Identifying Effective Attractants and Rodenticide Baits for Gambian Giant Pouched Rats

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ABSTRACT: Following the escape of 8 Gambian giant pouched rats (Gambian rats) from an exotic pet breeder in 1999, Gambian rats became an established invasive species that persists in the wild on Grassy Key, Florida. Because of their large body size, the free-ranging Gambian rats pose a serious threat to native species and agricultural crops, especially if they find their way into mainland Florida. Initiated in 2005, the USDA Wildlife Services has been conducting an eradication and detection program in the Florida Keys. Today however, detecting, baiting, trapping, and removing the now sparse population of Gambian rats are proving difficult. Therefore, we conducted a laboratory trial with wild-captured Gambian rats from Grassy Kay to test 15 potential materials that could be used for attracting the remaining free-ranging population. We found that a conspecific scent (i.e., feces and urine) from other Gambian rats was the most attractive, but also peanut butter, anise, ginger, and fatty acid scent seemed to attract Gambian rats. In an additional study, we tested the efficacy of 6 commercially available rodenticide baits (all with different formulations of active ingredients) in multiple-choice food trials. We found that brodifacoum (second-generation anticoagulant) and zinc phosphide (acute rodenticide) formulated baits were highly effective. Using these various attractants and rodenticides could be useful for eliminating the sparse population of invading Gambian rats in the Florida Keys.

KEY WORDS: attractants, *Cricetomys gambianus*, efficacy, Florida, Gambian giant pouched rats, invasive species, rodenticides

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INTRODUCTION

Background on Gambian Giant Pouched Rats

The basic biology and ecology of Gambian giant pouched rats (*Cricetomys gambianus*; Gambian rats) have been reviewed in several texts, mostly guides to African mammals (Kingdon 1984, Nowak 1999, Smithers 1983). Gambian rats are native to a large part of central and southern Africa. They use a variety of habitats, mostly savanna, shrublands, grasslands, drier forests, riverine systems, and human-disturbed areas. Like many rodent species, they are adaptable, feed on a variety of foods (but mainly green vegetation, tubers, fruits, and nuts), and have a high reproductive potential. Females produce several litters per year (up to 10), each with about 4 young. They live in burrow systems which were built by the Gambian rats or sometimes by other animals, or were created naturally (e.g., crevasses, under logs, rock piles, termite mounds, or human dwellings). These burrows may be simple or quite elaborate with a nest chamber, fecal chamber, food cache chambers, and several openings to the surface. They may block openings with soil/debris before spending the day there. The rats are mainly nocturnal and are not particularly social. Although they can travel considerable distances, they usually don't travel far from a food source. They use their sizable cheek pouches to carry foods back to the burrow for later consumption and may make a large number of such trips; their incredible abilities in this skill are almost legendary. They may relocate their place of residence as food sources shift in time and space. Because of their size (i.e., up to 1 m in length and 2.8 kg in mass; Kingdon 1984), high reproductive rate, and fast growth rate, they have been used as a source of food by humans in Africa, and even have been raised for that purpose, especially because of their relatively docile nature (Ajayi 1975). They have also been popular in the pet trade, which likely helped lead to an outbreak of monkey pox virus originating from domestic Gambian rats in 2003 in the U.S. (Enserink 2003). Gambian rats are also reservoirs for other diseases in Africa, including leptospirosis, murine typhus, and Q-fever (Fiedler 1994).

In the U.S., Gambian rats shifted from a domestic pet to an invading species following the suspected escape or release from a pet breeder on Grassy Key, Florida in 1999 (Perry et al. 2006). Gambian rats were able to establish a free-ranging and breeding population on Grassy Key (Engeman et al. 2006). A dead Gambian rat was found about 33 km from Grassy Key, en route to mainland Florida on U.S. Highway 1 (Parker Hall, USDA Wildlife Services, pers. commun.). This Gambian rat likely originated from the free-ranging population on Grassy Key, suggesting these rats can travel long distances or can hitch rides on vehicles and potentially invade new islands and mainland Florida. Because of the large size of Gambian rats, they pose a serious threat to native species (e.g., particularly nesting species) and agricultural crops (Fiedler 1988), especially if Gambian rats invade mainland Florida (Peterson et al. 2006).

Eradication of Gambian Rats on Grassy Key

Grassy Key is an island located about halfway along the chain of islands comprising the Florida Keys. This chain of islands extends from the southern tip of Florida and curves down and westward into the Gulf of Mexico. Most of the islands are connected by the major highway, U.S. Highway 1. Grassy Key is about 405 ha (1,000 acres) and of very low relief (≤2 m above mean sea level). The substrate is coral and the water table is near the surface so that there is often standing water in some areas. The vegetation consists of a mixture of native and

invasive species (Long and Lakela 1971, FNAI 1990). Most areas that have not been developed are covered with trees and shrubs. These species include various species of mangroves, various species of palms, Australian pine, Brazilian pepper, and numerous ornamentals. Periodic tropical storms and hurricanes occur damaging vegetation and structures and flooding many areas.

In 2006-07, USDA Wildlife Services (WS) conducted Gambian rat distribution surveys on Grassy Key, using cage traps and motion-sensitive cameras. Based on the results, WS designed and implemented an eradication strategy using a grid of about 1,000 bait stations containing a 2% zinc phosphide bait (ZP bait), but also using cage traps and remote cameras. Wildlife Services also designed a bait station that allowed access by Gambian rats, but seemed to prevent access by most non-target mammals (e.g., raccoons, opossums, cats, and dogs).

After a pre-baiting period, the ZP bait was placed and maintained in the stations during May-June 2007. Even after two baiting sessions and considerable trapping efforts, camera surveillance soon made it clear that some Gambian giant pouched rats remained after the main baiting effort. Using the "2-year rule-of-thumb" (Engeman et al. 2007), the eradication effort on Grassy Key could be considered successful when intensive, periodic surveys do not reveal any Gambian rats for a 2-year period. Despite intense efforts using remote cameras and cage traps, this has not occurred. While the capture of Gambian rats has steadily declined over the months, WS continues to occasionally capture or detect individuals. The most recent capture was an adult female in September 2009. It is clear that improved methods could aid the eradication of Gambian rats on Grassy Key or wherever else they might become established. Hopefully, the invasive rodent eradication effort on Grassy Key will ultimately end with the complete removal of all invasive Gambian giant pouched rats before they reach the mainland of the United States.

METHODS

Thirteen wild Gambian rats were live-captured on Grassy Key during 2008 and transported to the USDA APHIS WS National Wildlife Research Center (NWRC) in Fort Collins, CO. Additionally, 3 females gave birth to litters while in captivity, totaling 25 study animals.

Evaluating Potential Attractants Study

To simulate natural conditions for the wild captured Gambian rats, we conducted attractant trials within Simulated Natural Environment rooms at the NWRC. We tested 15 attractants that could be used in traps for capturing or detecting Gambian rats on single and pairs of Gambian rats. Further details of the study are reported by Witmer et al. (2010).

Efficacy of Rodenticides Study

We also tested a variety of commercial rodenticides with our captive Gambian rats at the NWRC. We tested 2 formulations of diphacinone baits, 1 formulation of chlorophacinone bait, 1 formulation of brodifacoum bait, 1 formulation of bromethalin bait, and 1 formulation of zinc phosphide bait using multiple-choice food trials. Further details of this study are currently in review and can also be found in Witmer (2008).

RESULTS

Evaluating Potential Attractants Study

We found that a conspecific scent (i.e., feces and urine) from other Gambian rats was the best attractant type for attracting single and paired Gambian rats from the materials that we tested (Figure 1 and Figure 2). Single Gambian rats visited many of the attractants that we tested, whereas Gambian rats in pairs did not spend as much time exploring the other attractant types we tested.

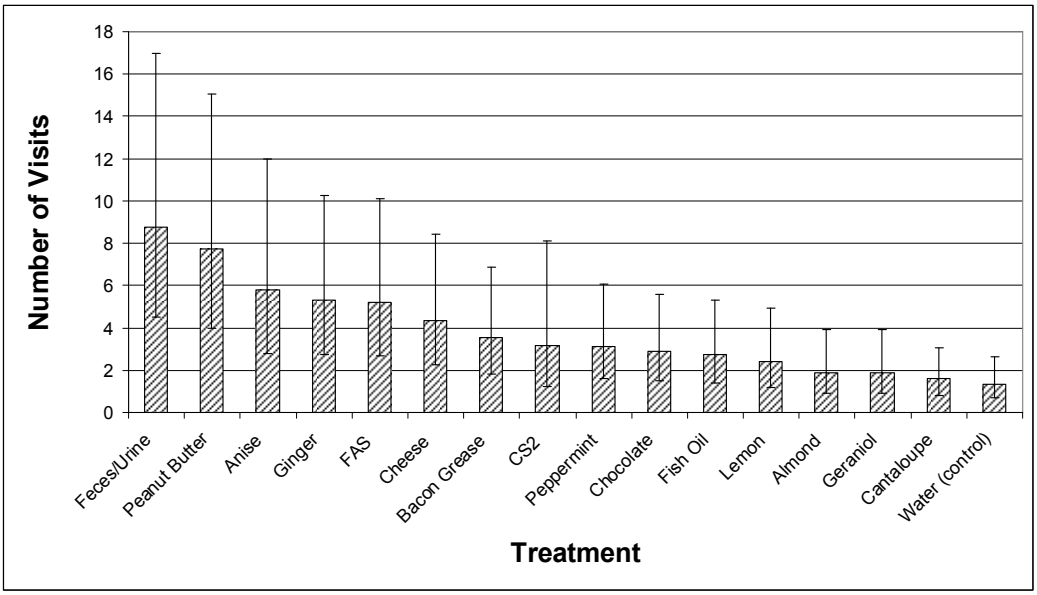

Figure 1. Mean number of visits (back-transformed from log scale) to treatment types with 95% CI for 24-hour, indoor trials with single Gambian giant pouched rats during 2007-2008.

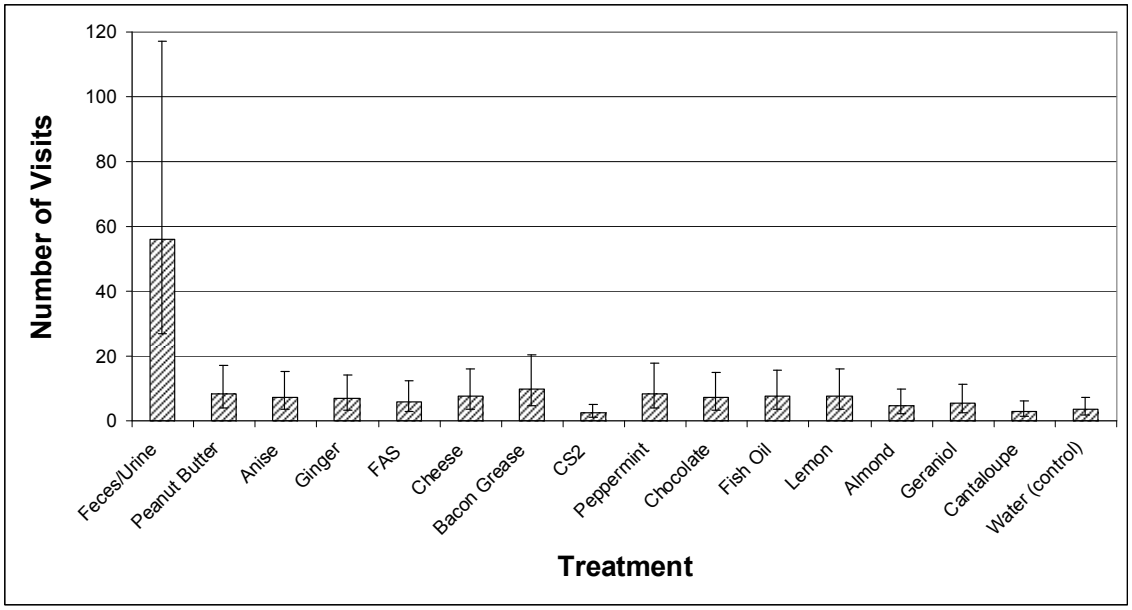

Figure 2. Mean number of visits (back-transformed from log scale) to treatment types with 95% CI for 24-hour, indoor trials with male and female pairs of Gambian giant pouched rats during 2007-2008.

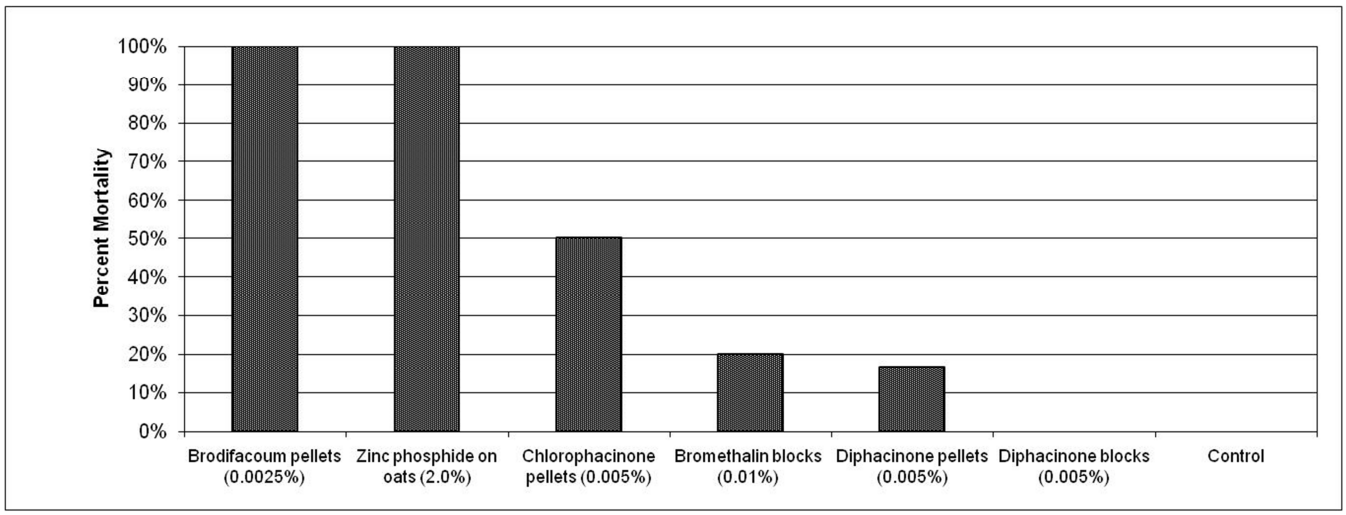

Figure 3. Percent efficacy observed for 6 rodenticide treatments and control in a 2-choice laboratory trial with Gambian giant pouched rats during 2007-2009.

Efficacy of Rodenticides Study

The Gambian rats consumed some or all of the rodenticide baits that we offered them. We found both the brodifacoum and zinc phosphide baits were highly effective (Figure 3). The chlorophacinone bait was marginally effective, whereas bromethalin and the 2 diphacinone baits were considered ineffective.

DISCUSSION

In addition to the peanut butter that is already being used on grassy key to detect Gambian rats, we recommend that urine and feces from Gambian rats be used. Our results also indicate that anise, ginger, and fatty acid scent could be useful for attracting the currently small population of Gambian rats on Grassy Key. Single Gambian rats explored more attractant types than paired Gambian rats, thus multiple attractant types should be used to capture or detect the currently sparse population (i.e., sparse population = pairs may be less likely to exist).

Also, we suggest that the second-generation anticoagulant rodenticide, brodifacoum pellets (d-CON®, Reckitt Benckiser, Inc., Wayne, NJ), be added to the arsenal already used on Grassy Key to remove Gambian rats. Zinc phosphide should continue to be used; however, we recommend that zinc phosphide on oats may be a good alternative to the bait balls that have previously been used.

These studies have identified new attractants and rodenticides that could be helpful in future efforts to control or eradicate invasive Gambian rats. Tests of these materials in field situations should be conducted before their implementation in the Florida Keys.

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