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NEW TECHNOLOGY FOR POISON DELIVERY

Summary: A long-life poison bait dispenser, consisting of a tree-mounted platform that dispenses a highly attractive liquid bait only when triggered by actions characteristic of a possum (*Trichosurus vulpecula*), was developed. The liquid bait formulation prevents deterioration due to the action of oxygen, moisture, bacteria and insects. The prototype is designed to dispense 100 lethal doses of poison, and is expected to last more than five years in the field without attention. The equipment is designed to avoid fouling by algae, debris or nesting insects. The selectivity for possums provides a low risk of exposing non-target mammals, birds and insects to poison. A reset delay reduces the likelihood of over-consumption of bait.

Keywords: Possum; *Trichosurus vulpecula*; poison; control.

Introduction

The brush-tailed possum, *Trichosurus vulpecula* (Kerr), is a serious pest in New Zealand. The most common method of control is poisoned pellets or carrots distributed in bait stations or by aerial broadcasting. The success of poisoning operations is limited by the high labour costs due to frequent visits to bait stations; the short period for which the bait remains potent; problems with aversion; and non-target poisoning, mainly of birds and dogs.

A new poison delivery technology, dispensing metered doses of liquid bait, is showing promise for overcoming some of these limitations. Although much validation work has yet to be done, there are good prospects for achieving the following targets: a field durability of more than five years, with up to 100 poison doses delivered; no maintenance or recharge visits; little induction of learned aversion through sub-lethal dosing; negligible non-target poisoning, particularly of native birds; and low cost.

Results

Description

Fig. 1 illustrates the operating principles of the current prototype. The bracket on the left of the figure attaches the dispenser to a tree. The platform (120 mm wide and between 300 and 400 mm long) provides a stable surface from which the possum can investigate a scent lure that is emitted from a point at the end of the platform.

When the possum puts weight on the trigger plate, a connecting rod pushes on the buckling latch

(a coil spring). If there is a weight of a kilogram or more on the platform AND the trigger plate is depressed with a force of about 200 g, the latch will collapse, and the platform will drop by about 10 mm. This downward movement compresses the valve of the poison bait can and a dose of about 1 ml of semi-gelled liquid bait is deposited on the trigger plate, close to the possum's nose.

The reset-delay timer holds the platform in the down position for about 20 minutes, long enough that most possums should leave the platform. The timer then releases abruptly, and the platform, when free of the possum's weight, springs up and allows the entire mechanism to reset.

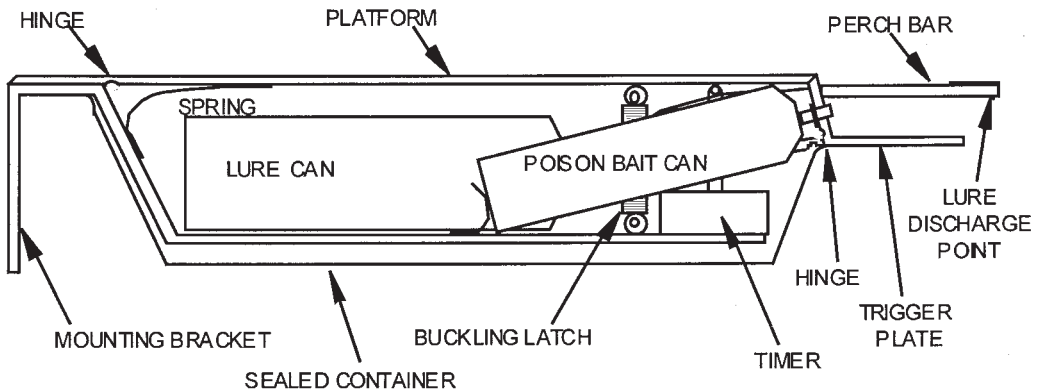
Liquid bait

Use of a liquid bait is advantageous, because liquids can be protected from deterioration inside a container in a way that solid baits cannot. Mass-produced aerosol-type cans provide air-tight containers with sophisticated valves at very low cost.

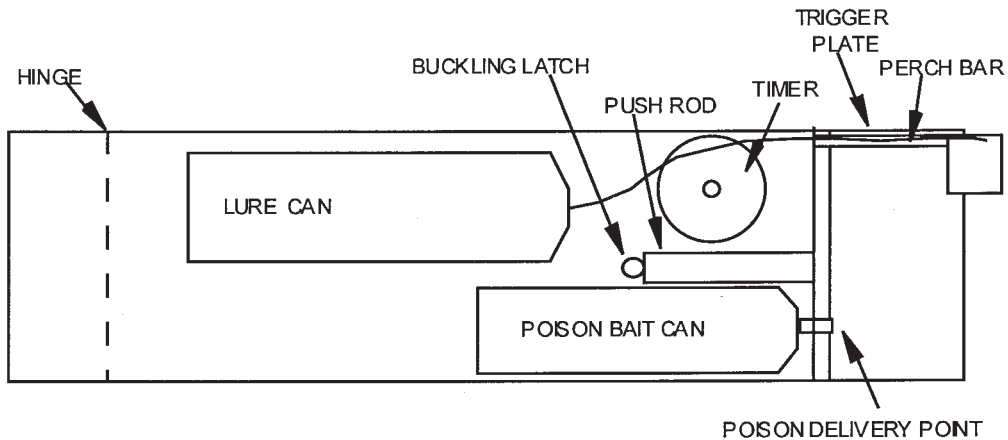
Bait dispensed only "on demand" will always be fresh and fully potent, even though visits from possums might be months apart once the initial population knockdown has taken place. Dispensing on demand should make it unlikely that non-target species such as birds and bees will be exposed to the bait.

A liquid bait can be dispensed in metered doses, so on each occasion a full lethal dose is offered. Learned aversion due to sublethal dosing is unlikely, provided that the offered dose is fully eaten. This proviso will be discussed later.

Metered-dose aerosol cans that dispense millilitre volumes of gel are commercially available. The one selected for the prototype dispenses 1 ml of



1A: SIDE VIEW



1B: TOP VIEW

Figure 1: *Essential elements of the prototype. Poisoned bait is released only when a possum, sitting on the platform, also puts weight on the trigger plate. Lure discharge may be continuous. The perch bar helps to minimise triggering by birds. The timer reduces over-consumption of bait.*

semi-gelled liquid on each activation of the valve. Recharge occurs in a few seconds after the valve is released. A small can with a capacity of 100 ml of bait should be able to supply the poison demands of a 2-hectare catchment for five years, if the devices are deployed over a sufficiently wide area that the re-infestation rate is low.

The continuous availability of fresh bait throughout the year is expected to overcome limitations occasionally encountered in conventional baiting operations, when bad weather or abundant natural food supply can reduce effectiveness. It

should also provide economical maintenance control of low-density populations.

Species selectivity

Species selectivity is achieved because only a substantial weight on the platform as well as the trigger plate would activate the dispenser. This makes triggering by birds very unlikely. Tree mounting provides additional protection for flightless birds. To avoid the possibility that one

heavy bird lands on the trigger plate while another is on the platform, a perching bar is placed above the trigger plate to make the plate an unattractive landing site.

The perch bar also serves to carry the scent lure to an outboard discharge point. A baffle plate attached to the perch bar above the lure discharge point is intended to encourage the possum to move downwards onto the trigger plate as it investigates the lure. A version of this perching bar system was tested in a free-flight aviary. In over 400 interactions with native birds, including weka, kea, NZ wood pigeon, parakeets, tui, kingfisher and ducks, there was only one triggering, by a kaka (Day and Matthews, 1998). This was induced by a fragment of apple bait on the trigger plate, which would not normally be present. Both trigger and platform were set lighter than normal in this test to provide a severe test of species selectivity.

Triggering by humans could expose poisoned bait to birds, but this can be done only by a deliberate two-handed action. Pulling down on the trigger plate alone does not cause triggering.

Full bait consumption

If sub-lethal dosing is to be avoided, the bait offered must be fully consumed. The species selectivity of the dispenser should allow attractive baits to be formulated without restrictions due to concern for birds and bees, and should make full consumption highly probable.

Possums have a strong appetite for sugar syrups. Using platforms on which the weight of the possum and the weight of syrup in the reservoir are continuously logged, we have observed several instances of individual possums working a dispenser pump for over 30 minutes to maintain syrup flow, consuming up to 50 ml of liquid at a steady rate of about 2 ml min⁻¹. The pump was powered only by the animal's own work, without assistance from pressure or gravity.

Limiting bait consumption

The design includes a low-cost mechanism for limiting each possum to a single dose of poison. This minimises wastage of bait due to over-consumption, and because the possum's appetite will not be satiated, there will be less chance that any unconsumed bait will be left to endanger birds. The intake limitation is achieved by a time delay of about 20 minutes between dispensing events. We have observed this to reduce bait consumption 40-fold, when compared with systems that reset without a delay, while not greatly reducing the number of

visits by identifiably different possums.

The timing function is performed by a suction cup, which is pushed to the bottom of a container of oil when the top platform drops. The cup adheres firmly to the bottom of the container until a sufficient amount of the oil leaks through a bleed hole, when its grip releases abruptly. Suitable choice of oil allows a time delay of 20 minutes or more. The 20-minute delay period begins when the possum leaves the platform.

The abrupt release allows the metering section of the poison can to be fully recharged in a second, which prevents a sublethal dose being presented to another possum arriving soon after the platform is vacated.

Long-life attractant dispenser

Attractant (a scent which need not be the same as the scent in the poisoned bait) is dispensed from an aerosol can. Dispensing rate is controlled by flow of liquid through a low-permeability porous plug, and can be 0.5 ml or less per day. This corresponds to a duration of five years from less than a litre of liquid. The optimum balance of flow and catchment area has yet to be determined, and will depend on the performance of new lures currently under development.

A timed-valve system could be used to discharge attractant only at the most effective times and could provide high-concentration scent pulses. The additional cost of the timer might be justified if a substantially larger catchment area than 2 ha can be demonstrated.

Sealed mechanism

The dispensers will be assembled and armed shortly before use. It is suggested that they be permanently sealed and not replenished when exhausted, although it is possible that the mechanism will be robust enough for two or more cycles of use.

There are no openings other than the liquid discharge points, so the device should be resistant to fouling by insects, algae and other organisms. It is also designed to be resistant to jamming by twigs and leaves.

Discussion

This poison dispenser design addresses all the problems we have been able to anticipate, after many field observations of the interactions of wild possums with an evolving series of prototypes. There are a number of choices still to be made,

particularly in attractant and bait formulation, and the ultimate tests of impact on possum population and the incidence of sub-lethal dosing and by-catch have yet to be made. Nevertheless, it seems likely that long-life poison dispensers will be able to provide a significant new tool for possum management.

Possum control has been the object of the first generation of this device, but the principles of long life, mechanical selection of target species and intake limitation could be useful in control of other species, from deer to rats.

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