Persistence of sodium monofluoroacetate (1080) and diphacinone in hen eggs for control of stoats (*Mustela erminea*)

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Abstract

Hen eggs injected with either sodium monofluoroacetate (1080) or diphacinone are being used by the Department of Conservation for the control of stoats (*Mustela erminea*). The eggs remain attractive to stoats for at least 1 month. This study investigates the persistence of the toxins in eggs incubated at two temperatures (15°C and 30°C) for up to 28 days. The amount of 1080 in eggs incubated at both temperatures and the amount of diphacinone in eggs incubated at 15°C had not declined after 28 days. However, the amount of diphacinone in eggs incubated at 30°C declined by about 20% after 28 days. More diphacinone could be injected into eggs to compensate for this loss. However, eggs are seldom likely to be exposed to temperatures as high as 30°C in bait stations in the field. Thus, under most field conditions, hen eggs containing 1080 or diphacinone can be left in bait stations for at least 28 days without loss of efficacy to stoats.

1. Introduction

The amount of sodium monoflucoroacetate (1080) or diphacinone remaining in hen eggs, up to 28 days after the toxicants were injected into the eggs, was determined by Manaaki Whenua - Landcare Research for the Department of Conservation, Wellington, in August-October 1996.

2. Background

Hen eggs injected with either sodium monofluoroacetate (1080) or diphacinone are being used by the Department of Conservation for control of stoats (*Mustela erminea*) in summer and autumn (Spurr 1996; Spurr & Hough 1996). The eggs remain attractive to stoats for at least 1 month (Spurr, personal observation). However, it is not known if the 1080 or diphacinone in the eggs breaks down during this time. Daytime field temperatures during summer in areas where DoC controls stoats may occasionally reach 30°C.

3. Objective

To determine the amount of 1080 or diphacinone remaining in hen eggs 0, 7, 14, 21, and 28 days after injection with the toxicant and incubation at 15°C or 30°C.

4. Methods

4.1 PERSISTENCE OF 1080

Eighteen hen eggs were injected with 1 ml of nominally 0.1% 1080 (nominally 1 mg 1080/egg). When analysed, the 1080 solution proved to be 0.097% 1080 (0.97 mg 1080/egg). The contents of two of the eggs were frozen immediately after injection for later analysis. Half the remainder were placed in an incubator at 15°C and half in an incubator at 30°C (humidity not controlled but in the range 10-30%). Injection holes in the eggs were not sealed. Two eggs were removed from each incubator after 7, 14, 21 and 28 days, and the contents removed and frozen for later analysis. The extracts were derivatised with 2,4-dichloroaniline in the presence of dicyclohexylcarbodiimide, cleaned on a silica solid phase extraction cartridge, and taken up in toluene for gas chromatography using electron capture detection and a 25m 320µm BP-5 column.

4.2 PERSISTENCE OF DIPHACINONE

Eighteen hen eggs were injected with 1 ml of nominally 0.5% diphacinone in monopropylene glycol (nominally 5 mg diphacinone/egg). The contents of two of the eggs were frozen immediately after injection for later analysis. Half the remainder were placed in an incubator at 15°C and half in an incubafor at 30°C (humidity not controlled but in the range 10-30%). Injection holes in the eggs were not sealed. Two eggs were removed from each incubator after 7, 14, 21 and 28 days, and the contents removed and frozen for later analysis. Analysis for diphacinone was carried out by mixing the contents of each egg with water and extracting the diphacinone with acetonitrile.The extracts were diluted with a solution of tetrabutyl ammonium phosphate, filtered, and injected into a high performance liquid chromatograph with UV/vis detection at 280 nm and a Brownlee 22 cm x 4 mm 5µm Spherisorb RP18 column. The solvent system uses Waters PIC A reagent in methanol/water (75/25).

5. Results

5.1 PERSISTENCE OF 1080

The amount of 1080 recovered from hen eggs immediately after injection was 0.96 mg, 1% less than injected (Appendix 10.1). Therefore, the amount of 1080 extracted from eggs at later time points was expressed as a percentage of that recovered immediately after injection (Appendix 10.2). The amount of 1080 in eggs incubated at either 15°C or 30°C had not declined after 28 days.

5.2 PERSISTENCE OF DIPHACINONE

The amount of diphacinone recovered from hen eggs immediately after injection was 4.7 mg, 6% less than injected (Appendix 10.3). Therefore, the amount of diphacinone extracted from eggs at later time points was expressed as a percentage of that recovered immediately after injection (Appendix 10.4). The amount of diphacinone in eggs incubated at 15°C had not declined after 28 days, though there was 40% less diphacinone than expected in the eggs sampled at 7 days. Because this result looked anomalous, the 7-day samples were re-analysed. The results were the same.The amount of diphacinone in eggs incubated at 30°C declined steadily by about 20% after 28 days.

In one egg injected with diphacinone, a spare not used in any of the above analyses but opened at the end of the study, the inside of the shell surrounding the injection point was discoloured bright yellow similar to the colour of the diphacinone solution.The amount of diphacinone adhering to the shell membrane was not determined.

6. Conclusions

The results of this study suggest that 1080 persists unchanged for at least 28 days in hen eggs incubated at either 15°C or 30°C, and that diphacinone persists for at least 28 days at 15°C but declines by about 20% over 28 days at 30°C. The small number of eggs analysed, and the anomalously low amount of diphacinone in eggs incubated at 15°C for 7 days, mean that these results should be considered preliminary.

Only two eggs were analysed at each time point in this study to keep costs down. Although the amount of both 1080 and diphacinone recovered from the two eggs was mostly within 10% of the mean for each of the time points sampled, variation between replicates could be reduced by analysing a larger sample of eggs.

The lower than expected amount of diphacinone in the two eggs incubated at 15°C for 7 days is unlikely to have been caused by analytical error because a repeat analysis of extracts of the same eggs produced the same results. It is also unlikely to be related to the time component of the study because eggs analysed before and after that time contained the correct amount of diphacinone. The problem would appear to be a mechanical one, perhaps injection error (though all care was taken and all eggs were supposedly injected with the same amount of toxicant), leakage from the eggs during incubation (none was observed but a detailed check was not made), or adherence of diphacinone to the egg shell membrane (not tested for). We cannot readily explain the result without doing further research. The result has implications for stoat control if, for whatever reason, some eggs are placed in the field with lower than desired amounts of diphacinone.

Diphacinone in hen eggs incubated at 30°C was the only toxin/temperature combination tested that declined after 28 days. More diphacinone could be injected into eggs to compensate for this loss. However, eggs are seldom likely to be exposed to temperatures as high as 30°C in bait stations in the field.

7. Recommendations

- DoC should continue to leave hen eggs containing either 1080 or diphacinone in bait stations for at least 28 days, under most field conditions, without expecting loss of efficacy to stoats.

- Follow-up research is required to determine (a) how much longer than 28 days 1080 and diphacinone remain stable in eggs under field conditions, (b) the reason for some eggs having a lower than expected diphacinone content, and (c) the proportion of eggs likely to be affected in this way.

8. Acknowledgements

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9. References

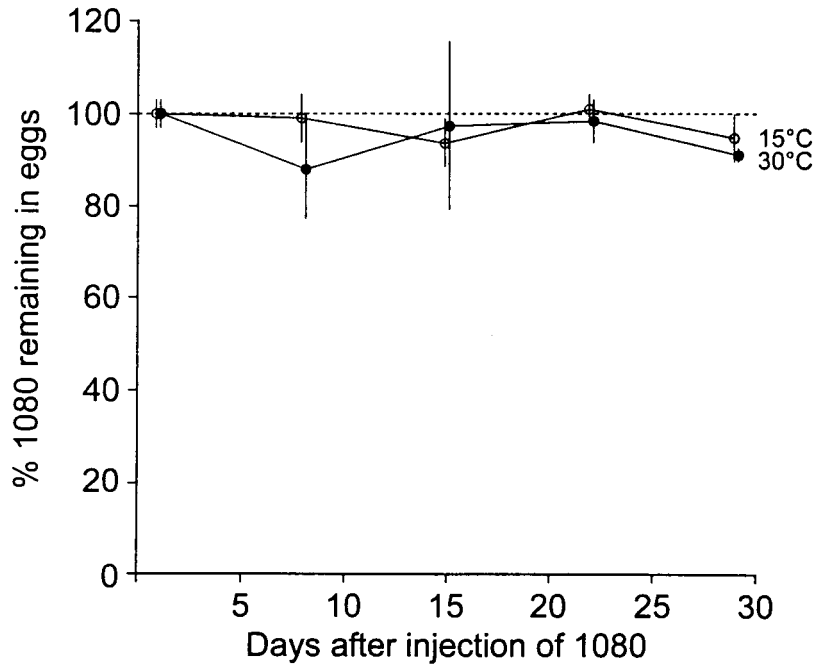
Spurr, E B 1996. Using poisoned hen eggs for stoat control. *Forest & Bird 281:* 22-23.

Spurr, E B; Hough, S J 1996. Instructions for using poisoned hen eggs for control of stoats (*Mustela erminea*). Landcare Research contract report LC9596/25 (unpublished) 14 p.

Appendices

10.1 Mean amount (mg) of sodium monofluoroacetate (1080) recovered from hen eggs injected with 0.97 mg 1080 and incubated at two temperatures (n = 2 for each data point).

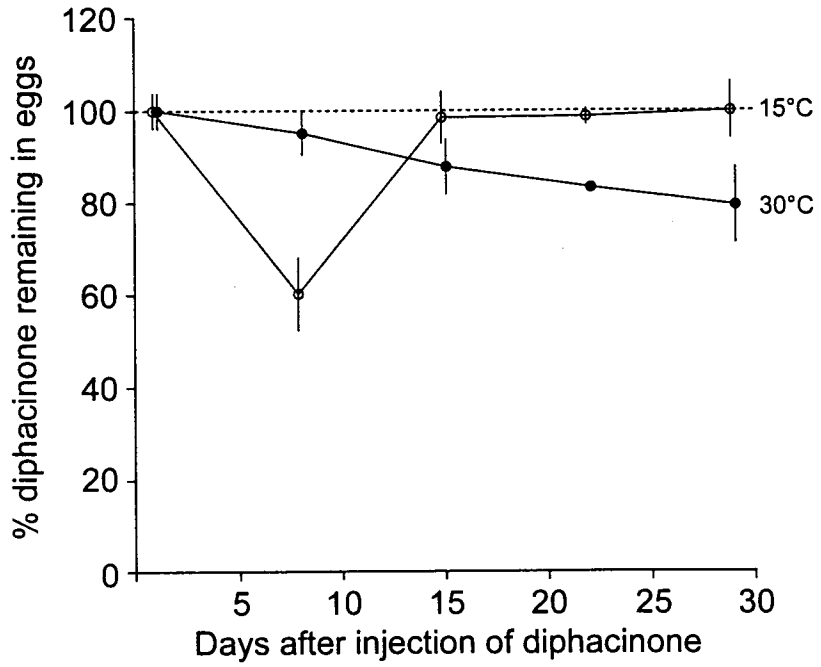
	Amount of 1080 after incubation at:	
Days	**15°C**	**30°C**
0	0.96	0.96
7	0.95	0.85
14	0.90	0.94
21	0.97	0.95
28	0.91	0.88



10.2. Mean amount of 1080 recovered from hen eggs up to 28 days after injection with 1080 as a percentage of the amount recovered immediately after injection. Vertical lines represent the range.

10.3 Mean amount (mg) of diphacinone recovered from hen eggs injected with 5.0 mg diphacinone and incubated at two temperatures (n = 2 for each data point).

	Amount of diphacinone after incubation at:	
Days	15°C	30°C
0	4.7	4.7
7	2.9	4.5
14	4.7	4.2
21	4.7	4.0
28	4.8	3.8



10.4. Mean amount of diphacinone recovered from hen eggs up to 28 days after injection with diphacinone as a percentage of the amount recovered immediately after injection. Vertical lines represent the range.