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# Antibiotic Treatment of Ulcerative Enteritis of Bobwhite Quail <sup>1</sup>

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## Abstract

Penicillin-streptomycin<sup>5</sup>, bacitracin methylene disalicylate<sup>6</sup>, zinc bacitracin<sup>7</sup>, soluble bacitracin methylene disalicylate<sup>8</sup>, streptomycin (25%) and spectinomycin<sup>10</sup> were used as prophylactic and therapeutic treatments for ulcerative enteritis in bobwhite quail (*Colinus virginianus*). Penicillin-streptomycin was the most effective prophylactic and streptomycin (25%) was the most effective therapeutic agent.

## Introduction

One of the major problems encountered in pen-raising Bobwhite Quail is ulcerative enteritis.<sup>7</sup> Ulcerative enteritis outbreaks severely hamper the raising of bobwhites for game preserve<sup>1</sup> area restocking<sup>2</sup> and raising of quail for the specialty food market.<sup>3</sup>

Peckham has described the causative organism of ulcerative enteritis in Bobwhite Quail as a gram positive, anaerobic,

spore-forming bacillus.<sup>9</sup> This organism has been isolated from the yolk sac of embryonated chicken eggs which had been inoculated with gut material from infected bobwhites. It has not been possible, however, to reproduce the disease in quail using isolates grown on artificial media.<sup>8</sup>

Various antibiotics have been tested as treatments for ulcerative enteritis infec-

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<sup>5</sup> Pro-Strep, Merck Sharpe and Dohme, Rahway, N.J.

<sup>6</sup> Fortracin-25, S. B. Penick and Co., New York, N.Y.

<sup>7</sup> Baciferm-10, Commercial Solvents, New York, N.Y.

<sup>8</sup> Fortracin Soluable-25, S. B. Penick and Co., New York, N.Y.

<sup>9</sup> Vet-Strep, Merck Sharpe and Dohme, Rahway, N.J.

<sup>10</sup> Spectam, Amdal, Abbott Laboratories, North Chicago, Ill.

tion of bobwhites.<sup>4,5</sup> In these studies, treatment was started at a predetermined time following the introduction of infection. In such situations it is difficult to determine the degree of potency of the medications involved because treatment is started before it is known whether the disease has been established in the experimental subjects.

The object of this study was to deter-

mine the efficacy of six different antibiotics as treatments for ulcerative enteritis infection of bobwhites. The experimental method in this test attempted to simulate field conditions. This involved two approaches. One involved continuous feeding of the test drug to prevent infection. In the other, an outbreak of ulcerative enteritis was allowed to start before treatment was initiated.

### Materials and Methods

*Experimental birds.* A total of 220 bobwhites (*Colinus virginianus*) were divided into 10 equal-sized groups and placed in pens with fresh clay floors inside of a poultry house. They were fed a standard bobwhite ration.

*Establishment of infection.* Infection was started in the experimental groups by randomly infecting two birds of each group. These contact birds were infected by giving them 1 ml. of homogenized infected gut and liver material *per os*. This infected gut and liver material was collected from field outbreaks of ulcerative enteritis.

*Prophylactic treatment.* Three antibiotics were used in this phase of the study. They were penicillin-streptomycin and zinc bacitracin. The penicillin-streptomycin was fed at the rate of 75 g. of streptomycin per ton of feed, and the bacitracin methylene disalicylate at the rate of 50 g. per ton of feed. The medicated feed was started 30 days before the introduction of infection into the groups and continued for 56 additional days.

*Therapeutic treatment.* Four antibiotics were tested for efficacy as treatments for outbreaks of ulcerative enteritis:

- Bacitracin-MD—at levels of 0.5 pound and 1 pound per 50 gallons of water for 10 days.
- 25% Streptomycin in two treatment regimens,
  - 20 ml. per gallon of water for 1 day then
  - 4 ml. per gallon of water for 18 days; and
  - 4 ml. per gallon of water for 19 days.

—Zinc Bacitracin, at 200 g. per ton of feed for 14 days.

—Spectinomycin at 2 g. per gallon of water for 5 days.

In addition one control group of bobwhites was left untreated.

In these groups, treatment was not started until at least one of the exposed birds died with lesions of ulcerative enteritis. For this reason, the number of birds per treatment group was not the same.

All the birds dying during the course of the experiment were necropsied, and all deaths were judged to be due to ulcerative enteritis infection.

*Prophylactic Treatment.* The results of this phase of the study are summarized in Table 1. Of the three antibiotics tested in this manner, penicillin-streptomycin was quite clearly the most effective treatment. It protected all 20 birds in the group; whereas bacitracin protected only 7 out of 20 birds (35%) and zinc bacitracin protected only 2 out of 20 birds (10%).

*Therapeutic Treatment.* The results of this phase of the study are summarized in Table 2. 25% streptomycin was the most effective material tested as a treatment for ulcerative enteritis. The high therapeutic level (20 cc./gal. water for 1 day, and 4 cc./gal. water for the next 18 days) of 25% streptomycin protected 95% of the bobwhites exposed to infection. The low therapeutic level of 25% streptomycin (4 cc./gal. water for 19 days) protected 79% of the birds ex-

TABLE 1. *Prophylactic effects of antibiotics\* against ulcerative enteritis in bobwhites*

Drug	Concentration	Survivors/ total	% survivors
Penicillin-Streptomycin	75 g Streptomycin/ton of feed	20/20	100
Bacitracin	2 lbs Premix/ton of feed (50 g Bacitracin MD/ton)	7/20	35
Zinc-Bacitracin	5 lbs Premix/ton of feed (50 g Zinc Bacitracin/ton)	2/20	10

\*Medication started 30 days prior to contact challenge and continued for 56 additional days.

TABLE 2. *Therapeutic effects\* of antibiotics against ulcerative enteritis in bobwhites*

Drug	Concentration	Survivors/ Total	Percent Survivors
Bacitracin	1 lb/50 gal water for 10 days	6/19**	31.6
Bacitracin	0.5 lb/50 gal water for 10 days	4/15	26.7
25% Streptomycin	20 cc/gal water for 1 day 4 cc/gal water — 18 days	18/19	94.7
25% Streptomycin	4 cc/gal water — 19 days	11/14	78.6
Zinc Bacitracin	20 lb premix/ton feed for 14 days (200 g. zinc Bacitracin)	4/14	28.6
Spectinomycin	2 gm/gal water for 5 days	6/14	42.9
Control		0/20	0.0

\*Deaths occurring during treatment period

\*\*Treatment did not start until at least one principal died in each pen as the result of contact exposure. A Chi-square of 9.35 (not significant with 5 df) was calculated in a comparison of the pre-treatment living to dead ratio.

posed to infection. The other antibiotics had a protective level ranging from 27-43%.

Deaths due to ulcerative enteritis were recorded during a 14 day post-treatment period (Table 3). No post-treatment

deaths occurred in groups of birds receiving penicillin-streptomycin or zinc bacitracin. Only 16.7% and 18.2% of the groups respectively treated with bacitracin or 25% streptomycin died after treatment was removed. All other death rates were greater than these.

TABLE 3. Number of deaths in bobwhites during a 14 day period following the cessation of various antibiotic treatments for ulcerative enteritis.

Drug	Treatment Method	Deaths/Total	Mortality
Penicillin-Streptomycin	Prophylactic	0/20	0
Bacitracin	Prophylactic	6/7	85.7
Zinc Bacitracin	Prophylactic	0/2	0
Bacitracin (soluble) (1 lb/50 gal water)	Therapeutic	1/6	16.7
Bacitracin (soluble) (0.5 lb/50 gal water)	Therapeutic	4/4	100.0
25% Streptomycin (20 cc/gal 1 day and 4 cc/gal 18 days)	Therapeutic	8/18	44.4
25% Streptomycin (4 cc/gal for 19 days)	Therapeutic	2/11	18.2
Zinc Bacitracin	Therapeutic	3/4	75.0
Spectinomycin	Therapeutic	6/6	100.0

### Discussion

To mimic a natural outbreak of ulcerative enteritis in the groups of bobwhites, two steps were taken. First, since it is possible that bobwhites differ in their susceptibility to ulcerative enteritis they were randomly assigned to the various groups. Secondly, birds were exposed to infection by contact with infected bobwhites. In this manner, within the limits of some undetermined error, the bobwhite population of each pen was uniform as to their susceptibility. It was assumed then that subsequent exposure to the disease agent by the contact method would result in a gradation of symptoms as seen in natural outbreaks of this disease.

This assumption is supported by an examination of the initial living to dead ratio which resulted from contact exposure prior to the start of antibiotic treatment. A chi-square test provides evidence that this ratio did not vary by more than chance from pen to pen. On this basis, it was concluded that both the susceptibility and the exposure to the

disease agent was uniform in each pen. Additionally, to remove bias all of the antibiotics used in this experiment were assigned randomly to individual bobwhite pens.

Therapeutically, antibiotics are of value in controlling ulcerative enteritis. Once the disease was established in a group of bobwhites, 25% streptomycin was highly effective in preventing further losses (Table 2).

The prevention of ulcerative enteritis by the continuous prophylactic feeding of antibiotics is very effective. This is particularly true for penicillin-streptomycin where continuous feeding of the antibiotic protected 100% of the quail at risk during the feeding period (Table 1).

Antibiotics are of value both prophylactically and therapeutically. However, the nature of ulcerative enteritis is such that the disease usually can only be controlled effectively by continuous treatment. When treatment is discontinued the bobwhites succumb, once again,

to the disease (Table 3). Penicillin-streptomycin, which was fed on a continuous level prior to and after the introduction of diseased bobwhites, appears to be an exception to this rule since none of the bobwhites in this group died following the cessation of medication. It should be noted, however, that

only the inoculated birds died, indicating that the disease was never established in this group.<sup>6</sup> Since these birds were still susceptible to ulcerative enteritis, Pro-Strep no doubt should be fed on a continuous basis in order to be effective in the prevention of ulcerative enteritis.

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