

# Limitations of Phenothiazine in the Control of Cecal Worms and Blackhead Disease of Turkeys

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THE relationship of the cecal worm, *Heterakis gallinae*, to enterohepatitis, or so-called blackhead disease of turkeys and chickens, was demonstrated by Graybill and Smith (1920) and by Tyzzer, Fabyan, and Foot (1921). By carefully controlled experiments, these investigators succeeded in infecting chickens and turkeys with blackhead by feeding them embryonated eggs of the common cecal worm.

It has been shown, however, that poultry may contract blackhead in the absence of the cecal worm. Studies by Moore (1896), Tyzzer and Fabyan (1920), Tyzzer and Collier (1925), and DeVolt and Davis (1936) showed that fowls became infected with blackhead by feeding to them bits of infected livers and ceca, and by the direct inoculation of excreta from infected birds. It would appear, therefore, that even though it were possible by medication or otherwise to eliminate completely the cecal worm as a source of infection, the possibility still remains that blackhead might continue to be propagated.

McCulloch and Nicholson (1940) and Allen, Olivier, and Peterson (1942) administered phenothiazine in single and repeated daily doses to infested chickens and reported the treatment to be from 95 to 100 percent effective for the removal of the cecal worm. Olivier, Allen, and

Hardcastle (1943) fed phenothiazine in the mash in 0.5 percent concentration to infested chickens and removed nearly 100 percent of the heterakids. Van Ness and Hamilton (1944) stated that phenothiazine in a mash fed to chickens for rather prolonged periods, failed to control blackhead. Examination of the cecal contents of birds that died showed freedom from cecal worms.

The objects of the present experiments were (1) to determine the effectiveness of the addition of phenothiazine to the mash, in 1 and 2 percent concentrations, for the prevention of cecal worms in turkeys and chickens when the latter were ranged on soil heavily seeded with the eggs of this parasite, and (2) incidentally to determine what effect such treatment might have on the incidence of blackhead in turkeys. The present paper presents data on the incidence of cecal worms in chickens and turkeys and of blackhead in turkeys as influenced by the feeding of phenothiazine in the mash continuously for a period of 4 to 6 weeks.

## MATERIALS AND METHODS

Parasite-free birds were penned in small experimental plots, 30 by 30 feet, which were equipped with centrally located shelters. No special precautions were taken to rear the birds under sanitary conditions. The feeders and waterers were

of the open type, and no provision was made to protect the feed and water against contamination.

Dead birds were examined as soon after death as possible. A record was kept of the cause of death, if ascertained, and of the number and stage of development of all the recovered cecal worms.

The phenothiazine powder was mixed with the dry mash and the birds were allowed to eat the medicated mash *ad libitum*.

The experiments were terminated only when it seemed certain that no more deaths from blackhead would occur. At the end of each experiment all the surviving birds were examined carefully for blackhead lesions and for the presence of cecal worms.

#### EXPERIMENTAL DATA

*Experiment I.* On May 25, 1943, a mixed group of 30 turkeys and 30 chickens were placed in an experimental pen and a mixed group of equal size in another pen. The turkeys, Beltsville Small White Type, were 60 days old; the chickens, Rhode Island Red, were 42 days old. It has been mentioned frequently in the literature that turkeys contracted blackhead more readily when ranged with or on ground previously occupied by chickens. Hence, the reason for including chickens in this experiment. One of the mixed groups of 60 birds was given a mash containing 1 percent concentration of phenothiazine as its only diet, and the other group received only plain mash.

During the course of the experiment, 15 of the 30 treated turkeys and 26 of the 30 control turkeys died of blackhead. One chicken from the control pen died of blackhead; and none of the treated chickens died. Three turkeys from the control pen and one from the treated pen were the first to succumb to the disease, the former dying on the sixteenth and the

latter on the seventeenth days of the experiment. Thereafter deaths from blackhead occurred almost daily in both the treated and control pens until the twenty-eighth day of the experiment. After this period there was a 9-day period in which no deaths occurred. One turkey from the treated pen died from blackhead on the thirty-seventh day of the experiment. The largest number of deaths recorded for any single day was 5, on June 12, 18 days after the start of the experiment. Four turkeys from the treated group died from blackhead on June 14. The experiment was terminated on July 2.

The results of experiment I showed that medicated mash, containing 1 percent phenothiazine, administered as a mass treatment to young chickens and turkeys exposed continuously for 38 days to soil contaminated with cecal worm eggs did not prevent the birds from becoming infested with these parasites. However, the treatment showed considerable merit in that it expelled the worms before or very soon after they reached maturity. Whether the smaller number of deaths from blackhead in the treated group was due to the treatment is uncertain.

*Experiment II.* In the hope that a concentration of phenothiazine in the mash higher than 1 percent might afford better protection against the establishment of the cecal worms, the amount of the drug added to the mash given to the birds in this experiment was increased to 2 percent. Chickens were excluded from experiments II and III because reseeding of the plots with cecal worms was considered unnecessary. The birds were started on the medicated mash one day before being placed on the contaminated ground.

Forty-five turkeys which were hatched on May 27, 1943 were divided into two groups, and placed on contaminated lots on July 12. The same lots which were used in experiment I were used for experiment

II. Eleven days intervened between the termination of the first experiment and the inauguration of the second. This interval, during which no birds were allowed on either of the two experimental plots, afforded an opportunity for any blackhead organisms not present in the cecal worm eggs to be destroyed before the clean birds were put on the lots. According to Tyzzer, Fabyan and Fort (1921) *Histomonas meleagridis*, outside of the cecal worm egg, rarely lives longer than 24 to 48 hours.

Of the 22 turkeys in the treated group, 12 died of blackhead; of the 23 control birds, 15 died of blackhead. On the fifteenth day of the experiment, the first deaths were recorded; one treated and one control bird succumbed to the disease on that day. Other birds became sick and died at the rate of 1 to 4 every day for several days, the last death occurring on August 21. The experiment was terminated on September 1. Most of the birds that died of the disease, as well as those that survived, had cecal worms, a fact which was determined by postmortem examination. No mature cecal worms were recovered from any of the birds. The control birds harbored a few more worms than the treated birds.

The feeding of a mash containing as much as 2 percent by weight of phenothiazine to turkeys for a period of 38 days was not effective in preventing the establishment of cecal worms in these birds. The incidence of blackhead in experiment II was similar to that experienced in experiment I.

*Experiment III.* A lot, 30 feet square, which one year prior to this experiment had been divided through the center so as to accommodate two different groups of turkeys, was used for this test. As turkeys had occupied the two halves of this lot up to the time this experiment was started, and a few deaths from blackhead had been

recorded, any further preparation of the soil was deemed unnecessary. Twelve days intervened between the time the first group of turkeys were removed from the lot and the clean birds put on it.

Thirty-five turkeys, 108 days old, were placed, on July 14, 1943, on the experimental lot, 16 in one-half and 19 in the other. The two groups were treated similarly, except that one received a mash containing 2 percent concentration of phenothiazine and the other straight mash.

During the course of the experiment all the 16 untreated and 13 of the 19 treated birds died of blackhead. The first deaths occurred on August 1, at which time 4 controls and 1 treated bird died. Birds continued to succumb to the disease almost daily until August 11; after this time only one bird died of blackhead, on August 21, when the experiment was terminated.

The total number of cecal worms found in the control birds was 313, of which 290 were small and 23 were partly grown worms. Only 30 small worms were found in the ceca of the treated birds.

Although a smaller number of cecal worms were found in the treated birds of this experiment, the incidence of blackhead cases remained relatively high.

#### DISCUSSION

The mixing of a similar number of young chickens and turkeys in each of the experimental pens in experiment I was deliberately designed as a possible means of increasing the chances of the turkeys becoming infected with blackhead. Tyzzer and Fabyan (1922) showed that blackhead could be produced in turkeys by feeding them on hen-yard soil which, presumably, contained embryonated cecal worm eggs. The work of Graybill and Smith (1920) and of Smith and Graybill (1920) demonstrated definitely that the

common fowl may be instrumental in the spread of blackhead to turkeys. However, these workers did not determine whether the chickens served as a source of cecal worm eggs only, or of both the eggs and the histomonads. Tyzzer, Fabyan and Foot (1921) confirmed the experimental production of blackhead by the feeding of cecal worm eggs, and infected a turkey by exposing it to hens infested with cecal worms.

herein show rather conclusively that the feeding of phenothiazine to chickens and turkeys did not prevent them from becoming infested with cecal worms. This drug did prove to be efficacious, however, in keeping birds free or nearly free of adult worms. So far as the experiments recorded here are concerned, the question as to how important a rôle the cecal worm plays in the transmission of blackhead is not answered.

TABLE 1.—*Number and stage of development of cecal worms removed from birds at autopsy after being treated with phenothiazine*

Experiment No.	No. of birds in each group	Percentage of phenothiazine in mash	Stage of development of worms	No. worms in chickens		No. worms in turkeys	
				Controls	Treated birds	Controls	Treated birds
I	30	1	Small	155	71	208	92
			Half-grown	362	25	57	0
			Mature	46	0	0	0
			Total	563	96	265	92
II	22	2	Small			161	119
			Half-grown			45	1
			Mature			0	0
			Total			206	120
III	19	2	Small			290	30
			Half-grown			23	0
			Mature			0	0
			Total			313	30

Since blackhead is also transmitted from one bird host to another in the absence of the cecal worm, presumably as a result of swallowing with the feed or drinking water the causative agent found free in the feces of infected birds, the question arises as to which of the two modes of infections is most likely to occur under natural conditions. The determination by McCulloch and Nicholson that phenothiazine is an effective remedy for the removal of cecal worms from chickens, afforded hope that some information on the point raised might be obtained through removal of cecal worms from chickens and turkeys by this medication.

The results of the three tests reported

Table 1 lists the number and developmental stage of cecal worms recovered from the control and treated groups of each of the three experiments discussed in this paper. The figures are based on autopsy findings of all the birds entered in each of the experiments. The table reveals that mature worms were conspicuously in the minority, having been recovered from one group only, the control chickens of experiment I. Half-grown worms were found in both the treated and control groups of chickens (experiment I), and in each of the control groups and in one treated group of turkeys. One half-grown worm was recovered from the treated group of turkeys

of experiment II. Very small, immature worms were present in both groups of chickens and turkeys, being more numerous in the turkeys than in the chickens.

The results of the present experiments do show, however, that regardless of the rôle that the cecal worm may play in the transmission of blackhead under natural conditions, the practice of feeding phenothiazine in the mash over a period of four to six weeks to prevent the propagation of this parasite cannot be expected to reduce appreciably blackhead disease.

#### SUMMARY AND CONCLUSIONS

1. Three experiments, involving the rearing of chickens and turkeys together, and of turkeys alone, were conducted.

2. Parasite-free birds were placed on soil heavily contaminated with cecal worm eggs and held there for 4 to 6 weeks. During this time one-half of the birds received phenothiazine in the mash and the others were fed plain mash.

3. Except in experiment I, in which the number of deaths from blackhead in the treated group was only about one-half that in the controls, there was no significant difference in the number of deaths in the treated and control groups.

4. Chickens to which a mash containing 1 percent of phenothiazine and turkeys to which a mash containing 2 percent of phenothiazine were fed did not remain free of cecal worms. However, under this regime of treatment, the worms were evidently expelled before or soon after they reached maturity. No mature cecal worms were found at autopsy in any of the surviving treated birds or those dying from blackhead.

5. The total number of immature cecal worms removed from the treated birds was about one-third of that removed from the control birds.

6. The results of these experiments

indicate that the feeding of a mash containing phenothiazine for a period of 4 to 6 weeks had no significant effect on the incidence of blackhead in turkeys ranged on soil heavily contaminated with cecal worm eggs.

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