WASP CONTROL BY POISON BAITING: EXPERIMENTAL USE OF HYDRAMETHYLNON IN CANNED SARDINE BAIT

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SUMMARY

Canned sardine cat-food containing 1% hydramethylnon placed in bait stations at 40/ha for 2 days under ideal conditions reduced wasp (predominantly *Vespula vulgaris*) numbers on baits by 95% after 1 day and wasp traffic at nest entrances within 100 m of baits by 75% after 5 days. Wasp traffic at nests remained low for the rest of the season. Hydramethylnon is slower acting and less effective against wasps but safer to non-target species than compound 1080.

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

INTRODUCTION

In New Zealand, two introduced species of wasp (Hymenoptera: Vespidae), the common wasp (*Vespula vulgaris*) and the German wasp (*V. germanica*), are a problem because they occur in large numbers, scavenge on human food, and have a painful (rarely fatal) sting (Spurr 1991). Poison baiting to reduce wasp numbers was developed in the USA in the early 1960s (Grant *et al* 1968; Wagner and Reiersen 1969) and first used in New Zealand in the early 1970s (Perrott 1975). The poisons used (mirex and chlordane) were successful because wasps could not detect them in the bait. However, use of these persistent organochlorines has now been banned. Compound 1080 (sodium monofluoroacetate) is a very effective alternative, but it is highly toxic to humans and not suitable for use in public places (Spurr 1991). Wasp control by poison baiting is currently hampered because there is no effective chemical registered specifically for this purpose.

Hydramethylnon (C₂₃ H₂₄ F₄ N₄) has been used in the USA for the control of ants (Davidson and Stone 1989), cockroaches (Worthing and Walker 1987), and more recently wasps. In a bait preference trial in Indiana, the addition of 1% hydramethylnon powder to ground ham did not reduce the amount of bait collected by German wasps (Reid and MacDonald 1986). In a poison baiting operation in Hawaii, tuna cat-food containing 0.5% hydramethylnon (dissolved in acetone) at 1 bait/20 ha every 3 days reduced western yellowjacket (*V. pensylvanica*) numbers within 1 month (Chang 1988). Poison baiting with hydramethylnon (dissolved in oleic acid) also reduced western yellowjacket numbers in trials in Washington State (Akre 1991).

This paper reports the results of research on the use of hydramethylnon in sardine baits to reduce wasp numbers in New Zealand.

METHODS

Initial small-scale trials in January 1988 and January-February 1989 were done in three areas adjacent to beech (*Nothofagus solandri* var. *cliffortioides*) forest at Mt Thomas, Canterbury; Link Rd (0.5 km of roadside and forest track), Glentui (a 3-ha picnic area), and Reserve Rd (0.5 km of forest track). Wasps were also monitored in two non-poison areas; Reserve Rd (2 ha of river terrace) in 1988, and Garry Rd (2 ha of hillside terrace) in 1989. In all areas, common wasps occupied 95-97% of the nests (E.B. Spurr, unpubl. data).

Subsequent large-scale trials in February-April 1990 and March 1991 were done in co-operation with the Department of Conservation (DOC) at six locations (picnic areas, camping sites, and forest tracks) in the northern South Island and one on the east coast

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of the North Island (Table 1). In these trials, field work was done by DOC staff under instructions prepared by FRI. Most nests were occupied by common wasps, except at Punakaiki and Waikaremoana where they were all occupied by German wasps. Wasp numbers were not monitored in non-poison areas in these trials.

On the basis of preliminary bait preference tests (E.B. Spurr unpubl. data), canned sardine in aspic jelly cat-food (Wonder Cat, Pataya Food Industries, Thailand) was used for bait. Hydramethylnon (American Cyanamid Company) was added to the bait at the manufacturer's recommended concentration of 1%, either as a dry powder (Link Rd, Glentui, and the subsequent management trials) or dissolved in acetone (Reserve Rd). Oleic acid was not used as a solvent because it repelled wasps. The poison and bait were mixed for about 1 min in a cake mixer for the small-scale research trials, and for 15 min in a concrete mixer for the large-scale management trials. Prepared baits were frozen in 100 g plastic pottles (research trials) or in 400 g plastic tubes (management trials).

Bait stations were made from cans or plastic bottles (50-75 mm diameter) open at one end and tied horizontally to wooden stakes, 1.2 m above ground. They were located about 10 m apart along transects spaced to give about 40 bait stations/ha in treatment areas.

It was intended that baits be placed in bait stations only in dry weather but rain fell during some management trials. Non-toxic bait (50 g per bait station) was put out daily for at least 3 days before poison bait in the initial research trials to attract wasps to the bait stations, but for only 1-3 days in the management trials. It was replaced by poison bait (thawed the day before) only when more than five wasps (on average) were present simultaneously on each bait. Poison bait was left out for 2 days in the research trials and 1-2 days in the management trials. In the management trials, fresh non-toxic bait was put out again 1 week after the poison bait to monitor wasp populations.

Wasp populations were monitored before and after poison-baiting by counting: (a) the number of wasps simultaneously present on either non-toxic or toxic baits (1-5 counts per bait, 30-60 baits per trial, between 10 am and 4 pm NZST, at half-hour to 1-week intervals, for 1-2 weeks), and (b) the number of wasps in 1 min leaving or entering nests (i.e., the wasp traffic rate) (one count per nest, 1-47 nests per trial, between 10 am and 4 pm NZST, at 1-10 day intervals, for 16-20 weeks). Most nests in the research trials were dug out to confirm wasp death.

TABLE 1: The effect of baits containing 1% hydramethylnon on wasp numbers at bait stations after 1 day and on wasp numbers at nests within 100 m of bait stations after 4-5 days.

Site	Date of poison baiting	Wasps per bait			Wasps/minute/nest		
		pre-poison mean	(n)	% reduction	pre-poison mean	(n)	% reduction
Research trials							
Link Rd	28/1/88	6.0	(30)	96.7	35.1	(9)	71.0
Glentui	26/1/89	13.0	(60)	90.6	46.2	(17)	73.3
Reserve Rd	15/2/89	13.4	(40)	99.2	51.9	(12)	79.8
Mean		11.5	(130)	94.7	45.4	(38)	74.8
Management trials							
Kerr Bay	15/2/90	13.0 +	(40)	83.6	42.7	(38)	33.6
Kaiteriteri	07/3/90	11.8	(40)	98.7	40.0	(2)	51.3
Anchorage	08/3/90	6.9 +	(40)	86.1	125.0 +	(1)	90.0 +
Hanmer	10/3/90	7.9	(40)	91.5	41.6	(47)	59.1
Punakaiki	16/3/90	5.1	(40)	70.5	—	—	—
Waikaremoana	08/4/90	5.3	(40)	95.8	63.0	(1)	65.6
Glentui	07/3/91	9.8	(40)	95.4	66.9	(10)	62.5
Mean		8.5	(280)	88.8	45.6	(99)	49.9

RESULTS

Research trials, 1988 and 1989

The number of wasps present on baits decreased rapidly after bait containing hydramethylnon was placed in bait stations. The average reduction in the three research trials was about 40% after 2 h, 75% after 5 h, and 95% after 24 h (1 day) (Table 1).

The number of wasps leaving or entering nests within 100 m of bait stations also decreased rapidly after poison baiting, by an average of 45% after 1 day and 75% after 4-5 days (Table 1; Fig. 1). This is less than the reduction in number of wasps present on baits, probably because wasps collecting bait are the ones most likely to be directly affected by poisoning. Wasp traffic at nests remained low for the rest of the season (Fig. 1), although there was a slight resurgence in numbers 2 weeks after poisoning, probably from wasps newly hatched from pupae, which being non-feeding would have survived poisoning.

Fig. 1: Comparison of the number of wasps/minute leaving or entering nests in areas where sardine baits containing 1% hydramethylnon were placed in bait stations (solid lines), and in non-poison areas (broken lines), Mt Thomas Forest. Vertical lines represent $\pm$ least significant intervals.

All wasps had died in 18% of nests ($n = 38$) 5 days after poison baiting, and in 76% of nests by the end of April (12 weeks after poisoning at Link Rd and Glentui, and 8 weeks after poisoning at Reserve Rd). In non-poison areas, all wasps had died in only 11% of nests ($n = 47$) by the end of April (representing the natural seasonal decline). Most wasps that survived poisoning were in nests at the edge of the poison area. The reason why some wasps survived poisoning was not clear, but was presumably related to the amount of poison bait collected.

Management trials, 1990 and 1991

The average reduction in wasp numbers after poison baiting in the seven management trials was 89% on baits after 1 day and 50% at nests within 100 m of baits after 4-5 days (Table 1). Wasp numbers at nests continued to decline for the 4 weeks they were monitored. However, wasp numbers on non-toxic baits increased from about 11% of pre-poison numbers 1 day after poisoning to about 30% after 1 week. These wasps presumably came mostly from nests more than 100 m away because wasp numbers at nests closer to bait stations did not increase.

DISCUSSION

The results of the management trials were not as good as those of the initial research trials because they were not obtained under ideal conditions. For example, in some management trials there was insufficient pre-feeding, too few wasps collecting bait, rain before or during the trials, insufficient time for wasps to collect enough poison, and/or the bait was unattractive. Although the same brand of sardines was used in both the initial trials and subsequent management trials, the bait texture in the latter trials was much finer, a result of being mixed for longer. In a subsequent bait preference test (E.B. Spurr, unpubl. data) wasps collected less of the fine textured bait used in the management trials than of the lumpy bait used in the initial trials. Reid and MacDonald (1986) also found that wasps collected less bait when it was finely ground.

The reduction in the number of wasps in the initial trials was much greater and more rapid than that achieved by Chang (1988) in Hawaii. Although there were differences in the wasp species (predominantly *V. vulgaris* vs. *V. pensylvanica*) and in the concentration of hydramethylnon in baits (1% vs 0.5%), the main difference was in the density of baits (40/ha vs 1/20 ha). As a consequence, baits needed to be put out only once, not repeatedly over the summer as in Chang's study.

The reduction in the number of wasps (on baits and at nests) after poisoning with hydramethylnon was not as great nor as rapid as that achieved after poisoning with compound 1080 (Spurr 1991). Wasps more rapidly re-invaded hydramethylnon poison areas also, indicating that the effect of hydramethylnon was not as widespread as that of 1080 (Spurr 1991). However, used under ideal conditions, hydramethylnon reduced wasp numbers sufficiently to alleviate the wasp nuisance for the rest of the season. Hydramethylnon is far less toxic than 1080 to non-target vertebrates. The LD_{50} for laboratory rats is 1131 mg/kg for hydramethylnon compared to 0.2 mg/kg for 1080 (Worthing and Walker 1987). Thus, hydramethylnon is safer than 1080 for use in public places. It readily degrades in sunlight and decomposes in soil (Worthing and Walker 1987), and therefore, like 1080, does not accumulate in the environment.

There is now sufficient information to seek Pesticides Board registration of hydramethylnon as an effective poison for wasp control. However, at present, hydramethylnon has to be mixed with sardine cat-food or an alternative fresh bait by the user. The development of a user-friendly ready-made product is dependent upon finding a satisfactory method of preserving fresh bait without reducing its attractiveness to wasps and without destroying the poison, or finding an attractive long-lasting synthetic bait.

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