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Micromalthus debilis LeConte, 1878 (Coleoptera: Micromalthidae), an American wood-boring beetle new to Italy

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Abstract

Micromalthus debilis LeConte, 1878, an alien wood-boring beetle, is recorded for the first time in Italy and is recognized as a pest on wood structures of historical buildings in Europe.

Key words: Archostemata, Mediterranean Basin, Trieste, invasive, origin, timber, conifer, transport

Introduction

Globalization and international trade are causing important movements of fauna with a consequent increase in the rate of introduction of exotic species, including potential pests (Perrings *et al.* 2005; Meyerson & Mooney 2007; Hulme 2009). Among alien species, wood-boring and wood-associated beetles are widely introduced, and in many cases established, in the Euro-Mediterranean countries (Kirkendall & Faccoli 2010; Marini *et al.* 2011; Rassati *et al.* 2016). Alien beetle establishment is imputable to suitable climate, ecological conditions and woody plant diversity available in European habitats (Rassati *et al.* 2016). The aim of this paper is to document the first population of the Nearctic *Micromalthus debilis* LeConte, 1878 (Coleoptera: Micromalthidae) found in Italy, and report the first record of this species developing and damaging the wooden infrastructure of a historic building in Europe.

Material and methods

On August 26th 2017, one insect sample, containing several adults and larvae, was sent by a private citizen to the Museum of Natural History of Trieste (North-East Italy) for identification. The samples were initially identified by the second author and then confirmed by the first as *Micromalthus debilis* (125 adults and 32 larvae) (Fig. 1) and *Pselactus spadix* (Herbst, 1795) (Coleoptera: Curculionidae) (5 adults). All the specimens were collected inside a historical building in downtown Trieste (via Santi Martiri 6; 45.646548°N, 13.765190°E), where they were falling from the ceiling in conspicuous numbers. This material is deposited in the collection of the Museum of Natural History of Trieste, Italy.

Systematics and Biology

Micromalthus debilis is the only species of family Micromalthidae (Archostemata) (Lawrence & Newton 1995; Beutel & Haas 2000; Beutel & Hörnschemeyer 2002). The unique and complex life cycle of this species, involving pedogenesis and several types of parthenogenesis (Barber 1913a, b; Pringle 1938; Scott 1936, 1938, 1941), has been recently revised by Pollock & Normark (2002) and Perotti *et al.* (2016). *Micromalthus debilis* represents a "living fossil" (Hörnschemeyer *et al.* 2010), with records from Cretaceous Lebanese amber (Crowson 1981), Eocene Baltic and Dominican amber (Lawrence & Newton, 1995), and Mexican amber (Chiapas) (Rozen 1971).

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Micromalthus debilis has wood-boring larvae, developing in and feeding mainly on moist and decaying wood, frequently in association with brown or white rot fungi infections (Heming 2003).

This species, most probably primarily adapted to gymnosperms as recorded in other Archostemata beetles (Friedrich *et al*. 2009), is a polyphagous insect able to develop on wood of both conifers such as *Pinus*, *Tsuga* (APHIS 2010), *Pseudotsuga* (Mudge *et al.* 2001), and broadleaf trees such as *Quercus*, *Castanea* (Arnett 1985; Evans 2014), *Acacia* and *Eucalyptus* (Lawrence 1991). Up to now, *M. debilis* has been recognized as a minor pest on timber of wood buildings, telephone poles, railroad ties, bridges, fences and woody structures exposed to humid conditions in general (Craighead 1950; Suzuki 1999; Mudge *et al*. 2001; Philips & Young 2001).

FIGURE 1. *Micromalthus debilis* LeConte, 1878, adult: dorsal view (left), lateral view (right).

Distribution

Apparently native to the eastern United States (Lawrence 1982), *M. debilis* has been found also in South Africa (Paterson 1938; Pringle 1938), Hawaii (Swezey 1940), Cuba and Brazil (Silvestri 1941), Hong Kong (Marshall & Thornton 1963), British Columbia, New Mexico, Florida, Gibraltar (Lawrence 1991) and most recently in Japan (Suzuki 1999), Austria (Jäch & Komarek 2000), Belize (Philips 2001), Oregon (Mudge *et al.* 2001), and Alabama (King & Brattain 2012) (Fig. 2). This unusual distribution pattern outside the native range is apparently attributable to passive dispersal by humans, connected to the timber trade (Lawrence 1982, 1991; Lawrence & Newton 1995; Pollock & Normark 2002). The larvae, associated with and feeding on moist and decaying wood (Craighead 1950; Normark 2013), have been most probably spread worldwide with the same dynamics occurring in other wood-bor-

ing beetles, such as Buprestidae, Cerambycidae, Curculionidae: Scolytinae and Platypodinae (Koch *et al*. 2012; Hu *et al.* 2013; Gohli *et al.* 2016; Rassati *et al*. 2018). Except the established populations occurring in western North America and South Africa (Pringle 1938; Paterson 1938), all other records are scattered and limited to a reduced number of adult specimens (Philips 2001) or larvae (Marshall & Thornton 1963), suggesting that this species has probably never completely succeeded in establishing itself in the new habitats.

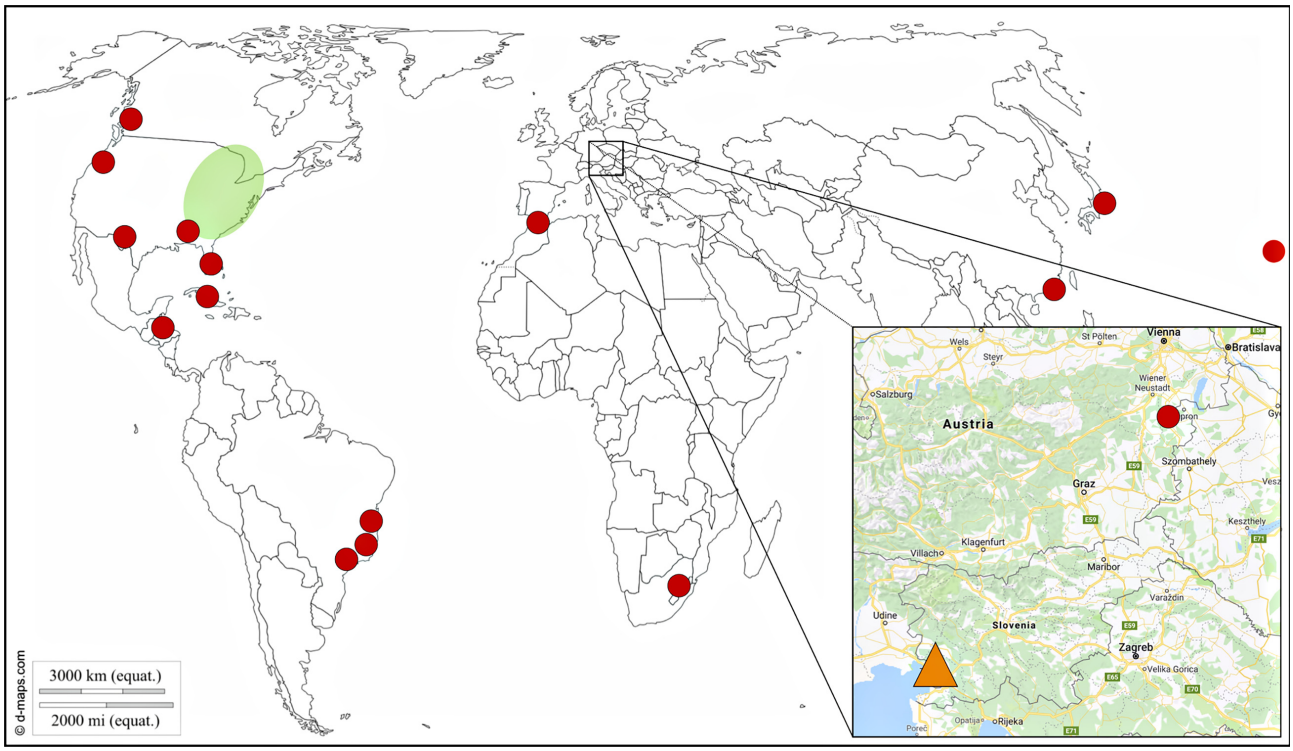

FIGURE 2. *Micromalthus debilis* LeConte, 1878, distribution. Green ellipse: area of origin; red dots: record in the literature; orange triangle: first breeding record in Europe (Trieste, Italy).

Discussion

Here we present the first record of an established population of *M. debilis* in Europe. Although two findings of *M. debilis* are known in the Western Palearctic region, in Gibraltar and Austria (Lawrence 1991; Jäch & Komarek 2000; Löbl 2003), none of them mentions a reproductively active community; in fact Jäch & Komarek (2000) specifically refer to a single specimen collected while flying, whereas no information about number of collected specimens or collecting methods is given for the Gibraltar material nor the source of this record (Lawrence 1991).

Micromalthus debilis is unequivocally recognized as a minor pest in wooden dwellings in its native area. However, the true extent of the damage that it is capable of causing in different environments is still unknown: only Suzuki (1999) extensively documented the effects caused by *M. debilis* to the main structure of a traditional wood house in Kawagoe (Japan). The situation encountered in Trieste was similar in some respects to what was observed by Suzuki; the larvae were developing in the wood beams supporting the roof of a historical building, although the presence of this species was restricted to a humid spot where water infiltrated the roof, causing partial rotting of the wood structure. The building in which *M. debilis* was found was built between 1834 and 1836; in absence of information about maintenance work done on the building between the nineteenth and twentieth centuries it is assumed that the wooden structure of the building is still original. The occurrence of such a large number of *M. debilis* individuals infiltrating the building was apparently stimulated by the intense rains in the previous weeks that disturbed the population living in the roof. Those beetles were part of an established population, as suggested by the presence of several larvae at different stages and a large number of adults, which were developing in the wooden roof structures, already weakened and rotted by water infiltration. This hypothesis is further supported by the presence of the wood-boring *Pselactus spadix*, a species that develops in similar conditions and that is widely recognized as a pest of timber (both hardwood and softwood) in both larval and adult life stages (Overing *et al*. 2003). Collecting

circumstances suggest that *M. debilis* could be a pest even in Europe, especially regarding historical building and wood infrastructures.

Since after the finding of *M. debilis* the infested building has undergone a complete restoration, the authors hypothesize that the colony has been destroyed; however, no specific measure based on insecticides has been made. Notably no information is available in the literature about the control of this species.

The presence of *M. debilis* in Trieste (Italy) and Wiesen (Austria) may suggest a remote introduction of this species through naval commerce. Actually, the presence of this species in Europe was already supposed by Silvestri (1941), due to the import of large amounts of timber from the USA. Between the nineteenth and twentieth centuries Trieste was the first port of the Austro-Hungarian Empire and one of the most important in the world for international traffic and cargo handling. The large amount of wood for commercial and construction use, combined with the presence of forest areas near the port, could have favored the establishment of this species in Trieste, as already proved for other wood-boring beetles (Rassati *et al.* 2018). It is then plausible that this species was spread throughout the country along the main railway lines (Ascensão & Capinha 2017).

Future research should investigate the actual distribution of this invasive species in Europe and worldwide, evaluate introduction pathways and risks associated with the international timber trade, develop effective monitoring practices, define new or specific quarantine methods and adopt adequate pest control strategies, especially in regard to historical buildings.

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