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COLLEGE OF AGRICULTURE
AGRICULTURAL EXTENSION SERVICE

PREVENTION AND CONTROL OF POULTRY DISEASES AND PARASITES

By

W. J. PISTOR AND CLYDE F. ROWE

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PREVENTION AND CONTROL OF POULTRY DISEASES AND PARASITES

By

W. J. PISTOR¹ AND CLYDE F. ROWE²

INTRODUCTION

The incidence of disease and parasites in a poultry flock, resulting in high mortality, low egg yield, or stunted growth greatly reduces the possibilities of financial success. Since these are three of the most important factors involved in successful poultry production, every poultry plant should be arranged and constructed with prevention and control of disease and parasites as the first consideration.

WORK EVERLASTINGLY TOWARD A GOAL

The goal of every poultryman should be the complete eradication of disease and parasites from his farm. The attainment of such a goal is dependent on a number of factors or practices, the more important of which are: (1) obtaining disease-free foundation stock; (2) isolation, segregation, and quarantine; (3) cleanliness; (4) proper housing, feeding, and care.

HIGH QUALITY STOCK

Obtaining high-producing, disease-free foundation stock is not only one of the most important factors involved in starting a poultry project, but it is one of the most difficult to attain.

In the beginning every poultryman is dependent upon some other poultryman for his foundation stock. Too much emphasis cannot be placed on the importance of making proper selection.

Experimental results of recent years have proved beyond doubt that mortality, resistance to certain diseases, and high egg production and growth are very greatly influenced by breeding. It has likewise been proved that the performance of a family is the only safe guide available to the poultryman in evaluating the breeding worth of a bird. The selection of foundation stock from a high-producing, long-lived individual has little to recommend it unless this individual comes from a high-producing, long-lived family.

Once the foundation line is established a breeding program should be followed which will maintain and promote these desirable characteristics.

ISOLATION, SEGREGATION, AND QUARANTINE

All diseases with the exception of those referred to as of a nutritional nature are caused by disease organisms. This fact suggests

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that the more rigid the isolation program, the less likely are disease outbreaks.

The following are some of the more common means by which disease germs and parasite eggs are spread:

1. By bringing onto the farm young or mature birds among which are healthy carriers (healthy birds carrying disease organisms).

2. By bringing onto the farm contaminated coops, feed sacks, or other equipment.

3. By birds, insects, dogs, cats, and other animals including men.

4. By windstorms and contaminated irrigation water.

These methods by which disease organisms are spread point out the importance of isolation of the farm, segregation of the young from the old stock, quarantine of poultry returned from shows, egg laying contests, etc., and proper protection from birds, insects, and other means of spread.

CLEANLINESS

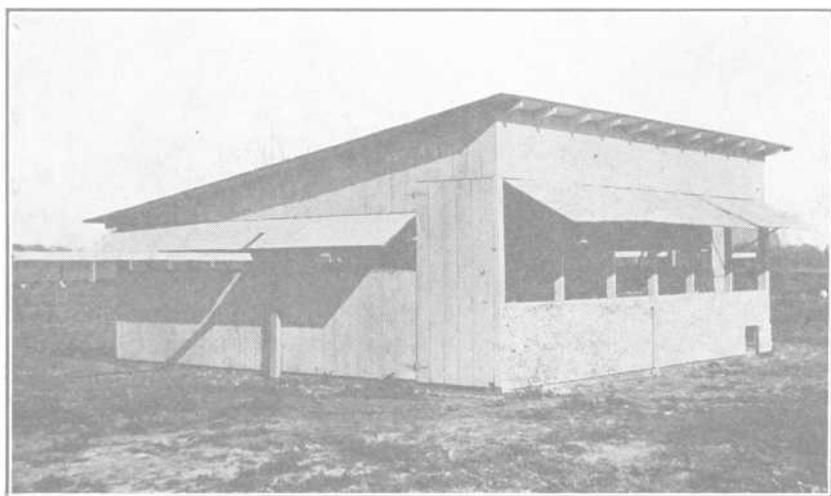
A clean, well-arranged, attractive poultry plant and farmstead create not only an added insurance against disease outbreaks but also pride in ownership and attract the public, thereby helping to build a demand for the products produced.



Screened-in tree hole at University of Arizona poultry plant.

HOUSES

There are a number of important factors to be considered in the planning and construction of a poultry house: (1) ease of cleaning and disinfection; (2) protection from weather conditions such as heat, cold, moisture, and drafts; (3) protection from predatory and other animals, birds, and possibly flies, mosquitoes, and other parasites peculiar to poultry such as blue bugs, mites, etc. They should be constructed and equipped to provide the recommended brooding, floor, perch, nesting, watering, and feeding space per



A well-ventilated laying house adapted to southern Arizona. (Courtesy U.S. Poultry Experimental Farm, Glendale, Arizona.)

bird. For more details in construction and arranging of poultry houses ask for Extension Circular No. 98, *Poultry Houses and Equipment for Arizona*.

YARDS

Filthy, contaminated yards or runs are a very dangerous source of disease and parasitic infection. Parasite eggs, coccidia, and many disease germs when given the protection of trash and droppings may remain alive for long periods of time. Since no reliable, economical method has been developed for disinfecting dirt yards or runs, a system of rotation, sweeping, and hauling away of all trash, filling of dusting holes, periodic removal of surface dirt near the buildings, trees, etc., and replacing with clean dirt is the only alternative for keeping down the possibilities of spread from these sources. Where yards and runs are likely to flood from irrigation ditches or are difficult to maintain in a sanitary condition, poultrymen may find it advisable to keep their birds in the house at all times.

DISINFECTANTS AND THEIR USE

Scraping, sweeping, and in some cases scrubbing with a stiff brush are the first and possibly the most important steps in the use of a disinfectant.

All removable equipment should be taken out of the house after which all surfaces are scraped, swept clean, and thoroughly scrubbed with a hot lye solution. When the building has dried it is ready for the disinfecting spray. A driving type of spray

nozzle and plenty of pressure should be used. Careful attention should be given to cracks and crevices, and the entire surface should be covered.

Every piece of equipment should be treated in like manner before it is returned to the house.

There are many kinds of disinfectants available. Heat, sunshine, and dryness are three highly effective natural disinfectants and should be utilized to the fullest extent.

DISINFECTANTS FOR POULTRY HOUSES AND FIXTURES

Cresol compounds are most effective for disinfecting poultry houses and all equipment such as nests, feed hoppers, etc. There are numerous types of this disinfectant, most of which are saponified to insure ready mixing in hot or cold water. Two to 3 per cent solutions are recommended.

Carbolic acid is another highly effective disinfectant. However, it is sometimes expensive. It should be used in 3 to 5 per cent solutions.

Sheep dips of various kinds are used, and their effectiveness is determined by their phenol coefficient which should be not less than 6 and should be used in about 5 per cent solutions.

Colloidal iodine preparations are highly effective as a disinfectant on a clean surface. This product is recommended for the destruction of worm eggs and coccidia; however, the active ingredient is readily destroyed in the presence of foreign material, and the expense of the product sometimes prohibits its use.

DISINFECTANTS FOR DRINKING WATER FOUNTAINS, ETC.

Chlorine compounds are probably one of the most desirable types of disinfectants for drinking water, drinking fountains, and other equipment which can first be perfectly cleaned. There are a number of these products on the market, and directions on the container should govern its use. Chlorine, the active ingredient in these compounds, is readily destroyed by oxidation and by contact with foreign matter.

Drinking fountains or other equipment to be disinfected with these products should first be washed thoroughly. Drinking water may be disinfected with chlorine compounds effectively by following directions on the containers.

POISONOUS GASES AS A DISINFECTING AGENT

All types of poisonous gases used in disinfecting houses or other equipment are dependent upon the concentration of the gas and a high humidity. Poultry houses are frequently too open to enable one to build up a sufficient concentration of gas to make it effective for disinfecting purposes.

Incubators or other type of equipment that can be effectively closed are efficiently sterilized by these gases, providing all dirt, droppings, or pieces of egg shells, which may provide protection for disease germs, are previously removed.

Formaldehyde gas is one of the most widely used of the poisonous gases for such fumigation. Bulletins outlining procedure and instructions are available from county agricultural agents or the Agricultural Extension Service of the state universities.

DISINFECTANTS FOR YARDS AND DIRT FLOORS

No highly efficient, economical method has been developed for disinfecting dirt yards and floors. Sweeping the yards and floors free of foreign material and allowing them to bake in the direct sunlight is one of the most effective means of destroying disease germs and parasite eggs.

In small runs a 3 per cent solution of household lye may be used with some success, providing a sufficient amount of the solution is used to thoroughly saturate the soil to a depth of 2 inches.

The most common method of cleaning yards and floors is to remove at least 2 inches of the top soil and replace with clean, uninfected soil.

FIRE GUNS

The use of fire guns and blow torches has been recommended as a means of destroying disease germs and parasite eggs. The effectiveness of these instruments, as is the case in the use of other disinfectants, is dependent upon a thorough job of cleaning before use. Fire guns and torches are hazards in the hands of inexperienced operators.

CAUTION

ALL OF THE DISINFECTANTS MENTIONED ABOVE ARE POISONOUS AND SHOULD BE KEPT AWAY FROM CHILDREN AND IRRESPONSIBLE PERSONS.

DISEASES OF CHICKS

Some diseases which affect chicks are caused by bacteria, protozoa, or fungi. Other chick diseases are the result of faulty nutrition or management.

PULLORUM DISEASE (BWD—BACILLARY WHITE DIARRHEA)

Pullorum disease is a contagious disease of chicks caused by a specific organism known as *Salmonella pullora*. The disease appears usually within 3 days after hatching. The mortality is high, ranging from 25 to 75 per cent. Losses are greatest during the first 2 weeks but may continue for 4 weeks. The infection also occurs in adults but is seldom recognized because it is localized in the ovaries and does not produce any symptoms; however, some of the eggs laid by these hens carry the infection and transmit it directly or indirectly to chicks hatched from them. The infection from adult ovaries is the most common source of the infection in chicks. It is also possible for pullorum disease to be picked up by chicks in contaminated incubators, brooders, or pens. The droppings of infected chicks contain many organisms (*Salmonella pullora*) and are means of spreading the infection through a flock.

Pullorum disease usually appears before the chicks are 2 weeks old. Frequently in acute cases chicks die suddenly without showing any definite symptoms. Generally chicks huddle together and remain under the hover; they appear listless and drowsy. The wings droop and the feathers are ruffled. The droppings may be white and foamy. Frequently there is a "pasting up behind" caused by the accumulation of droppings around the vent. Chicks usually show labored breathing just before death.

Chicks that survive or are infected lightly may grow to maturity and, while they appear healthy, harbor the infection and become carriers of the disease.

The post mortem lesions vary greatly in chicks. If chicks die within the first 5 days, very few if any significant changes occur. Older chicks frequently show small necrotic spots, whitish in appearance, in the lungs, liver, and on the heart muscle. The caeca may be filled with a white, cheesy substance. Lesions on other organs are difficult to detect.

These symptoms and lesions when found in chicks must be confirmed by bacteriological findings before a diagnosis of pullorum can be made. Common causes such as improper incubation, chilling, overheating, and improper feeding may manifest symptoms and lesions very similar to pullorum disease. Symptoms and lesions, therefore, are only indications of a possibility of pullorum disease. Flock owners who suspect pullorum should send specimens to a bacteriological laboratory for diagnosis.

Most hatcheries in Arizona are co-operating with the National Poultry Improvement Association in following a plan to control and possibly eliminate pullorum disease from the breeding flocks. This program has been responsible for reducing the losses due to pullorum in chicks, and poultrymen should insist on buying pullorum-free chicks.

NONSPECIFIC BACTERIAL INFECTIONS

This group of infections includes diseases caused by a variety of bacteria, which are usually unable to cause disease unless the chicks have been subjected to conditions which have lowered their resistance. At the laboratory these bacteria can be found in the heart, liver, and unabsorbed yolk. These diseases are generally due to some faulty management such as wet or damp conditions under the brooder, insanitary surroundings, chilling, overheating or faulty feeding. The infection may be acquired in the incubator or shipping crates.

Diarrhea, droopiness, and lack of appetite are common signs of these diseases, for which sanitation and isolation are the best methods of control. All visibly sick chicks should be removed to reduce the numbers of organisms to which the healthy chicks are exposed. Since the chicks are unthrifty it is advisable to raise the brooder temperature from 5 to 10 degrees.

Symptoms of diarrhea show up after the chicks are a few days old and reach their peak at about 2 weeks. The death losses are

high in infected flocks but survivors grow out and mature well. The diarrhea can be treated by giving the chicks a laxative of 1 tablespoonful of Epsom salts to 1 gallon of drinking water. This should be given all morning and changed to fresh water at noon. Another good method is to temporarily change the diet. The addition of 20 per cent milk mash or the changing of the chicks to hard grains and milk gives them a flush and also stimulates their appetite. The brooder house should be kept very clean and dry. All drafts should be eliminated, and there should be at least $\frac{1}{2}$ square foot of floor space per chick.

MYCOSIS

Several types of fungi frequently found on milo or other similar grains produce disease in the upper digestive tract, especially in the crop. Small, slightly raised, whitish nodules appear, which run together to form gray, easily detachable membranes. These lesions are found in the mouth, crop, and proventriculus.

The finding of these lesions is peculiar to mycosis, but it is necessary to submit chicks to a laboratory for microscopic study of the organisms to establish a diagnosis of mycosis.

The control of mycosis is similar to control of other fungus infections. Infected chicks should be isolated. The feeding and drinking equipment should be thoroughly cleaned. Favorable results are obtained by adding bluestone (copper sulphate) to the drinking water. This should be done at the rate of 1 level teaspoonful of copper sulphate to 2 gallons of water every second day during 1 week. Earthenware vessels should be used for water containing copper sulphate.

BROODER PNEUMONIA

Brooder pneumonia is suspected of causing losses in baby chicks in Arizona. It is not prevalent but occasionally is found associated with wet, overheated, or poorly ventilated brooder houses. The disease is caused by an infection of the lungs and air sacs by members of the *Aspergillus fumigatus* group. The term brooder pneumonia is applied to fungus infections of the respiratory system.

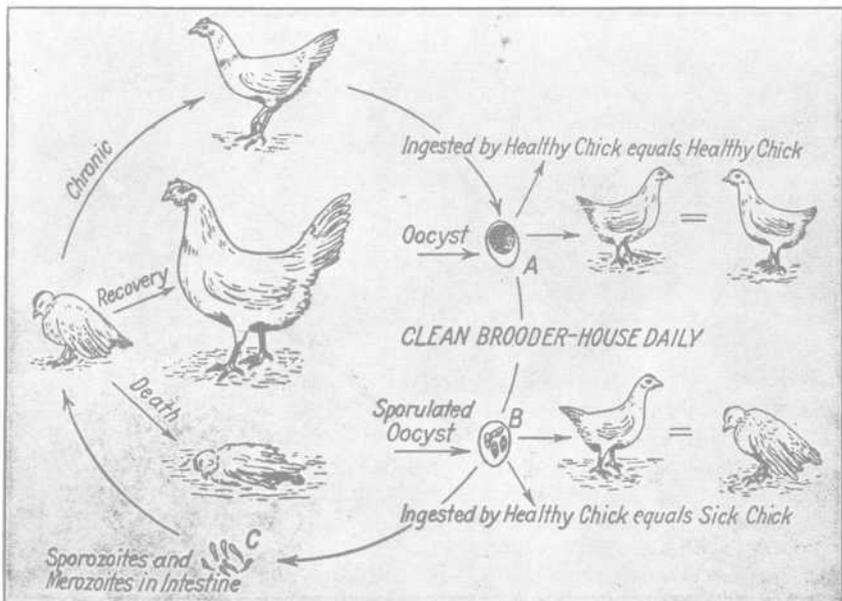
The symptoms of brooder pneumonia are similar to pullorum disease. The chicks hover around the brooder and gape. The disease usually occurs during the first few weeks of brooding.

The lesions are characterized by small yellowish nodules on the lungs or air sacs. Sometimes the infected tissues have a moldy appearance.

Strict sanitation and isolation of infected chicks are necessary for control. The hovers and floors should be thoroughly cleaned and kept dry. Infected chicks should be isolated. No medicinal treatment has been found to combat this disease. Since the disease is comparatively rare and since it resembles pullorum, it is necessary to send suspected chicks to a laboratory for diagnosis.

COCCIDIOSIS

Coccidiosis is caused by microscopic parasites known as protozoa, of which there are six species which affect chickens. These parasites live on the surface or deep cells of the intestinal tract where they multiply rapidly and finally pass out in an egg form called an oöcyst. The parasites stay in the intestinal tract about 7 days. Chickens acquire a certain immunity by successive mild attacks. The severity of the disease depends upon the type and the number of organisms present. It is possible for coccidiosis to appear so suddenly that the origin of the infection is difficult to explain. Old birds which are immune are the most common source of infection, although it is possible to spread the infection on the shoes, chick pullmans, crates, feed sacks, etc. Flies and birds or other animals may carry the infection on their bodies. Coccidia oöcysts are resistant to disinfectants and can live outside the chicken body for many months in a moist environment. Dryness,



Life cycle of the coccidiosis parasite. (Courtesy, University of California.)

heat, and decomposing manure destroy the parasites in a short while. Experimental evidence does not support the belief that infection is carried on hatching eggs. The so-called bloody or caecal type of coccidiosis is caused by *Eimeria tenella*. The intestinal type is caused by five recognized varieties—*Eimeria necatrix*, *E. maxima*, *E. accurvlina*, *E. tenella*, and *E. praecox*—named in order of their ability to produce disease. Frequently a single

variety causes disease, but mixed infections are more common. It is difficult to determine the exact types of infection by clinical or post-mortem examination.

The bloody or caecal type is the most common in Arizona. It usually occurs after the third week of brooding and is characterized by bloody discharge in the droppings. The onset may be sudden, affecting a large number of chicks at one time. The chicks lose weight rapidly and become listless. All the organs appear normal and pale except the caeca or blind guts which are swollen and dark red in color. In older cases the caeca contain yellowish, cheesy material.

The intestinal type has wrongly been referred to as chronic coccidiosis. Infection with *Eimeria necatrix* may be acute and may discharge blood as in the caecal type. The other symptoms of this type are varied and may cause sudden death, droopiness, "wasting away," or "going light." The lesions of this type also vary from bloody discharges to small, grayish pin-point areas on the outside of the intestines.

Coccidiosis control depends upon strict sanitation. The treatments or controls are useful only in so far as they help the body eliminate the parasites from the system. No drug or remedy is known that will kill the parasites in the intestinal walls without doing irreparable harm to the chicks. Careful watch should be maintained for the first indications of coccidiosis. The diagnosis should be established immediately by a qualified person. If any doubt exists, suitable specimens should be sent to a laboratory for examination. It is not necessary to differentiate between the different species, except to determine whether it is caecal or intestinal coccidiosis. The treatments for these two types differ. In the bloody or caecal type, if only a few chicks are affected, it may be possible to stop the spread if strict isolation is practiced. If many chicks are affected at once the entire flock should be treated. The chicks should be given a 30 to 40 per cent milk mash flush for 3 or 4 days. (Reliable poultry feed concerns handle coccidiosis control mash which can be used instead of milk mash.) The house must be thoroughly cleaned. All litter should be scraped away and disposed of. The floors should be kept dry and new litter used each day. The chicks should be kept comfortable by eliminating all drafts and increasing the temperature so that no huddling occurs.

The problem in controlling the intestinal type of coccidiosis is very different. Milk mash flushes or control mashes are not effective against this type. Careful sanitation and management are essential and should be combined with the following recommendations¹ which have been used in Arizona with good results.

1. Careful attention must be given to house and yard sanitation as indicated previously.

2. An accurate diagnosis should be made by a competent diag-

¹H. A. Hoffman and W. J. Pistor, California monthly Bulletin.

nostician and the seriousness of complicating diseases and parasites considered.

3. All feed should be supplied in sanitary hoppers or troughs and not in the litter or on the ground. Ample feeding space must be provided.

4. Care should be exercised in the use of vermifuges. Birds that are in poor physical condition as the result of coccidiosis should not be treated for worms until their general condition has improved unless the degree of worm infestation requires prompt action.

5. Diseased birds should be segregated.

6. Supply all feed in meals, allowing liberal periods during the day when the birds are without food.

7. Give an early morning feeding of "A" and "B" as indicated.

A. Rolled barley soaked overnight in milk.* Before feeding, add wheat bran equal in weight to the rolled barley, 7 to 10 per cent dehydrated alfalfa, and 1 per cent cod-liver oil or sardine oil. This may be fed four or five mornings each week.

B. On two or three mornings each week the above mixture should be replaced by wheat bran with 7 to 10 per cent dehydrated alfalfa and 1 per cent cod-liver oil or sardine oil. This mixture should be slightly moistened with hot water.

The moist feeds should be alternated and should be fed in quantities sufficient to last the birds for approximately 1 to 2 hours. They should not be allowed to stand in the troughs for more than 2 hours.

8. Feed dry mash from 10:00 a.m. to 2:00 p.m. If moist mash is used it may be fed at approximately the same time.

9. Feed liberally with grain during the late afternoon.

10. The birds should be fed fresh greens if available. Flocks that are seriously affected or sick birds that have been culled from a flock are benefited by two feedings a day (morning and noon) of the rolled barley, milk, bran, alfalfa, and oil mixture, with a substitution of the bran, alfalfa, and oil mixture two or three mornings each week. With this schedule, grain is fed as usual and no mash is used. The latter feeding method has been beneficial, apparently, for those flocks that were affected with acute intestinal coccidiosis. Poultrymen sometimes experience difficulty in inducing birds to eat the bran and the dehydrated alfalfa. If such difficulties occur, the quantities of each may be reduced for a time but should be increased gradually until the recommended amounts are used.

NUTRITIONAL DISORDERS

The nutritional disorders found in chickens are usually caused by a lack of or a deficiency of one or more essential substances such as vitamins or minerals. These disorders are made evident

*The recommendation includes skim milk, buttermilk, or condensed milk diluted one part in three parts of water.

by retarded growth, unthriftiness, lameness, paralysis, convulsions, hemorrhages, tissue degeneration, and other abnormalities.

The common feedstuffs in poultry rations are usually well supplied with most of these essential vitamins or minerals. In controlling nutritional disorders it is of practical importance to include proper amounts of vitamins A, D, G, and manganese in poultry rations. Care should be taken in receiving high carotene alfalfa meal and biologically assayed fish oils for vitamins A and D. Vitamin G is also supplied by alfalfa meal and milk by-products. The manganese requirements are usually supplied by adding small amounts of manganous sulphate to the ration. The disorders resulting from deficiencies and the source of materials to convert them are discussed briefly below. In making up poultry rations it is well to consult the Poultry Department of the University of Arizona or your county agent so that the proper ingredients are included.

Vitamin A deficiency in rations results in slower growth, lowered disease resistance, and increased mortality. The margins of the eyelids become granular and secretions from body glands are diminished. Vitamin A deficiency may produce white pustules in the roof of the mouth and along the esophagus. Urates may accumulate in the ureters and kidneys so that these organs are enlarged and pale. Chickens walk in a wobbly manner when the nervous mechanism is affected. If the eyes become infected because of lowered resistance, the disease is called nutritional roup.

Vitamin B deficiency causes loss of appetite, emaciation, poor digestion, and frequently convulsions.

Vitamin A is found only in animal tissue. Cod-liver or other fish oils are sources of vitamin A. Carotene and other pigments are known as provitamin A or precursors of vitamin A. They are present in alfalfa, grasses, yellow corn, carrots, and other materials and are converted to vitamin A in the liver of chickens.

Vitamin B (thiamin) deficiency causes loss of appetite, emaciation, poor digestion, and convulsions. This vitamin is found in cereals, milk, and fresh green plants. Yeast and wheat germs contain large amounts of vitamin B.

Vitamin B₆ (pyridoxin) deficiency also causes emaciation, poor digestion, and, occasionally, convulsions. Cane molasses, cereal wheat by-products, and yeast contain this vitamin.

Vitamin G (riboflavin) deficiency causes high mortality and poor growth. Frequently young chicks develop leg weakness which causes chicks to walk on their hocks with the toes curling inward.

Deficiencies of the antidermatitis vitamin known as pantothenic acid cause poor feather development and slow growth. The corners of the mouth have crusty scabs, while the eyelids become granular and stick together. Frequently nervous symptoms appear causing abnormal gaits. Although these symptoms are typical of a deficiency of this vitamin, they may appear in chicks

with adequate amounts. Cane molasses, milk by-products, and dried yeasts contain large amounts of this vitamin.

The lack of vitamin D in the absence of sunlight causes poor bone formation and rickets. Rickets is manifested in chickens by a stiff-legged gait and poor balance. There may be enlargements of the joints and a bending of the ribs. In adult hens the laying of thin-shelled eggs of low hatchability occurs as well as rickets. The chief sources of vitamin D are fish-liver oils such as cod-liver oil or shark-liver oil and fish oils such as sardine oils.

Deficiencies in vitamin E cause poor fertility in chickens. The hatchability of eggs from hens deficient in vitamin E is low. Deficiencies seldom affect chicks. The symptoms manifested are sudden causing the chicks to fall with legs outstretched and toes flexed. Leafy green plants and cereals or wheat germs contain large amounts of this vitamin.

Deficiencies in vitamin K interfere with blood clotting, and chicks on a deficient ration bleed to death from injuries.

Deficiencies of the antigizzard erodin factor cause erosions in the gizzard which interfere with digestion if they become large. Small erosions do not cause any noticeable disorders. This factor is found in cholic acid, milk by-products, and green alfalfa.

Slipped tendon, hock disease, or perosis is caused by a deficiency of manganese or choline. The birds show a malformation of the bones causing the tendon of Achilles to slip out of the bony groove. The leg or legs are bent near the hock and turn out laterally. Perosis symptoms are increased in rations high in calcium and phosphorus with a deficiency of manganese.

DISEASES OF PULLETS AND MATURE CHICKENS

PARALYSIS

There are several types of lameness or leg weakness which are caused by infectious diseases, parasites, or deficiencies of vitamins. These diseases are frequently confused with paralysis. Paralysis as discussed here is a specific disease, the cause of which has not been definitely established, but there is much evidence that the cause is a filterable virus. Birds may be affected at any time, but the highest incidence of the disease is between 3 and 8 months.

The symptoms most commonly seen in paralysis are lameness and drooping of the legs and wings. The symptoms in young birds appear very suddenly. Affected birds show a slight lameness which progresses rapidly into paralysis. The most common symptoms are those of a bird lying on its breast with one leg forward and the other backward. Either one or both legs or wings may be affected. Although these are the most common symptoms, gray eyes, skin tumors, and spasms of the neck are frequently noticed. Gray eyes in which the eyes lose their color is more often seen in mature birds. In some cases there are spasms of the neck muscles in which the neck is drawn to either side or straight



A typical case of paralysis of the leg.

back. Skin tumors may be small and numerous or they may be very large and few. In skin tumors the centers are frequently necrotic. Acute cases may cause death in a few days, whereas chickens with chronic cases may live for weeks or months with a very few apparently recovering.

The post-mortem examination shows an enlargement of the nerve supplying the affected part. The nervous tissue is frequently enlarged and shows tumor formation. In acute cases the birds are in good flesh. The liver is frequently enlarged.

There is considerable evidence that this disease is transmitted through the egg. It is also possible to spread the disease through contact of healthy birds with infected birds or with contaminated environment.

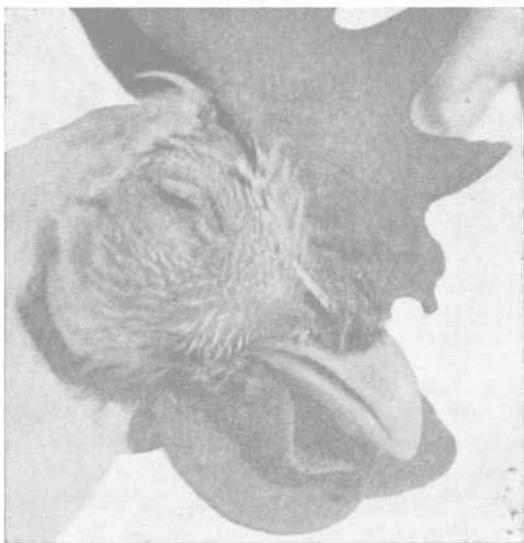
With the limited information on this disease control measures have to be general in nature. It is advisable to dispose of all infected birds and clean and disinfect the premises and utensils. All new additions, including baby chicks, should be selected from sources known to be free from this disease. If infection has been on the farm, new additions should be kept separate.

LEUCOSIS (BIG LIVER)

Leucosis is a blood disease characterized by increases of certain blood cells and their deposition in various organs. These cells may accumulate in the ovaries causing a large tumorlike swelling or in the liver which increases greatly in size. Similar cells frequently accumulate in nervous tissue and it is thought by some investigators to be closely related to paralysis. The cause or method of spread has not been determined, but it is advisable to isolate all infected birds. The same precautions as suggested in paralysis should be followed for leucosis.

COLDS (INFECTIOUS CORYZA)

A cold or infectious coryza, is an infectious disease of poultry which is spread by active cases of colds, or carrier bird, in the flock. Numerous organisms have at various times been implicated



An inflamed eye in early stage of cold or roup.

in the cause of colds, but more recently one organism, *Hemophilus gallinarum*, has been shown to cause about 90 per cent of all colds. This organism is usually found in the nasal exudate of infected birds.

Coryza or colds may vary in severity from a very mild disease, manifested by a nasal discharge, which is usually discolored with dust, to a very serious disease accompanied by edematous swellings of the face and sometimes the wattles. There is involvement of the eyes,

inflammation of the trachea and bronchi with coughing and gasping, emaciation and death of many birds. When the disease is severe and coughing and gasping occur, this disease is easily mistaken for laryngotracheitis or bronchitis.

Experiments have shown that the disease is easily transmitted by the direct contact of susceptible birds with diseased birds. The recovered birds may carry the disease and transmit it to susceptible birds with which they are later in contact. This shows that the disease is held over on the farm by carriers and mild infections among the older birds. Coryza apparently does not establish an immunity in birds after they have had the disease and have recovered.

The control methods of colds are based on this knowledge of the disease, and the following suggestions should be followed:

1. Control methods are for prevention rather than cure:
 - A. There has been no success in immunizing chickens against colds.
 - B. Vaccination against infectious bronchitis will not protect against colds.
 - C. All susceptible birds, such as young pullets and new additions, should be kept away from carriers or active cases. If new birds are to be added to the flock, a careful investigation should be made to make sure that colds are not present in them or that there has been no history of colds on the farm from which they are bought.
 - D. Watch the general health of the pullets. Keep them free from parasites and allow sufficient room in the houses and

yards. About 2 to 3 square feet of floor space should be allowed for each bird in the house.

- E. Supply well-balanced feed with sufficient amounts of greens. Vitamin A is a factor in raising resistance to colds.
2. Control methods to be followed on farms that do not get rid of all infected or carrier birds:
 - A. All infected birds should be removed as soon as possible and kept isolated.
 - B. Houses should be well ventilated.
 - C. Birds should be free from all parasites.
 - D. Birds should be fed a nutritious laxative feed. Usually this can be supplied by giving them rolled barley soaked overnight in milk as one feed in the morning. About 3 pounds to 100 birds is sufficient. The mash hoppers should be closed except for 4 or 5 hours during the middle of the day. A good feed of mixed grains should be given in the evening. Sufficient succulent greens should be available to the birds.
 - E. The drinking water should be kept clean. A good chlorine disinfectant should be put in the water to check the spread by this means. Chlorine is a volatile gas, so chlorine disinfectants will have to be added several times daily to be effective.

These control methods may help in stopping some of the losses, but the disease will reappear in all susceptible birds. According to present knowledge of the disease, it is probably the best plan to get rid of all infected birds and carriers and start out with clean birds on the farm.

3. Control methods on farms that can get rid of all infected and carrier birds:
 - A. All the birds on the farm should be sold off.
 - B. Houses should be thoroughly cleaned. To clean a house it is necessary to remove all the dirt by mechanical means, followed by a lye solution. This should be followed with a good spray. A 3 per cent solution of compound cresol is an effective spray.
 - C. After the farm has been depopulated and the houses cleaned, new chicks can be raised with a reasonable assurance that they will not be affected with colds. The suggestions for prevention should be followed to keep the farm free of colds.

There are several drugs and biologics on the market for the control of colds, but their values are definitely limited. Disinfectants in the drinking water help to check the spread of the disease and should be used. The biologics are of doubtful value and usually do no good. The drugs, such as Douglas mixture, can be used to stimulate the appetite of the birds. Iodine applied on the lesions helps in treating individual cases.

The treating of sick birds is usually unsuccessful and requires much time. Poultrymen should direct their efforts to establishing flocks free from colds and to keeping them clean.

BLACK HEAD (ENTEROHEPATITIS)

Black head is a disease which frequently causes heavy death losses in turkeys and occasionally attacks chickens. The disease is caused by a protozoan (*Histomonas meleagridis*) with the help of the common caecal worm. The caecal worm is believed to cause the injury to the caeca (blind gut) that allows the protozoan to gain entrance into the tissues and cause the characteristic lesions. Black head occurs on low, wet, irrigated areas or farms on which chickens and turkeys are raised together in confinement. The disease is most serious during the first months of life. Young birds may die suddenly without showing symptoms, while older birds become droopy and linger on for weeks before they die or recover. There are no characteristic symptoms of black head, and a definite diagnosis can be made only by an examination of the birds at autopsy.

The lesions found are confined to the caeca and the liver. The protozoan burrows into the lining of the caeca causing it to become thickened and bloody. The contents of the caeca mix with the blood and frequently form a cheesy plug in one or both caeca. Many of the protozoans are carried from the caeca in the blood to the liver where they cause dark red, grayish, or yellowish spots. The liver is enlarged and very soft.

Black head can be prevented by raising chicks away from old birds and on dry soil not contaminated by the eggs of the caecal worm. In areas that are contaminated with caecal worms, considerable results are secured by raising chicks on a ration containing 2 per cent tobacco dust. Phenothiazine is a new drug which offers considerable promise in controlling caecal worms. In infected flocks it is advisable to remove all sick birds immediately and keep them isolated. Good care and proper feeding, including sour milk if available, give as satisfactory results as the numerous drugs suggested for the prevention and cure of black head.

FOWL POX

Fowl pox, which includes chicken pox, canker, contagious epithelioma, avian diphtheria, and sore head, is a highly infectious disease of poultry caused by a filterable virus. Two types of this disease usually occur in outbreaks. One type is manifested by wartlike growths on the wattles, comb, or skin of the face, and the other by the formation of masses of cheesy material in the mouth and eyes. Although these two types of lesions are entirely different in character, they are usually due to the same cause—namely, the fowl-pox virus.

Outbreaks of fowl pox may occur at any season of the year, although the most prevalent time is during the fall and winter months. Several different modes of transmission of this disease are recognized. Chickens infected with the disease coming in contact with susceptible birds is the most important method of

spread. Sparrows and other birds may carry the infection on their feet and bodies or by being infected themselves. Flies, mosquitoes, and other insects may carry the infection on their bodies from infected flocks to others. Salesmen and visitors who have been on infected farms may carry the infection on their shoes or clothes. A very important way of introducing the infection on a farm or into a district is by the addition of pullets or older chickens which come from an infected flock or from flocks that may have the disease in the incubative stage. They will break out with pox soon after they are mixed with the flock or may act as carriers and infect susceptible chickens.

Pox outbreaks vary greatly in severity. In some flocks the lesions may be confined to the combs and wattles, and only a few may become infected. There is no loss from death or in egg production. In other flocks the lesions may be in the mouth, forming cankers, causing considerable loss from death, and a decrease in egg production. Other flocks may have a combination of comb and wattle lesions with the cankers in the mouth and eyes. Losses usually are great in this type. The length of time that the chickens may be infected varies with the intensity of the outbreak. The disease may disappear in a month's time, or it may be present in a flock for many months with only a few birds being affected at any one time.

Since chicken pox is so widely spread in all poultry sections and causes so much loss of production and mortality in chickens, the question of proper control methods should be carefully studied by the poultryman so as to prevent such losses. There are a number of important steps which should be followed as carefully as possible to insure proper control and also prevent the losses from a large variety of causes following control methods. These control methods consist of vaccination of birds with the live virus of chicken pox or pigeon pox.

Preventive vaccination

Vaccination should be used on all farms that have had outbreaks of chicken pox or on farms situated in districts where pox is prevalent on adjoining or near-by farms. Those farms which buy pullets and hens or introduce cockerels from other farms which have had pox should vaccinate. Those poultry farms free from chicken pox that buy day-old chicks and are situated away from infected farms should not vaccinate.

Experience has shown that between 60 and 90 days is probably the best age at which to vaccinate. Lately, considerable work has been done on day-old-chick vaccination. Results have been varied so that it is not advisable to vaccinate at this age unless it is done by one who has had experience or under the guidance of an experienced person.

Properly prepared fowl-pox vaccine from a reliable biological supply company should be used to give proper immunity to the chickens. The use of pigeon-pox vaccine has been advocated be-

cause it does not produce as severe a reaction on the chickens as fowl-pox vaccine, but it must be remembered that neither does it give lasting immunity against a natural infection, and outbreaks may occur following vaccination. Mixed bacteria are being sold to protect chickens from fowl pox, but this product has no value in preventing fowl pox. It is used in colds and roup with limited results.

There is a definite reaction produced in chickens following successful vaccination. After an incubation period of 7 days, the chickens run a course of fowl pox which lasts from 3 to 4 weeks. During this period the chickens may become listless and lose their appetites. Their resistance to other disease is lowered and if not properly cared for they may become infected with colds or other prevailing diseases. Chickens which have been vaccinated can transmit chicken pox to susceptible chickens on the farm. Susceptible birds are birds which have not had chicken pox or which have not been previously vaccinated. Chickens which have been vaccinated should not be mixed with susceptible birds for at least 3 months after vaccination.

Only healthy chickens free from intestinal parasites and chickens which are not suffering from malnutrition because of faulty management or incorrect feeding should be vaccinated. The flock should be carefully culled and examined for disease or parasites and *only the healthy chickens should be vaccinated*. The culls and chickens suffering from other diseases can be segregated and placed in a yard by themselves until they are in proper condition to vaccinate. When worm treatment is given just as a routine measure it is safe to administer worm remedies at the time of vaccination.

There are two methods of vaccination which are commonly used and which give good results if properly applied. The feather follicle method consists of applying the vaccine with a small brush to about four or five feather follicles on the leg after the feathers have been plucked. This method is carefully described in most of the pamphlets which accompany fowl-pox vaccine purchased from reliable firms. These methods described on the pamphlets should be carefully followed.

The stick method consists of making two or more pricks through the skin of the leg, breast, or wing web with an instrument having sharp points about $\frac{1}{8}$ inch long immediately after it has been moistened with vaccine. These instruments usually have a buffer made of string or some absorbent material to hold the vaccine. The newer instruments have a small cup to contain the vaccine. This method is also described in pamphlets accompanying vaccine, and the method described should be followed.

These methods are both very satisfactory and give the same results if carefully applied.

The chickens should be examined for "takes" after vaccination. A big percentage of larger flocks and all of the smaller flocks should be examined after 5 to 7 days for takes or lesions. These

takes are raised scabbed areas at the point of vaccination and are indications of proper vaccination. At least 90 per cent of the chickens should have takes. If there are only a few slight takes and many birds without any, the vaccination has not been successful and should be done over. The conditions responsible for no takes are poor or old vaccines. Vaccines which have been mixed with the diluent too long lose their strength. The vaccine may not have been applied properly over the follicles or sticks because of haste. Care is necessary in assuring proper vaccination.

The vaccinated chickens should receive special attention for a period of at least 4 weeks following vaccination. The chickens should be protected from all weather changes and provided with sanitary surroundings. The feeding should be altered to encourage the consumption of feed during this reaction period. A satisfactory method used is to reduce the amount of mash to about one half the usual quantity and in its place give a feed of rolled barley soaked in milk as a morning feed. About 3 pounds of barley to 100 chickens is sufficient. Usually the amount is regulated by the length of time it takes the chickens to eat it. Enough should be fed so that it is all consumed in about 45 minutes. In the place of the barley feeding, scalded bran should be given every fourth morning. The quantity is the same. Mash should be restricted to about 4 hours during the middle of the day, and in the evening grain should be fed. This care of vaccinated chickens is very important and many times success or failure is dependent on how carefully the chickens are nursed through this period.

A proper vaccination usually gives immunity to fowl pox for a period of 2 years. One vaccination is usually sufficient because few birds are kept after their second laying season.

Control methods

Natural outbreaks of fowl pox occur in laying flocks or younger pullets, and measures for control are necessary. In considering control measures it is necessary to study the effect of pox on the flock. This has been discussed in the description of pox. Control measures should therefore consist of a program that will stop the disease, although it may cause a sharp decline in production.

Sanitation is the first step in the control of fowl pox. This includes the isolation of all affected chickens, litter, feed hoppers, watering troughs, or other equipment that may be contaminated with the virus. If only a few chickens are infected they should be removed to separate quarters, and the house and yards should immediately be cleaned and disinfected. The healthy flock should be watched daily and any additional sick birds should be taken out. If 25 per cent of the flock is infected, it probably is advisable to move the healthy birds to new clean quarters and leave the infected birds in the contaminated quarters. By starting these sanitary measures when the disease first breaks out it may be possible to control the losses from death and in egg production, but outbreaks may continue and last for several months, causing

severe losses. Since vaccination with fowl-pox vaccine will immunize chickens to fowl pox within a month after vaccination, it is sometimes advisable to use this method with proper sanitation. The same precautions are necessary in adult vaccination that were outlined for pullets. There are several important additional points to consider that do not necessarily exist in preventive vaccination:

1. The egg production in flocks will be materially reduced for a period of 30 to 60 days. The chickens may go into a molt if vaccinated during heavy production.

2. Vaccination of an infected flock will not stop the spread of the disease immediately. It usually requires from 3 to 6 weeks to produce immunity.

3. The use of pox vaccine does not increase the severity of the lesions on the chickens that are already infected or that become infected after vaccination.

4. If one pen becomes infected and vaccination is used as a control, it is necessary to vaccinate all susceptible chickens on the premises.

5. The use of vaccination in controlling outbreaks of pox is to hasten the course of the disease to a period of 3 to 4 weeks. Sometimes a natural outbreak will run a short course, while other outbreaks will last several months.

6. Vaccination with pigeon-pox vaccine is used and recommended by various agencies because egg production is not affected as much as when fowl-pox vaccine is used. It is doubtful in many instances if pigeon-pox vaccine is effective in checking an outbreak of fowl pox.

The treatment of individual infected chickens consists in the immediate removal of these infected chickens from the flock to clean, well-ventilated quarters. The scabs on the combs and wattles should be removed and the areas painted with tincture of iodine. The cheesy material which collects in the mouth and eyes should be removed and the raw areas should be painted with tincture of iodine. When material collects in the lid, tincture of iodine can be applied to the eye without endangering the eyesight. This cheesy material should be removed by squeezing the lids.

In connection with these individual treatments or control methods in infected flocks, it is always necessary to feed the chickens as suggested in the method of handling chickens after preventive vaccination.

LARYNGOTRACHEITIS (INFECTIOUS BRONCHITIS)

Laryngotracheitis is an infectious disease of the respiratory system affecting the trachea (windpipe) and the larynx (Adam's apple). The disease is caused by a virus which is found in the exudate formed on the trachea and larynx. This exudate may be capable of producing the disease for more than a year if kept under suitable conditions. The characteristic symptom of this disease is "gasping for breath" with the bird in a sitting position.

The head is thrown out at inhalation accompanied with a loud wheezing sound. Frequently the bird coughs and expels the exudates from the trachea. The onset of the disease is sudden and it spreads rapidly. The usual course of the disease in a flock lasts about 2 to 4 weeks. The death losses vary from 5 to 30 per cent, and there is almost a total stopping of egg production in laying flocks. The only organs affected in this disease are the larynx and trachea. The linings of these organs are inflamed and covered with mucous or clotted blood. In some cases the mucous becomes thickened resembling a cheesy mass, while in others there is only a mass of clotted blood. Death in most cases is caused by asphyxiation because the larynx or trachea is filled with mucous or clotted blood.

The control methods used for laryngotracheitis include prevention by sanitation, vaccination, and treatment.

On isolated farms it is possible to prevent recurrence of the disease if the following suggestions are followed. The houses and yards occupied by diseased birds should be thoroughly cleaned and disinfected. All chickens which have survived the disease should be segregated for life. This is necessary because it has been shown that chickens may carry the virus in their tracheas for more than a year after recovery. These birds act as healthy carriers to infect susceptible chickens which may come in contact with them. It is essential to segregate the recovered birds in yards and houses as far removed from the susceptible flock as possible. The success of this method depends upon careful application of all sanitary precautions available. There should be no interchanging of equipment or feed, and care should always be taken to prevent carrying infection on the clothing or by dogs or insects.

The isolation method of controlling this disease is not applicable to farms where the disease has occurred repeatedly or in areas where the disease has occurred on adjoining farms. The procedure to follow, under these conditions, is to vaccinate all susceptible birds. The vaccination has been proved to be a very effective and practicable method of control for laryngotracheitis.

Two methods of vaccination used depend upon the age of the birds. Poultrymen should secure the services of a trained person to vaccinate their birds or have the proper procedure demonstrated to them. The problem which usually confronts the poultryman is to know when and for what to vaccinate.

1. Vaccination for laryngotracheitis is a control for this disease only. It will not protect birds against other diseases resembling laryngotracheitis. It is essential to establish a proper diagnosis before vaccinating.

2. Chickens of any age can be vaccinated. There is no systemic reaction from the vaccination. Results are more satisfactory in birds from 10 to 12 weeks of age. Birds should be at least 6 weeks old to be vaccinated properly.

3. New flocks or healthy flocks located in congested areas in which the disease is prevalent should be vaccinated.

4. All new susceptible birds which are added to a flock in which the disease is present or has been should be vaccinated. Survivors of the disease are possible carriers.

5. All young replacements on farms when the disease has been prevalent should be vaccinated at about 10 weeks of age.

6. Vaccination will prevent the spread of the disease on a farm after it has appeared in one pen. If the other pens are immediately vaccinated, they will be immunized before the natural spread reaches them.

7. If the vaccine is used, it is necessary to vaccinate all birds on the farm. Vaccinated birds are not carriers of the disease after the vaccination reaction which lasts about 10 days.

8. It is necessary to keep all vaccinated birds away from susceptible birds until all have been vaccinated.

9. No flock that is affected with other diseases or in poor condition should be vaccinated.

These above suggestions should be carefully studied before vaccinating.

Most poultrymen are inclined to try various "cures" or treatments on individuals or the flock. There are no such treatments known today that are of value. The only suggestion that might help is to keep the birds as quiet as possible and avoid dusty yards that add to the irritation of the larynx or trachea. The individual treatment that may help is to remove the masses of exudate from the larynx with a pair of forceps. Do not excite the bird during this treatment because it may die during the operation.

FOWL CHOLERA

Fowl cholera is an infectious disease caused by an organism usually found in the droppings and nasal discharges of infected birds. The disease may occur suddenly and kill birds rapidly, or it may localize in some organ to cause a long lasting disease.

In the acute cases cholera affects many birds at once and causes large death losses. The disease affects the entire body, and all organs are inflamed. Laboratory isolation of the organism is necessary to establish a diagnosis of this disease. In the chronic type there are no distinctive symptoms or lesions and, as with the acute form, bacteriological studies are necessary to establish a diagnosis.

Outbreaks of cholera are few in Arizona. Usually this disease will not occur in flocks properly fed and kept under sanitary conditions. Recovered chickens usually carry the infection and may spread the disease organisms to susceptible birds. The control methods necessary in cholera include the general principles of sanitation and proper disposal of all dead and affected birds. Careful feeding and housing are necessary. Biologics usually are of no value in controlling this disease. There are two disease conditions occurring in Arizona that are caused by the same organism.

These will be discussed under the heads of edema of the wattles and ruptured yolk.

EDEMA OF THE WATTLES (WATTILITIS)

Edema of the wattles occurs most commonly among cockerels on breeding farms. There is a severe swelling of the wattles which usually later develops into a hard, cheesy ball. The cholera organism usually causes this localized lesion. Biologics are of little value in controlling this disease. Where the disease appears it is necessary to crop the wattles on young males at about 3 months of age. This operation consists of cutting away a little more than half of the wattles with a pair of shears. The hemorrhage can be controlled by applying iron chloride (ferric chloride) to the wound.

RUPTURED YOLK

Ruptured yolk is more correctly a group of conditions found in heavy producing adult hens or pullets just coming into production than a disease. Frequently the cholera organism is found in these birds, but other disease-producing organisms may also be involved. The exact cause of the disease has not been established. Affected birds are sick only a short time and frequently they are found dead on the nest or roost. The symptoms include droopiness, diarrhea, and darkening of the comb. Usually the only birds affected are those that are laying heavily. On autopsy the constant lesion found is yolk material free in the abdominal cavity. It may be fresh or in a cheesy mass. Other lesions include a general inflammation of all organs.

In controlling this condition the close relation of heavy production to losses should be considered. Good results have been secured by adding large amounts of wheat bran to the ration. Egg production is usually reduced. The bran should be mixed dry with the mash in equal quantities. Moistened bran can be given alone in two feedings daily after the mash has been restricted. Hoppers containing the mash should be closed and the flock allowed access to the mass for only a few hours daily. Laxatives of $\frac{3}{4}$ pound of Epsom salts per 100 birds given daily for 3 days will sometimes help in controlling this condition. Since infection is closely allied to this condition, strict sanitation should be followed. Sick or dead birds should be immediately removed from the flock. All moist spots in the yards or houses should be eliminated, and feed and water containers should be cleaned thoroughly each day. The use of chlorine in the drinking water will prevent infection by this manner.

FWL TYPHOID

Fowl typhoid is primarily a disease of young chicks and causes symptoms and lesions identical to pullorum disease. Methods applied to control of pullorum disease are applicable to typhoid. Typhoid in older chickens occurs frequently in flocks in irrigated

districts where yards are flooded by water. Typhoid of adult birds is very similar to cholera in that outbreaks occur after predisposing causes such as faulty nutrition, wet, flooded yards, or exposures. Typhoid is controlled in the same manner as cholera and can be prevented by proper feeding and management. Biologics are of little value in the control of this disease.

TUBERCULOSIS

Tuberculosis is very uncommon in Arizona poultry flocks. The infection is caused by an organism and usually manifests "wasting away" symptoms in older birds. The disease will spread in dark, damp, crowded houses and yards. The typical lesions found in tuberculosis consist of cheesy nodules on the spleen, liver, and intestinal lymph glands. These lesions vary in size from as small as a pin point to as large as peas. It is necessary to examine these lesions in a laboratory to diagnose tuberculosis. In localities where tuberculosis is a factor chickens are tested by means of a tuberculin test.

NUTRITIONAL ROUP

Nutritional roup is a disease caused by a deficiency of vitamin A in the ration. In partial deficiencies the chickens manifest symptoms of colds, but if the ration is very deficient and fed over a long period of time the chickens show more pronounced symptoms and lesions. These are general debility, lack of appetite, watery eyes followed by cheesy material within the eyelids, and the formation of white, cheesy, blisterlike patches in the mouth and throat. These patches are usually on the surface of the lining and can be removed without causing a hemorrhage. The post-mortem shows a general emaciation and the kidneys are very pale. Occasionally white material is found deposited over the liver, heart, and other organs.

Vitamin A has been described under nutritional diseases in chicks. One of the major problems in poultry raising in Arizona is the lack of vitamin A during dry seasons. Most commercial feeds contain dehydrated alfalfa and cod-liver oil, but when grains are fed in excess to growing pullets the amount of vitamin A from the mash is diminished to the point of a deficiency. It is advisable to have succulent green feed available when possible, and during seasons when it is not available a good green quality of alfalfa hay should be supplied.

Chickens showing symptoms of vitamin A deficiency improve rapidly if supplied with green feed or vitamin A analyzed cod-liver oil.

ENTERITIS

Inflammation of the intestines is a lesion of many diseases and parasites, but very frequently an inflamed condition of the intestine results from malnutrition or irritating substances. The degree of inflammation varies from a catarrh, manifested by ex-

cess mucous, to a deep hemorrhagic erosion manifested by blood and ulcers. Enteritis interferes with digestion and generally causes a diarrhea. The birds lose weight rapidly and are droopy. A proper diagnosis is necessary to establish the cause of the enteritis, but usually a laxative of Epsom salts followed by proper feeding will correct most cases not caused by parasites.

IMPACTED CROP

Crop bound or impacted crop is an overloaded crop filled with fibrous material. Feathers, straw, Bermuda grass, tamarisk leaves or stems, and coarse, mature grasses are most frequently found in the crops. The affected chicken loses its appetite and stands around trying to swallow. If the condition persists the chicken usually dies from weakness. The crop is large and feels hard or doughy. The mass of food may be massaged and broken up after giving the bird a tablespoonful of oil, but if this does not correct the condition, it is necessary to open the crop with a sharp knife and remove the material. The incision should be about 1 inch long near the upper end of the crop. After the material is removed the crop is washed with warm water and sewed together with white thread. About four stitches are taken in the wall of the crop and then two are taken in the skin. The bird should be fed only soft feed for a few days and then gradually changed to mash and grain.

EGG BOUND

Frequently in pullets at the beginning of laying or in adults during heavy laying a condition known as egg bound occurs. The condition is due to an inflammation or obstruction in the oviduct or egg passage. In pullets it is usually caused when a large egg is developed in a small oviduct. Affected birds become restless and go to the nest frequently to lay. Straining sometimes causes a prolapse of the oviduct. If the egg is not passed the bird droops and finally dies. The egg may be felt by passing the forefinger through the vent. The method of treatment is to pass the forefinger through the vent and direct the egg toward the vent. Pressure is applied to the abdomen with the other hand. As soon as the egg is observed at the vent it should be punctured and broken. Remove all the parts and inject a little cold water into the cloaca.

VENT GLEET

Vent gleet is an infectious disease of the vent. It is usually spread by male birds. The disease is probably caused by a variety of organisms causing putrefaction of the mucous discharges. The skin around the vent is swollen, reddened, and an offensive odor is usually present. The disease is resistant to treatment and usually the best control is to dispose of infected birds. If treatment is undertaken a 3 per cent silver nitrate solution can be applied to the mucous membranes with a cotton swab.

TUMORS

Chickens are frequently affected with a variety of tumors. Usually tumors affect the ovaries, oviduct, intestine, and may cause hemorrhage. Tumors occur on the skin of chickens. These tumors may be small or large with necrotic centers. There is no treatment except surgery. Usually since many are cancerous in nature, it is advisable to destroy the bird.

BUMBLEFOOT

Bumblefoot is a large swelling of the foot in chickens usually resulting from injuries or bruises to the skin of the foot which becomes infected. The organisms cause inflammation which develops into an abscess or cheesy swelling in the ball of the foot and between the toes.

The swelling should be lanced, and all the material removed. After carefully cleaning out the injured area it should be painted daily with tincture of iodine. The chicken should be placed in clean quarters until the wound is healed.

CANNIBALISM

Toe, tail, and body picking is referred to as cannibalism. It is more apparent where a large number of fowls are confined in a very limited space. Although young stock are more frequently troubled in this respect, the older fowls also take up this habit. Good management does not seem to prevent or eliminate this trouble, for it creeps into a flock fed recommended rations, in properly designed houses, where sanitary conditions are of the best. Idleness, close contact, and large numbers in one unit seem to be predominating reasons why chickens take the notion to "pick on each other."

Treatment

Any practice which will tend to keep chickens busy will, to a certain extent, eliminate cannibalism, especially where they are confined in large units. This might be a sequence of practices, such as the feeding of green alfalfa hung around in convenient positions in the house, the feeding of semisolid buttermilk placed around the side walls near the floor, the scattering of pieces of red cloth in the pens where there will be competition for their possession, the placing of light litter on the floor and scattering grain in it, or similar ideas.

If the birds are confined and cannibalism breaks out, the best move would be to get the stock out on a green range, where they will have a wider territory to range over with green feed and bugs to keep them occupied.

Darkening of the room and the eliminating of any light streaks, which might focus attention, have proved helpful. The painting of windows and curtains a red color in order to throw a red hue over the interior of the brooder room has been used with some

success. The use of red light bulbs in a darkened brooder room has been recommended.

If chlorine (salt) deficiency is the cause, good results can be secured by the addition of 1 to 2 per cent table salt to the ration.

POISONING

There are several different types of poisons which affect chickens. The plants commonly used as shade, such as oleander, castor bean, chinaberry, and tamarisk are poisonous to chickens. Chickens do not usually eat these plants but shedding seeds frequently contaminate feeds. All these plants except the tamarisk have a definite toxin which poisons the chickens causing nervous symptoms and death. Tamarisk leaves or stems cause impaction of the crop, previously described. Several varieties of milkweeds growing in the higher elevations frequently grow on poultry ranges or contaminate the green feed. These weeds contain a toxin which is very dangerous to poultry, causing severe nervous symptoms and death.

Laxatives of Epsom salts may help correct the effects of these poisonous plants, but the main consideration should be to prevent chickens from having access to them.

Salt poisoning is caused by chickens eating ice cream salt or brine carelessly thrown out within reach. Salt causes severe enteritis which is difficult to treat and the chickens usually die.

Botulism or limberneck is caused by chickens eating spoiled feed or rotting meat in which the organisms causing the poison are growing. This poisoning is characterized by a paralysis of the neck muscles preventing the affected chicken from raising its head. Treatment must be administered immediately to save the chicken. Epsom salts or other laxatives may help. The condition can be prevented by sanitation and careful feeding. Spoiled canned food, meat, eggs, or vegetables should never be fed chickens.

PARASITES

Parasites in chickens are common in all sections of Arizona. External parasites such as lice, fleas, mites, and ticks may carry infections but more commonly cause irritation to the chickens, resulting in unthriftiness and poor production. The control of these parasites requires constant examination and treatment, but good results are usually obtained at little cost if a proper program is followed. Internal parasites such as roundworms and tapeworms usually cause more damage to chickens than the external parasites. Internal parasites cause irritation to the lining of the digestive tract interfering with digestion and also excrete toxic substances which are absorbed by the infected chickens causing emaciation and weakness. Internal parasites cause more damage to young chickens than mature birds. A careful program should be followed to control internal parasites, but before worming

chickens it is always necessary to determine the presence of worms. The careless use of worm medicine frequently does considerable damage to poultry flocks.

The control of parasites affecting chickens is one of the greatest problems of poultrymen in Arizona. Parasites are generally divided into two groups, external and internal.

EXTERNAL PARASITES

External parasites include lice, mites, fleas, and ticks. Generally these parasites can be controlled by sanitation and proper housing, but additional individual treatment is frequently necessary. The life cycles of these parasites vary and there are many species of each kind. Typical species of each will be briefly discussed and control methods are applicable to the other species.

Lice

Lice are flattened insects which have three pairs of legs. The head, thorax, and body are distinctly divided. They are about $\frac{1}{4}$ inch long and of a gray or yellow color with or without dark stripes. Lice spend their entire life on the chicken and do not leave their host except to migrate to another chicken or after death when the body becomes cold. The various species of lice live on the body, wings, head, and fluff, but all live and lay their eggs on the chicken.

In order to control this parasite it is necessary to treat the chickens. Nicotine sulphate (Black Leaf 40) is the most efficient drug to use if proper conditions are available. Nicotine sulphate is painted on the roosts with a small brush or an oil can just before the chickens go to roost. This type of treatment is only of value on farms where chickens are housed indoors on roosts. It acts better during cool weather in houses free from drafts. The nicotine should be used carefully and not spilled. Do not apply nicotine to newly whitewashed roosts.

Sodium fluoride controls lice effectively in the pinch method where small amounts of the powder are placed over the body under the feathers. Sodium fluoride mixed as a dip is also effective. One ounce of commercial sodium fluoride is mixed with 1 gallon of warm water. Chickens are dipped into this solution.

Dusting boxes containing dry dirt and sodium fluoride (1 part powder to 3 parts dust) may help prevent lice from attacking chickens. The best program is to use one of the above-described methods whenever lice are found and treat all infested chickens.

Fleas

Fleas are dark brown insects having three pairs of legs, an arched back, and no wings. They spend their adult life on the chicken usually around the head parts. The eggs usually hatch on the ground or in debris and mature away from the chicken. Occasionally the eggs stick to the body of the chicken and develop but this is unusual. There are several varieties of fleas affecting

chickens, but the control methods are similar. Fleas on chickens can be treated by dipping in a 1½ per cent solution of creolin or dusting with a flea powder, but this procedure is of little value unless the source of infection is eliminated. All houses, yards, and areas close to poultry plants should be cleaned of debris. The houses should be sprayed with crude oil, carbolineum, or kerosene emulsion. The yards should be plowed up and allowed to dry, eliminating all wet spots. Nests should be frequently cleaned and treated with flea powder or tobacco dust.

Mites

The common poultry mite attacking chickens is migratory and spends most of its time off the birds in cracks and crevices in the poultry house or in rubbish. These mites crawl on the chickens at night to suck blood. These mites are very small and grayish red in color. When enlarged with blood they are about as big as a pinhead. Mites have four pairs of legs, which helps in distinguishing them from lice and fleas. The control of these mites must be directed against their hiding places, because they are so seldom found on chickens. A definite program of cleaning up all rubbish, boxes, and nests should be made. After this, the cracks should be thoroughly sprayed with a pressure spray, using carbolineum or crude oil, diluted with kerosene. It may be necessary to repeat the treatment several times and frequently in some of the old adobe houses it is impossible to destroy these mites. Iron built poultry houses are the most satisfactory type to control this parasite.

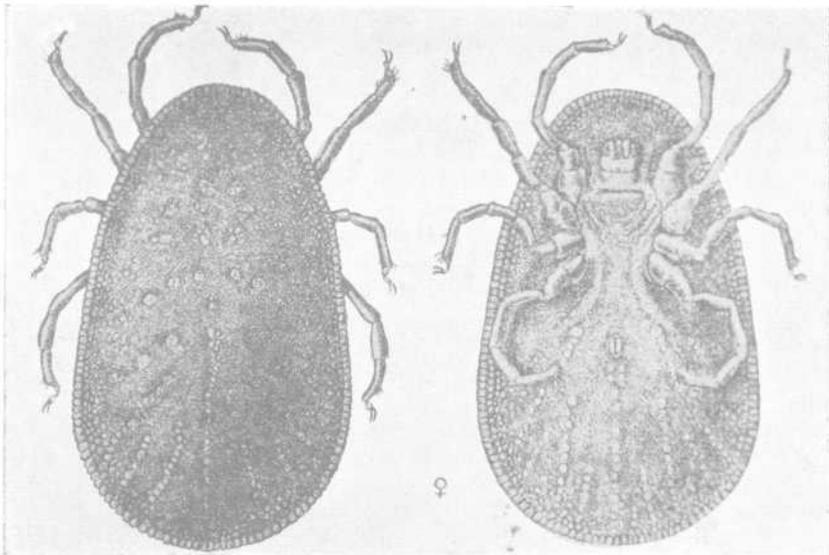
The scaly leg mite burrows beneath the scales of the leg and causes inflammation and swelling. The mites are microscopic and usually the deformed legs are all that can be seen. The treatment for these mites consists of a local application of kerosene or equal parts of crude oil and raw linseed oil. Care should be taken not to get these oils on the skin above the scales.

Depluming feather mites which burrow into the skin at the base of feathers are very seldom found in Arizona.

The air-sac mite which lives in the air passages of chickens has not been found in Arizona.

Ticks

The blue bugs or fowl ticks are similar to the mites but much bigger. These ticks attack chickens in the same manner as the mites. The control measures are the same. Anthracene oil sprayed into cracks and crevices is the most effective material to use. This should be repeated after 30 days. Ticks and mites can live for many months away from the bird without food. Because of this fact, uninhabited houses may harbor the parasites and should be thoroughly cleaned and sprayed before use for poultry. Young ticks may stay on chickens for several days before they become engorged. This makes it necessary to examine the birds before they are placed in a clean house or one which has been



The fowl tick: adult female, upper and lower sides, greatly enlarged. (Courtesy, U.S. Department of Agriculture.)

treated. Chickens infested with young ticks can be dipped in a 2 per cent sheep dip solution.

INTERNAL PARASITES

Roundworms and tapeworms are the most common internal parasites affecting chickens in Arizona.

Roundworms

The roundworms are slender rounded worms found in the digestive tract. The worms found in the intestine are long, measuring from 1 to 3 inches. Roundworms found in the gizzard are very small, while those found in the caeca are about $\frac{1}{2}$ inch long.

The intestinal roundworms are the most common. These worms deposit their eggs which pass out of the intestine with the droppings. These eggs are again infective to chickens after a few days. If eaten by chickens they hatch out to form worms in the intestine. Roundworm eggs may remain in the soil for many months. Much of the roundworm infestation can be controlled if chickens are kept away from droppings or soil containing the eggs. The use of wired dropping boards to keep chickens away from the droppings is beneficial. Dryness and sunshine are the most effective weapons to kill the eggs in the yard. All moist spots should be eliminated, and feed and water should be guarded against fecal contamination.

The treatment for roundworms is best administered by treating each individual bird. Nicotine sulphate in combination with Fuller's earth is probably the most efficient roundworm remedy.

These pills can be secured from most feed or poultry supply houses. Care must be taken to place the pill down the chicken's throat and then to massage the outside of the gullet moving the pill into the crop. It is not necessary to starve poultry before treatment. The poultry house and dropping boards should be well cleaned after treatment. A practical method to determine the presence of roundworms is to pick out a few birds and treat them in a coop or small inclosure. If many worms are expelled it is logical to suspect a general infestation of worms in the flock. Flock treatments in which nicotine is mixed with the feed frequently give good results. There are other drugs on the market recommended for roundworms but are usually more expensive and less efficient. Phenothiazine is a new drug which may be very satisfactory in treating worms in chickens.

Caeca worms

Caeca worms are small, round worms, ranging in length from $\frac{1}{4}$ to $\frac{1}{2}$ inch, found in the blind pouches (caeca) of chickens. They seldom cause disease in chickens but play an important part in enterohepatitis (black head) of turkeys acting as a carrier for the infection. It is because of this fact that turkeys and chickens should not be raised together.

Gapeworms or gizzard worms have not been found in poultry of Arizona. Suspected cases should be sent to the laboratory for diagnosis.

Tapeworms

There are several species of tapeworms which infest poultry in Arizona. Some are very small and can be seen only if a piece of opened intestine is placed in water or with a lens; others are large and frequently reach 8 inches in length. Tapeworms are flat and have many segments. They attach themselves to the lining of the intestine by means of a scolex. Tapeworms differ from roundworms in that the eggs cannot directly infest another chicken but have to be injected by another animal (intermediate host) where they develop into the infective form. The various species of tapeworms have different intermediate hosts. These intermediate hosts have been found to be flies, earthworms, beetles, and snails.

Tapeworm infestation can be reduced by sanitation if these intermediate hosts are controlled. The most important consideration of this program is to dispose of the manure in flyproof containers or by spreading it over the ground away from poultry so that it dries out rapidly.

Kamala is the most common drug used to treat tapeworms in chickens. This drug frequently causes severe reactions in laying birds. It is advisable to select a few birds to treat before administering the drug to the whole flock. There are other drugs on the market for treating tapeworms, but experiments have shown that there is no efficient drug available which will get rid of all tapeworms in chickens.