INVASION OF TWO WIDELY SEPARATED AREAS OF MEXICO BY *FORFICULA AURICULARIA* (DERMAPTERA: FORFICULIDAE)

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The European earwig, *Forficula auricularia* L. 1758 (Dermaptera: Forficulidae), is a household pest and an invasive species with cosmopolitan distribution. It is native to Europe, Western Asia and probably North Africa, although it has spread to all continents except Antarctica (Crumb et al. 1941; Clausen 1978; Shakai 1987). Earwigs are carried from one place to another on clothing or commercial products such as lumber, ornamental shrubs, newspaper bundles and groceries. European earwigs are nocturnal omnivorous scavengers and predators, most commonly found in temperate climates. They prefer moist and warm habitats, having an optimum mean growth temperature of 24 °C, and are most active when the daily temperature has minimal fluctuation (Crumb et al. 1941; Capinera 2001; Jacob 2009). The species has been known to cause significant damage to crops, flowers, and fruit orchards when they occur at high population densities (Vickery & Kevan 1986; Walker 1997; Capinera 2001; Weems & Skelly 2009).

Forficula auricularia was recorded a number of times in North America along the 19th century before becoming established on the continent (Vickery & Kevan 1983; Guillet et al. 2000). The first known colony of the species on the Atlantic coast appeared in Newport, Rhode Island in 1911 (Glaser 1914; Guillet et al. 2000), whereas on the Pacific coast, the earwig was present in Seattle already in 1907 (Coyne 1928) and in Oregon in 1909 (Guillet et al. 2000). Since then, the species has spread on both coasts of the US (Wirth et al. 1998), as well as to several Canadian provinces. Expansions were initiated by population bursts in harbors, a phenomenon never observed in Europe, and the species rapidly became a nuisance, thus causing concern on the part of agricultural authorities, who used different measures to eradicate this pest, including poisoning campaigns. The geographic range of *F. auricularia* has clearly expanded since, as it has continuously been reported in different localities farther inland (Crumb et al. 1941; Wirth et al. 1998). Despite this ability to colonize new environments, there were no precise records of *F. auricularia* in Mexico and Central America prior to this work (Scudder 1868; De Bormans 1893; Hebard 1917; Clausen 1978; Young 1986; Maes & Haas 2006; Weems & Skelly 2009).

During a recent field trip carried out at the Lagunas de Zempoala National Park, in the state of Mexico (municipality of Ocuilan; 2824 m absl; 21-VIII-2010), we found a reproductive aggregation of about 20 specimens of *F. auricularia*, which was grouped under loose bark on a vertical fence pole. This fence separates the surrounding pastures from one of the tourist stands at Lagunas de Zempoala. Most of the specimens dropped from the pole after being exposed, but 6 were captured and photographed (Fig. 1). No other specimens were found immediately nearby.

Furthermore, we observed an explosive irruption of *F. auricularia* on the Mexican island of Guadalupe (N 29° 07', W 118° 32'; 3/4-V-2011), located 260 km off the coast of Baja California in the Pacific Ocean. Many thousands of flying individuals were seen in cypress (*Cupressus guadalupensis* S. Watson) groves and surrounding areas in the north of the island. The swarm appeared suddenly around 11:00 am (roughly the same time on both days) and stayed in the wind for a few hours. Individuals tended to land on trunks and building walls and to climb upwards, sometimes reaching concentrations of many hundreds of individuals at the tips of cypress stumps. They were commonly seen in the area for the following 2 wk, walking on the ground or on tree trunks, but very few were still flying around after the first 3 days of the irruption. Hundreds of dead carcasses (about 5 individuals per m^2, quite evenly spread) were observed on the gravel-covered ground between the buildings of the biological station soon after the irruptions.

This to our knowledge is the first report of *Forficula auricularia* in Mexico. The significant

Fig. 1. Female specimen of *Forficula auricularia* found at Lagunas de Zempoala National Park (Estado de México: Ocuilan; 2824 m; 21-VIII-2010). Morphological characteristics of the specimens found in Mexico do not differ from European and North African material examined (Spain, Portugal, Hungary, and Morocco).

distance between both localities, and the high number of specimens found in the remote oceanic island of Guadalupe, indicate that the species is probably widely distributed across the country. Because *F. auricularia* occurs in temperate climates, its presence and settlement in the Central Mexican Highlands was not unlikely; however its presence at high altitude in a well preserved National Park, dominated by conifer forests (*Abies religiosa* (Kunth) Schltdl. & Cham.), was unexpected. This species could have reached the Park through the products that are sold in the touristic stores or through visitors who bring their own goods. Recent climate change might favor its future acclimation to high altitude. *Forficula auricularia* individuals on Guadalupe may have accessed the island through the harbors as previously reported in other areas of North America. The nearest known populations of *F. auricularia* are located in the United States. It is possible, therefore, that the species arrived as a result of the intense commercial activity between Mexico and the USA, especially since Jan 1994 when the North American Free Trade Agreement (NAFTA) came into effect (Villareal 2010).

Forficula auricularia could potentially displace species of Dermaptera that are native of Mexico. Nevertheless, current knowledge about the Mexican fauna of Dermaptera is scarce; thus the consequences are unpredictable. Additional studies on the prevalence of *F. auricularia* in Mexico would be useful in order to establish measurements to avoid and control the problems that this species could cause in agriculture and the natural environment, and to minimize the probability of expansion.

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Summary

The invasive species, *Forficula auricularia* L., is reported from 2 localities of Mexico: Lagunas de Zempoala (State of Mexico), a high elevation area 2824 m absl on the Transversal Neovolcanic Belt, and on the island of Guadalupe (State of Baja California), 260 km off shore in the Pacific Ocean. These data confirm that the geographic range of *F. auricularia* keeps expanding throughout the American continent since its first introduction into the USA about 1 century ago.

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