Abstract  This study investigates patterns of habitat use and competition in sympatric populations of the bush rat, Rattus fuscipes, and swamp rat, R. lutreolus, in the Blue Mountains National Park, New South Wales, Australia. Radiotracking showed that the home ranges of R. fuscipes tended to occupy woodland more than those of R. lutreolus, whereas use of heath and sedgeland by both species was equal. Home range overlaps were less between the two species than between individuals of R. lutreolus. Trap-captures showed that both species used structurally complex microhabitats, but also that R. fuscipes occupied relatively drier sites with denser leaf litter and taller canopy than R. lutreolus. In a field enclosure containing equal parts dense sedge and woodland, both species spent most time in the sedge. R. lutreolus frequently initiated agonistic behaviour and dominated its smaller congenere; subordinate individuals fled or vocalized loudly. To test whether the observed patterns of habitat use of R. fuscipes resulted from habitat selection or competition with R. lutreolus, a field experiment was carried out in which the latter species was removed from two study sites but maintained in two controls. Following removal, the capture rate of R. fuscipes increased some 6.5-fold in sedgeland habitat that had been occupied formerly by R. lutreolus, while capture rates in sedge in the control sites remained unchanged. The rapidity of the habitat shift implicates current or intense competition, mediated by interference. Although interference is a costly process, it may benefit the dominant R. lutreolus by allowing priority of access to preferred moist habitats containing important food or shelter resources. Conversely, R. fuscipes may tolerate interference if it benefits from even temporary access to moist habitats, can reliably detect and avoid R. lutreolus prior to encounters, or has access to drier woodland areas under-used by the dominant species. We suggest finally that extensive gene flow in R. fuscipes may preclude adaptive shifts in habitat preferences in local populations that are sympatric with R. lutreolus, thus reducing the importance of competition but maintaining its intensity over time.

Keywords Field experiment · Enclosure · Radiotracking · Rodents · Interference

Introduction

If animals can recognize differences among habitats, we might expect them to prefer the highest-quality habitats that are available. Preferred habitats should contain resources that are essential for individual survival and reproduction, including food, shelter and mates. However, such habitats may also contain competitors, predators or other limiting factors so that the actual habitat an individual uses is likely to be a compromise that maximizes the benefits relative to costs (Levins 1968; Holt 1993; Shenbrot and Krasnov 2000). At equilibrium, we might predict further that communities should contain habitat selectors that have a competitive edge in some but not all habitats that are available (Brown and Pavlovic 1992). Generalist species may co-occur if they exploit ephemeral habitats where competition from specialists is minimal (“fugitive species”; Hutchinson 1951) or habitats underused by the specialists (Brown 1996; Kotler and Brown 1999).

Among small mammals, competition between species is often an important determinant of habitat use (Grant 1978; Framstad and Stenseth 1984; Rosenzweig 1989; Morris 1999a). On a coarse, or macrohabitat, scale, interspecific competition has been shown to restrict species’ use of broad vegetation types or to result in mutual exclusion from large areas (Brown 1971; Dickman 1984). On a finer, microhabitat scale, competition may promote differential use of habitat components such as shrubs, trees or open spaces (Price 1978; Dickman 1986a, 1986b, 1986c, 1988), with segregation being more marked at high than at low competitor densities.
Influenced by competition from its larger congener. Both species eat green plant material; areas and upland localities such as the Blue Mountains (Banks 1989). We then evaluate Rattus habitat and microhabitat use in two species of native Australia (Flannery 1989) and the consequently great option could be expected to be particularly important rather than intense (Welden and Slauson 1986) among species of Rattus due to the Pleistocene arrival of the genus in Australia (Flannery 1989) and the consequently great opportunities for evolution of divergent habitat preferences.

In the present study, we first describe patterns of macrohabitat and microhabitat use in two species of native Rattus, the swamp rat R. lutreolus (180 g) and the bush rat R. fuscipes (150 g), that occur sympatrically in the Blue Mountains of New South Wales. We then evaluate whether the observed patterns likely arise from habitat selection or interactions between the two species, and finally test the hypothesis that habitat use in R. fuscipes is influenced by competition from its larger congener.

Materials and methods

Study species and study area

Both study species occur along the eastern seaboard of Australia, and achieve high population densities (>10 ha⁻¹) in some coastal areas and upland localities such as the Blue Mountains (Banks 1991). Both species eat green plant material; R. lutreolus takes primarily monocotyledonous plants, while R. fuscipes includes considerable arthropod, seed and fungal material in the diet (Warneke 1971; Catling 1986). R. fuscipes occurs in a wide range of habitats that provide dense cover at ground level, including woodland, wet and dry sclerophyll forest, rainforest, coastal heath, edges of swamps and mangroves (Warneke 1971; Wood 1971; Taylor and Calaby 1988a). R. lutreolus also occupies diverse heath and woodland habitats, but prefers moister areas than its smaller congener, with a dense ground layer of sedge or tall grasses (Braithwaite and Gullan 1978; Taylor and Calaby 1988b; Haering and Fox 1995). In montane areas, both species of rats are food-limited during winter (Banks and Dickman 2000).

Four study sites containing both Rattus species were set up near Blackheath, in the Blue Mountains National Park, 100 km west of Sydney. Each site was situated along a narrow valley with a small creek; sites were at least 200 m apart. Woodland dominated by Eucalyptus sclerocephala, E. stricta and E. mannifera occurred from the creek sides up the valley slopes in each site, with small shrubs (Leptospermum spp., eucalypt saplings) providing patchy cover at ground level. Closed heath dominated by Grevillea acanthifolia, Hakea teretifolia and Leptospermum spp. occurred on the valley floors and lower slopes, while sedgeland of Gymnoschoenus sphaerocephalus occurred patchily in flats near the banks of the creeks. Small numbers of non-target mammals, the brown antechinus Antechinus stuartii and dusky antechinus A. swainsoni, occurred in the study sites.

Trapping and radiotracking

R. fuscipes and R. lutreolus were trapped and radiotracked in each site to determine their use of habitat on both a micro- and macro-habitat level.

A grid of 48 trap stations, with stations spaced 10–25 m apart, was set up in each of the four study sites. The grids covered an area ranging from 0.8 ha to 1.3 ha and incorporated the three macro-habitat types (woodland, closed heath and sedgeland). Some variation in trap spacing and grid size was necessitated by the configuration of the valley floors. An Elliott trap (33×10×10 cm) was po-