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# Use of Rodenticide Bait Stations by Commensal Rodents in Southern California

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**ABSTRACT:** Non-native, commensal rodents damage property and represent a significant public health hazard through the spread of diseases. Pest management professionals commonly use second-generation anticoagulant rodenticides, usually placed in tamper-proof bait stations, to control commensal rodents in urban areas; however, there are significant concerns about poisoning of native wildlife, especially through secondary exposure of predators and scavengers that consume prey killed by rodenticides. Behavioral responses of commensal and native rodents to bait stations are not well understood, especially at the urban-wildland interface. The goals of this project were to 1) determine temporal patterns of bait station use by commensal rodents; 2) identify factors that may influence bait station visitation by native species; and 3) devise simple mitigation techniques to reduce wildlife exposure to rodenticides.

We deployed Reconyx™ PC800 digital cameras to monitor bait stations placed in 90 residential yards across Orange County, California. Two bait stations, armed with non-toxic bait, were monitored continuously in each yard for approximately 30 consecutive days from December 2017 to August 2018 (Session 1). A subset of 64 of these yards were surveyed again from September 2018 to March 2019 (Session 2). One bait station was placed on the ground, whereas the other was elevated 1-1.5 m in a tree or along a fence to determine if non-target exposure to rodenticides could be reduced by elevating bait stations.

Roof rats (*Rattus rattus*) were the only commensal rodents detected in Orange County yards, and were present at 80% of sites, with average activity ranging from 0 to 9 hours each night. Bait stations were discovered quickly in yards with a lot of rat activity, especially at boxes placed directly on the ground, where rats were recorded in nearly 90% of yards within 10 days of placement. Time to discovery did not differ significantly, however, between ground and elevated stations, with mean times ranging from 7 to 10 days across both sampling sessions. Mean time to enter the bait station also did not differ between elevated and ground stations, varying from 10 days in Session 1 and 11-12 days in Session 2. Rats entered only 59-70% of the bait stations they visited, suggesting some degree of neophobia. Native rodents, including California ground squirrels (*Otospermophilus beecheyi*), woodrats (*Neotoma* sp.), and deer mice (*Peromyscus* sp.) were relatively rare among our 90 sites (13% of yards), and were recorded at elevated stations much less frequently than ground stations. Woodrats, deer mice, and, in one instance, a juvenile Virginia opossum (*Didelphis virginiana*), were photographed entering bait stations, and non-native fox squirrels (*Sciurus niger*) were able to access bait by chewing through the top and walls of the bait stations. Yards visited by native rodents tended to be closer to areas of natural vegetation and to have no significant barriers to entry (e.g., solid fences or walls) from nearby open spaces.

We identified several ways that our results may help improve the management of commensal rodents at the urban-wildland interface in southern California, where reducing non-target exposure is a critical concern. First, the high level of rat activity in some yards suggests that bait may be rapidly depleted, which could reduce effectiveness. Rats had a behavioral response to bait depletion and replenishment, so it may be useful to monitor bait consumption frequently during the first week of bait application and adjust levels accordingly. We caution, however, that our stations contained bait but lacked rodenticides, so we do not know how the presence of toxicant or the deaths of other rats might alter behavioral responses to bait stations. Second, the fact that rats were photographed entering only a fraction of the bait stations suggests either that cameras missed some of these events or that rats showed some reluctance to enter bait stations, even in the absence of rodenticide. Even in yards where rats eventually entered bait stations, it was 7 or 8 days until their first direct exposure to bait. Because the first mortalities from rodenticide might not occur for more several days, pest management professionals should be prepared to communicate the possibility of delays to customers to prevent them from becoming impatient and taking more drastic (and potentially illegal) measures if results are not immediate. Lastly, given the mobility of many wild predators and scavengers in southern California, if rodenticides are the only option available for effective pest control, special efforts should be made to search for and remove rat carcasses quickly, especially in yards that are accessible to native wildlife or adjacent to natural areas. In open, accessible yards close to natural areas, integrated pest control approaches should first be attempted to minimize risk to non-target wildlife species. If rodenticides must be used to control roof rats, bait stations should be elevated to try to prevent native rodents from consuming bait; this approach may also reduce exposure to children and pets.

**KEY WORDS:** bait stations, commensal rodents, neophobia, non-target wildlife, *Rattus*, rodenticides, vertebrate pest control

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