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A Rat-Resistant Bait for Kill Traps

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Summary

Project and Client
The purpose of this project was to assist in the development of an effective rat-resistant bait for possum kill traps. The work presented in this report was carried out by Pest Control Research between July 2003 and June 2004 for the Animal Health Board (AHB).

Objectives
To provide a rat-resistant bait for kill traps by:

- Comparing the ability of three compounds to resist bait consumption by rats.
- Determining the efficacy of the most rat-resistant bait for capturing possums.

Methods

- A unique plastic bait clip that contains grooves to hold a possum attractant (e.g. peanut butter) was manufactured using injection moulding technology.
- Differences in the ability of three bait types (i.e. the bait clip containing compound A, the bait clip containing compound B and a standard long-life cereal/polymer bait used as a control) to resist rat consumption were tested in a field study conducted in mixed podocarp forest at Hohonu (Westland).
- A total of 10 lines 220 m long and 100 m apart were established in the forest and possum proof rat tunnels were located on the lines at 20 m intervals. Each tunnel contained one of the three bait types with four of each bait type tested per line.
- Baits were weighed at 1 week and then at 2 weekly intervals for a period of 1.5 months. Loss in bait weight expressed as a proportion of initial bait weight was used as a measure of consumption of the baits by rats.
- The ability to capture possums using the bait identified as loosing the least amount of weight in the above trial (this was the bait clip with compound A) was measured by comparing possum captures in kill traps using this bait and captures using the cereal/polymer bait control. This trial was conducted in the absence of rats to prevent biasing the results towards the bait clip.
- Ten 200m long trap lines were established in pine forest at Eyrewell Forest (Canterbury) and Sentinel Kill Traps were located at 20m intervals along the lines (i.e.10 traps/line). The traps were located in pairs and one of the pair was baited with the bait clip while the other was baited with the cereal/polymer bait.
- Traps were checked at intervals of 1, 2, 4 and 6 weeks and reset and rebaited if a possum was captured or if the bait had been removed.
- Comparative efficacy of the bait types was determined by calculating possum captures/line for each bait type for each trap checking period.

Results

- By week 6 bait weight was reduced by 7.2% for the bait clip with compound A and 17.3% for bait clip containing compound B. This reduction was significantly different (t = 11.7, n = 10, $P < 0.001$).
- Both bait clips containing compound A and B were considerably more resistant to consumption by rats than the cereal/polymer control bait which was totally

removed by week 6. Field observations indicated that peanut butter was still present in all bait clips after week 6 whereas all polymer baits had disappeared.

- A total of 169 possums were captured in the field trial. Kill traps containing the bait clip captured 76 possums (45%) and the cereal/polymer bait captured 93 possums (55%). This result was not significantly different for the 4 trap checking periods except in week four when the bait clip captured significantly more possums (t = 2.8, n = 10, P = 0.02). Reasons for this difference were unknown.

Conclusions

- Both the bait clips containing compound A and B had a smaller proportion eaten and appeared to be more resistant to consumption by rats than the cereal/polymer bait. The bait clip containing compound A was most effective and is likely to last several months in the presence of rats.
- The weight of the cereal/polymer bait reduced rapidly, suggesting it is unlikely to be effective for long-term control of possums when used in kill-traps where rats are present.
- The cereal/polymer bait and the bait clip containing compound A captured similar numbers of possums in a location where there was no rats. However where rats are present it is assumed that possum captures on the cereal/polymer will be less than captures using the bait clip because the cereal/polymer bait will be removed at a faster rate by rats. This assumption was not tested in this study.

Recommendations

- Field trials comparing possum captures where rats are present should be conducted to add to the findings of this study. These should be undertaken in areas where sustained control of low-density possum populations is required such as bush/pasture margins.
- During the course of the study the encapsulation of lure oils into the plastic bait clip material was identified as a possible method to further increase possum captures on the bait clip. Field trials should be undertaken to test this idea.

1. Introduction

The purpose of this project was to assist in the development of an effective rat-resistant bait for possum kill traps. The work presented in this report was carried out by Pest Control Research between July 2003 and June 2004 for the Animal Health Board (AHB).

2. Background

In the past 5 years the Animal Health Board has had a control target of very low possum densities in an effort to reduce the risk of disease transmission between possums and domestic stock. This has been achieved in many areas using control techniques that have been developed to achieve rapid knockdown over short time periods. Examples are application of cereal based baits and intensive leg-hold trapping. The emphasis has now shifted to maintaining these populations at low levels (maintenance control) to prevent the rapid build up of possum numbers that can occur (Thomas et al. 1995, Cowan 2000).

The majority of control techniques currently available have been developed for rapid knockdown and are unsuitable for maintenance control which requires sustained effort over long time periods. When rapid knockdown methods are used for maintenance control they are generally expensive because they require a high labour input. For example cereal baits have to be replaced regularly because they rapidly loose toxicity and palatability (Henderson & Frampton 1999) and legally leg-hold traps have to be checked daily (Animal Welfare Act 1999).

If maintenance control is to be undertaken efficiently it is important that technologies that provide continuous control with a low labour input be developed. One method that has potential to achieve this aim is the use of kill-traps. Unlike leg-hold traps, kill traps are not required to be checked daily (Animal Welfare Act 1999) which means there are labour savings especially where population densities are low. Recently a number of kill traps have been developed commercially. However, despite the labour savings kill traps are not effective where rats are present because rats can remove the bait used to trigger the trap. This reduces possum kills (Warburton & Poutu 2002) and prevents the trap remaining armed between the times it is checked. The development of a rat-resistant bait for kill traps has the potential to overcome this problem and provide continuous sustained control of low density possum populations.

The requirements for an effective kill trap bait are different from the requirements for a conventional toxic bait. It is necessary for a kill trap bait to be attractive but not necessarily palatable, because the possum does not need to consume a certain quantity of bait in order to be killed. The commercially available kill traps on the market operate by the possums pulling on the bait to trigger the trap. Therefore, what is required is that the bait is sufficiently attractive for the possum to hold it in its teeth and pull.

A plastic bait clip for kill traps has been developed (patent pending no. NZ 532933) that clips onto the trigger plate of suitable kill traps (Fig. 1). The bait clip has been designed with 1mm wide grooves and ridges, which are smaller than the width of rat incisors (Fig. 2). A possum attractant such as peanut butter or apple paste is pushed into the grooves. The narrow groves prevent rats gaining access to the attractant unless they eat away the plastic that forms the ridges. The injection moulding process allows the inclusion of compounds in the plastic that have the potential to prevent rats eating the ridges to gain access to the attractant. These are compounds A and B tested in this study. This project included trials aimed to identify the most effective compounds included in the plastic that will reduce or prevent rats chewing the plastic ridges on the bait clip.

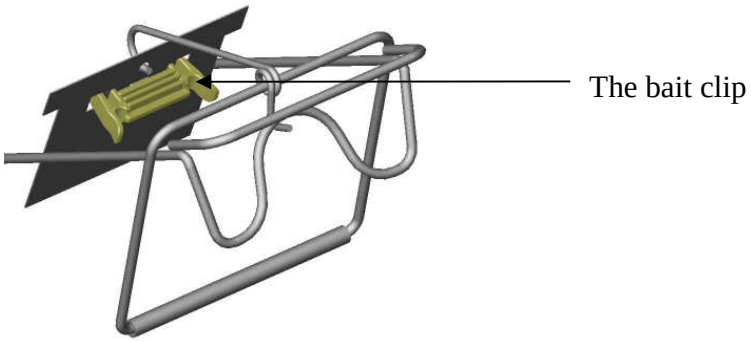

Figure 1. *The bait clip located on the trigger plate of an armed kill trap.*

Figure 2. *Left, the injection moulded bait clip. Right, a cross section of the bait clip showing the rat-proof grooves and ridges that hold the possum attractant such as peanut butter. The injection moulding process used to make the bait clip allows the inclusion of compounds that have the potential to prevent the rats chewing the plastic ridges.*

3. Objectives

To provide a rat-resistant bait for kill traps by:

- Comparing the ability of three compounds to resist bait consumption by rats.
- Determining the efficacy of the most rat-resistant bait for capturing possums.

4. Methods

4.1 Comparing the ability of three compounds to resist bait consumption by rats

Differences in the ability of three baits to resist rat consumption were tested in a field study conducted in mixed podocarp forest at Mitchells (Westland). A total of 10, 220 m long lines 100 m apart were established in the forest. Bait testing sites were marked along the lines at 20m intervals using flagging tape, so that 4 groups of the 3 treatments types were located on the lines (Fig.3). The three treatments tested were:

1. The bait clip (see above) containing compound A incorporated into the plastic during the injection moulding process.
2. The bait clip containing compound B incorporated into the plastic during the injection moulding process.
3. A control consisting of a long-life cereal/polymer bait manufactured specifically as a trigger bait for kill traps.

Both bait clips containing compound A and B had plain peanut butter smeared into the grooves present in the clips (see Fig. 2). The three treatment types were located separately in possum proof 80mm diameter tunnels so that confounding effects that could be caused by possums eating the baits were eliminated. Efficacy of the treatments to resist consumption by rats was measured by weighing each bait to the nearest 0.1 g initially at week 1 and then at 2 weekly intervals for a period of 1.5 months. The proportion of initial bait weight that was removed for each treatment was calculated from the line values (i.e. the 4 groups per line). Significant differences between the 2 compounds and the control bait were determined using *t*-tests.

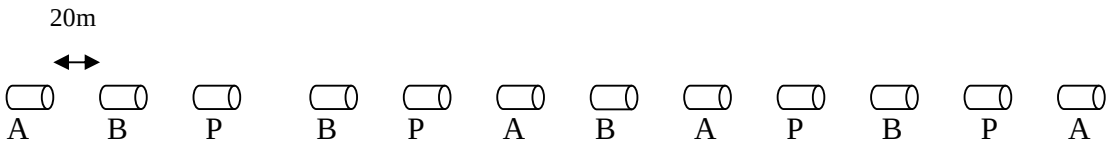

Figure 3. *A line of possum proof tunnels containing one of the bait types per tunnel. A = the bait clip containing compound A, B = the bait clip containing compound B and P = the standard cereal/polymer bait. There were 10 of these lines located at least 100 m apart. Treatments were randomly located in groups of 3. Compound A and B were included in the plastic of the bait clip during the injection moulding process. The bait clips contained plain peanut butter smeared into the grooves.*

A total of 4 lines containing 5 Black Trakka rodent tracking tunnels (Connovation Ltd) were randomly located throughout the study site for 3 fine nights immediately after the bait trial. The tracking tunnels were baited with 20 g of peanut butter. The proportion of tunnels containing rat footprints was calculated to provide an indication of rat density at the study site.

4.2 Measuring the efficacy of the most effective rat-resistant bait for capturing possums

The efficacy of the bait identified as the most effective for resisting rat consumption in 4.1 above (this was the bait clip containing compound A) was measured to determine whether it is effective for capturing possums. This was undertaken by comparing possum captures with captures using the standard cereal/polymer bait.

Trials were undertaken during February–April 2004 in established pine forest at Eyrewell Forest (Canterbury). The forest contained medium to low possum densities and did not contain rats (rats would confound the results by eating the cereal/polymer bait). A total of ten 200m long trap lines were established and Sentinel Kill Traps were located at 20m intervals along the lines (i.e.10 traps/line). The traps were located in pairs 20 m apart and fixed onto trees (Fig. 4). One of the pair was baited with the bait clip containing compound A with peanut butter smeared into the grooves (NB aniseed oil was added to the peanut butter at a concentration of 0.2% wt/wt) while the other was baited with the cereal/polymer bait. Traps were checked at intervals of 1, 2, 4 and 6 weeks and reset and rebaited if a possum was captured or if the baits had been removed.

Figure 4 *Tree set for the Sentinel Kill Trap as used in the study*

Comparative efficacy of the bait types was determined by calculating possum captures/line for each bait type for each trap checking period. Mean captures were

compared using a paired *t*-test to determine whether significant differences in capture rates occurred when the two bait types were used.

5. Results and Discussion

5.1 Comparing the ability of three compounds to resist bait consumption by rats

A total of 16 of the 20 tracking tunnels (80%) contained rat footprints and these were located on all four lines located at the study site (the lines had 4, 4, 5, and 3 tunnels tracked from the 5 tunnels per line). This tracking rate indicates that rats were present in medium to high densities. Mouse prints were also recorded in 16 of the 20 tracking tunnels.

The bait clip containing compound A had significantly less reduction in weight at each weighing period than the bait clip containing compound B (Fig. 5). By week 6 the bait clip with compound A was reduced in weight by 7.2% whereas the bait clip containing compound B was reduced in weight by 17.3%. This was a significant difference ($t = 11.7$, $n = 10$, $P < 0.001$). No rat gnawing was observed on the bait clips containing compound A. However, gnawing was observed on the bait clips containing compound B.

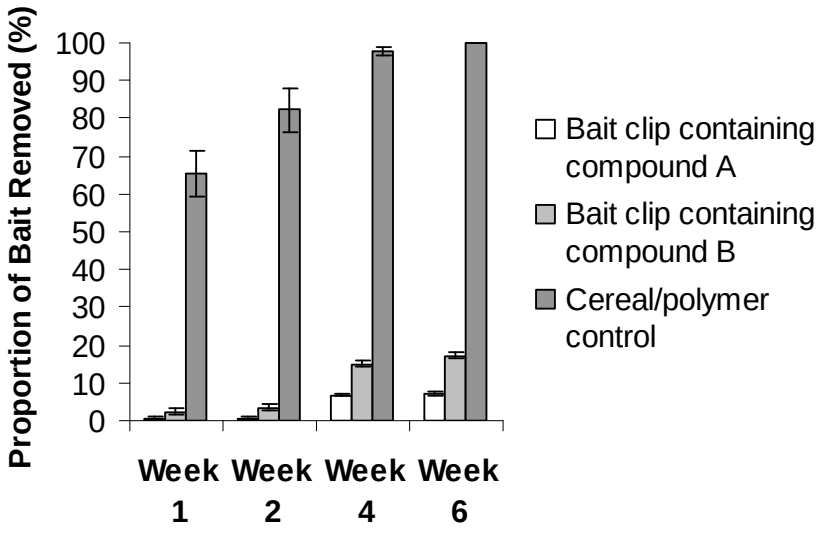

Figure 5. *Proportion of bait eaten when containing two rat-resistant compounds when compared to a control consisting of a cereal/polymer bait manufactured specifically for kill traps. Error bars are ± 1 SE.*

Both bait clips containing compound A and B had considerably less weight reduction than the cereal/polymer bait. A large proportion (66%) of the cereal/polymer bait was removed in the first week and by week 4 virtually all the cereal/polymer bait had disappeared (98%). Total removal of the cereal/polymer bait occurred after 6 weeks, rat consumption being the most likely reason.

Because a large proportion of both bait clips was made of unpalatable plastic compared to the totally palatable cereal/polymer bait the bait clips would have incurred less weight reduction. However observations of the bait clips at week 6 showed that all baits still contained the peanut butter attractant in the grooves whereas all cereal/polymer baits had disappeared. This result suggests that the bait clips would have remained effective for at least 6 weeks at this study site.

5.2 Measuring the efficacy of the most effective rat-resistant bait for capturing possums

A total of 169 possums were captured in the kill traps (Fig. 6). Traps baited with the bait clip containing compound A with peanut butter captured 76 possums (45% of the total) and the cereal/polymer bait captured 93 possums (55% of the total). There was no difference in possum capture rates between kill traps baited with the bait clip containing compound A and peanut butter, and kill traps baited with the cereal/polymer bait for the 4 trap checking periods except in week four when the bait clip captured significantly more possums (t = 2.8, n = 10, P = 0.02 Fig 7). The cause of the difference at week 4 is unknown but may have been due to differences in evaporation rates of the lure oil (aniseed) from the baits.

The higher kills using the cereal/polymer bait in this study may indicate that this bait type was more effective for capturing possums. However the presence of rats is likely to remove the cereal/polymer bait at a faster rate which could reduce its effectiveness for capturing possums. Additional studies investigating possum captures in areas were sustained control of low density possum populations is undertaken and where rats are present would provide additional information on the comparative efficacy of this new bait type.

Figure 6*. Possums killed in kill-traps baited with the bait clip containing compound A with peanut butter smeared into the grooves (left) and the cereal/polymer bait (right).*

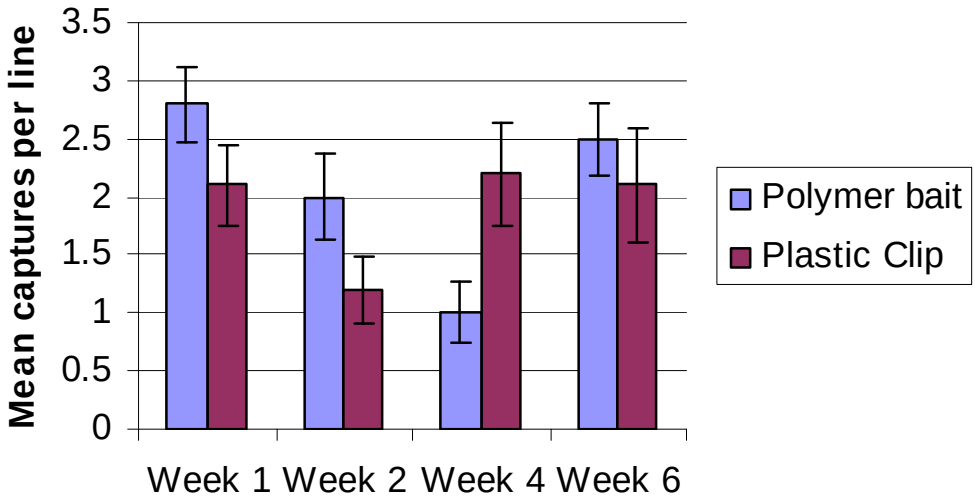

Figure 7. *Mean possum captures per line for Sentinel Kill Traps baited with a plastic clip containing compound A and a cereal/polymer bait. Trap lines contained 5 pairs of 2 bait types per line. There were 10 trap lines in total. Error bars are ± 1 SE.*

6. Conclusions

- Both the bait clips containing compound A and B had a smaller proportion eaten and appeared to be more resistant to consumption by rats than the cereal/polymer bait. The bait clip containing compound A was most effective and is likely to last several months in the presence of rats.
- The weight of the cereal/polymer bait reduced rapidly, suggesting it is unlikely to be effective for long-term control of possums when used in kill-traps where rats are present.
- The cereal/polymer bait and the bait clip containing compound A captured similar numbers of possums in a location where there was no rats. However where rats are present it is assumed that possum captures on the cereal/polymer will be less than captures using the bait clip because the cereal/polymer bait will be removed at a faster rate by rats. This assumption was not tested in this study.

7. Recommendations

- Field trials comparing possum captures where rats are present should be conducted to add to the findings of this study. These should be undertaken in areas where sustained control of low-density possum populations is required such as bush/pasture margins.
- During the course of the study the encapsulation of lure oils into the plastic bait clip material was identified as a possible method to further increase possum captures on the bait clip. Field trials should be undertaken to test this idea.

8. Acknowledgements

We thank Jennifer Brown (University of Canterbury) for assistance with planning design and data analysis.

9. References

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