AVERSIVE CONDITIONING TESTS OF BLACK BEARS IN BEEYARDS FAILED

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ABSTRACT: This study evaluated the effectiveness of emetic compounds (lithium chloride and cupric sulfate) in honey baits as a technique for preventing black bear damage in fenced beeyards. LiCl and $CuSO_4$ in honey baits did not reduce black bear damage at beeyards. Our experience indicates that LiCl is not a suitable emetic for producing taste aversions in free-ranging black bears.

INTRODUCTION

Black bear (Ursus americanus) damage to beeyards in Alberta has been a serious economic problem for several years, especially in the Peace River region. Bear damage was estimated at $200,000 in 1976 in spite of increased numbers of electric fences around beeyards and a bear removal program conducted by Alberta Fish and Wildlife Division.

Recently, several researchers have tested aversive conditioning as a method of reducing damage and discouraging approach by carnivores. Aversive conditioning is a specialized form of learning that involves pairing a food, space, or an event with a painful experience or other negative reinforcer which leads to an avoidance of that item in subsequent encounters.

Wooldridge (1975) and Colvin (1976) produced a taste aversion in captive black bears with LiCl (lithium chloride) in honey baits. Gilbert and Roy (1977) evaluated taste aversion as a method of preventing black bear damage in beeyards in Alberta in 1974. They used LiCl in broodcomb and honeycomb baits. These baits were set inside beehive ground supers and located on likely avenues of approach or immediately outside electric fences enclosing beeyards. They found a significant difference in damage at unfenced yards ($P<.05$); damage per bear visit averaged 4.3 hives in unbaited yards and 2.0 hives in baited yards. There was also a reduction in damage at fenced yards although the difference was not significant; damage per bear penetration of the electric fences averaged 0.7 hives in unbaited yards and 0.2 hives in baited yards.

This paper reports the results of a follow-up study conducted in 1975 and 1976 to evaluate the aversive conditioning techniques described by Gilbert and Roy (1977), as a method for preventing black bear damage in fenced beeyards.

We wish to thank the beekeepers in the study area for their cooperation; gratitude is also extended to the problem wildlife staff of Alberta Fish and Wildlife Division for their cooperation.

STUDY AREA AND METHODS

The study area previously described by Gilbert and Roy (1977) included the area around Peace River and Falher, Alberta. The same area was selected for the follow-up study because bear damage in beeyards had been severe in past years (Gunson, 1973).

Our methods were similar to those of Gilbert and Roy (1977) except that we used only beeyards that were enclosed by an electric fence. These beeyards had a history of bear damage. Baited yards were randomly selected from this group. Bait boxes (beehive ground supers containing bait) were placed on the outside of the electric fence, on the side of the beeyard most likely to be approached by bears. Two bait boxes were used at each treated beeyard. Each bait box contained an emetic, LiCl or $CuSO_4$ (cupric sulfate), wrapped in broodcomb or honeycomb. LiCl tablets were wrapped in Parafilm (American Can Company, Neenah, Wisconsin); $CuSO_4$ powder was packaged in number 2 gelatin capsules.

Track plots (areas of land worked with a hoe and shovel to obtain imprints of bear tracks) were dug 20-30 cm from the electric fence on the sides of the beeyard most likely to be approached by bears. One to three track plots were dug per beeyard.

In 1975 each beeyard was checked every 3 days for a 15-day period, weather and roads permitting; thereafter, beeyards were not checked for 6 days. The 15-day period was then repeated. In 1976 beeyards were checked every 3 days throughout the summer. Bear sign, fence charge and bear damage were recorded during each beeyard check. Track plots were reworked as required. Beeyards were rebaited when the bait had been taken by bears or had spoiled.

The criteria for bear visits were based on the presence of new bear signs (such as tracks, trails, and hair) at each check. Since these checks were made every 3 days, a bear could possibly visit a beeyard more than once. Thus, numbers of bear visits in this experiment represent minimum estimates of visitation.

Individual bears were differentiated according to track size, results of control effort, and time interval between visits. A time interval of 14 days or more between bear visits at any one yard was chosen as a sufficient period of time to justify the assumption that the succeeding bear visit was made by a different bear.

A hive was considered to be destroyed when it was no longer profitable as a honey-producing unit and its use was discontinued by the beekeeper. A hive was considered damaged when at least one super of frames was overturned. Since the estimated loss of a damaged hive was $40 and of a destroyed hive $120 (Gunson, 1973), the measure of damage inflicted by bears was standardized in units of equivalent hives as the sum of damaged hives plus three times the sum of destroyed hives.

Control efforts continued throughout the experiment as an attempt was made by personnel of the Fish and Wildlife Division to eliminate any bear that was causing damage in a beeyard.

In 1975, 35 beeyards were baited with honeycomb or broodcomb and LiCl while 30 unbaited beeyards were used as a control. Each bait (two per beeyard) contained initially 4.5 g of LiCl (6 tablets). The dosage was increased to 9 g (12 tablets) per bait in July. Baited and unbaited beeyards were monitored for 2831 and 2167 beeyard-days, respectively. Baits contained 9 g of LiCl at 22 beeyards for 993 beeyard-days.

In 1976, 23 yards were baited with LiCl in honeycomb or broodcomb, 22 yards were baited with $CuSO_4$ in honeycomb or broodcomb, and 32 unbaited yards served as a control. These classes of beeyards were monitored for 1279, 1371, and 1797 beeyard-days respectively. LiCl baits contained 12 g (12 tablets) of LiCl in 1976. $CuSO_4$ baits contained initially 0.7 g (2 capsules) of $CuSO_4$ dosages were increased to 1.4 g (4 capsules), and then to 2.8 g (8 capsules) per bait.

RESULTS AND DISCUSSION

Gilbert and Roy (1977) reported a reduction in bear damage at beeyards baited with one broodcomb or honeycomb bait containing 6 g of LiCl in 1974. However, they found that baits were consumed during only about 50 percent of the bear visits. In 1975, we initially placed two baits per yard, each bait containing 4.5 g of LiCl. Bait consumption was improved; bears consumed or partially consumed bait during 84 percent of the visits in 1975. Since damage was not reduced at baited yards, the dosage of emetic was increased from 4.5 g to 9.0 g of LiCl per bait in July 1975. Because that did not produce the desired results, the dosage of emetic was increased to 12.0 g of LiCl per bait or a total of 24.0 g of LiCl per yard in 1976.

Black bear damage figures from baited and unbaited beeyards during 1975 and 1976 are shown in Tables 1 and 2. These data include bear visits and damage at beeyards where the bait remained undisturbed. The percent of bears causing damage, percent of beeyards penetrated by bears, and hives damaged per penetration did not differ significantly between baited and unbaited beeyards during 1975 (Table 1) and 1976 (Table 2). Penetrations per bear visit were significantly lower at beeyards with 12 g of LiCl per bait than at unbaited yards ($P< .05$) (Table 2). However, bear visits per yard and visits per bear were significantly greater at beeyards with 12 g of LiCl per bait than at unbaited yards ($P< .05$) (Table 2). Thus, bears were more inclined to return to beeyards where bait was present, although the presence of bait did not change the overall damage rate. We conclude that our techniques were ineffective in reducing bear damage in beeyards.

Eighty-five percent of the bears disturbed the bait, and 72 percent of the bears consumed or partially consumed bait during their first visit to a beeyard in 1975 and 1976. It appeared that bears normally walked around the outside of a beeyard before attempting to penetrate an electric fence. Thus, if a bait was disturbed, the bear probably disturbed or consumed the bait before an electric fence was penetrated. Assuming this is true, then 21 of 26 bears (81 percent) of the bears consumed bait before they penetrated an electric fence and caused damage at baited yards. Thus, the failure of this technique in reducing bear damage can only be partially explained by unsatisfactory bait placement and bait acceptance.

Bears consumed an average of 14 g of LiCl the first time they took the bait in 1976. Thereafter, bait consumption tended to decline with each subsequent visit; bears consumed an average of 12, 7, and 3 g of LiCl on their second, third, and fourth visit, respectively. Thus, the honeycomb and LiCl bait tended to become less acceptable with each subsequent visit. However, there was one notable exception, one bear made eight visits and consumed an average of 16 g of LiCl per visit.

In 1976, nine bears penetrated electric fences on their first visit, and two bears penetrated electric fences on their second visit to unbaited beeyards. Numbers of bears penetrating fences at baited beeyards were 3,4,1, and 1 on the first, second, third, and fourth visit, respectively. Thus, the presence of bait tended to defer a penetration until a later visit.

We suspect that two honeycomb baits may have satisfied the immediate food requirements of a bear. On the first visit to a beeyard, a bear probably consumed the bait and then left without making a serious attempt to penetrate the electric fence. Twenty-four grams of LiCl may have created a mild aversion to the bait. Thus, on subsequent visits to a beeyard, the bear consumed less bait and made a greater effort to penetrate the electric fence.

Our data indicate that 24 g of LiCl is not sufficient to produce a strong, long-lasted taste aversion in free-ranging bears. Presumably, a taste aversion can be produced in free-ranging bears with larger quantities of LiCl; Wooldridge (1975) and Colvin (1976) produced taste aversions in captive black bears with 20-80 g of LiCl. However, large quantities of an emetic create problems with packaging. Our data suggest that bears learned to avoid the bait, but not the beehives. If this is true, LiCl will be difficult to administer, undetected, in large quantities.

Table 1. Black bear damage in fenced beeyards, 1975.

Bear Visitation and Damage	Beeyard Type		
	Baited		Unbaited
	4.5 g LiCl/Bait	9.0 g LiCl/Bait	
No. of beeyards visited by bears	21	10	12
No. of bears	30	11	20
No. of bear visits	61	15	21
No. of penetrations	10	3	7
Bear visits per yard	2.9[1/]	1.5	1.8[1/]
Visits per bear	2.0[2/]	1.4	1.1[2/]
Penetrations per bear visit	.16	.20	.33
Hives damaged per penetration	3.2	2.3	4.1
Percent of yards penetrated	38	30	42
Percent of bears causing damage	27	25	30

[1/] Significantly different, T = 2.75, 1 and 31 df, P = .01.

[2/] Significantly different, T = 3.00, 1 and 48 df, P<01.

Table 2. Black bear damage in fenced beeyards, 1976.

Bear Visitation and Damage	Beeyard Type		
	Baited		Unbaited
	2.8 g $CuSO_4$/Bait	12.0 g LiCl/Bait	
No. of beeyards visited by bears	13	18	22
No. of bears	18	37	35
No. of bear visits	31	98	60
No. of penetrations	8	10	15
Bear visits per yard	2.4	5.4[1/]	2.7[1/]
Visits per bear	1.7	2.6[2/]	1.7[2/]
Penetrations per bear visit	.26	.10[3/]	.25[3/]
Hives damaged per penetration	4.1	3.9	4.9
Percent of yards penetrated	40	33	45
Percent of bears causing damage	39	24	31

[1/] Significantly different, T = 2.82, 1 and 38 df, P<.01.

[2/] Significantly different, T = 2.27, 1 and 70 df, P<.05.

[3/] Significantly different, X^2= 6.11, 1 df, P 05.

In summary, there is no evidence to suggest that **LiCl** in honeycomb and broodcomb baits reduced black bear damage at beeyards. The presence of baits increased the probability of bears returning to beeyards on subsequent visits. Most bears penetrated unbaited yards on their first visit; the presence of bait tended to defer a penetration until the second, third, or fourth visit. Our experience indicates that LiCl is not a suitable emetic for producing taste aversions in free-ranging black bears.

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