (1994) and compared with voucher specimens of workers of *Reticulitermes* spp. from Florida, Texas, California, and France. However, because morphological measurements of *Reticulitermes* spp are often misleading, a genetic identification was performed to confirm the species by mtDNA sequencing. At present, it is unclear what the swarming dates for *R. flavipes* are on Terceira Island, but it would not be unprecedented that they are somewhat synchronous with their congeners from North America, which swarm from late February through May.

SUMMARY

Reticulitermes flavipes, a Holarctic pestiferous subterranean termite species, particularly to structures and non-indigenous trees, is reported for the first time from Terceira Island, Azores, Portugal. The establishment of *R. flavipes* on Terceira Island likely represents more than one anthropogenic introduction with a high probability of military involvement.

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