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Mycetophylax simplex (Emery, 1888) (Hymenoptera: Formicidae): first record in Uruguay and distribution extension

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Abstract: This study provides the first record of *Mycetophylax simplex* (Emery, 1888) for Uruguay and extends the known distribution of this species south in South America. *Mycetophylax simplex* is currently the only species of the genus that occurs in Uruguay. Workers and queens were captured with pitfall traps in a sandy beach on east coast of Uruguay. Data and figures of *M. simplex* for the recognition of the species and map of distribution are presented.

Key words: Myrmicinae; fungus growing; *Atta* genus-group; Neotropical Region; new record; sandy beach; Rocha

Mycetophylax Emery, 1913 is a rather compact taxon, including three species that nest only in sandy soils along the South Atlantic coast and in Venezuela and Puerto Rico, along beaches of the Caribbean Sea (Klingenberg and Brandão 2009). *Mycetophylax conformis* (Mayr, 1884) is the most widely distributed species of the genus, being found from the state of São Paulo (Brazil) to Puerto Rico. *Mycetophylax morschi* (Emery, 1888) occurs along Brazilian beaches from Rio Grande do Sul to Rio de Janeiro states. On the other hand, the current known geographic distribution of *Mycetophylax simplex* (Emery, 1888) includes only the states of Rio Grande do Sul and Santa Catarina, Brazil (Klingenberg and Brandão 2009) (Figure 1; Table 1). *Mycetophylax simplex* and *M. conformis* do not overlap in their geographic distribution; however, *M. simplex* and *M. morschi* are found sympatrically. Both species occur in the same beaches at Santa Catarina Island and Rio Grande do Sul state, but occupy different microhabitats that do not overlap within the coastal dune zone: *M. simplex* builds nests in the pre-dune and fore-dune zones, while *M. morschi* prefers Restinga areas covered with permanent vegetation (Klingenberg et al. 2007).

As all species of the *Atta* genus-group (Ward et al. 2014), *Mycetophylax* species are fungus-growing ants (Hölldobler and Wilson 1990). They form small colonies with a few hundred monomorphic workers, which collect dried plant material, feces and dead insects to feed its symbiotic fungus (Hölldobler and Wilson 1990; Diehl-Fleig and Diehl 2007). For detail observations on nest and colony structures of these species, see Klingenberg et al. (2007) and Diehl-Fleig and Diehl (2007).

In Uruguay, studies on systematics, taxonomy and species diversity of ants have been very scarce (Berg 1890; Kusnezov 1958; Zolessi et al. 1976, 1989). The most recent studies in the country have focused on ecology, behavior and genetic of some leaf-cutting ant species that are well recognized as agricultural pests (Bollazzi et al. 2008, 2012, 2014; Bollazzi and Roses 2010; Rabeling et al. 2013). In particular, surveys of the ant fauna in coastal ecosystems at Uruguay have been almost non-existent. In the only available study on an insect community in a Uruguayan sandy beach, ant species were identified to genus level or listed only as morphotypes (Mourglia et al. 2015). The main goal of that study was to assess the spatio-temporal distributional patterns of the entomofauna on an oceanic beach-dune system and their relationship with environmental factors.

The Uruguayan coastline expands along 670 km along the Río de la Plata and the Atlantic Ocean, and comprises dissipative and reflective beaches, rocky points, sedimentary gullies, sand dunes, littoral lakes and wetlands (Gómez-Pivel 2006). Coastal sand dunes are an important habitat type providing a suite of both environmental and socio-economic functions. This systems support a broad range of flora and fauna owing to the diversity of the ecological niches found within them (Everard et al. 2010). Correctly assessing terrestrial dune ecosystem conservation status is a priority in order to manage them adequately and to plan

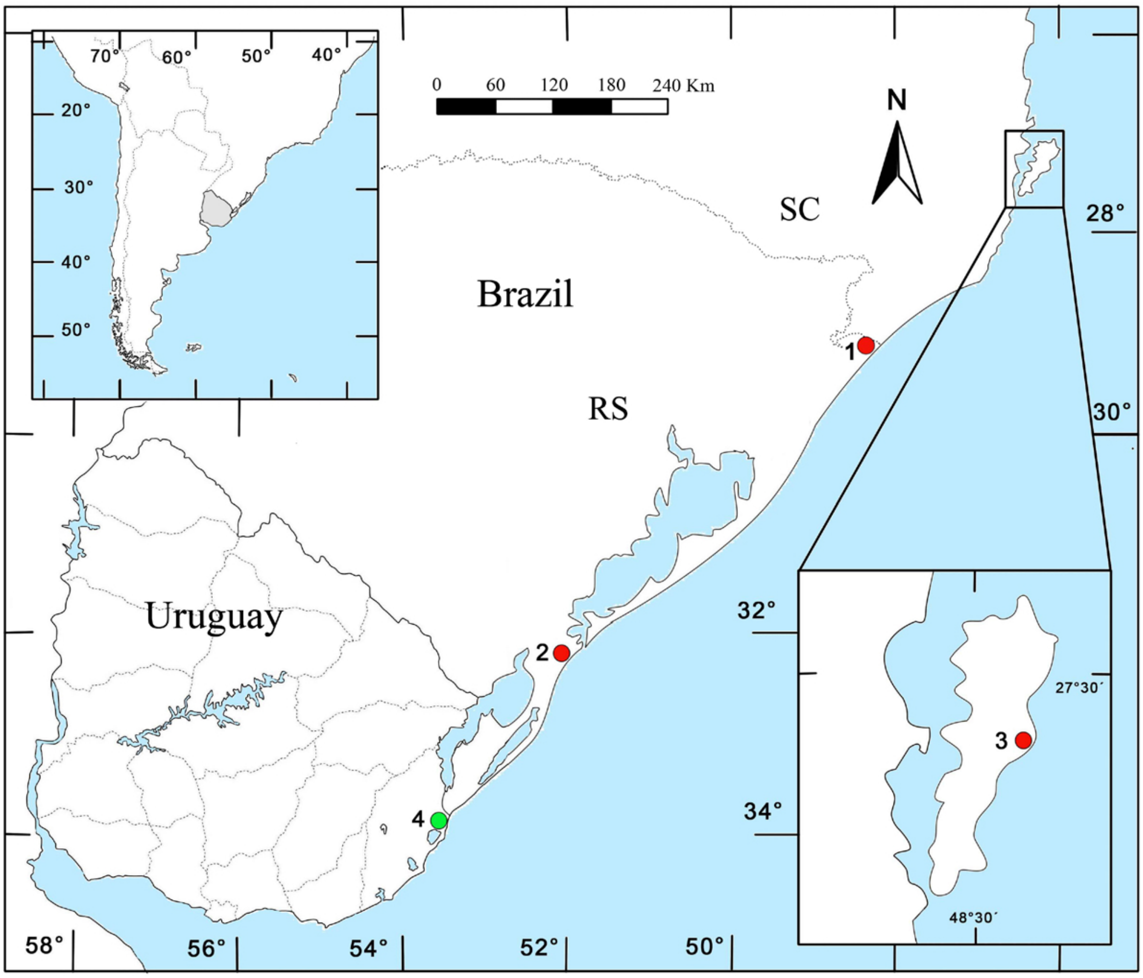


Figure 1. Distribution of *Mycetophylax simplex*. Red dots are historic localities. Green dot is the new record. The numbers correspond to the records in Table 1.

Table 1. Mycetophylax simplex records including historic and new records. Some close localities are represented under the same label.

Label	Locality name	Latitude	Longitude	Reference
1	Praia Grande, Rio Grande do Sul (Brazil)	29.3333° S	049.7167° W	Albuquerque et al. (2005); Diehl-Fleig and Diehl (2007)
1	Morro da Guarita, Rio Grande do Sul (Brazil)	29.35° S	049.7333° W	Diehl-Fleig and Diehl (2007)
2	Praia do Cassino, Rio Grande do Sul (Brazil)	32.2° S	052.1667° W	Klingenberg and Brandão (2009)
3	Praia da Joaquina, Santa Catarina (Brazil)	27.0° S	048.0° W	Klingenberg et al. (2007)
4	Barra del Chuy, Rocha (Uruguay)	33.75° S	053.45° W	This publication

urban development in coastal regions (Carboni et al. 2009). Nowadays, management plans for conservation of coastal ecosystems in Uruguay only include the monitoring of aquatic organisms, but terrestrial bio-indicators should also be considered (Aisenberg et al. 2011).

The aim of this study is to report for the first time, the occurrence of *M. simplex* in a sandy beach of Uruguay, the only species of the gender known in the country. We also discuss the potential use of *M. simplex* as bio-indicator of human impact on the Uruguayan coast.

The sampling was undertaken in Barra del Chuy (33.77° S, 053.40° W), a sandy beach on east coast of Uruguay (Department of Rocha) (Figure 1). This is a wide dissipative beach (beach width ca. 70 m) with fine to very fine (grain size = 0.20 mm) well-sorted sands and a gentle slope (3.53%) (Defeo et al. 2001). Samples were taken in nocturnal and seasonal surveys during 2012. In total, 30 pitfall traps were set every 8 m from the swash zone to 40 m inland from the beginning of the active dune, along three transects spaced 8 m apart (Figure 2). Each trap consisted of a plastic bucket (12 cm diameter and 12 cm depth) buried with the rim level with the ground and filled with 150 ml of propylenglycol (50%).

Fifteen workers and thirty queens of *M. simplex* were captured in the traps located from 8 m to 32 m landward, from the start of the active dune (Figure 2), on 18 April 2012 and 22 August 2012. Three workers and three queens were deposited pinned (numbers 6631 – 6636) while 1 worker and 12 queens were preserved in alcohol

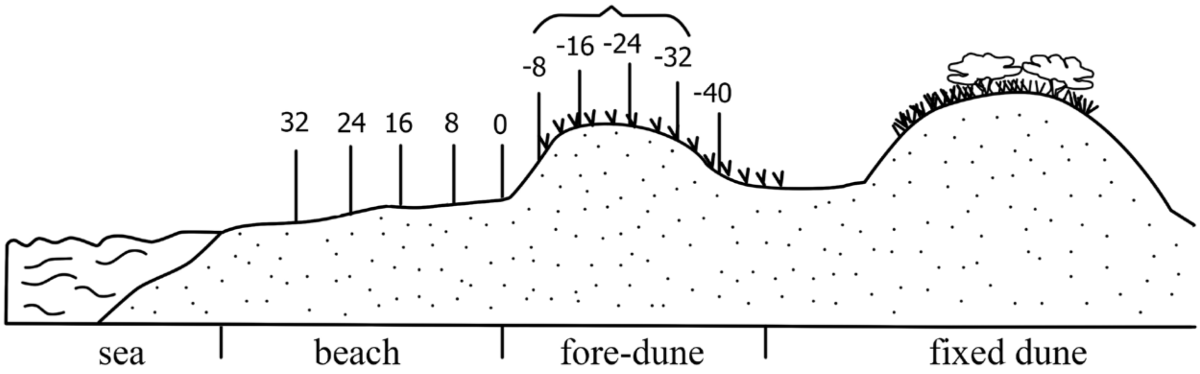


Figure 2. Profile of the beach studied in Barra del Chuy, Uruguay. The numbers represent the distance (in m) of the pitfall traps from the base of the dune. The bracket indicates the traps in which individuals of *Mycetophylax simplex* were collected.

70% (numbers 6637– 6641) in the collection of the Universidad Nacional del Nordeste, Facultad de Ciencias Exactas y Naturales y Agrimensura (CARTROUNNE), Corrientes, Argentina. The remaining specimens were preserved in alcohol 70% and deposited in the Entomological Collection of Facultad de Ciencias, Universidad de la República (Montevideo) (numbers 001 and 002). Photographs of specimens were taken with a digital camera (Canon Eos Rebel T3i) coupled to a binocular stereomicroscope; images were processed with CombineZP 1.0.0. Morphometric characters following Klingenberg and Brandão (2009) were obtained using a micrometric reticule adapted to a binocular stereomicroscope. The following characters and indices were registered and calculated for each measured specimen:

Interocular distance (IOD): maximum width of the head in full-face view, taken at the middle of the internal margins of the compound eyes.

Head length (HL): maximum length of the head in full-face view, from the midpoint of the clypeal border, in a transverse line, to the mid-point of the transverse line that spans the apices of the posterolateral corners of the head.

Cephalic Index (CI): IOD/HL × 100.

Scape length (SL): maximum chord length of the scape, excluding its basal condyle.

Scape Index (SI): SL/IOD × 100.

Mandible length (ML): maximum length of the mandible at full closure, in full-face view, from the tip of the apical tooth, in a transverse line, to the midpoint of the clypeus.

Mandibular Index (MI): ML/HL × 100.

Pronotal width (PrW): maximum width of the pronotum in dorsal view.

Weber's length of the mesosoma (WL): diagonal length of the mesosoma in lateral view, measured from the anteriormost portion of pronotum collar to the posteroventral corner of the mesopleuron.

Petiole length (PL): maximum length of the petiole, in lateral view.

Postpetiole length (PPL): maximum length of the postpetiole, in dorsal view.

Gaster length (GL): maximum chord length of the gaster, from the meeting of abdominal tergum 4 and sternum 4 at its anterior end to the most posterior point of the last segment, in lateral view.

Metafemoral length (FL): maximum chord length of metafemora.

Total length (TL): sum of ML, HL, WL, PL, PPL and GL.

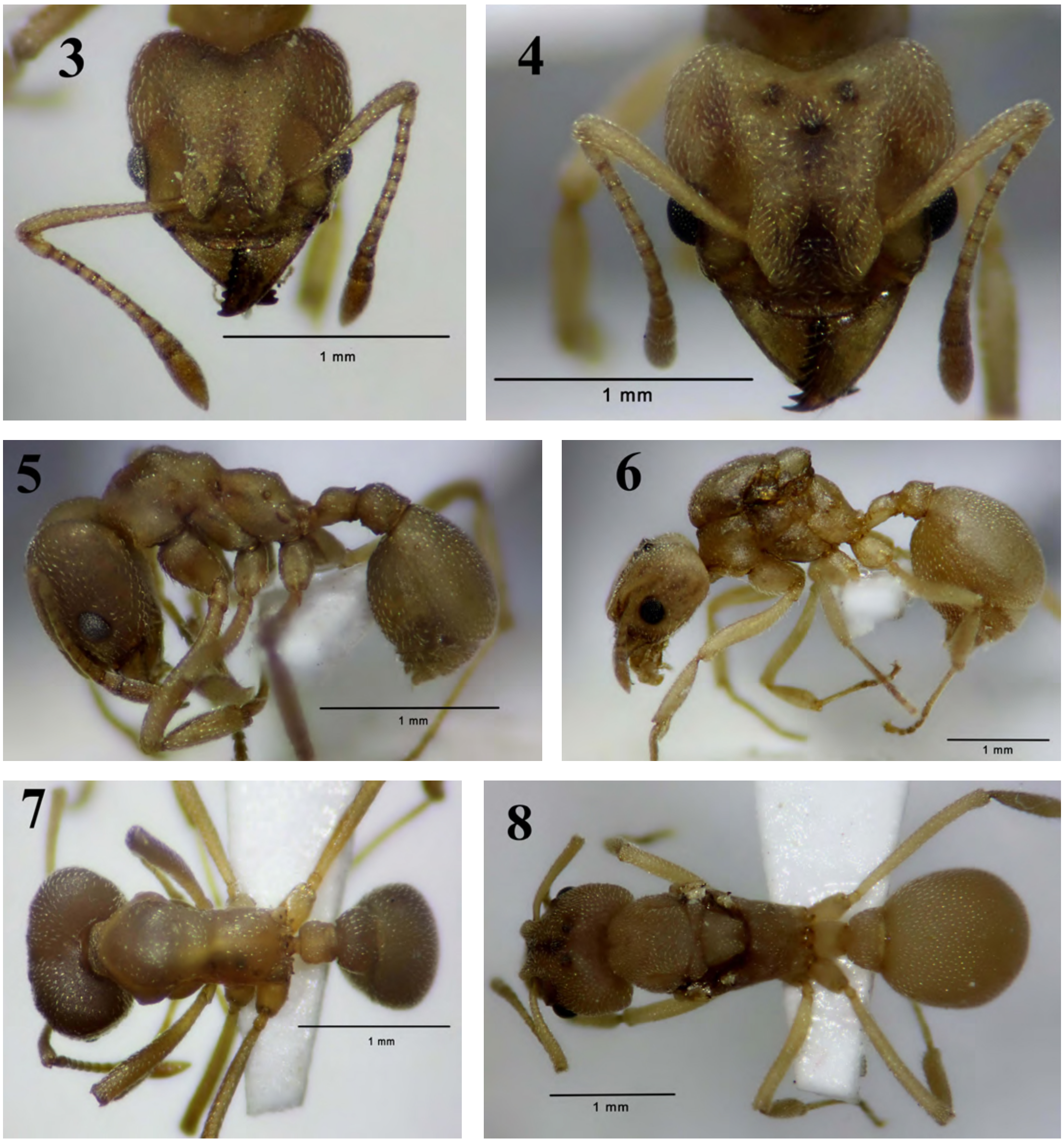
In order to illustrate the distribution map, historical records on the geographic distribution of the species were obtained from published data (Table 1). When geographic coordinates were not provided by references, data were geolocated with Google Earth (Google 2015). The distribution map was composed using Quantum GIS 2.2.0, Valmiera software.

Specimens were identified using the taxonomic key of Klingenberg and Brandão (2009) and Brandão C.R. (pers. comm., 15 September 2015) confirmed the species identification.

Mycetophylax simplex can be easily distinguished from other *Mycetophylax* by its yellow-brownish color and the unarmed propodeum. Other distinctive features were: head as long as wide or a little longer than wide; mandibles with eight to nine teeth; vertexal carina absent; integument of the frontal lobes semitransparent; antennal scapes not attaining the posterolateral corners of the head (Figures 3–8).

Range of measurements (in mm) and indices of examined worker ants (Figures 3, 5 and 7): IOD 0.81–0.82; HL 0.97–0.99; CI 83-84; SL 0.89–0.91; SI 95; ML 0.47–0.49; MI 49–50; WL 0.75–0.80; PrW 0.58–0.62; PL 0.18–0.20; PPL 0.19–0.22; GL 0.82–0.84; FL 0.92–0.95; TL 3.26–3.54.

Range of measurements (in mm) and indices of examined queen ants (Figures 4, 6 and 8): IOD 0.84–0.91; HL 1.05–1.07; CI 80–85; SL 0.78–0.87; SI 92–96; ML 0.49–0.51; MI 45–46; WL 1.22–1.30; PL 0.30–0.35; PPL 0.18–0.20; GL 1.34–1.38; TL 4.58–4.81.



Figures 3–8. *Mycetophylax simplex* from Barra del Chuy, Uruguay. **3**, **5** and **7**: Worker in frontal, lateral and dorsal view, respectively. **4**, **6** and **8**: Queen in frontal, lateral and dorsal view, respectively. Photos by D. Larrea.

This record represents the southernmost distribution for the genus *Mycetophylax*. Currently, *M. simplex* is the only species of the genera known in Uruguay. This may be due to the habitat preference of these ants, since no previous studies of ant species have been carried out along the beaches of the seacoast in Uruguay. The collection of specimens of *M. simplex* on the fore-dune is consistent with the findings of Klingenberg et al. (2007) which show that this species preferably builds its nests in the active dune zone with sparse vegetation.

During the last decades, in Uruguay, coastal ecosystems have been reduced and notoriously fragmented, while dynamic dunes have been strongly reduced to small areas on the Atlantic coast of the country (Costa 1995). The establishment of conservation plans on the landscape of the Uruguayan coast is urgent to preserve the coastal dynamics and the native flora and fauna. Traditionally, bioindicators have been used to assess ecosystem responses to environmental perturbation, often associated with human land use (Noss 1990; McKenzie et al. 1995). Ant species in particular have been incorporated in monitoring programs of environmental stress and disturbance and also have been used as indicators of restoration success in ecosystems highly impacted by human activity (Andersen 1997). Albuquerque et al. (2005) showed that the spatial arrangement of *M. simplex* nests in sandy beaches is related to the physical characteristics of the environment, distribution and availability of foraging resources and to the availability of nesting places. These reasons, coupled with the strict association between this ant species and the sand dunes, make *M. simplex* a good candidate for terrestrial biological indicator of conservation in coastal ecosystems. The presence, abundance, scarcity or absence of colonies of this species may reflect the degree of conservation of these areas. Behavioral and local ecological studies on this species are essential for implementing adequate management and conservation plans for coastal dunes in Uruguay.

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