

RECORDS OF AN INVASIVE DUNG BEETLE SPECIES, *DIGITONTHOPHAGUS GAZELLA* (FABRICIUS, 1787) (COLEOPTERA: SCARABAEIDAE), IN PERU

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ABSTRACT. *Digitonthophagus gazella*, a dung beetle of indoafrikan origin was first introduced to the Americas in the 1970s. Since then it has increased its range through deliberate introductions by national programs and by natural spread in the absence of geographical barriers. The species continues to expand its range as it invades new regions following the anthropogenic clearing of forests. We present the first reports of *D. gazella* in Peru and indicate that the species is now, perhaps, the most widespread dung beetle in tropical and subtropical pastures.

Key words: Scarabaeidae, *Digitonthophagus gazella*, dung beetle, invasive species, Peru.

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RESUMEN. *Digitonthophagus gazella*, un escarabajo coprófago de origen Indoafrikan fue inicialmente introducido en el continente Americano en 1970. Desde ese momento su rango de distribución se ha incrementado debido a introducciones deliberadas en nuevas regiones y por procesos naturales de dispersión en ausencia de barreras geográficas. Esta especie ha continuado expandiendo su rango de distribución ayudado por el efecto antrópico producido por la tala de bosques. Se presenta el primer reporte de *D. gazella* para el Perú, indicando que esta especie se constituye en el escarabajo coprófago más ampliamente distribuido en pastizales tropicales y subtropicales.

Palabras clave: Scarabaeidae, *Digitonthophagus gazella*, escarabajos coprófagos, especies invasoras, Perú.

INTRODUCTION

Digitonthophagus gazella (Fabricius, 1787) (Scarabaeidae: Onthophagini) is a dung beetle species of Indoafrican origin that was introduced to Texas (USA) in 1970 for the biological control of bovine dung (Fincher *et al.* 1983). The species has increased its distribution range, helped by anthropic introductions to other countries, colonizing Central and South America and the Caribbean (Huchet 1992, Kohlmann 1994, Gámez *et al.* 1997, Maes *et al.* 1997, Ruiz 2000, Noriega 2002, Noriega *et al.* 2006, Vidaurre *et al.* 2008).

Digitonthophagus gazella has been deliberately introduced on a number of occasions to the Neotropics. The initial release in the United States and its subsequent spread through Mexico and Central America has been well documented (Fincher *et al.* 1983, Kohlmann 1994, Maes *et al.* 1997). Its spread through the Caribbean has been less well studied; however, it is now known to occur in Cuba (F. Horgan personal observation), San Andres-Colombia (Noriega 2002), and the Antilles (Huchet 1992). It is perhaps from these regions that it made its way to the Caribbean coast of Colombia (Noriega *et al.* 2006).

The spread of *D. gazella* in South America, other than the Caribbean coast, has been less well documented. The beetle was deliberately introduced into Brazil by the National Center for Beef Cattle Research of the EMBRAPA (Brazilian Enterprise for Research on Agriculture) in 1989, to increase soil productivity in open cattle pastures and as a biological control agent for the horn fly, *Haematobia irritans* (L., 1758) and gastrointestinal helminthes (Oliveira *et al.* 1997, Miranda *et al.* 2000). The first area of liberation was Campo Grande in Mato Grosso do Sul (MS); however, it appears that the species was released over a wide area during the 1990's (i.e., Oliveira *et al.* 1997), and has rapidly built-up numbers and spread from these initial sites. Currently, *D. gazella* features as a prominent species among the recent and extensive documentation of dung beetle communities in Brazilian pastures and grasslands (i.e., Koller *et al.* 1999, Aidar *et al.* 2000, Marchiori *et al.* 2003, Koller *et al.* 2007, Matavelli & Louzada 2008). *Digitonthophagus gazella* is now known to occur in Paraguay, Bolivia and Argentina, presumably through natural spread and has been deliberately introduced into Uruguay and Venezuela (Vidaurre *et al.* 2008, Álvarez *et al.* 2009).

In this paper, we present the first records of *D. gazella* in Peru, indicating further expansion of the species' range in South America. Records were compiled from pitfall trapping and direct collections from cow pads, carried out over five years (1999-2003) by the authors in different localities of Madre de Dios and Ucayali.

RESULTS

Examined specimens (Fig. 1): PERU. **Madre de Dios:** 12 (♂ and ♀), Iñapari, 238 m, (12° 3' S - 69° 24' W), Dec 2002 and May 2003, *F. Horgan leg.*, Universidad Agraria la Molina (UAM). 28 (♂ and ♀), Jorge Chavez near Puerto Maldonado in cattle pastures, 230 m, (12° 38' 59.4" S - 69° 06' 24.3" W), Sep 1999, *T. Larsen leg.*, Adrian Forsyth Insect Collection Washington, D.C. (AFIC). 2 ♂, Tahuamanu, near Iñapari, Sep 2002, *F. Horgan leg.*, Entomological Collection of the Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos (MUNMSM). **Ucayali:** 1 ♂ and 2 ♀, Ucayali river region near Pucallpa, 160 m, (8° 25' S - 74° 27' W), Ago 2000, *J.A. Noriega leg.*, Reference Collection Jorge Ari Noriega (CJAN).



Figure 1. Localities (●) where *D. gazella* has been registered in Peru. Shaded area indicates Andes mountains.

Digitonthophagus gazella appears to be limited to cattle pastures and open savannas at low elevations, it has not been found in the forest interior or in traps placed in nearby forest. *Digitonthophagus gazella* sampled by T. Larsen were captured using two different kinds of bait, human dung and cattle dung, 2.33 ± 0.84 individuals were caught in each 24-hour trap sample based on standard sampling techniques (Larsen & Forsyth 2005). Out of seven dung beetle species sampled in cattle pastures, *D. gazella* was the second most abundant after *Pseudocanthon xanthorus* Blanchard, 1843 (T. Larsen, unpub. data). Similarly, *D. gazella* was recorded in pitfall traps baited with horse and cattle dung in pastures by F. Horgan, with no records from adjacent forest where a similar trapping protocol was conducted. Only, small numbers of *D. gazella* were captured in traps baited with ca. 0.7 kg of dung, possibly because of bait drying in the pastures during the day (baits were set out in the early mornings). Twelve Scarabaeidae species were recorded in the pastures, of which *Gromphas* sp. was the most common.

Digitonthophagus gazella has not been sampled above 1000 m in Peru despite extensive sampling by the authors. Assemblages of dung beetles have been sampled thoroughly in grasslands and pastures in other regions of Peru (Huanuco, Tingo Maria, Pasco, Oxapampa, San Ramón, Cusco, Lower and High Urubamba Region); but, *D. gazella* has not been registered in any of these studies (Valencia 2001, Horgan 2005, 2009, Valencia & Concha 2007, Valencia *et al.* 2009a, b).

DISCUSSION

The present paper is the first record of the occurrence of *D. gazella* in Peru, notably along Peru's border with Acre-Brazil, a region of extensive cattle production, particularly near Rio Branco in the South of the state (Fig. 1). The records from near Pulcalpa are relatively isolated from Brazilian pastures. Similarly, Matavelli & Louzada (2008) indicate that in Brazil, the species has invaded inter-Amazonian grasslands that are geographically isolated from cattle pastures due to an extensive barrier of rainforest.

The accumulated records on the occurrence of *D. gazella* suggest that the species has invaded new regions in three ways: initially, through deliberate introductions (e.g., the United States, Venezuela, Brazil and Chile); later, by natural dispersal where sites are connected by a series of open pastures (e.g., through Mexico, Central and South America and to some Caribbean islands that are close to the mainland); and finally, through accidental introductions associated with the transportation of livestock in cattle-trucks and river boats (e.g., possibly to inter-Amazonian grasslands, coastal Colombia, Argentina and Ucayali-Peru).

This new report of *D. gazella* in Peruvian territory confirms its status as a highly invasive species; at this time, *D. gazella* is perhaps the most widespread dung beetle in tropical and subtropical pastures. Its ecological success in Neotropical pastures

may be related to its unique functional role as a nocturnal-crepuscular fast tunneller, a functional group that has no native Neotropical members (Horgan 2008), however the possible effects that the species has on the native dung beetle assemblage structure and ecosystem dynamics remains to be studied.

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