Fowl Pox (Diphtheria)

BY HUBERT BUNYEA

THE SKIN FORM of fowl pox is a comparatively mild disease, but it has a diphtheritic form that can be extremely serious. Fortunately, it is one of the diseases for which successful vaccination methods have been developed.

Fowl pox is a disease complex consisting of lesions, or tissue injuries, of the skin (pox) and of the mucous membranes (diphtheria). It affects many species of domestic fowls and free-flying wild birds.

It is now known that fowl pox is caused by an invisible disease-producing agency. From time to time many agents, including bacteria and protozoa of various kinds, have been believed to produce the disease. In an old book on poultry diseases the origin of diphtheria is attributed mainly to “improper care, and sudden changes of weather and variations of temperature,” and the author adds that “it is also occasioned by improper and damp coops and roosts.” About the beginning of the present century, however, it was discovered that infectious material from pox-infected fowls was capable of retaining its disease-producing power even after it had passed through filters too fine to permit the passage of bacteria. Such an infective agent is known as a filtrable virus.

Two types or strains of the virus are known to be infectious for avian species. The more common and more important strain causes natural outbreaks in chickens and other barnyard fowl, including turkeys, guinea fowl, pheasants, ducks, geese, and other species. Of less importance is pigeon pox virus, which, as its name implies, produces the disease in pigeons. Other species are relatively resistant to pigeon pox virus, but it has produced mild lesions experimentally in chickens, particularly when inoculated into feather follicles, a fact that is the basis for immunization of chickens with this type of the virus, as discussed later. Pigeons are quite resistant to the other type.

1 Hubert Bunyea is Veterinarian, Pathological Division, Bureau of Animal Industry.
2 LEWIS, W. M. THE PEOPLE'S PRACTICAL POULTRY BOOK. Ed. 7, 228 pp., illus. New York. 1876.
The virus of fowl pox, or chicken pox, is very resistant to desiccation, or drying. Infectious matter from the diseased birds may therefore be scattered around the premises and will remain in a dried condition for many months, during which time it may come into contact with susceptible birds and bring about a new outbreak. Such an outbreak usually begins with the occurrence of the typical pox lesions on the face parts of the fowls. The virus may gain entrance where the comb or wattle has been wounded, possibly during fights with other birds. Certain species of mosquitoes may spread the disease by carrying the infection from a diseased fowl to a susceptible one. A mosquito may be infectious for as long as 27 days after feeding on an infected fowl.

It is probable that the disease is transmitted only through damaged or broken skin or mucous membranes. Wounds too small to be observed may afford an entrance for the virus into the skin.

Fowl pox virus is not infectious for human beings or any species of mammal; so-called chicken pox (varicella) in human beings is an entirely distinct disease. Fowls and free-flying birds of any age are susceptible to fowl pox. Usually, however, very young and very old birds are not affected, probably because the young birds are more sheltered from exposure and the old birds have in many cases survived a previous outbreak and developed immunity. Fowls of any breed and practically all species are susceptible to the disease. Large-combed and large-wattled birds seem to acquire the pox lesions more often, probably because of the greater surface of these parts exposed to skin wounds. The diphtheria manifestations affect all breeds equally.

**SYMPTOMS**

The cutaneous (pox) lesions are usually the first to appear, the membranous (diphtheria) lesions occurring later. The infection gains a foothold in the flock through the pox lesions, but in the diphtheritic form it may persist longer and do greater damage. Fowl pox may appear at any season, though as a rule it is more likely to occur in the fall or winter.

The pox manifestations, known as fowl pox, bird pox, chicken pox, sorehead, dry pox, avian molluscum, or contagious epithelioma, occur as wartlike nodules (fig. 1) on the unfeathered parts of the body such as the comb, wattles, eyelids, and vent. The diphtheritic manifestations, known as avian diphtheria, diphtheritic roup, wet pox or canker, occur as a deposit on the mucous membranes of the eyes, mouth, or respiratory region, and are sometimes accompanied by coughing and gasping. Both types of lesion frequently occur in a single outbreak of the disease.

For many years the two manifestations were regarded as entirely distinct diseases due to different infective agents. Within comparatively recent times, however, it has been clearly demonstrated that the two disease manifestations have a common origin. Virus collected from pox lesions has been shown by inoculation to be infective for the membranes of the eye, mouth, and air passages, whereas virus collected from diphtheria lesions, when rubbed into scarified
(scraped) areas on the comb, wattles, or other parts of a fowl's body, has been shown to be capable of producing typical pox lesions.

In the cutaneous, or pox, manifestation of the infection, the lesions appear 3 to 4 days after exposure, in the form of minute grayish pimples or blisters, usually on the unfeathered parts of the fowl's body. The blisters contain a straw-colored fluid which is very virulent. In the course of several days they begin to enlarge and run together. Meanwhile the skin around the blisters takes on an angry red appearance. After 10 to 14 days, the blisters may begin to darken and form dry, hard scabs resembling warts, which may cling to the skin for another week or two or even longer. Finally the scabs loosen and drop off, revealing new and possibly scarred skin beneath.

In the diphtheritic form the disease has no definite course, but may persist for weeks or possibly months before it is terminated by death or recovery. Yellowish or whitish cheesy patches form on the
mucous membrane of the tongue, mouth, esophagus, and larynx. The patches of membranelike material found in some cases within the trachea may cause gaping and labored breathing, which may be mistaken for symptoms of infectious laryngotracheitis. The patches are very tough and adherent. If forcibly removed, they leave the true membrane in a bleeding and ulcerous condition. Similar deposits may occur in the sinuses of the eye, preceded by watering and inflammation. The eyelids eventually become swollen and tend to stick together. This type of diphtheria is sometimes incorrectly alluded to as diphtheritic roup.

The presence of the cheesy membranous deposits in the mouth, eyes, and air passages interferes seriously with the bird’s vision and respiration and tends to interfere with its eating. As a result, progressive emaciation sets in, and egg production definitely and sometimes permanently stops. Weakness, starvation, and in many cases suffocation precede death. Recovery may occur in mild cases of diphtheria, imparting prolonged immunity, as does recovery from the cutaneous or pox manifestations of the disease.

MORTALITY AND ECONOMIC IMPORTANCE

The cutaneous pox manifestations are usually mild and after a fairly definite period terminate in an uneventful recovery. The diphtheritic type of infection, however, may cause more or less mortality among the birds, the rate being influenced by the age of the birds and general health conditions in the flock. Other things being equal, the death rate is highest among pullets in egg production. However, complication with other diseases of a debilitating nature, poor nutrition, bad housing conditions, severe weather, or even a moderately heavy parasitic infestation will increase the losses.

No authentic statistics on the economic loss to the poultry industry occasioned by this disease are available. It has been estimated that uncontrolled outbreaks may cost poultry keepers $30 to $70 per hundred birds. Losses are chargeable to such items, in addition to mortality, as the time, work, and equipment used in isolating and treating sick birds; the loss of vitality of sick birds; the suppression of egg production in affected birds—many do not return to production for a number of months, and some never regain normal production; the decreased reproductive power in breeding stock; and the predisposition of affected birds to other diseases.

TREATMENT AND CONTROL

In severe outbreaks medicinal treatment is usually of little or no value. Birds lightly affected, if of more than ordinary value, may be removed from the flock and placed under quarantine in comfortable quarters. The false membrane should be removed from the mouth or larynx so that the bird may eat and breathe more easily. Tincture of iodine, argyrol, or iodoform powder should be applied to the underlying ulcers to promote healing. The drinking water should be made antiseptic by the addition of one-third of a dram (one-third
teaspoonful) of potassium permanganate crystals per gallon. Strict sanitation should be observed in the quarantine house, and the attendant, if possible, should refrain from visiting the quarters of the healthy flock. Changing clothes and disinfecting the footwear should be done faithfully after working in the quarantine house.

No special control measures can be recommended for fowl pox. General hygienic precautions should be adopted. Affected birds should be segregated and, if in a serious condition, may as well be slaughtered, since the likelihood of their becoming profitable is remote. The premises from which sick birds have been removed for quarantine or slaughter should be thoroughly cleansed and disinfected. A good disinfectant for this purpose may be made by dissolving 1 pound of commercial lye (containing 94 percent of sodium hydroxide) and 2½ pounds of water-slaked lime in 5½ gallons of water. Unless kept tightly covered, this solution will deteriorate on standing. It is injurious to painted or varnished surfaces, aluminum utensils, and some fabrics, but it is relatively harmless to the equipment usually found around chicken houses.

Precautions should be taken against introducing the disease in pox-free flocks or areas. So far as possible, wild birds should be excluded from contact with the flock and prevented from visiting premises used for poultry. Visitors who own poultry that may be harboring the infection should not be permitted access to the flock, or, if this is unavoidable, they should be provided with a pair of clean rubbers. Hucksters, peddlers, feed dealers, and other itinerant persons are potential transmitters of infection, as they frequently visit many poultry establishments in a day, and they should by all means be excluded from the poultry houses. Veterinarians and officials engaged in various lines of poultry work may be expected to take what precautions are necessary to avoid transmitting infections from place to place in the discharge of their duties.

**VACCINATION**

If the outbreak is light and of recent origin, vaccination of the healthy birds may be resorted to after removal of the affected ones. After the disease has been present for several weeks or months, however, vaccination is of doubtful value. Birds that remain healthy for that long may be presumed to be resistant; it is always possible that they may have acquired unseen pox lesions and have thereby developed immunity. The fact that fowls that recover from the disease possess a solid immunity to further attack for a considerable length of time has been the basis for much of the experimental work that has led to the present methods of vaccination of poultry for the prevention of fowl pox.

As early as 1910, investigators reported favorable results from the injection into the veins of pox-scab material ground in a physiological salt solution (one that is like the body fluids). Later workers announced the production of immunity in fowls injected twice at 5-day intervals with a saline suspension of pox scabs and diphtheritic membrane that had been filtered and heated for an hour at 55° C.
These methods, however, failed to gain wide acceptance owing to the lack of uniformly satisfactory results.

Within the last 22 years a definitely successful procedure has been developed for the immunization of chickens against pox. The basic agent employed is the living virus of chicken pox or of pigeon pox. Instead of these materials being injected under the skin or into the veins, they are applied by superficial stabs into the skin or to four or six follicles from which the feathers have been plucked. Except in the stab, or stick, method the vaccine is usually vigorously applied with a bristle brush to the prepared area. A successful vaccination is followed by the development of a typical pox lesion at the point of vaccination. Pigeon pox vaccine is applied only to the feather follicles; 12 to 20 feathers are plucked and the follicles are inoculated (fig. 2). In employing the stab method, any clean, sterile, sharp-pointed instrument may be used that will penetrate the skin and convey a minute amount of the virus to the inoculated area. A popular method is to bind two sewing-machine needles to the end of a wooden handle about the thickness of a lead pencil, leaving exposed only the eyes of the needles. When this instrument, after being disinfected, is dipped into the vaccine suspension, sufficient vaccine is picked up in the eyes of the needles to inoculate the skin on both sides of the wing. The needles are then thrust through the web of one wing. This method is economical, efficient, and speedy. Other parts of the skin, such as the thigh, may be inoculated if preferred.
Fowl Pox (Diphtheria)

The vaccine is a standardized powder consisting of material that came originally from pox scabs, thoroughly dried and finely pulverized. Under proper conditions, the powder will retain its potency for a long time. For immediate use it is usually mixed with a sterilized fluid consisting of equal parts of glycerine and physiological salt solution. This fluid suspension of the vaccine is very short-lived. It should be kept from exposure to extreme temperatures, excessive sunlight, or atmospheric contamination, and any part remaining unused at the end of the day should be destroyed by burning or disinfection.

Within the last decade it has been discovered that certain viruses, including those of fowl pox and pigeon pox, can be propagated on the embryonic tissue in incubated eggs of chickens. This method of propagation, which eliminates the necessity of constantly collecting virus from actual cases, has therefore come into use for the production of virus vaccines. It is more economical than methods previously employed for preparing fowl pox and pigeon pox vaccines, and, when properly produced, such vaccine has been found to be as potent as that made from pox scabs.

The question is sometimes asked, "if a natural outbreak of fowl pox will produce immunity, why go to the bother of vaccinating?"

The reasons may be summed up as follows:

1. To prevent the possible losses that might result if the disease were allowed to run its course. Vaccination is likely to be considerably cheaper than natural immunity.
2. To speed up the production of immunity.
3. To have some control over the time of occurrence of the disease (vaccination is an artificial production of the disease). Without vaccination, a natural outbreak might occur at a most inconvenient time and might take a long time to go through a flock.
4. To be sure that the lesions have time to heal completely before egg production begins. (Vaccination as well as a natural outbreak immediately prior to or during egg production is likely to depress productivity.)
5. To control the size and location of the lesions. Occasionally the disease spreads from the vaccinated area to other parts of the body, and it may even break out in the diphtheritic form. As a rule, however, the lesion remains confined to the vaccinated area and does not appreciably enlarge.

Birds that have been vaccinated within a year with fowl pox vaccine or that have recovered from the disease within that period may be presumed to be immune. Pigeon pox vaccine imparts only temporary immunity of a relatively low degree. Birds previously vaccinated with the pigeon pox vaccine only and all susceptible adults, yearlings, or pullets should be vaccinated with fowl pox vaccine. Baby chicks should be safeguarded from all contact with the disease, as it is not considered profitable to attempt to immunize them. Other species on the premises, especially turkeys, guineas, and pheasants, should be vaccinated.

The program of vaccination should not be unduly prolonged but should be completed as rapidly as is compatible with efficient work.
If the work is carried over several days, freshly mixed vaccine should be used each day, and birds not yet vaccinated should be kept completely isolated for their own protection. If any adult birds cannot be included, they too must be completely isolated from any contact with the vaccinated birds or their attendants. When pigeon pox vaccine is used, there is little or no danger of the disease spreading among chickens.

Birds to be shipped or to be entered in egg-laying contests or exhibitions may be vaccinated with pigeon pox vaccine in order to impart a temporary immunity without undue disturbance of productivity. This vaccine may also be safely employed in protecting a flock approaching the laying season or when the disease has broken out during a period of egg production. Following the cessation of production, however, it would be well to revaccinate the birds with fowl pox vaccine in order to insure a prolonged immunity.

Birds that are weakened by a heavy parasitic infestation or the effects of some other disease condition should not be subjected to vaccination with fowl pox vaccine. Poorly feathered, undernourished, undersized birds or crowded or otherwise poorly housed flocks are not fit subjects for vaccination.

In areas where it is known that the disease does not exist, vaccination is not necessary or desirable. In the first place, the fowls are in no danger of acquiring the disease, and, secondly, the vaccine itself, being the active principle of the disease, may introduce it into the flock and necessitate a continuous vaccination program.

Vaccination at various ages and various times of the year has been recommended. It is possible to vaccinate baby chicks, but it has been shown that this temporarily interferes with gains in weight, and complications with pullorum disease, coccidiosis, and other infections are likely to cause a high mortality from vaccination in young birds.

The practice usually recommended is to vaccinate the pullets with fowl pox vaccine well before the expected onset of egg production. If possible, vaccination should be performed at least 2 months in advance to permit the flock to recuperate fully from the artificially induced disease before beginning to lay. Vaccination between the ages of 12 to 16 weeks usually allows for such an interval.

Contest or exhibition birds should be immunized in time to recover fully before leaving the premises.

Although pigeon pox vaccine may be used without any appreciable disturbance of the bird's health or productivity, it has the disadvantage, as already noted, of giving only temporary and sometimes partial immunity.

Immunity established with fowl pox vaccine, on the other hand, may endure for 1 or 2 years or even for the life of the bird. The lesions caused by this type of vaccination, however, are likely to be severe and may spread to other parts of the body. They usually appear 4 to 9 days after vaccination. Failure of lesions to appear may indicate that the vaccine is impotent or that the bird is already immune. Egg production may be indefinitely postponed by vaccination, or, if it has started, it may be stopped abruptly. The vaccinated
Fowl Pox (Diphtheria) 

985

birds may be droopy and depressed for a number of days or weeks. Appetite is likely to be impaired. Heavily parasitized or debilitated birds will succumb. Should the artificially induced disease break over into the diphtheritic form, more or less mortality and chronic diphtheria will probably result. However, in the vast majority of flocks, vaccination is not accompanied by these serious after effects, and immunity is established in an interval of 2 to 4 weeks.

**Practical Suggestions for Vaccination**

It is desirable to have one or more assistants in catching and handling the fowls that are to be vaccinated. Adequate help and properly coordinated teamwork play a large part in expediting the work.

In follicular vaccination, the operator plucks from the thigh of the bird the necessary number of feathers (fig. 3). The same leg or wing should always be vaccinated to facilitate the checking of takes (positive vaccination reactions) later. The flock should be examined for takes in 7 to 10 days. A take is indicated by a typical pox vaccination lesion at the site of inoculation. Birds showing no take should be revaccinated at once with fresh vaccine. A predominating number of no takes suggests either that the flock possesses a certain amount of immunity or that the vaccine used was low or lacking in potency. A history of convalescence from a previous outbreak of fowl pox would go far to explain the occurrence of no takes following vaccination.

The powdered vaccine should be mixed with the fluid furnished in the package and nothing else. Under no circumstances should additional water or other fluids be added in order to make it go...
farther or for any other reason. During operations the mixture should be kept from the rays of the sun and from intense heat or freezing, and it should be kept covered when not in use, to prevent contamination. It should be used the same day it is mixed. If operations are to be interrupted or suspended for as long as 1 hour or more, the mixed vaccine should be placed in a refrigerator. It should not be used the day after it has been mixed.

In large establishments the work of vaccination may require several days, and vaccinated birds should be kept separate from those not yet vaccinated. Systematic procedure will insure that all birds come up for vaccination and that susceptible birds do not come in contact with those that have been vaccinated.

Vaccinated birds are sick birds. They should be made as comfortable as possible, kept dry, and be properly fed and watered.

Some operators prefer to vaccinate at night when the fowls are on the roosts. They are quiet then and may be handled with a minimum of disturbance. Adequate illumination must be provided for night vaccination, but the roosts must be shielded from the light in order not to disturb the rest of the flock.