Effect of herbivorous rodents (cavies and tuco-tucos) on a shrub community in the Monte Desert, Argentina

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The importance of tuco-tucos (Ctenomys eremophilus) and cavies (Microcavia australis) as herbivores in the Monte Desert was assessed on a creosotebush community dominated by Larrea cuneifolia. Herbivory by tuco-tucos or cavies affected 35% of the total plants. The most highly damaged plant species was Atriplex lampa, followed by Larrea cuneifolia and Lycium sp. The level of damage caused by Ctenomys was higher than that produced by cavies.

Keywords: Monte Desert; mammals; herbivory; creosotebush

Introduction

The influence of domestic livestock on natural plant communities has been thoroughly studied in several ecosystems (e.g. Crawley, 1983; Guevara et al., 1996). Yet information on the relationship between small wild mammals and plant communities is scarce. Studies addressing this topic deal, for example, with the floristic modification of Arctic tundra by the Arctic ground squirrel (Spermophilus parryii; Mallory & Jeffersn, 1987), the effect of browsing on seedling establishment (Myster & McCarthy, 1989), the influence of fossorial rodents on vegetation (Reichman & Jarvis, 1989; Gómez-García et al., 1995) and the dispersal of geophytes by mole-voles (Microtus (Terricola) gerbel, M. (T.) duodecimcostatus and M. (T.) lusitanicus) in the Pyrenees (Borghi & Giannoni, 1997) among others.

Studies have been made in arid and semi-arid regions of South America concerning the effect of the fossorial rodent Spalacopus cyanus on the herbaceous vegetation of central Chile (Contreras & Gutiérrez, 1991) Contreras et al., 1993, the effect of the native rodent Octodon degus and the European rabbit Oryctolagus cuniculus as browsers of shrub seedlings (Fuentes et al., 1983), vegetation disturbances by Lagostomus maximus in semi-arid scrubs (Kufner & Chamboulieuron, 1993; Branch et al., 1996; Campos, 1997) and the importance of native mammals as seed dispersal agents (Campos & Ojeda, 1997).
Bucher (1987) has suggested that herbivory plays an important role in modelling plant community composition, structure and function. However, he was thinking of present and extinct large herbivorous mammals (Camelidae, Cervidae and T apiridae, or Gophoteridae, T oxodontidae and Megateridae, respectively) and insects (leaf-cutting ants and migratory locust), rather than of medium-sized herbivorous rodents such as tuco-tucos (Ctenomys eremophilus) or cavies (Microcavia australis and Galea musteloides). The mammal fauna of South American drylands is characterized by medium-sized and small rodents, mainly herbivores and omnivores (Mares, 1980; Kelt et al., 1996), and by only a few large herbivores (Bucher, 1987).

The M onte biogeographical province, one of the largest dry areas of Argentina, consists mainly of an extensive shrubland dominated by Larrea spp. interspersed with open forests of Prosopis spp. (Morello, 1985). In the Reserve of Nacuñán, located in the central area of the M onte Desert, there are medium-sized herbivorous rodents: Dolichotus patagonum Zimmermann (Caviidae), Lagostomus maximus Desmarest (C hinchillidae), Ctenomys eremophilus Contreras & Roig (C tonymyidae), M icroavia australis I. Geoffroy & D’orbigny (Caviidae) and G alea musteloides M eyen (Caviidae), and only one small herbivorous rodent, G raomys griseoflavus Waterhouse (M uridae) (Campos, 1997). These medium-sized species are hystricognaths and belong to the oldest rodent group in South America (Pascual, 1996).

As tuco-tucos and cavies are typical of the M onte Desert (Cabrera & Willink, 1980), and the most abundant rodents in the Nacuñán Reserve, the aim of this study was to quantify their effect on a creosotebush community dominated by Larrea cuneifolia.

Material and methods

The study was conducted in September 1995, in the M onte and Biosphere Reserve of N acuñán (M endoza province, Argentina), located 200 km from M endoza city (34° 03' S, 67° 58' W). This protected area is a lowland with semi-arid climate. Rainfall occurs primarily in summer, and mean annual precipitation is 322 mm (Campos, 1997). Average maximum and minimum temperatures (1972–1990) range from 32·4°C and 16·0°C in January to 14·9°C and –0·9°C in July, respectively (Guevara et al., 1996).

The extent of herbivory by cavies and tuco-tucos can readily be quantified by counting damaged plants. T uco-tucos browse with their incisors, cutting diagonally across the stem of shrubs, as jackrabbits do in the Chihuahuan Desert (Ernest, 1994). Cavies, on the other hand, use their incisors to strip the bark of shrubs (Rood, 1972; Mares & Hulse, 1972; Mann, 1978).

Samples were taken from a scrubland dominated by creosotebush (Larrea cuneifolia Cav.) associated with other shrubs such as L yci um sp., A tripex lampa Gill. ex M og., Condalia microphylla Cav. and C apparis atamisquex M iers ex H ooker et Arnott (Roio, 1970). With the exception of L yci um sp. all these shrubs are perennial.

The effect of tuco-tucos (C tenomys eremophilus) and cavies (M icroavia australis) on vegetation was quantified on 207 samples (2 m²) taken along 18 transects (30 m long) randomly run in the study area.

Damage to vegetation was scored by percentages of cut or stripped stems, as follows: totally damaged, 100% of stems cut or debarked; seriously damaged, 99–50% of stems cut or debarked; damaged, less than 50% damaged; undamaged, 0% damaged. Damage to plants is expressed as percentages of damaged shrubs.

Plant density was also quantified on the 207 samples, as number of individual shrubs 2 m–2. To express plant density as shrubs 10 m–2, data was analysed by joining them in 41 groups of five samples. Then, results of plant density are given as mean number of shrub plants 10 m–2 ± 1 S.D.
The association between plant species and degree of damage was analysed by Chi-square analysis of contingency tables. The same analysis was used for estimating the association between damaged creosotebush shrubs and rodent species (Zar, 1984).

Results

Plant density was found to be $3.95 \pm 2.25$ shrubs $10 \text{ m}^{-2}$. For \textit{Larrea cuneifolia}, the most abundant shrub, density was estimated as $3.32 \pm 2.03$ shrubs $10 \text{ m}^{-2}$. Other species were present in lower densities, such as \textit{Lycium} sp. ($0.27 \pm 0.55$ shrubs $10 \text{ m}^{-2}$), \textit{Atriplex lampa} ($0.22 \pm 0.57$ shrubs $10 \text{ m}^{-2}$), \textit{Condalia microphylla} ($0.12 \pm 0.33$ shrubs $10 \text{ m}^{-2}$) and \textit{Capparis atamisquea} ($0.02 \pm 0.16$ shrubs $10 \text{ m}^{-2}$).

Herbivory by tuco-tucos or cavies affected $35\%$ of the total plants sampled. The most highly damaged plant species was \textit{Atriplex lampa} ($44.4\%$) followed by \textit{Larrea cuneifolia} ($37.2\%$) and \textit{Lycium} sp. ($9.1\%$), but damage differences were not statistically significant ($\chi^2$ test, Chi-square: $3.833$; df. 2; $p = 0.15$; Table 1).

Out of the total damaged plants, $62.5\%$ were damaged by tuco-tucos and $37.5\%$ by cavies. Considering creosotebush only, the level of damage caused by tuco-tucos was significantly higher than that produced by cavies ($\chi^2 = 4.738$; $p = 0.03$; df. = 1; Fig. 1). In fact, only tuco-tucos caused total damage to these plants ($7\%$).

\textbf{Table 1.} Number (and frequency in parentheses) of damaged \textit{Larrea cuneifolia}, \textit{Lycium} sp. and \textit{Atriplex lampa} in a creosotebush community, Ñacuñán Reserve, Monte Desert, Argentina

<table>
<thead>
<tr>
<th>L. cuneifolia</th>
<th>Lycium sp.</th>
<th>A. lampa</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undamaged</td>
<td>86 (0.63)</td>
<td>10 (0.91)</td>
<td>5 (0.56)</td>
</tr>
<tr>
<td>Damaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuco-tucos</td>
<td>31 (0.23)</td>
<td>-</td>
<td>4 (0.44)</td>
</tr>
<tr>
<td>Cavies</td>
<td>20 (0.15)</td>
<td>1 (0.09)</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

\textbf{Figure 1.} Number and status of \textit{Larrea cuneifolia} damaged by \textit{Ctenomys eremophilus} and \textit{Microcavia australis} in Ñacuñán Reserve, Monte Desert, Argentina. (□) = totally damaged; (■) = seriously damaged; (●) = damaged.
Discussion

Medium-sized herbivorous rodents, tuco-tucos and cavies, damaged an important number of plants in the creosotebush community. Tuco-tucos browsed a great number of creosotebush shrubs (22.8%), as was also observed by Mares & Hulse (1977) in another site of the Monte Desert. Cavies have also been found to strip the bark of creosotebush shrubs (14.6%). The great damage to creosotebush plants was done mainly during the dry season (pers. obs.). A similar pattern was found for herbivory by black-tailed jackrabbits on Larrea tridentata in North American warm deserts (Ernest, 1994).

Diet data reported by Monge et al. (1994) suggest that cavies only forage on creosotebush at the end of the dry season. Madoery (1993) found that Larrea is also present in the diet of tuco-tucos mainly during the dry season. Both these data and our results suggest that this plant species becomes an important food resource during the dry season, when little other green vegetation is available, in spite of the high number of defensive substances that these plants accumulate (Rhoades, 1977). Therefore, cavies and tuco-tucos probably forage on creosotebush to obtain food with higher water content. Nevertheless, creosotebush is rejected as a food resource by other herbivorous mammals of Nacuán (Campos, 1997).

This study highlights the present importance of herbivory by medium-sized rodents in the arid and semi-arid lands of Argentina. Actually, the current significance of these herbivores has been enhanced because large herbivorous mammals (e.g., Lama guanicoe) have become extinct in the Reserve (and in almost all of the Monte Desert), and the migratory locust has almost disappeared (Morello, 1985).

We can conclude that herbivory by tuco-tucos and cavies is of great importance in Monte Desert communities. Further studies are needed to understand the relationships between these herbivores and the floristic composition, structure and function of these dry neotropical ecosystems.

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References


