PRELIMINARY STUDY USING CHEMOSTERILANTS FOR CONTROL OF NUISANCE BEAVER

by
KENNETH L. GORDON
Mississippi Agricultural and Forestry Experiment Station
Department of Wildlife and Fisheries
Mississippi State University
Mississippi State, Mississippi 39762[1]

DALE H. ARNER
Mississippi Agricultural and Forestry Experiment Station
Department of Wildlife and Fisheries
Mississippi State University
Mississippi State, Mississippi 39762

ABSTRACT

Sixteen beaver (Castor canadensis) *were live trapped, marked, and orally administered the chemosterilants 17 α-ethynylestradiol-3-cyclopentyl ether and SC-24674 of Searle Laboratories. Treated beaver were released at the point of capture and retrapped near the end of the breeding season. Five treated breeding age males showed significant reduction in both testes weight ($P<0.01$) and seminal vesicle weight ($P<0.05$) as compared to untreated males. Histological examination of testes of treated males indicated suppression of spermatogenesis and disruption of the cells of the seminiferous tubules. Five treated breeding age females showed significant reduction in both ovulation ($P<0.005$) and pregnancy ($P<0.05$) when compared to 25 untreated females.*

The use of chemosterilants as antifertility agents to control nuisance pest species has received wide study since its first discussion by Davis (1961). Arner (1964) suggested the use of chemosterilants to control nuisance beaver. Harper (1968) used injections of Polystilbestrolphosphate on beaver with some success, but his conclusions were limited by sample size.

This study was initiated to determine the effectiveness of two orally active estrogen compounds in reducing fertility in beaver. The chemosterilants used were 17 α-ethynylestradiol-3-cyclopentyl ether and Searle Laboratories' SC-24674.

METHODS

Live trapping with Bailey traps (National Live Trap Co., Tomahawk, WI) was begun October 1972 on the Noxubee National Wildlife Refuge, Brooksville, MS. Thirty captured beaver were removed from the traps and transported in burlap bags to the wildlife laboratory of Mississippi State University. Each beaver was weighed and sexed by palpation as described by Osborn (1955). Beaver trapping with #330 conibear traps (Woodstream Corporation, Lititz, PA) was begun January 1973 in areas where treated beaver had not been released to obtain beaver for comparison.

To insure positive identification of treated beaver, a combination of marking techniques was tried. The methods found to be of the most value were (1) placing a #681 Monel ear tag into the webbing of each hind foot through two 0.6 cm holes punched in the webbing with a leather punch, (2) punching 0.3 cm coded holes in the side of the tail, and (3) tattooing a number on the webbing of the hind foot.

Marked beaver were acclimated in 3m × 3m pens with food, water and shelter, (usually three to four days) prior to treatment with chemosterilants. Sixteen beavers were orally administered one of the chemosterilants.

Measured doses of a chemosterilant (1 to 2 mg/kg body weight) were mixed with ethanol and poured into a cavity cut in an apple and sealed with a plug secured with a non-toxic white glue. The treated apple was placed in a wire mesh cage with the beaver and observed until eaten. Treated beaver were released in the area of capture. Trapping for recapture started February 1973 and continued through April 1973.

[1] Present address: Mississippi Natural Heritage Program, 2304 Riverside Drive, Jackson, Mississippi 39202.

The carcasses of the beaver were weighed, measured and necropsied in the field. Reproductive tracts were removed and preserved intact in Mossman's AFA.

Seminal vesicles and testes were weighed to the nearest 0.001 gm on a Mettler 160 balance. Reproductive organ weights (g) were divided by body weights (kg) to give a ratio of the relative size of the organs so that comparisons could be made between animals of different weights.

Blocks of testicular tissue from five treated and five untreated males of approximately the same body size and date of capture were sectioned and stained with Hematoxylin and Eosin.

Mean weights of testes and seminal vesicles were used as indices to the effectiveness of the chemosterilant on male beaver. For this comparison, the five adult males treated by the two chemosterilants were grouped since the two drugs are assumed to be similar in action. Sixteen adult, untreated males captured during the same trapping period were used for comparison.

Following fixation in AFA, the female reproductive tracts were transferred to 70 percent ethanol. The ovaries and uterus were examined macroscopically (Provost 1962) to determine the reproductive status of the individual. Only visible fetuses or implantation sites were considered evidence of pregnancy. The rate of pregnancy determined was a conservative estimate of breeding as implantation would not be evident in very early pregnancies and we would consider them not pregnant.

RESULTS AND DISCUSSION

A total of 78 beaver was trapped from January to April 1973. Of these, 10 were adult beaver (five female and five male) previously marked and treated with chemosterilant. Provost (1958) stated that beaver begin breeding at 2.5 to 3 years of age when they reach 30-35 pounds (13.6-15.9 kg) body weight. He also reported mature sperm in the epididymis of males weighing 25-30 pounds (11.3-13.6 kg), and he felt that most males are capable of breeding during their second year. Wilkinson (1962) found that the youngest females found in breeding condition were all two-year-olds, and the smallest pregnant beaver captured weighed 32 pounds (14.5 kg). Harper (1968) used 30 pounds (13.6 kg) body weight as the lower limit to identify potential breeders in his chemosterilant study. As a result, 30 pounds (13.6 kg) was selected as the arbitrary lower limit to separate sexually mature beaver.

Effect on Males

Five of the treated males were considered sexually mature and were compared to 16 untreated males. Treated males had smaller testes and seminal vesicles than untreated

Table 1. Comparison of mean testes and seminal vesicle weights, in grams per kilogram body weight, of treated and untreated beaver.

Group	*Mean Testes Weight (g/kg)*	*Mean Seminal Vesicle Weight (g/kg)*
Treated (n=5)	0.964**	1.050*
Untreated (n=16)	1.395	1.632

* = (P<0.05), ** = (P<0.01)

Table 2. Comparison of ovulation and reproduction rates of treated and untreated beaver.

Group	*Number Ovulating*	*Number Corpora Lutea*	*Number Pregnant*	*Number Fetuses*
Treated (n=5)	1***	3	0*	0
Untreated (n=25)	20	68	13	38

* = (P<0.05), *** = (P<0.005)

males (Table 1). Mean weights were compared by Student's t-test as described by Steel and Torrie (1960:43).

Histological examination of the testes of the treated and untreated beaver indicated suppression of spermatogenesis by the chemosterilants. Spermatogenesis, as evidenced by mature spermatids or spermatozoa, was entirely lacking or much reduced in the testes of treated males. The germinal epithelium within the seminiferous tubules was disorganized and similar to that frequently found in hypophysectomized animals or animals under long-term stilbestrol treatment (Dr. B. Baker, personal communication 1973, Professor of Animal Science, Mississippi State University, Mississippi State, Mississippi). This may indicate a possible interruption of the pituitary-testicular axis by the chemosterilant. This hypothesis is given added plausibility by the reduction in weight of the seminal vesicles in the treated beaver. Growth and secretion of the accessory sex glands are stimulated by testicular androgens; therefore, lowered levels of testicular androgen secretion usually results in smaller accessory sex glands. In general, testes of the treated beaver resembles those of a male under long-term estrogen treatment, but it is of interest that this effect was prolonged with little apparent change up to 149 days.

Effect on Females

Eighty percent (20) of the untreated beaver had ovulated compared to 20 percent (1) of the treated females. This treated female was not considered pregnant as the corpora lutea were small and not well consolidated. The muscle tone and overall appearance of the uterus was not typical of a pregnant beaver. Chi-square analyses were used to test the significance of differences between treated and untreated females (Steel and Torrie 1960:346). The results are summarized in Table 2.

CONCLUSIONS

The two chemosterilants tested show promise of being capable of controlling nuisance beaver populations. No attempt was made to evaluate differences in the effectiveness between the two chemosterilants used due to the small number of treated beaver recaptured. Further investigation of these two chemosterilants seems warranted based on the findings of this study. An effective method for treating beaver in the wild will be necessary if this technique is to have practical management implications.

LITERATURE CITED

Arner, D. H. 1964. Research and a practical approach needed in management of beaver and beaver habitat in the Southeastern United States. Trans. N. Am. Wildl. Conf. 29:150-158.

Davis, D. S. 1961. Principles for population control by gametocides. Trans. N. Am. Wildl. Conf. 26:160-166.

Harper, W. R. 1968. Chemosterilant assessment for beaver. M. S. Thesis, Colorado State University. 40 pp.

Osborn, D. J. 1955. Techniques of sexing beaver, (*Castor canadensis*). J. Mammal. 36(1):141-142.

Provost, E. E. 1958. Studies on reproduction and population dynamics in beaver. Ph.D. Dissertation. Washington State University. 85 pp.

_____. 1962. Morphological characteristics of the beaver ovary. J. Wild. Manage. 26(3):272-278.

Steel, R. G. D., and J. H. Torrie. 1960. Principles and procedures of statistics McGraw-Hill Book Company, Inc. New York. 481 pp.

Wilkinson, P. M. 1962. A life history study of the beaver in east-central Alabama. M. S. Thesis, Auburn University. 71 pp.