Consumption and efficacy of rodent baits to Norway rats

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ABSTRACT

A method currently being used by the Department of Conservation to prevent reinvasion of rodent-free offshore islands aims to increase the stability and life of toxic bait by wrapping it in tinfoil or placing it into plastic ziplock bags. A laboratory study was conducted to assess the acceptance of the baits presented in this manner. Wild Norway rats (*Rattus norvegicus*) were used to assess the consumption of Storm® wax blocks, Talon® 50WB wax blocks, Talon® 50WB wrapped in tinfoil, or Talon® 50WB placed in a plastic ziplock bag. Each rat was offered a choice of toxic bait and non-toxic RS5 pellet baits as a control over four nights. All test baits had low consumption, resulting in very low mortality. When bait was wrapped in tinfoil or placed in a ziplock plastic bag, its consumption was reduced even further, resulting in no deaths within these treatment groups. These baits and the way they are currently being used appear to be unsuitable for control of Norway rats on offshore islands.

Keywords: *Rattus norvegicus,* reinvasion, brodifacoum, flocoumafen, consumption, palatability, mortality, neophobia.

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1. Introduction

New Zealand, and the Department of Conservation (DOC) in particular, has become very successful at eradicating rats from offshore islands. The next stage is the protection of these islands from rodent reinvasion, which requires the development and use of effective monitoring and control systems. Confidence in the effectiveness of toxic baits and the method of delivery used on offshore islands is important. To assess this, the consumption and efficacy of two different toxic rodenticide products, presented in the same manner as they are currently being used on some offshore islands, were tested.

2. Background

Offshore islands that are pest-free become sanctuaries for New Zealand's vulnerable native species. Island protection systems require tools that ensure that more than 95% of individuals of all four rodent species present in New Zealand consume a lethal dose of bait on first exposure (O'Connor & Eason 2000). Tools presently available to detect or control very low rodent populations and stop rodents from reinvading offshore islands are limited and often unproven. There is also a lack of species-specific information on the relative palatability and efficacy of commercially available rodent baits. The palatability and efficacy of four toxic rodenticide products for wild mice (*Mus musculus)* have been assessed (O'Connor & Booth 2001), but the relative palatability of rodent baits to other wild rodent species in New Zealand (i.e. ship rats, Norway rats, and kiore) needs to be determined.

Currently on some offshore islands, baits are wrapped in tinfoil or placed in plastic ziplock bags in an attempt to increase their field life. The effectiveness of these delivery methods and the resulting effect on bait consumption has not been tested. Norway rats (*Rattus norvegicus*) have been identified as the species most often involved in reinvasions, and are considered the most likely rodent species to cause a problem, because of their commensal living habits (e.g. around dumps and wharves). Hence the study used Norway rats to assess the consumption and efficacy of two commonly used rodent baits.

3. Objective

To determine the consumption and efficacy of rodent baits currently used for island protection against captive Norway rats.

4. Methods

Wild-caught Norway rats were housed at the Landcare Research Animal Facility in individual solid metal cages with a heavy mesh ceiling. The cages consisted of two compartments: a nest box measuring (L × W × H) 15 × 30 × 13 cm containing sawdust and shredded paper for nesting, and a run measuring 32 × 30 × 13 cm also containing sawdust. During acclimatisation the rats had free access to rat and mouse pellets (Western Animal Nutrition, Rangiora). Supplementary food (e.g. a piece of fruit) was provided occasionally, and water was available at all times. Rats were allowed a minimum of 14 days acclimatisation and were then weighed prior to testing.

Four types of toxic bait were tested: Storm® wax blocks (containing flocoumafen), Talon® 50WB wax blocks (containing brodifacoum), Talon® 50WB wrapped in tinfoil, or Talon® 50WB placed in a ziplock plastic bag. This selection was made after consulting DOC staff, so that baits were presented to rats in the same manner as they are currently being used on some offshore islands. The LD_{50} for Norway rats for brodifacoum is 0.27 mg/kg (Godfrey 1985) and for flocoumafen 0.25 mg/kg (Huckle et al. 1989). Hence, rats would need to eat approximately 2 g of the trial baits to obtain a lethal dose.

Three batches of rats were caught and tested at different times: batch 1 (n = 24) tested 30 May 2002; batch 2 (n = 16) tested 13 June 2002; and batch 3 (n = 16) tested 29 August 2002. Each batch of rats was randomly divided into the four treatment groups. In a standard choice-test the rats were offered 80 g of toxic bait and 80 g of industry-standard non-toxic RS5 pellet bait (Animal Control Products, Waimate) for one night, then returned to a normal diet for the next four consecutive nights. Originally the trial was planned for one 24-h period only (i.e. lethality of first encounter), but since consumption of bait was very low for the first night, and by the fifth night all rats (except one that died) still looked healthy (i.e. showed no signs of toxicosis), baits were then offered for another three consecutive nights and consumption for each 24-h period was monitored. Hence, on nights 5–7 the rats were again offered 80 g of toxic bait and 80 g of industry-standard bait (non-toxic RS5) per night.

Data presented are the mean total weight eaten plus or minus the standard error. Efficacy was measured by the percentage mortality for each bait type over 21 days.

5. Results

The three batches of rats behaved similarly and ate similar amounts of RS5 (e.g. mean RS5 consumption ± SE on night 6 was: batch 1 = 18.45 ± 1.83 g; batch 2 = 17.82 ± 1.94 g; batch 3 = 20.01 ± 1.97 g), and therefore the data for all batches have been combined.

The mean total weight (± SE) of Talon® 50WB bait eaten over the duration of this trial was 2.00 ± 1.30 g/rat compared with 1.62 ± 1.07 g/rat of Storm® (Table 1). Once the bait was either wrapped in tinfoil or placed within a plastic ziplock bag, the amount eaten was reduced even further. The mean total amount eaten of Talon® 50WB wrapped in tinfoil was 0.25 ± 0.06 g/rat, and of Talon® 50WB placed in a plastic ziplock bag was 0.13 ± 0.04 g/rat (Table 1). Rats in all groups ate on average 19.57 ± 0.52 g of RS5 each test night, with a mean total of 76.92 ± 3.54 g/rat.

TABLE 1. MEAN (± SE) BAIT CONSUMPTION (g) OVER 24-h PERIODS BY GROUPS OF NORWAY RATS. RS5 = control: n = 14 for each treatment and control group.

GROUP	NIGHT 1		NIGHT 5		NIGHT 6		NIGHT 7		OVERALL	
	Treatment	RS5	Treatment	RS5	Treatment	RS5	Treatment	RS5	Treatment	RS5
Talon	0.26	17.21	0.83	22.32	0.53	16.78	0.57	16.48	2.00	67.22
SE	0.20	1.37	0.67	2.54	0.41	2.42	0.38	2.33	1.30	8.15
Tinfoil	0.01	19.98	0.04	24.15	0.05	17.22	0.15	19.87	0.25	81.22
SE	0.01	2.24	0.01	1.65	0.02	2.16	0.04	1.77	0.06	6.37
Ziplock	0.02	19.18	0.01	24.86	0.07	22.25	0.03	16.99	0.13	83.28
SE	0.01	2.05	0.01	1.85	0.03	1.82	0.02	1.93	0.04	5.66
Storm	0.18	17.47	0.43	21.92	0.54	18.40	0.47	18.16	1.62	75.95
SE	0.11	2.02	0.34	2.05	0.30	2.34	0.40	1.79	1.07	7.79

Storm® had a low consumption, resulting in a low mortality of 21.4% (3/14). Talon® 50WB had a similar consumption level, while mortality was 14.3% (2/14). However, one of these rats ate enough on night 1 to die before being offered any further bait. All rats that died in these treatment groups were the only individuals that ate at least 2 g of toxic bait in one 24-h period. When the bait was wrapped in tinfoil or placed within a plastic ziplock bag, the negligible consumption by Norway rats resulted in zero mortality.

6. Conclusions and recommendations

Both Talon® 50WB and Storm® are unsuitable for Norway rat control on offshore islands, as consumption was low, resulting in a very low mortality rate. Their consumption and efficacy with other rat species need to be determined, as does the consumption of other rodent baits by Norway rats.

Presenting baits in tinfoil or ziplock plastic bags to increase their longevity in the field appears to reduce their palatability or increase neophobia, thus further reducing the efficacy of the bait. More suitable methods of improving bait field-life, or alternative 'long-life' bait matrices, should be investigated.

Acclimatised wild Norway rats are well known for displaying reactions to new foods and objects (neophobia) (Cowan 1977). Hence this very low consumption could be a result of low palatability and/or neophobia, and their relative influence should be determined.

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