FOWL TYPHOID, ITS DISSEMINATION AND CONTROL

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INTRODUCTION

The epizootiological problems in the control of diseases of birds closely parallel the epidemiological problems in human beings. Intensive production of poultry in recent years has increased the problems of disease control, close study applied to this subject in the past few years bringing out the fact that even the closest system of quarantine leaves unexplainable loopholes for the spread of contagious poultry diseases.

Fowl typhoid undoubtedly stands out among the septicaemic diseases of the domestic fowl as a particularly virulent contagion. It is distributed throughout the various countries of the world, recognized as a particularly virulent disease caused by the Bacterium sanguinariae or gallinarium (Eberthella sanguinariae Moore), or, on the Continent, Klein's bacillus. As far back as 1888, Klein, in England, made an investigation of this disease, with such concise work as to have this specific bacterium known by his name in Europe. In 1895, Moore investigated the disease in the United States, calling it Infectious Leukemia of Fowls, and the causative organism the Bacterium sanguinariae. Since that time, the disease has been reported and investigated by various authorities.

MORPHOLOGY

The fowl typhoid bacterium is a short, thick rod, occurring singly or in pairs, measuring 1 to 2 microns by 0.5 micron; stains peripherally; non-spore forming; Gram-negative, staining readily with most stains but best with fuchsin; non-motile.

CULTURAL CHARACTERISTICS

Growth on agar slant beaded, abundant, raised, smooth, opaque in 24 hours; agar colonies raised, entire, circular, and finely granular; optimum temperature 37.5°C; optimum acidity of medium pH 6.4, although the organism has a high tolerance to organic acids, suitable growth being obtained on agar acidified with formic, malle, and oxalic acids between the ranges of pH 4.8 and pH 7.0; does not liquefy gelatin; non-chromogenic; heavy nitrate reduction in nitrate broth and on nitrate agar without gas; aerobic growth in glucose agar shake; slight production of hydrogen sulphide on surface of acetate agar; growth on potato fairly abundant and yellow-brown in color. There is a slight production in some instances of indol with the Salkowski test, but no reaction was obtained with the vanillin test, nor with Ehrlich's method; slight diastatic reaction takes place on starch agar; over 50 strains studied in 16 carbohydrates and higher alcohols showed no gas production at 37.5°C for 5 days. Acid is produced in

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all sugars with the exception of lactose, which remains neutral, with a slight tendency toward alkalinity; milk slightly acidified in 5 days. The thermal death point is 62° for 10 minutes; the bacterium lives in both distilled and tap water in the dark for over 20 days, but is killed in the same medium in the sunlight in less than 24 hours; on glass rods the organism retains its vitality in the dark for up to 89 hours, but loses it in the sunlight in less than 30 hours; resists dry heat to the extent of giving good growth when subjected to 75° C. for 5 minutes, but fails to give growth when subjected to the same temperature for 10 minutes. Killed in dilution 1:1,000 phenol, HgCl₂, 1:20,000. Stock cultures show decided loss of virulence after being transferred several generations on artificial media.

ARTIFICIAL INFECTION

Studies on 38 cases of typhoid, artificially infected per os, by subcutaneous inoculation, or through the drinking water, show the incubation period to be from four to six days before definite clinical symptoms appear. Temperature in severe cases runs as high as 111.5°, respiration going as low as 23. The organism was recovered from the blood current of infected birds in two instances, four days after infection and six days after infection. In one instance the organism recovered was used as an infecting agent of another bird, this bird dying, while the original host recovered, having a normal laying rate until accidentally injured. There is a slight formation of agglutinins during the early part of the disease, demonstrated by Widal, and macroscopic agglutination tests in low dilutions. Hematological studies show a reduction of erythrocytes; leucocytosis, with a decided increase in the polymorphonuclear leucocytes. There is a decided lack of coagulability of the blood. The polymorphonuclear leucocytes may run as high as 95 per cent while the lymphocytes go down to 5 per cent; the erythrocytes fall as low as 1,160,000; the face, comb, and wattles become anemic; hemoglobin may fall to 75 per cent.

Fig. 1.—Map of region in which eight outbreaks of fowl typhoid occurred in the winter and spring of 1922.
CLINICAL STUDIES

In the course of investigation of this disease, the writers were consulted on numerous outbreaks in the territory adjacent to the institution. The outbreaks were marked by exceptional severity of infection, with an ensuing high death rate. In these outbreaks the disease usually affected the adults. Clinically the symptoms are not pronounced at first, the birds being dull, sleepy, showing a loss in appetite, with marked increase in thirst. There is a rise in temperature with a sulphurous discharge from the bowels which sometimes is whitish mucoid in character. Death is usually preceded by partial loss of use of limbs, dispnoea, subnormal temperature and profuse diarrhea. The duration of the disease depends on the severity of infection and the natural resistance of the bird. Some of the birds doubtless recover, to become carriers through virulent bacilli voided in the dejecta.

GROSS AND MICROSCOPIC ANATOMY

Post mortem examinations show rigor mortis soon after death. The comb, face, and visible mucous membranes may be anemic. Serous effusion may be observed around the heart and liver; hydropericardium may be present; the heart is congested and has a parboiled appearance; microscopically congestion is present, some of the muscle fibres have lost their cross striation, and cloudy swelling exists. The gross appearance of the liver shows enlargement, friability, dark-red in some cases, areas of focal necrosis exist, and blood drips from the sectioned surface; microscopically both active and passive congestion is present, areas invaded by cells of inflammation indicating hepatitis; cloudy swelling present; some areas show groups of cells losing their nuclei and nearing focal necrosis. The kidneys appear swollen, the sectioned surface is graying in color, narrow red streaks are observed over the surface, indicating congestion; microscopically both active and passive congestion is present. Areas in which cells are losing their nuclei and nearing a state of focal necrosis are seen; glomerulitis may be present. The spleen is enlarged, dark, and sometimes mottled. The lungs are normal. *Eberthella sanguinaria* may be recovered from the heart, liver, spleen, kidneys, lungs, ovaries or testicles according to sex, bone marrow, and brain.

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**FIG. 2.—Map of region in which three outbreaks of fowl typhoid occurred.**

- Farm C - 3rd Epidemic
  - Loss: 29 out of 100 birds
  - Sanitary Conditions: Good

- Farm B - Initial Epidemic
  - Loss: 75 out of 87 birds
  - Sanitary Conditions: Poor

- Farm A - 2nd Epidemic
  - Loss: 12 out of 60 birds
  - Sanitary Conditions: Fair

**NOTATION:**
- No contact established between Farms A, B, C with B.
- Boys of Farm C visit with boys of Farm A.
- Hogs from Farm A sold to Farm C prior to epidemics.
- No birds or eggs sold or interchanged between farms.
EPIORNITHOLOGICAL STUDIES

As to the foci of infection, field studies in cases of well-defined epidemics have revealed in each case a starting point, with a definite advance of the disease. No conveying agent could be found, as only in rare instances could the investigators establish such contact between the locations of outbreaks as would be a factor in transmitting the disease. The possibility that English sparrows were the conveying agent is under investigation at the present time. Figures 1 and 2 show graphically the history of two typical epidemics of fowl typhoid. The progressive advance of the disease may be clearly traced.

METHOD OF CONTROL

The most practical method of treating this disease is vaccination, using autogenous vaccines when possible, and stock vaccines when the former are not procurable. The same principle of desensitization as in making other vaccines is used in preparing fowl typhoid vaccine, 24-hour bacillary saline emulsion being heated one hour at 60° C., tested for efficiency of desensitization by pig inoculation and cultures, and preserved with one-half per cent phenol. The dosage used was 1 cc. for adults and one-half cc. for chicks, each weighing 1 to 2 pounds.

In 19 epidemics 2,140 birds were vaccinated. Prior to vaccination the loss had been 303 birds in these flocks; subsequent to vaccination the loss was 41, practically all of the birds lost having well-defined fowl typhoid when vaccinated. Of 974 birds prophylactically vaccinated this year on infected premises, no losses occurred from this disease.