hope that some of them will recover.

The other birds should be placed on a medicated mash or given water in which the right amount of the drug has been added. Some poultrymen are equipped with a water system that is well suited for the administration of medicated water; for others, the use of medicated water would require a large amount of extra time and labor. They will find that medicated feed is more economical.

A number of drugs for preventing and treating coccidiosis can be bought from feed companies, commercial drug houses, or drug salesmen.

Nitrofurazone and sulfamethazine, nicarbazin, and nitrophenide have been thoroughly tested and found to be satisfactory for the prevention of the disease. Any one of them can be administered in a low concentration for a period of several weeks without causing any ill effects.

In the event of an outbreak, however, the drug of choice is sulfamethazine or sulfamethazine. The medicated water or mash must be prepared exactly as directed on the package or bottle containing the drug.

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Blackhead of Turkeys and Chickens

BLACKHEAD is caused by a microscopic, single-celled animal, Histomonas meleagridis.

It was a devastating disease in turkeys in the East and Midwest a generation or two ago. It still causes heavy losses in some flocks of turkeys and is recognized as a serious disease in chickens whose resistance is lowered by other diseases, by vaccination, or by undue exposure to adverse conditions.

The death rate in individual flocks of turkeys may run as high as 50 percent. Most of the survivors are seriously affected. Turkeys of any age may contract blackhead, but losses are usually greatest among birds 8 to 18 weeks old.

Outbreaks are most common in the spring and fall and usually are more serious in wet seasons than in dry ones. A study in Minnesota in 1951 revealed that of every 1,000 poults started, 87 died with blackhead after being placed on the range; only 6 were lost while poults were still in the brooder house. The average age of birds succumbing to blackhead on range was 17 weeks.

The symptoms of blackhead—which is known also as histomoniasis and infectious enteric hepatitis—are quite distinct, but the name is misleading in that the head does not always turn dark. Other diseases also may cause the head to get black.

The first symptoms are not specific for blackhead but are suggestive. The birds stand with their heads tilted downward or drawn to the body. Their feathers are ruffled. The wings droop.
Their eyes are partly closed. At first the birds are alert when they are disturbed, but they quickly become indifferent if they are seriously ill. Young poult's may die within 2 or 3 days after the first signs of illness, but older birds may suffer for several days before dying or starting a slow recovery.

The passage of thin, sulfur-colored droppings is characteristic of blackhead, but the disease is well advanced in turkeys before this is conspicuous and it often does not appear as a symptom in chickens.

When birds that have just died from blackhead are opened, fairly characteristic symptoms may be expected. The ceca—the blind pouches—are inflamed and ulcerated; they may be filled with a greenish-white material as thick as curdled milk or consolidated into cores. If the birds have been ill a long time, the cores will have become a foul-smelling, brown residue of a creamy consistency. The two ceca need not be affected equally.

By the time the sulfur-colored droppings have been passed, the liver also is visibly involved and has round, grayish-white lesions one-half inch or more in diameter. Nearby lesions may merge. Large lesions often are marked by concentric rings. Small lesions are elevated, but as they increase in size the centers flatten, and then shrink below the level of the margins, until finally the entire lesion may appear as a depressed and pox-marked area. Secondary infections sometimes set in and alter the appearance of the lesions.

The membranes covering the visceral organs and the lining of the visceral cavity sometimes become involved, and they may have a slippery feel. Peritonitis develops in extreme cases and causes death if the blackhead does not.

Blackhead occurs when the parasites gain access to the ceca of the bird and are able to multiply in the cecal wall and in the cavity.

Occasionally the bird ingests the naked organism in contaminated feed or water or while picking gravel or preening itself. But in most instances a second parasite, the cecal worm (Heterakis gallinae), is involved. This little worm lives in the ceca of chickens, turkeys, and some other birds. Either the worm itself (which is one-third to one-half inch long and as thick as basting thread) or its egg (which is microscopic) can harbor the blackhead germ and carry it from one bird to another.

Passage by means of the worm eggs seems to be the usual method. Thus the blackhead organism, which is fragile and can live by itself outside the bird for only a few hours and which only rarely reaches its destination in a vigorous state if swallowed alone, has in the cecal worm's egg a nearly perfect means of survival outside the bird's body.

The cecal worm itself usually does little harm. But most chickens reared on the ground eventually harbor cecal worms. A great many also have histomonas, the blackhead organism. Many turkeys also become infected with cecal worms. When that happens, the danger of blackhead becomes great, for it may then be spread rapidly if the histomonad gets into the flock. In such a situation, contamination of feed, water, soil, or feathers with cecal worm eggs, now likely to be carrying histomonads, becomes a serious problem. The cecal worm egg is sturdy and may survive in the soil for a year or longer. Temperature, soil humidity, the action of micro-organisms, and probably other factors influence its survival and may account for the relative ease or difficulty experienced in controlling blackhead.

Prevention depends first of all on proper management. Turkeys must be kept entirely away from other fowl. Poult's should never be brooded in houses that have been used by chickens, unless the buildings are of materials that can be made scrupulously clean and disinfected thoroughly. Even then they must be allowed to become
Blackhead of Turkeys and Chickens

entirely dry throughout before they are used. Buildings with earth floors or floors that are rough and broken or of porous material are hard to make entirely safe. The litter in brooder houses must be kept clean and dry. Good ventilation will help.

Traffic between places where chickens and turkeys are kept must be held to a minimum. If one person or one vehicle or other piece of equipment must service both chicken yards and turkey yards, absolute sanitation must be practiced. Shoes, boots, the bottoms of pails, the tires of carts, and other objects that come in direct contact with the soil or litter of both chicken yards and turkey yards and houses should be rinsed freely with water before bringing them into the turkey yard or house. If they can be left to become thoroughly dry after such a rinse, that, too, will help.

Sun porches with wire floors are recommended. Otherwise, runways should be rotated every 7 to 10 days in cool, moist climates. The runways should not be used until they have been cleaned and the surfaces are completely dry or have been turned under.

Turkeys should not be ranged on land recently occupied by other fowl, particularly chickens. Light soils in warm, arid climates, if barren, may become safe for use in a few weeks or months, but it may take years before heavier soils in moist climates become safe. Land on which poultry manure has been spread is to be regarded as having been occupied.

Turkeys should not be ranged in places to which drainage from chicken yards may carry eggs of the cecal worm. Turkey grounds should be fenced off from streams and low ground subject to such drainage.

The poultryman should provide ample range and be prepared to move the flock as often as conditions dictate. If blackhead is prevalent in the locality and the climate is cool and damp, he may need to move the flock as often as every 10 days until they are 18 to 20 weeks old. In dry climates the interval may be extended considerably. In very dry regions changing may be unnecessary if the soil about the feeders, waterers, roosts, and shelters is kept clean and dry.

Feeders and waterers should be on wire platforms so that the manure falls through and is out of reach of the birds and off their feet and feathers. If that is impractical, the location of feeders and waterers should be changed often enough to prevent accumulations of manure, which might contain cecal worm eggs in an infectious stage. It usually takes 7 to 10 days in a favorable environment for the eggs to reach that stage.

Poults should not be ranged with older birds or on land recently occupied by them. The owner might well institute a program of land utilization or reconditioning that will be effective in providing fresh, clean range as often as it is necessary or practical to return to the same plots. The farm adviser, county agent, or the State Experiment Station will be able to advise the farmer about the practical alternatives—which differ widely according to geographic, climatic, and economic considerations—in a locality.

If hazards are exceptional or management practices cannot be maintained at levels needed for effective control, drugs may have to be used.

If a heavy infection of cecal worms is the great hazard, a medicated ration containing 1 pound of phenothiazine per 100 pounds of feed may be given for 5 to 7 days and repeated after an interval of 15 to 20 days, from the time the birds are placed on the range until about 3 weeks before going to market. Phenothiazine has no direct effect on the blackhead organism, but it will greatly reduce the cecal worms and so reduce the hazard of transmission of blackhead. It reduces the number of cecal worm eggs reaching the soil and makes the range better for reuse later.

Drugs specifically for the control of the blackhead organism have been marketed under various trade names. If principles of good management are
ignored, none will be satisfactory, and all can be harmful if mishandled. The grower contemplating the use of such drugs should explore the situation well and use the drug as directed by the manufacturer. Three drugs offered as aids to the control of blackhead in 1956 are identified chemically as 2-acetylamino-5-nitrothiazole, furazolidone, and 4-nitro-phenyl arsonic acid.

If an outbreak occurs, the first thing to do is to get a diagnosis. Take 2 or 3 typical sick birds to your nearest poultry diagnostic laboratory, your State Experiment Station, or to a veterinarian who includes poultry in his practice. Other diseases cause symptoms resembling some of those of blackhead.

Isolate sick birds. Quarantine all pens or plots in which such birds have appeared. Always care for the unaffected flocks first, then those from which sick birds have been removed, and last of all those in the isolation quarters. Allow no traffic in the reverse order.

Intensify all measures recommended for preventing blackhead. You are now faced with preventing its spread. Claims have been made regarding the value of a few drugs in treating affected birds, but prevention must still be the major means of attack.

Be prepared to move the birds at least once a week. Cecal worms are almost certainly present, and any droppings are potentially infective within a few days of their passage.

Record carefully the houses, pens, or plots in which outbreaks have occurred or which are used later by birds from such sources. They must not be reused until they are made free of cecal worm eggs.

The successful interruption of an outbreak of blackhead may not be apparent until 2 to 3 weeks after the strict control measures have been invoked. Do not be discouraged or relax your efforts. It sometimes takes 3 weeks from the time a turkey takes in the cecal worm eggs containing the blackhead parasites until the bird is obviously ill: What you have done probably has not influenced the course of the disease in this bird, but you have saved others and your continued efforts will save still others.

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Hexamitiasis of Turkeys

EVERETT E. LUND

HEXAMITIASIS is an intestinal disease caused by a microscopic, single-celled animal (*Hexamita meleagridis*).

The parasite remained unnoticed until about 1938. The disease it caused was confused with other diseases for several years thereafter. Hexamitiasis was seldom reported in some large areas in which the turkey industry was extensive, but reports of it became more frequent after 1954—probably because it was recognized more generally.

Hexamitiasis is usually most serious in poult's still in the brooder house, where losses as high as 75 percent have been reported. Poult's on the range are also affected, and losses may continue