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RESEARCH ARTICLE - ANTS

First Record of the Dolichoderine Ant Genus *Gracilidris* Wild & Cuzzo (Hymenoptera: Formicidae) from Southern Brazil

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Abstract

The dolichoderine ant species *Gracilidris pombero*, sole representative of the genus, is recorded for the first time in southern Brazil. Until now, the species was known only for the open fields of the South American dry diagonal and for a single locality in the Colombian Amazon. The specimens reported here were collected with pitfall traps in grasslands of the Pampa biome, state of Rio Grande do Sul, Brazil. This record represents the southernmost occurrence for the genus, extending its distribution in approximately 450 km to the south in the Neotropics and in almost 1,150 km to the south in Brazil.

Introduction

The ant genus *Gracilidris* Wild and Cuzzo, 2006 (Formicidae: Dolichoderinae) includes a single extant species, *G. pombero* Wild & Cuzzo, 2006 and the fossil *G. humilioides* (Wilson, 1985). Morphologically, the genus is characterized by the unique combination of slender body, anterior margin of clypeus broadly convex, eyes located near the longitudinal midpoint of head and touching lateral margins of head in frontal view, antennal scapes longer than head length, petiole with a tall dorsal scale with apex curved posteriorly, and body dorsum devoid of erect pilosity.

The few observations on the species biology suggest that the colonies are established in the soil with the nest entrance consisting of a small earthen turret. The small number of workers collected in nest excavations suggests a small colony size (Wild & Cuzzo, 2006). Workers are often attracted to sardine baits in the soil which indicates that these ants may have generalist feeding habits (Costa-Milanez et al., 2014) as also observed for other soil-nesting

dolichoderine ants including *Dorymyrmex*, *Forelius*, and *Iridomyrmex*, for example. According to Wild and Cuzzo (2006) *Gracilidris* ants are probably nocturnal, which may explain their relative rarity in myrmecological collections. These authors mention that at the type locality (Paraguay), foraging workers were captured at dusk and after dark, while visual searches and baiting during the day at the same locality did not reveal any workers. Nothing is known about the reproductive biology of the genus.

Gracilidris was originally described based on specimens collected primarily along the so called South American dry diagonal, which includes the savannah lands of northeastern and central Brazil (caatinga and cerrado, respectively), and the chaco areas of Paraguay and Argentina (Prado & Gibbs, 1993). Until recently, it was thought that the extant lineage of *Gracilidris* was restricted to the low scrub forests and open fields of this dry diagonal. However, Guerrero and Sanabria (2011) provided the first record of *G. pombero* for the northern portion of South America, more precisely for the foothills of the Colombian Amazon Basin.



The record of *G. pombero* in Colombia and the presence of the fossil species *G. humilioides* in Dominican Amber, with age estimated in approximately 43 million years (Ward et al., 2010), suggest an ancient and widespread presence of the genus in the Neotropics.

In this paper we report the first record of *Gracilidris pombero* for South Brazil, considerably extending the distribution limits for the genus to the south. We also update the geographic information on *Gracilidris* and discuss the morphological variation found among populations of *G. pombero*.

Materials and Methods

Gracilidris pombero specimens were identified among the ants collected in a long term ecological research (LTER) network (PELD Campos Sulinos – CNPq) at southern Brazilian grasslands. These grasslands occupy a transitional zone between tropical and temperate climates, with hot summers and cool winters, and are composed of several phytophysiognomies and extremely high plant species richness. Vegetation is characterized by an association of C4 and C3 grasses and a variety of forbs and shrub species, and its structure responds directly to factors such as climate, soil and disturbance history. Cattle grazing is the traditional land use, which besides the economic importance also ensures the maintenance of typical grassland vegetation (Overbeck et al., 2007; Pillar et al., 2009).

In the LTER, an experimental setup was distributed over several natural grassland sites from Pampa (in the southern and western regions of the state of Rio Grande do Sul) and Atlantic Forest biome (on the highland plateau of Rio Grande do Sul) to investigate the effects of grazing management (e.g. exclusion, traditional and sustainable grazing) on biological communities, ecosystems processes and services. In Brazil, the Pampa biome is restricted to and occupies 63% of the territory of the state of Rio Grande do Sul, representing only 2.07% of the Brazilian biomes (Instituto Brasileiro de Geografia e Estatística [IBGE], 2004).

Ant specimens were collected with pitfall traps filled with formalin (formaldehyde 3%), set at the soil level, and exposed for seven days. After sorting, the ants were preserved in alcohol 80%. Vouchers are deposited in the Laboratório de Ecologia de Interações of the Universidade Federal do Rio Grande do Sul, RS, Brazil, and in the Entomological Collection Padre Jesus Santiago Moure of the Universidade Federal do Paraná (DZUP), PR, Curitiba, Brazil. We compared the Rio Grande do Sul workers with those (including types) deposited at the myrmecological collections of the Museu de Zoologia da USP (MZSP), São Paulo, and of the Comissão Executiva do Plano da Lavoura Cacaueira (CEPLAC), Bahia.

High resolution images were obtained under a Leica M125 stereomicroscope attached to a Leica DFC 295 video camera. Photos were combined using Zerene Stacker software at the DZUP. Images were then processed as TIFF files in

Adobe Photoshop CS5 to enhance parameters of brightness and contrast. The distribution map was generated by the software Quantum GIS 1.5.0 (Tethys) with coordinates imported from Google Earth after consulting the records for *Gracilidris pombero* in the literature (Wild & Cuzzo, 2006; Guerrero & Sanabria, 2011; Neves et al., 2013; Costa-Milanez et al., 2014).

Results and Discussion

Gracilidris pombero individuals were sampled in experimental sites distributed solely over the Pampa biome. Eighteen workers were recovered from pitfall traps. The specimens studied here came specifically from the traps installed in the experimental plots of Lavras do Sul (30°42'02"S, 53°58'53"W) and Aceguá (31°38'55"S, 54°09'26"W), near the border with Uruguay. Both sites are placed in private farms that use traditional grazing management. Workers were captured in 16th December, 2011 (one individual in Lavras do Sul, and eight individuals in Aceguá), 8th December, 2012 (one individual in Lavras do Sul, and seven in Aceguá), and 4th December, 2013 (one individual in Aceguá).

The records of *Gracilidris* for Rio Grande do Sul represent the southernmost register of the genus in the Neotropics and the first for the Pampa Biome, extending its distribution in approximately 450 km to the south. The most meridional record for the genus until now was represented by specimens collected in Santiago del Estero, Argentina (Wild & Cuzzo 2006). In Brazil, the southernmost record so far consisted of two workers collected in Agudos, state of São Paulo, in 1957 (Father W. W. Kempf collection at the MZSP). Thus, the specimens of Rio Grande do Sul (Aceguá county) extend the genus distribution in approximately 1,150 km to the south within Brazil.

Workers examined here can be securely identified as *G. pombero* (Fig 1), since they match most of the diagnostic characters of the species. When compared to the type specimens, the Rio Grande do Sul workers present a slightly shorter head (head length range 0.75-0.76 mm in Rio Grande do Sul workers and 0.80-0.93 mm in type specimens) and a more angulated propodeal dorsum (not gently convex as in the types). However, these discrete differences fall within the variation observed in northern populations of the species.

The specimens registered in Rio Grande do Sul were captured at the environment typically associated with the genus, grasslands and open fields. Despite the few observations on *G. pombero* natural history (Wild & Cuzzo 2006), the present record reinforces the theory that these ants can tolerate some degree of anthropic disturbance (Guerrero & Sanabria, 2011), since they were recorded in natural grasslands under traditional grazing management.

It is interesting to notice that despite the several ant inventories carried out in the states of Paraná (PR) and Santa Catarina (SC), the first occurrence of *Gracilidris* in South



Fig 1. *Gracilidris pombero* worker (Aceguá, RS, Brazil). A: Head in frontal view. B: Body in profile.

Brazil was reported from the southernmost state of this region, Rio Grande do Sul. This fact suggests that (1) *G. pombero* probably occurs in PR and SC, but (2) the Atlantic Forest that predominantly cover these states has received the bulk of the sampling effort, while the natural open fields and grasslands of South Brazil remain relatively undersampled.

The presence of *Gracilidris* in the fossil record of the Dominican Amber (Wilson, 1985; Wild and Cuzzo, 2006) and the present register of the most meridional population known for the genus reinforces the hypothesis that *Gracilidris pombero* is a remaining lineage of a previously widely distributed ant genus which predominantly occurred in open fields and/or arid zones (Fig 2).

The occurrence of the species in the Colombian Amazon is an enigmatic biogeographical issue that remains to be explained. Guerrero and Sanabria (2011) argue that the Amazon Basin could be a potential biogeographic barrier for the soil-nesting dolichoderine. Since *Gracilidris* occurs above and below the Amazon Basin (considering the fossil record), primarily in open environments, this could suggest that in the past *Gracilidris* could have been found in almost all open fields of the Neotropics, including the Amazon region during a drier climate period. These authors also suggest that the increasing humidity and the expansion of the Amazonian wet forest in the recent past could have resulted in local extinctions, with subsequent isolation of *Gracilidris* in the extreme north and

south of the Amazon Basin, and the subsequent extinction of the northernmost populations.

A second hypothesis raised by Guerrero and Sanabria (2011) considers the effect of the rise of the Andes on the Amazon Basin. In this case, the lifting of the Eastern slope of the northern Andes during the late Miocene changed the course of the rivers in the Amazon Basin from the west to the east of the continent, resulting in the current Amazonian river system, a new natural barrier that separated the populations of the different species in the genus. In both scenarios, the Colombian populations of *G. pombero* were separated from those of southern South America, but the biogeographical mechanism could have been different.

The presence of the fossil *G. humiloides* in the Dominican Amber and the peculiar distribution of the extant *G. pombero* reveal an interesting biogeographic scenario to be investigated. New collections of the genus in the open environments of northern South America and a detailed phylogeographic study of its single extant species would be extremely important to clarify the evolution patterns of the genus and even to confirm the precise identity of the different populations of *G. pombero*.

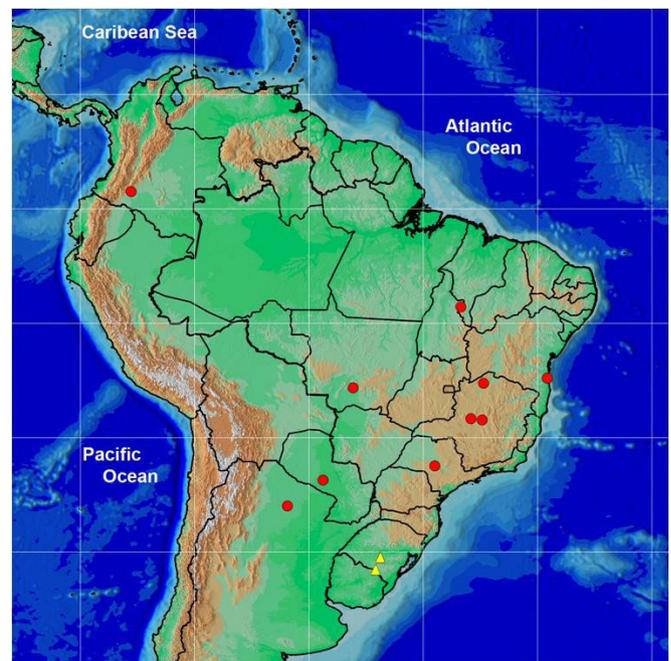


Fig 2. Distribution map of *Gracilidris pombero* in the Neotropics. Known distribution: red circles. New records from Rio Grande do Sul, Brazil: yellow triangles.

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