



Nota científica
(Short communication)

FIRST REPORT OF *DIGITONTHOPHAGUS GAZELLA* (FABRICIUS, 1787) AND NEW RECORDS FOR *EUONITICELLUS INTERMEDIUS* (REICHE, 1849) (COLEOPTERA: SCARABAEIDAE LATREILLE, 1802) IN EL SALVADOR

PRIMER REGISTRO DE *DIGITONTHOPHAGUS GAZELLA* (FABRICIUS, 1787) Y NUEVO REGISTRO PARA *EUONITICELLUS INTERMEDIUS* (REICHE, 1849) (COLEOPTERA: SCARABAEIDAE LATREILLE, 1802) EN EL SALVADOR

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ABSTRACT. The presence of the beetle *Digitonthophagus gazella* (Fabricius, 1787) is reported for the first time. In addition, the range of distribution of *Euoniticellus intermedius* (Reiche, 1849) in El Salvador is expanded, based on information obtained from collections made over twelve years and the current distribution map of *E. intermedius* in the territory is presented. In addition, the current situation of both species in the country and Central America is briefly discussed.

RESUMEN. Se reporta por primera vez la presencia del escarabajo *Digitonthophagus gazella* (Fabricius, 1787). Además, se amplía el rango de distribución de *Euoniticellus intermedius* (Reiche, 1849) en El Salvador, a partir de información obtenida de colectas realizadas a lo largo de doce años y se presenta el mapa de distribución actual de *E. intermedius* en el territorio. Adicionalmente, se discute brevemente la situación actual de ambas especies en el país y Centroamérica.

The introduction, dispersion and colonization process carried out by the African invasive dung species *Digitonthophagus gazella* (Fabricius, 1787) and the Afro-tropical *Euoniticellus intermedius* (Reiche, 1849), has been widely studied in Mexico (Rivera-Cervantes & García-Real, 1991; Kohlmann, 1994; Morales *et al.*, 2004), Central America (Maes *et al.* 1997; Solís & Kohlmann, 2012; Rivera & Schlein, 2014; Solís *et al.*, 2015) and South America (Noriega, 2002; Noriega *et al.*, 2006; Rivera &

Wolff, 2007; Vidaurre *et al.*, 2008; Álvarez *et al.*, 2009; Noriega *et al.*, 2010; 2017) since their initial liberation in the United States of America (Fincher *et al.*, 1983; Wood & Kaufman, 2008). Recently, the taxonomy of the genus *Digitonthophagus* has been clarified (Génier & Moretto, 2017), showing that the genus had several species unknown to science and that the identity of the invasive species in the American continent must continue being *D. gazella* (Génier & Davis, 2017). In this note, we report

for the first time the presence of *D. gazella* in El Salvador, Central America and we extend the geographic distribution range of *E. intermedius* in the country.

Cara Sucia is a town located in the municipality of San Francisco Menéndez, Ahuachapán Department, in the Southwest of El Salvador. Cara Sucia presents high mercantile activity due mainly to its strategical location between the highway to La Hachadura (at the Guatemala and El Salvador border) and the urban center of the Sonsonate Department, which facilitates commercial trade between both regions. We collected the specimens on two cattle pastures on the outskirts of Cara Sucia (grassland #1: 13°47'06.1'' N - 90°02'30.5'' W, 15 m a.s.l. and grassland #2: 13°46'09.2'' N - 90°03'25.6'' W, 7 m a.s.l.) (Fig. 1), using 20 pitfall traps baited with cow dung on July 2016, as part of the project: "Dung Removal Rates in Grasslands around the World", coordinated by the last author.

We captured 128 beetles, of which 65 were *D. gazella* (Fig. 2a), providing the first record for this species in the country, and 17 of them were *E. intermedius* (Fig. 2b), extending this species' geographical range in El Salvador. Additionally, we gathered all the records of *E. intermedius* made by the authors during the past twelve years and a map of the current countrywide distribution of the species is presented (Fig. 1). In the traps, 10 individuals of *Copris*

lugubris Boheman, 1858 and 36 individuals of *Ataenius sculptor* Harold, 1868 were also captured.

First evidence for the arrival of *D. gazella* in Central America comes from Northern Guatemala in 1987 (Kohlmann, 1994). The first recorders of the species in Mexico (Barbero & López-Guerrero, 1992; Kohlmann, 1994) provide estimations for their average dispersal distance. For instance, Barbero & López-Guerrero (1992) estimated that *D. gazella* was able to travel between 16.5 and 800 km/y (177.81 km/y on average) from the South of the USA and the North of Mexico to Central America. Kohlmann (1994) estimated the average distance that beetles traveled, both, in the Atlantic (103 km/y) and in the Pacific regions (220 km/y). His observations suggested that the beetles seemed to be moving faster in the Pacific region, probably due to more favorable climatic conditions to the dung beetle (Kohlmann, 1994).

In the Pacific coast, the Southernmost distribution area of the species, reported by Kohlmann (1994) was Oaxaca (Mexico), where individuals of the species were collected in 1989, approximately 815 km away from the Ahuachapán Department in El Salvador. Following Kohlmann's estimations (220 km/y), if *D. gazella* had travelled at a steady pace, the species would have arrived in El Salvador by late 1993.

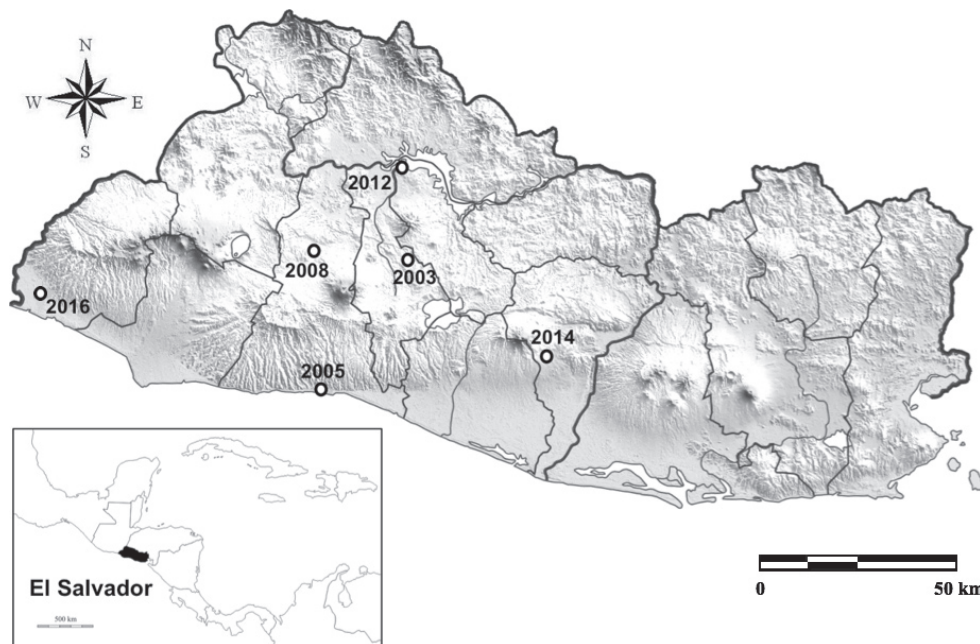


Figure 1. Map of the localities registered for current distribution of *E. intermedius* in El Salvador. 2003: Tonacatepeque, San Salvador; 2005: El Majahual, La Libertad; 2008: Laguna Caldera, La Libertad; 2012: Colima, Cuscatlán; 2014: Tehuacán, San Vicente; 2016: Cara Sucia, Ahuachapán.

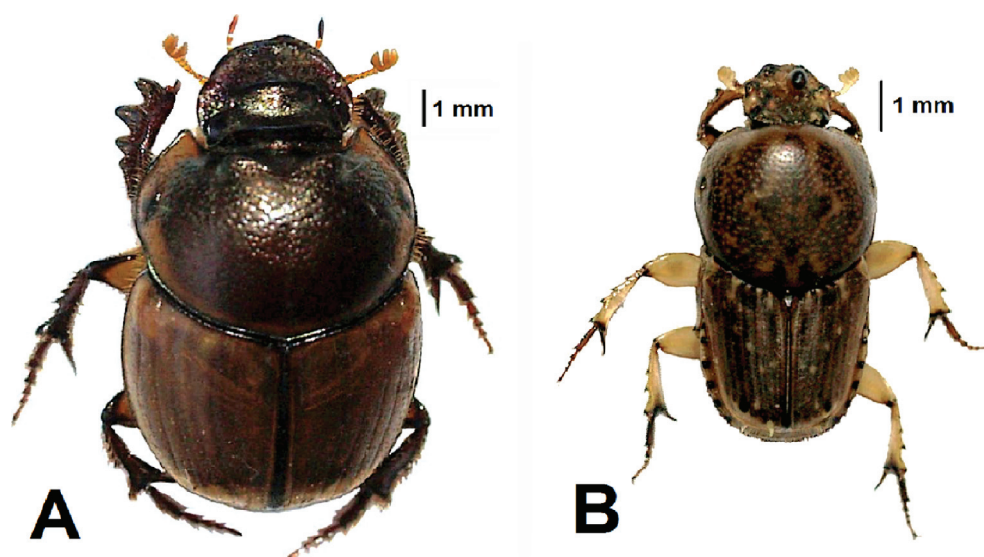


Figure 2. a) *Digithonthophagus gazella* and b) *Euoniticellus intermedius* collected in 2016 at Cara Sucia, El Salvador.

In the period between 1997 and 1999, numerous dung beetle surveys were carried out in several zones of the country, using pitfall traps baited with horse and cow dung in a variety of cattle pastures, including areas near to the current collection site, where the presence of the species was not recorded (Horgan, 2001; Horgan, 2002; Horgan & Fuentes, 2005). Fourteen years later, in 2013 a survey was carried out in the National Park (NP) El Imposible, a forest area located at less than 20 km from the current collection site, without any evidence of the species' presence (Pablo-Cea *et al.*, 2016). It is important to note that the altitudinal difference between these two regions can reach almost 900 m in some areas; however it doesn't exceed the altitudinal range limit reported for the species in America (Vidaurre *et al.*, 2008; Álvarez *et al.*, 2009; Noriega *et al.*, 2011). It is also important to mention that nor horse neither cow dung was used as bait in the NP El Imposible, however, the first author examined horse dung present around the area, during the whole period of the survey (June to November 2013) without successfully registering the presence the species.

It is very complicated to estimate the exact moment of arrival of this species in the country, since there hadn't been an active national monitoring program in past years. The entrance of *D. gazella* in El Salvador could be related to the cattle trade between Cara Sucia and adjacent areas in Guatemala (M. Cruz, personal observation), coming in from the neighboring country due to anthropogenic action.

Euoniticellus intermedius was collected for the first time by Fuentes in 2003 (Solís & Kohlmann, 2012) in Tonacatepeque, San Salvador (13°48'7.95" N - 89°7'51.74" W, 525 m a.s.l.). In 2005, a specimen was found in El Majahual Beach in La Libertad (13°29'19.81" N - 89°21'44.23" W, 5 m a.s.l.) (Fuentes, unpublished data). In 2008, specimens were collected near Laguna Caldera, also in La Libertad (13°50'26.28" N - 89°21'26.17" W, 450 m a.s.l.) (Fuentes, 2008). In 2012, Pablo-Cea and Velado-Cano (unpublished data) collected 112 specimens in pastures around the Natural Protected Area of Colima in Cuscatlán (14°02'44.4" N - 89°07'39.57" W, 300 m a.s.l.), where the species displayed dominance (in number of individuals) over the native species populations, and even a few specimens were collected inside the forest areas (an uncommon habitat for this species that prefers open areas). In 2014, Fuentes (unpublished data) collected specimens in pastures near the eco-touristic park Tehuacán in San Vicente (13°33'25.55" N - 88°47'1.01" W, 378 m a.s.l.). Tehuacán is considered the easternmost point of the species' distribution in the country, while the specimens collected in Cara Sucia represent the first record of the species' presence in the Western region of the country. Despite of that, we consider the west region, the one where *E. intermedius* got access to El Salvador, due to its location near Guatemala, where the species was collected in 2002, a year before Fuentes captured the first specimens in El Salvador (Solís & Kohlmann, 2012).

Of both invasive species, *E. intermedius* shows a higher adaptability and colonization potential. It has invaded faster into the national territory, presumably facilitated by its higher plasticity that has allowed it to adapt to the conditions and maintain relatively stable populations, during the dry season (Fuentes, 2008). As a result, the species was already found in the central El Salvador in 2002, it has colonized several areas of the country (from 0 to 525 m) and several more countries in Central America (Solís & Kohlmann, 2012; Rivera & Schlein, 2014; Solís *et. al.*, 2015). On the other hand, *D. gazella* is restricted to the Southwestern area of El Salvador. Its exact date of arrival has not been confirmed and its presence has not been reported yet in Belize, Honduras, Costa Rica, nor Panama.

To conclude, we stress the importance of tracking geographical distributions of invasive species in El Salvador, where is common to find cattle pastures surrounding natural protected areas, which can facilitate the potential entrance of foreign species into the small and isolated forest patches which still remain. This creates a potential risk for dispersing invasive species to outcompete and even displace the local native species (as seen for example, in the surroundings of Colima). Therefore, we recommend the creation and establishment of a National Monitoring Network to carry out more extensive surveys in an effort to cover more areas of the country, and to follow the current and future distribution of these and other potential invasive species occurring in El Salvador.

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