Small mammals (Didelphimorphia, Rodentia and Chiroptera) from Pampean Region, Argentina


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ABSTRACT: We studied small mammal assemblages recovered from owl pellets collected at 11 locations throughout the Argentina's Pampean Region. We identified 21 species, including two marsupials, one bat, and 18 rodents. From the analysis of this dataset, we could distinguish three main groups of small mammals that currently inhabit the Pampean Region: 1) a group of taxa related to Pampean agroecosystems (Calomys spp., Akodon azarae, and Oligoryzomys flavescens); 2) a group of Brazilian species (Cavia aperea, Oxymycterus rufus, Necromys lasiurus, Necromys obscurus, Holochilus brasilienensis, and Monodelphis dimidiat); and 3) a group including species from Patagonia, Espinal and Monte phytogeographic provinces (Microcavia australis, Oligoryzomys longicaudatus, Eligmodontia typus, Grosmys griseoflavus, and Akodon molinae). In addition, we documented the first record of a species of the large-bodied group of Calomys in Buenos Aires province, expanding its distribution ca. 420 km southward.

INTRODUCTION

The Pampean Region is a large ecosystem of grasslands plains located in Central-Eastern Argentina, including southern Córdoba and Santa Fe provinces, and most of La Pampa and Buenos Aires provinces (León 1991). This region is ecologically interesting, since it comprises three different phytogeographic provinces: Pampa, Espinal and Monte (Cabrera 1976). From a zoogeographic perspective, it also partially coincides with the zoogeographic Pampean Dominion, an ecotonal area that has suffered constant environmental changes during the Quaternary, acquiring Patagonian and Brazilian characteristics alternatively (Ringuelet 1961). In addition, during the last centuries, environmental changes have been intensified by human activities, gradually transforming the natural Pampean grasslands into a mosaic of agroecosystems (León and Burkart 1998), resulting in substantial changes in the taxonomic structure of the small mammal assemblages inhabiting this area (Pardiñas et al. 2010; Teta et al. 2010).

Small mammal assemblages from this area have been mainly studied through the use of trapping techniques or from material recovered from owl pellets (e.g. Reig 1964; Massoia and Fornes 1965; Contreras 1968; 1973; Massoia 1976; Galliari and Pardiñas 2000; Pardiñas et al. 2004; Leveau et al. 2006). When comparing this fauna with that of other regions of Argentina, the taxonomy and distribution of small mammals in the Pampean Region is one of the best established. In spite of this, recent extensive studies conducted at the Pampas revealed that gaps still exist in the knowledge of the small mammal communities (Pardiñas et al. 2004; 2010; Teta et al. 2010).

In this study, we provide a list of small mammal species recovered from owl pellets collected at 11 locations throughout the Pampean Region. In addition, we report for the first time a large-bodied species of Calomys (sensu Corti et al. 1987) in the Pampean Region, expanding southward the geographic distribution of the large-bodied group of this genus.

MATERIALS AND METHODS

During the last decade, pellets of barn owls (Tyto alba, Aves, Tytonidae) were collected at 11 locations throughout the Pampean Region (Figure 1 and Appendix I). Studied samples were deposited at the Museo de Historia Natural de San Rafael (MHNSR), Mendoza province, Argentina.

The climate of the Pampean Region is determined by the Atlantic anticyclone, which reduces its effects from northeast to southwest. This results in a heterogeneous climate, which changes gradually from humid in the northeastern area (mean annual precipitation of 1200 mm; mean annual temperature of 18°C) to dry subhumid in the southwestern area (mean annual precipitation of 600 mm; mean annual temperature of 14°C; Burgos 1968).

The small mammal assemblages studied came from the Pampa (locations 1 to 9) and from the Espinal (locations 10 and 11) phytogeographic provinces. The Pampa is composed by plains and a few isolated mountainous areas; the vegetation is characterized by grasslands, halophytic and psammophytic steppes, reedbeds, and shrublands, dominated by grasses such as Stipa, Aristida, Melica, Briza, Bromus, Eragrostis, and Poa. The Espinal surrounds the Pampa on its northern, western and southern boundaries; the vegetation is characterized by xerophytic forests, savannas and steppes of Prosopis, Acacia, Celtis, Schinus and Geophroea decoriticans (Cabrera 1976; León 1991).

From the disaggregated owl pellets, we identified cranial remains to the lowest taxonomic level possible by comparisons with reference collections deposited at Museo de La Plata (MLP) and published literature (e.g. Massoia and Fornes 1965; Massoia 1976; Galliari and Pardiñas 2000). Nevertheless, an open taxonomy was used for Myotis Kaup, 1829; Ctenomys Blainville, 1826...
and Rattus Fischer, 1803; since their fragmentary remains were difficult to indentify to the species level. In addition, Calomys laucha (Fischer, 1814) and Calomys musculinus (Thomas, 1913) are almost indistinguishable from craniodental remains (Pardiñas and Lescano 1995).

For each taxon, we calculated the minimum number of individuals (MNI) by quantifying the most frequent element (maxilla or mandible) from either the right or the left side.

Data on the small mammal assemblage from the location of Olavarría (locality 5) was previously published by Fernández et al. (2009). Nevertheless, when carefully revising the remains named as Calomys cf. C. laucha-C. musculinus by those authors, we realized that a few specimens were morphologically different and larger than the mean body size of the other specimens of Calomys. Therefore, we made morphological and quantitative comparisons between these larger specimens and reference material of species of Calomys that belong to the large-bodied group (see below for this grouping) inhabiting the proximities of the Pampean Region (C. callosus (Rengger, 1830), C. callidus (Thomas, 1916), and C. venustus (Thomas, 1894)), and the most frequent species of the small-bodied group (C. musculinus) inhabiting the Pampean Region. Collection numbers of Calomys specimens are given in Appendix I.

RESULTS AND DISCUSSION

Small mammal assemblages are listed in Table 1. A total of 3,421 small mammals were recovered from the pellets of the 11 analyzed samples. Among the 21 identified taxa, the sigmodontine rodent Calomys cf. C. laucha-C. musculinus was the most frequent taxon in almost all locations, constituting 63% of the total specimens, followed by Akodon azarae (Fischer, 1819) and Oligoryzomys flavescens (Waterhouse, 1837) (13.5% and 10.6%, respectively). Mus musculus Linnaeus, 1758 constituted 3.3% of the total sample and was especially abundant in Eastern locations, whereas E. lacertina typus Cuvier, 1817 constituted 3.2% of the total specimens identified, being present only in the Espinal (i.e. Laguna Chasició and Marahué). The remaining small mammals were scarcely represented (e.g. Ctenomys, Myotis, and Thylamyss pallidior Thomas, 1902).

The fossil record reveals that recent small mammal assemblages were already established in the Pampean Region during the Pleistocene (Pardiñas et al. 2010). However, at that time, some rodent species, such as C. laucha and C. musculinus, were much less frequent than they are today. During the last four centuries, especially during the 19th and 20th centuries, the development of agroecosystems would have favoured these species (though increases of population size and extension of their geographic ranges), to the detriment of other populations of rodents, such as Reithrodon auritus (Fischer, 1814) or Necromys lasiurus (Lund, 1840) (see Pardiñas et al. 2010; Teta et al. 2010). Genetic studies of population structure of C. laucha and C. musculinus confirm the hypothesis of recent range expansion (e.g. Chiappero et al. 2002; González-Ittig et al. 2007).

Based on ecological and biogeographic characteristics of the species recorded in this study, we can distinguish three main groups of terrestrial small mammals in the Pampean Region. One group is related to the natural grasslands and agroecosystems of the Pampa (Calomys spp., A. azarae, and O. flavescens). Akodon azarae, O. flavescens and C. laucha are distributed from southern Brazil to the southern Pampean Region; whereas C. musculinus has a wider distribution, from Bolivia to southern Patagonia (Pardiñas et al. 2010). The second group comprises Brazilian species [Cavia aperea Erxleben, 1777; Oxyymetrum rufus (Fischer, 1814); N. lasiurus; Necromys obscurus (Waterhouse, 1837); Holochilus brasiliensis (Desmarest, 1819) and Monodelphis dimidiata (Wagner, 1847)]. These species present wide distributions, in temperate and humid grasslands, ranging from southern Brazil to the southern Pampean Region, with the exceptions of N. obscurus on the one hand, which is restricted to the coast of Uruguay, Buenos Aires Province (Argentina), and hills in the Tandilia System; and C. aperea on the other hand, which presents a wider distribution throughout South America (Redford and Eisenberg 1992; Pardiñas et al. 2010). The third group includes species from Patagonia, Espinal and Monte phytogeographic provinces [T. pallidior; Microcavia australis (L. Geoffroy Saint-Hilaire and d’Orbigny, 1833); Oligoryzomys longicaudatus (Bennett, 1832); E. typus; Grammys griseoflavus (Waterhouse, 1837); Akodon molinae Contreras, 1968]; T. pallidior, M. australis, O. longicaudatus and E. typus are commonly associated with Patagonian and Monte environments, whereas G. griseoflavus and A. molinae are mostly restricted to the Espinal and Monte (Redford and Eisenberg 1992; Pardiñas et al. 2010). The exotic murids M. musculus and two species of Rattus [i.e. R. rattus (Linnaeus, 1758) and R. norvegicus (Berkenhout, 1769)], commonly associated with human settlements, could be regarded as an additional group.


<table>
<thead>
<tr>
<th>MAMMALIA</th>
<th>Didelphimorphia</th>
<th>Chiroptera</th>
<th>Rodentia</th>
<th>Caviidae</th>
<th>Cricetidae</th>
<th>Muridae</th>
<th>Total</th>
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<tr>
<td>Monodelphis dimidiata</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>17</td>
<td>28</td>
</tr>
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<td>Thylamys pallidior</td>
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<td>2</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>14</td>
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<tr>
<td>Myotis sp.</td>
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<td>1</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>20</td>
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<td>Ctenomys sp.</td>
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<td>1</td>
<td>7</td>
<td>16</td>
<td>1</td>
<td>32</td>
<td>197</td>
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Table 2. Descriptive statistics of craniodental measurements of large-bodied Calomys from Olavarría and selected samples of C. venustus, C. callosus, C. calidus, and C. musculinus. Sample size in parentheses, mean ± SD, and range of variation. Measurements are in mm. * Data from Bonvicino et al. (2010: Table 3).

<table>
<thead>
<tr>
<th>Species</th>
<th>Rostral width</th>
<th>Interorbital constriction</th>
<th>Palatal length</th>
<th>Palatal width</th>
<th>Incisive foramina length</th>
<th>Maxillary toothrow length</th>
<th>Upper diastema length</th>
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</thead>
<tbody>
<tr>
<td>Calomys sp.</td>
<td>4.87 ± 0.28</td>
<td>4.42 ± 0.25</td>
<td>11.64 ± 0.15</td>
<td>2.42 ± 0.23</td>
<td>5.97 ± 0.30</td>
<td>4.33 ± 0.20</td>
<td>6.67 ± 0.30</td>
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<tr>
<td>C. callosus</td>
<td>5.13 ± 0.31</td>
<td>4.37 ± 0.19</td>
<td>12.29 ± 0.58</td>
<td>2.93 ± 0.17</td>
<td>5.92 ± 0.28</td>
<td>4.81 ± 0.35</td>
<td>6.67 ± 0.44</td>
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<tr>
<td>C. calidus*</td>
<td>4.91 ± 0.46</td>
<td>4.19 ± 0.36</td>
<td>11.60 ± 0.74</td>
<td>2.86 ± 0.29</td>
<td>5.89 ± 0.47</td>
<td>4.35 ± 0.25</td>
<td>6.75 ± 0.56</td>
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<td>(11)</td>
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</tbody>
</table>

Some species of small mammals recorded by previous surveys in the Pampean Region (e.g. Pardiñas et al. 2010; Teta et al. 2010) were not recorded in this study. These include, for example, species restricted to the northeastern area and belonging to the second (Brazilian) group (e.g. Holochilus chacarius Thomas, 1906; Oligoryzomys nigripes (Olfers, 1818); Scapteromys aquaticus Thomas, 1920; Bibimys torresi Masoía, 1979; and Deltamys kempi Thomas, 1917), and species belonging to the above-mentioned third group (e.g. Akodon iniscatus Thomas, 1906; and Phyllostis xanthopygus bonariensis Crespo, 1964).

As mentioned above, few specimens of the genus Calomys from Olavarría were larger and morphologically different from those determined as Calomys cf. C. laucha-C. musculinus (Table 2 and Figure 2). Some authors informally grouped the species of Calomys by their size into two groups: small- and large-bodied size (e.g. Corti et al. 1987); see external measurements of some of the species of these two groups in Bonvicino et al. (2010: Table 3). In fact, molecular phylogenies show the existence of two natural groups: highland and lowland Calomys (e.g. Salazar-Bravo et al. 2001; Almeida et al. 2007). In
addition, these studies also supported a monophyletic clade containing all large-bodied species within the lowland Calomys group. Among the species of this large-bodied clade, only C. venustus has been registered in the northwestern Pampean Region, whereas C. callosus and C. callidus have a distribution that reaches the northern boundaries of this region. The taxonomy of these three species is controversial. Hershkovitz (1962) considered C. venustus and C. callidus as synonyms of C. callosus. Later studies based on morphometric, cytogenetic and molecular data have supported the validity of these species (e.g. Corti et al. 1987; Salazar-Bravo et al. 2001; 2002). Nevertheless, Contreras et al. (2003) on the basis of cytogenetic data and the relocation of the type locality of C. callosus (outside the range of its geographic distribution), stated that this species and C. callidus should be considered as conspecific.

In this context, we observed that the large specimens from Olavarría presented some morphological characteristics shared with species of the large-bodied group of Calomys. These include prominent lateral and divergent borders of the frontals, and parallel maxillary toothrows (Figure 2). On the contrary, smoother and less divergent borders of the frontals, and convergent maxillary toothrows are features of the small-bodied species of the genus registered in Buenos Aires Province to date (C. laucha and C. musculinus). The larger Calomys specimens from Olavarría also differed in other characteristics from the species of the large-bodied group (C. venustus, C. callidus, C. callosus): postero-palatal pits deeper (except when comparing with C. venustus); anterior border of the mesopterygoid fossa more attenuated M shape; zygomatic notch shallower and narrower; anterior border of the zygomatic plate nearly straight, as in all large-bodied species (with the exception of C. venustus, in which it is convex in its upper part). The craniodental measurements of the specimens of Calomys studied here are given in Table 2. Measurements of the specimens from Olavarría were within the range of those of the large-bodied group of Calomys and larger than those of C. musculinus, with the exception of palatal width.

The species of the large-bodied group of Calomys present a geographic distribution from the lowlands at central and southeastern Brazil, Paraguay and Bolivia to southern Córdoba, Santa Fe and Entre Ríos Provinces in Argentina. These species inhabit warm environments of the Chaco, Espinal, dry forests, savannas, and pampas (Contreras et al. 2003; Almeida et al. 2007; Bonvicino et al. 2010). Therefore, the material described here constitutes the first record of the large-bodied group of Calomys in Buenos Aires Province, expanding the known distribution of this group ca. 420 km southward. Despite the lack of an

**Figure 2.** Skulls and mandibles of large-bodied Calomys from Olavarría and reference species. A. Calomys sp. (MLP 1.I.03.17, MLP-1.I.03.23); B. C. venustus (MLP 31. XII. 02. 68); C. C. callidus (MLP 26. XII. 01. 3); D. C. callosus (MLP 30. XI. 01. 11) and E. C. musculinus (MLP 31. XII. 02. 07). Above: ventral view; middle: dorsal view; bellow: lateral view. Detailed views of Calomys sp. from Olavarría show morphological characters described in the text.
accurate identification of these remains, we do not discard the hypothesis that these specimens belong to a distinct species, possibly endemic to central Buenos Aires province. Future trapping efforts in the vicinity of Olavarría can shed light on their taxonomic status.

Our dataset shares similarities to previous studies in the Pampean Region. Nevertheless, the record of a species of *Calomys* of the large-bodied group in the center of this area points to the existence of gaps in our knowledge on the small mammal fauna of this region.

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**LITERATURE CITED**


