FREEZE-DRIED BAIT FOR WASP CONTROL

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ABSTRACT

An experimental freeze-dried sardine-based bait and a commercially-available frozen sardine-based bait, both containing 0.5% sulfluramid, were compared for attractiveness, palatability and effectiveness against common and German wasps. The freeze-dried bait was rehydrated and the frozen bait thawed before use. Compared to a fresh non-toxic sardine-based cat-food, both baits attracted a similar number of wasps and had a similar weight of bait removed by wasps. Both baits also caused a similar reduction in the number of wasps collecting bait and flying in and out of nests. Thus, if commercially feasible and cost-effective, freeze-drying would be a suitable alternative to freezing as a method for storing bait for wasp control.

Keywords: Hymenoptera, Vespidae, insect control, baits, sulfluramid

INTRODUCTION

The two species of introduced social wasp, the common wasp (*Vespa vulgaris* (L.)) and the German wasp (*V. germanica* (F.)) (Hymenoptera: Vespidae), are regarded as serious pests in New Zealand. Finitron (Elliott Chemicals Ltd, Auckland, New Zealand), a ready-to-use bait containing 0.5% sulfluramid in a sardine-based bait, has been developed for the control of these wasps in areas where they can be attracted to fish-based baits (Spurr 1993; Spurr and Elliott 1996; Spurr *et al.* 1996). However, a drawback of this bait is that it must be kept frozen until used. This creates problems for storage and transport.

One alternative to freezing is freeze-drying. A freeze-dried bait would have the advantage of being easy to store and transport without the need for a freezer. It would also be easy to prepare and package. Freeze-dried foods are available for human use, and Perrott (1975) reported that fish baits, attractive to wasps when fresh, could be freeze-dried and then rehydrated without loss of attractiveness. The present study was designed to compare the attractiveness, palatability, and effectiveness of toxic rehydrated (previously freeze-dried) sardine-based bait and toxic thawed (previously frozen) commercial sardine-based bait for wasp control.

METHODS

Bait was initially prepared by adding 0.5% sulfluramid to a commercially available canned sardine cat-food, and mixing slowly in a cake-mixer. The bait was then either packed into 400-g plastic tubes, frozen and stored at -18°C as for commercially-available bait, or packed into 20-mm thick trays, freeze-dried to $<2.5\%$ moisture in an experimental freeze-drier, and sealed in air-tight moisture-proof bags. The frozen bait was thawed overnight before use and the freeze-dried bait was rehydrated by adding four parts of water to one of freeze-dried bait immediately before use.

Attractiveness and palatability of baits

Attractiveness and palatability were assessed at Mt Thomas Forest, Canterbury, in a *Pinus radiata* plantation with remnants of mountain beech (*Nothofagus solandri* var. *cliffortioides*) infested with the honeydew-producing beech scale (*Ultracoelostoma* spp.), a favoured food of wasps. Thawed toxic bait and fresh non-toxic bait (freshly-opened canned sardine cat-food) were compared in March 1991, and rehydrated toxic bait and fresh non-toxic bait were compared in February 1994. In each trial, known weights (approx. 40 g) of bait were placed in 10 pairs of bait stations made from empty cat-food cans tied to 1.2 m wooden stakes, 10 m apart, along roadsides in the forest. One

bait of each type was randomly allocated to one bait station in each pair (i.e., $n=10$ for each bait type). Two additional baits of each type were protected under insect netting to enable correction for dehydration. Bait attractiveness was determined by counting the number of wasps collecting bait from each bait station at any one instant (mean of three counts made at 0.5-h intervals). Bait palatability was determined by reweighing baits after 3 h exposure (1100 to 1400 h New Zealand Summer Time) and calculating the weight loss after correcting for the effects of dehydration.

Effectiveness of baits

The effectiveness of rehydrated toxic bait was investigated in Mt Thomas Forest and thawed toxic bait in Ashley Forest (a neighbouring *Pinus radiata* plantation on the slopes of Mt Grey, also with remnants of mountain beech infested with the honeydew-producing beech scale), in February–March 1994. Wasps at paired sites about 1 km apart in each forest were pre-fed for 3 days with fresh non-toxic bait. In Mt Thomas Forest, the wasps at one site (with 65 bait stations and 15 nests within 150 m of the bait stations) were then offered rehydrated bait containing 0.5% sulfluramid for as long as they would collect it (2–3 days), while the wasps at the other site (with 20 bait stations and 15 nests within 150 m of the bait stations) continued to be fed fresh non-toxic bait. In Ashley Forest, the wasps at one site (with 25 bait stations and three nests within 150 m of bait stations) were offered thawed bait containing 0.5% sulfluramid for as long as they would collect it (2–3 days), while the wasps at the other site (with 20 bait stations and six nests within 150 m of the bait stations) were fed fresh non-toxic bait. Fresh non-toxic bait was placed in bait stations in the paired poison and non-poison sites in both forests 13 days after poison-baiting.

The instantaneous number of wasps collecting bait from bait stations (mean of three counts as above) and the number of wasps per minute leaving or entering nests (single count between 0900 and 1600 h) were counted in the poison and non-poison areas 1 day before and 13 days after poison-baiting. The percent reduction in wasp numbers in each poison area was calculated from the formula:

$$\text{Percent reduction} = (1 - (P_{\text{post}}/P_{\text{pre}}) \times (NP_{\text{pre}}/NP_{\text{post}})) \times 100$$

where P = the mean of counts in the poison area, NP = the mean of counts in the paired non-poison area, pre = pre-poison, and post = post-poison. In this formula, post-poison counts in the poison areas are multiplied by the proportional change in mean counts in the non-poison areas to correct for any natural change in wasp numbers. The effectiveness of poison-baiting by bait type was determined from an analysis of variance of the corrected raw data after $\ln(x+1)$ transformation. Least significant intervals were calculated from the formula given by Andrews *et al.* (1980).

RESULTS

Attractiveness and palatability of baits

The number of wasps attracted to thawed bait and to fresh bait in March 1991 did not differ significantly ($F_{1,18} = 0.183$, $P = 0.674$) (Table 1). Neither did the amount of each bait type removed by wasps ($F_{1,18} = 0.132$, $P = 0.721$). The number of wasps attracted to rehydrated bait and to fresh bait in February 1994 also did not differ significantly ($F_{1,18} = 0.006$, $P = 0.939$) (Table 1). Neither did the amount of each bait type removed by wasps ($F_{1,18} = 0.009$, $P = 0.924$). The difference between the two trials in number of wasps on baits and amount of bait removed by wasps reflects the level of the wasp populations in the different years and the different times of year in which the trials were done.

Effectiveness of baits

Thawed bait and rehydrated bait, both containing 0.5% sulfluramid, reduced the number of wasps collecting bait by 98.0% and 96.6%, respectively, when corrected for natural decline in the paired non-poison areas (Table 2). The difference in percent reduction is statistically significant ($F_{1,88} = 41.249$, $P < 0.001$) but is a result of the pre-poison counts in the poison areas in Ashley and Mt Thomas Forests being significantly different ($F_{1,88} = 55.311$, $P < 0.001$). The post-poison counts in the poison areas were not significantly different ($F_{1,88} = 0.524$, $P = 0.471$); i.e., both bait types reduced the number of wasps collecting bait to a similar level.

TABLE 1: Number of wasps attracted to baits and weight of bait removed by wasps, in relation to bait type (mean $\pm$ least significant interval).

Trial date	Bait type	Wasps/bait	Bait removed (g/h)
March 1991	Thawed toxic	2.13 $\pm$ 0.44	7.88 $\pm$ 2.06
	Fresh non-toxic	1.97 $\pm$ 0.45	7.23 $\pm$ 2.00
February 1994	Rehydrated toxic	0.80 $\pm$ 0.26	3.15 $\pm$ 0.73
	Fresh non-toxic	0.83 $\pm$ 0.21	3.27 $\pm$ 0.67

Thawed bait and rehydrated bait reduced the number of wasps per minute flying in and out of nests by 77.6% and 78.4%, respectively, when corrected for natural decline in the paired non-poison areas (Table 2). There was no significant difference between the two treatments ($F_{1,16} = 0.499$, $P = 0.490$).

TABLE 2: Number of wasps counted on baits and flying in and out of nests one day before and 13 days after poison-baiting with 0.5% sulfluramid, in relation to bait type.

Trial location	Bait type	Wasps/bait (no. of baits)		Wasps/min./nest (no. of nests)	
		pre-poison	post-poison	pre-poison	post-poison
Ashley	Thawed toxic	13.2 (25)	0.2 (25)	74.7 (3)	16.1 (3)
	Fresh non-toxic	14.0 (25)	10.4 (25)	72.3 (6)	69.6 (6)
Mt Thomas	Rehydrated toxic	4.4 (65)	0.1 (65)	30.1 (15)	6.3 (15)
	Fresh non-toxic	3.0 (20)	2.0 (20)	26.9 (15)	26.1 (15)

DISCUSSION AND CONCLUSION

The result for the thawed (previously frozen) sardine-based bait containing 0.5% sulfluramid is similar to that obtained in previous trials (Spurr 1993; Spurr and Elliott 1996; Spurr *et al.* 1996). Freeze-drying then rehydrating the bait did not affect its attractiveness, palatability or effectiveness for wasp control at Mt Thomas Forest. The greater reduction in number of wasps collecting bait than in wasp traffic flying in and out of nests has been noted before (Spurr 1993) and probably reflects the fact that wasps collecting bait are the ones most likely to be directly affected by poison-baiting. The successful result with freeze-dried bait suggests that freeze-drying is a suitable alternative to freezing as a method for storing bait for wasp control. However, this conclusion is tentative because the trial at Mt Thomas has not been replicated elsewhere.

Before freeze-drying is adopted as a method for commercial production of wasp baits, it will be necessary to have a freeze-drier dedicated to manufacturing baits containing pesticides. It will also be necessary to demonstrate the cost-effectiveness of freeze-dried baits (Spurr and Elliott 1996). The cost of production of freeze-dried baits is likely to be similar to that for production of frozen baits, but the cost of packaging, transport, and storage is likely to be lower.

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