

FOOT DISEASE OF CHIPPING SPARROW (*SPIZELLA PASSERINA*)¹.¹Contribution No. 12, of the Baldwin Bird Research Laboratory.

BY T. E. MUSSELMAN.

(Plate VII)

IN 1923 I accepted the invitation of Mr. S. Prentiss Baldwin, to operate the trapping station at Inwood Plantation, Thomasville, Georgia, and during the six weeks there, in February and March, I handled from the traps more than 4000 birds, the greater proportion of them being Chipping Sparrows.¹ As I glanced through the records of previous years at the station I was interested to see many entries like the following: "Claw off, middle toe, left foot."—"Claw off middle and hind toe, right foot"—"Right foot diseased"—"Entire first toe gone off left foot," and in Mr. Baldwin's report for that station for 1921² under "diseased feet of Chipping Sparrows"—"about the same number, nearly ten per cent of Chipping Sparrows were found this year with diseased claws." "It is now evident that by making careful note of the condition of each toe, on a diseased bird, every time it is taken, it will soon be possible to know something of how rapidly the disease changes or spreads, and to what degree the claws may recover."

The next year 1922, Mr. L. R. Talbot operated this trapping station and noted in his report³ "That the disease is not just a claw disease, but effects the whole foot"; "that more than the usual percentage of Chipping Sparrows had diseased feet;—71 out of 287, new and returns, or nearly twenty-five percent"; and Mr. Talbot emphasized: "It should be carefully noted that these injuries are not in any way due to trapping or banding the birds."

Consequently upon taking charge of the station in 1923 and after consultation with Mr. Baldwin, I decided to undertake some study of this diseased condition.

¹ *Auk*, Vol. 40, No. 3, pp. 334-350—July 1923.² *Auk*, Vol. 39, No. 2, April 1922.³ *Auk*, Vol. 39, No. 3, July 1922—Page 345.

I secured a note book on each page of which I placed a stencilled copy of a Chipping Sparrow's Foot. Whenever I captured a bird showing the least evidence of the disease, I placed the band number of the bird in question above one of these pictures and from day to day as the bird repeated in the traps, I recorded the development of the disease using different colored inks and dating each new tracing.

During that six weeks I banded 519 new Chipping Sparrows, and handled 44 return birds of previous seasons, making a total of 563 individuals; and as these birds repeated more than three thousand times, this gave me an opportunity to study the disease from day to day.

A careful survey of this season's record showed that instead of 10 per cent of the birds being affected as suggested by Mr. Baldwin, in 1921, or 25 per cent as given by Mr. Talbot, in 1922, that 42 per cent of all Chipping Sparrows captured during my stay in 1923 were actually suffering from or had suffered previously from this disease.

Dr. John B. May was the 1924 operator at Thomasville.¹ He says; "Not only were 'Chipping Sparrows' very scarce, but almost none showed any signs of active 'foot' disease. Many birds had one or two toes or even an entire foot missing but they were old, healed cases, and I was unable to send any fresh ones to you or to the Biological Survey at Washington for pathological examination."

Mr. Herbert L. Stoddard, in charge of the Quail investigation south of Thomasville, at Beachton, Georgia, has likewise captured and banded many Chipping and Field Sparrows. In 1926, at my request, he attempted to capture a number of infected birds to be used in a pathological study of this disease. However, a letter received from him notified me that during 1926, the prevalence of the trouble was far less than in 1925 and that he really had difficulty in securing specimens which were sufficiently diseased to give us the best tests.

A comparison of these reports indicate that the disease is variable, being much more prevalent some years than others.

Believing that weather conditions might be a factor in stimulat-

¹ Auk, Vol. 41, No. 3, July 1924.

ing the activity of the disease, I obtained from the Weather Bureau, Department of Agriculture, Washington, the statistics on temperature and precipitation at Thomasville, Georgia, for the years 1921, 1922, 1923, 1924, 1925. The temperatures were more or less uniform, but the following comparison of disease and precipitation is suggestive, although no definite conclusion can be drawn from such limited data:

Year	Precipitation during March. The month covering the principal migration of Chipping Sparrows through Thomasville.	Yearly percentage of diseased birds.
1921	3.31	10%
1922	4.12	25%
1923	5.23	42%
1924	2.15	Birds reported scarce— little disease
1925	.69	No numerical data— practically no disease.

It is noticeable in this chart that the years in which the disease was most prevalent, were likewise years of most abundant precipitation.

In order to determine the general distribution of the disease, I wrote to many banding stations at various points throughout the country. At the University of Alabama, about one hundred miles west and one hundred twenty-five miles north of Thomasville, they had captured one hundred and forty-one Chipping Sparrows, but none of these had apparently been host to this disease. Mrs. H. C. Miller at Racine, Wisconsin, reported no evidence of such a disease. Other replies from the country in general showed an absence of the disease at other banding stations, except through the New England States where Dr. Alfred O. Gross has occasionally discovered afflicted birds. In my own experience at Quincy, Illinois, I have never captured a bird with this trouble. Only Mr. W. B. Tabor at Kansas, Illinois, reported some sort of foot infection among the Mourning Doves he was banding. This suggested that the disease at Thomasville was probably one of local distribution.

My next problem was to determine whether the trouble was bacteriological or systemic in nature, or due to some external

source. My first thought was that perhaps the birds might have fed in the yards of a commercial fertilizing plant and that their feet had been burned by some caustic material. However, treatment for burns proved the fallacy of this hypothesis. In order to determine whether the trouble was infectious, I captured a Chipping Sparrow and pricked its middle toe with a needle. I then smeared blood from the blood sac of an infected bird over the tiny wound and, after making proper records, released the bird. Almost daily I caught this Chipping Sparrow. It was ten days before I noticed any unusual coloring on the inoculated toe. Four days later this affected district showed unmistakable signs of distention, and by the 18th day the epithelium was so greatly proliferated that a blood sac was formed the size of a pea. It was so cumbersome that the bird could progress only with difficulty.

On March 22, 1925, at my request, Mr. Stoddard tried a similar experiment at the Beachton, Georgia, station. He confined two Field Sparrows in a roomy box. One had a very bad case of foot disease while the feet of the other were normal. The scab from the badly infected foot was pulled off which caused it to bleed profusely. The feet of the other bird were just slightly pricked in a similar spot. A drop of blood from the sore foot was then washed over these spots. Examined April 5, the spots were red and just slightly enlarged but not sore. They were again examined April 12, and one foot had a great and very sore enlargement ready to bleed at the slightest provocation. Up to May 1, it had not changed in size or character except to harden somewhat. A very small spot appeared on the other foot between the dates April 12 and April 19, but did not develop further.

Two other pairs with which he experimented, escaped before any developments were noted. One Field Sparrow, with a small spot on a toe was confined with the others in late March. As late as August 3, 1925, it was in good health except that in one spot it had a sore the width of a dime completely locking two of the toes together, making the foot useless and handicapping the bird greatly. I attribute the length of time during which the scab clung, to the fact that the bird being in captivity did not get the infected area soaked with water. On every bird that I watched,

the scab clung until a drenching rain—then followed the loss of scab and, in fact, the entire infected area.

Mr. Stoddard found Chipping Sparrows very delicate and prone to die in captivity, while the Field Sparrow was hardy and seemed to keep in perfect condition with very little care, making it an ideal cage bird upon which to experiment.

In order to make permanent observations, I had many pictures taken with a magnifying camera. I was fortunate in selecting as one of my principal studies a bird which not only lost every toe on its right foot, but which likewise contracted the disease on its tarsus. Pictures show the progress of the disease and I present these to show the extreme malignancy of the infection.

CHIPPING SPARROW NO. 37,127—LATER NO. 37,304.

On February 23, 1923, I captured Chipping Sparrow number 37,127 in trap C, making the notation; "Right middle toe, infected."

It was captured again on February 25. The toe had swollen badly, and was about the size of a large pea, and the tarsus also showed a slight infection. I sterilized a needle with heat and alcohol, and punctured the large sac which had formed. Six drops of blood were pressed out, and a weak solution of iodine applied to the infected parts. Likewise the diseased condition of the tarsus was treated.

Normally, this disease limits itself in its progress to the feet of Chipping Sparrows, but this bird seemed to be unusually susceptible to its ravages as the following pictures will show. The bird was captured again March 2, 3, 5, 6, 7, and on the 8th the following notation was made:—"Right heel badly infected, middle nail gone, will soon lose 2-thirds of middle toe." The band was removed from the infected leg, and a new band No. 37,304 was placed on the opposite leg. (Pl. VII upper photo, fig. 4)

March 14, I have the following notations: "Pictures taken, right tarsus badly swollen, infection undoubtedly spread from the toe to the tarsus, middle toe has rotted off, heel nail gone, right heel infected." (ibid fig. 3)

March 20, my notation is: "Third nail and part of toe gone." (ibid. fig. 2)

On the 21st I removed the scab from tarsus, the iodine treatment having delayed the disease at this point. The last toe had become infected near the nail. The bird was captured again on the 22d. On the 25th the tarsus was completely healed. The bird was captured again on the 27th. On the 29th is the following notation: "Black scab on first toe very large and hard." During the night a heavy rain occurred, and on the 30th I captured the bird again, making this notation: "Rain soaked off scab and took part of the first toe with it." (ibid. fig. 1.)

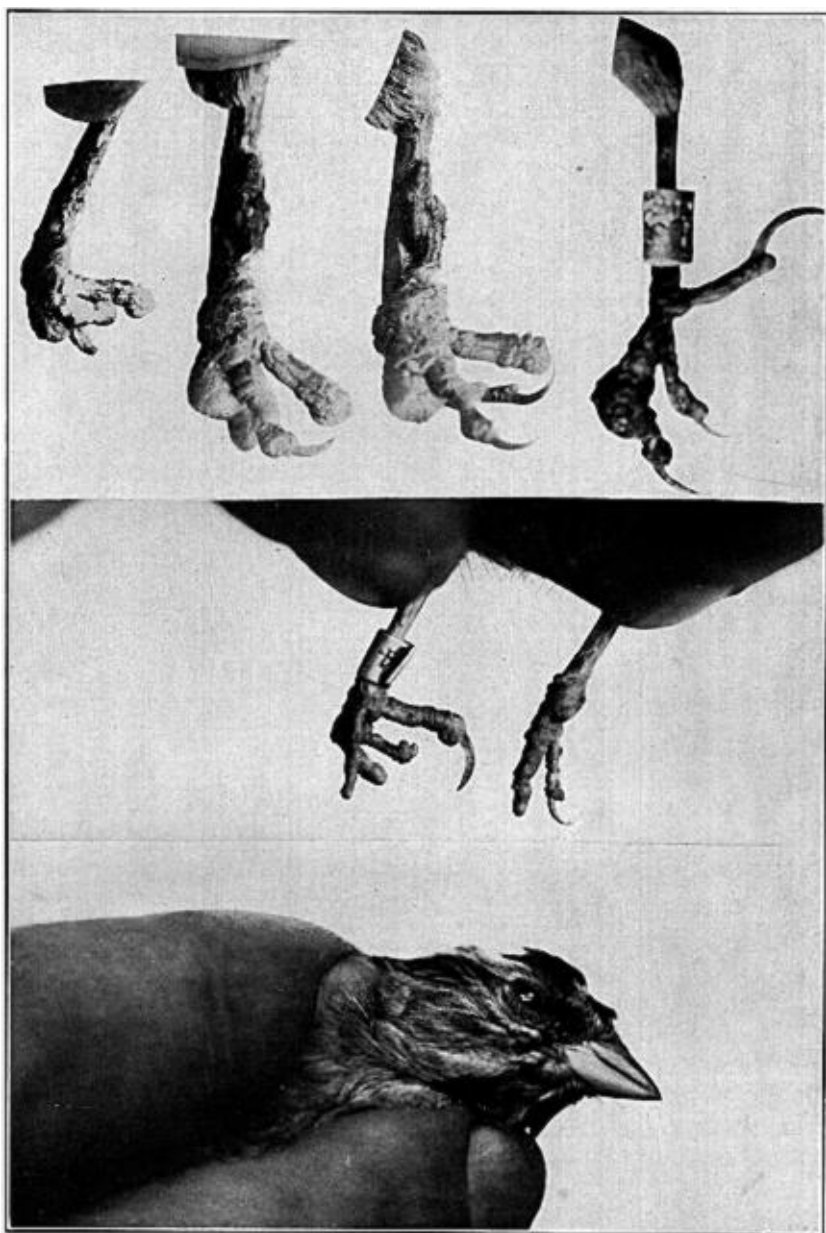
Thus in the course of one month's time this Chipping Sparrow had lost the entire complement of toes on its right foot; yet it showed little inconvenience because of the loss.

The following picture (Pl. VII. middle photo.) shows another bird which was banded in 1922 at which time its feet were deformed as seen in the picture. Yet in 1923 this bird fed with the flocks of Chippies and seemed very little inconvenienced by the affliction. The fact that it had lived for at least a year after the disease had run its course, indicates that it had met the dangers of migration and nesting equally well with those other birds about it which were not so handicapped.

The experiments convinced me at once that the disease was bacteriological in nature. As I had no microscope at Thomasville with which to make a histological study of the lesions, I communicated with Dr. E. E. Tyzzer, Department of Comparative Pathological, Harvard Medical School, Boston, Massachusetts, who, I had been informed, was very much interested in the diseases of birds. Upon furnishing him general information he suggested that the disease sounded very much like bird-pox and kindly offered to identify the disease if live birds were sent to him.

"This bird-pox is almost identical with the diphtheria and pox which afflicts domestic fowls, and to which Pheasants, Quail, and other wild birds are known to be susceptible" (Diseases of Domestic Birds, by Ward & Gallagher.)

In October 1925, I received a letter from a Mr. Murbach of Vermont, who had captured a Chipping Sparrow actively infected with a foot disease. His request for an identification sent to the Biological Survey at Washington was forwarded to me. I requested him to send the bird directly to Boston. Although it was



UPPER. RAPID PROGRESS OF FOOT DISEASE IN CHIPPING SPARROW, No. 37304
MARCH 30, 20, 14, 8.

MIDDLE. FEET OF A BIRD THAT HAD LIVED MORE THAN A YEAR WITH DEFORMED
FEET DUE TO DISEASE.

LOWER. BIRD-POX AFFECTING BASE OF BILL.

in a poor state of preservation upon its arrival, the slide of the disease mass from the foot, showed the trouble unquestionably to be bird-pox. It was the only time that I had known of the existence of this disease outside of the Thomasville neighborhood, and it was probably a specimen which passed through the district of infection on its migration northward. Of course, I was still uncertain that the Vermont specimen had a disease identical with that of the Georgia birds. Descriptions seemed the same so I requested Mr. Stoddard to send live birds with the disease in the primary stage to Dr. Tyzzer, also to the Pathological Division of the Biological Survey at Washington, as well as to me at Quincy, Illinois, for microscopic examination.

Of the two birds sent to Washington, one was dead and the other had already passed the bleeding stage and was in the black scab stage. An effort to transmit the disease to Canary birds was unsuccessful.

Several specimens were forwarded to Dr. Henry Ward at Urbana, Illinois. Laboratory tests in the Biological Department of the University of Illinois in an effort to inoculate live birds from the black scabs taken from diseased birds were likewise unsuccessful. In my own work I could get only negative reactions when experimenting with scabs. These three unsuccessful efforts led me to believe that the germ is infectious only during the bleeding period of the disease. In pox afflicted Domestic Chickens, however, "The scabs retain the virus of the disease and even after a period of five years may reproduce typical lesions."—(Ward and Galagher.)

I placed blood from a bleeding lesion under my microscope and found the bacteria too small to isolate, yet the life cycle of the disease with the characteristic lesions and scabby warts was truly typical of bird-pox.

The two birds with blood sacs and the typical warty scabs which were sent to Boston from Thomasville arrived in fair condition. Upon a histological examination Dr. Tyzzer again diagnosed the disease as bird-pox.

The prevalence of bird-pox in birds arriving at Thomasville probably is due to the fact that in no part of the country do Chipping Sparrows gather in such tremendous flocks as they do

south of there. The Chipping Sparrow is particularly susceptible to the infection, while the hardier Field Sparrow is not so easily inoculated. When a hundred or more birds gather in a sandy spot, only a few feet in diameter (I caught 51 birds at one fall of a drop trap 4' x 4') the presence of several birds with blood sacs spreading their germ-filled contents on the sand, would very quickly inoculate numbers of their companions whose feet are probably scratched or scarified from weeks of feeding on the sand, the infection undoubtedly occurring through the slightest lesion in the skin.

The following chart from the records of the year 1922 previous to my work at Thomasville is interesting:

Birds with no trace of disease.	216
Birds showing former infection now inactive.	28
Birds with active disease at the time of first catching.	40
Birds in which the disease developed at Thomasville.	3

A total of 25 percent show evidence of having been infected. A similar chart for 1923 is interesting:

Birds with no trace of disease.	322
Birds showing former infection now inactive.	110 or 19%
Birds with active disease at time of catching.	117 or 20%
Birds in which the disease developed at Thomasville.	14 or 2+%

The above chart suggests that the inception of the disease was probably somewhere south of Thomasville, as few birds which arrived in Thomasville with normal feet subsequently showed signs of its development.

On March 13, 1922, Chipping Sparrow No. 46,868 was caught. Comment: "Right foot middle toe swollen, claw coming out." This toe later disappeared and the foot healed. It was captured a year later on March 6, 1923, when the first toe, right foot, was swollen with characteristic bird-pox warts. This shows that the disease sometimes recurs in birds from year to year.

The trouble is not restricted to the feet and tarsus, however. About every one hundredth bird shows the infection about the head, particularly at the base of the bill as shown in Plate VII lower photo.

I could find no evidence of any sluffing of flesh or bill in several

such birds, but the characteristic pox wart was prominent at the base of the lower mandible.

Although these birds are probably inconvenienced by the incursion of the disease yet its course generally is quickly run and the bird soon recovers from the effect. Only in one case do I have record of its proving fatal.

Likewise Mr. Stoddard caught Chipping Sparrow No. 20,601-A, on February 27, 1925. Noting, "nail off rear toe left foot, otherwise normal."

"Return February 10, 1926, O. K."

"Return April 16, 1926. "In terrible condition, rear toes of both feet rotten with foot disease and sticking fast to breast feathers so tightly that bird could not hop. Both dried fast. Bird picked up dead next day, whole tarsi also terribly diseased."

Relative to the proper name for this disease, I again quote Dr. E. E. Tyzzer of Harvard University in a letter to Mr. Baldwin: "I think that 'bird-pox' is the only appropriate name for the disease in question affecting wild and domestic birds. It is sometimes called Contagious Epithelioma of birds, but while it is definitely contagious, the Epithelioma is more or less of a misnomer.

"All that is known about the causitive organism is that it is so minute that it is not visible under ordinary high magnification, and will pass through the porcelain filter. It has never been cultivated and like the causative agents of smallpox, vaccina, and other similar diseases, it is spoken of as a 'virus.' The organism not being recognizable nor culturable, it has never been given any specific name."

Remedies: A harmless and efficient cure is Mercurochrome in a four per cent solution. This liquid may be painted on with a small brush or bit of cotton, and is equally good not only to cure infection on birds from the traps, but also for use on animals or the bird bander himself to prevent infection in minor wounds. Mild cases of pox on trapped birds have been cured by one application, though in more serious cases where the birds have been coming to traps regularly we have made several applications about two days apart.

Another harmless remedy in ointment form is made up of Liquor

Carbonis Detergens one dram, worked into Unguentum Boracic Acid one ounce. Other efficient remedies are Mercury Bichloride or Silver Nitrate but as these are much more dangerous drugs they are best used only by those who are experienced in their use.

SUMMARY

Histological examination seems to prove the disease to be bird-pox: Careful study of several individuals shows that the disease is infectious during the bleeding period; that it can be inoculated from one bird to another; that the period of incubation is about ten days; that the enlargement of blood sac is at its height from the fifteenth to the eighteenth day; that the cracking and bleeding extend over a period of three days to a week at which time a scab forms; that with wild birds this scab hangs normally for several days but cases have been recorded in captive birds when the scab hung for several months; that the scabs are typical warts as found in bird-pox on domestic fowls; that in severe cases the lesions are so deeply seated that upon the dropping of the scab, the nail or toe is removed; that the scab is lost generally after a period of rainfall; that in many cases the entire disease cycle is complete within a month; that its distribution has been most noticeable in the Thomasville area and along the probable northern migratory course of these birds into the New England states where numerous afflicted birds have been reported; that the majority of the diseased birds are infected before arriving in Thomasville; that the disease is variable from year to year; that it seems to be most active during the months of February and March; that this disease generally does not affect the health of the bird; that the disease seems to be limited in its activities to the feet except in rare cases; that a bird which has suffered from the disease one year is not immune, but may be re-infected. (Chipping Sparrows No. 46,868 and No. 20601A.) That normally, although deformed, the bird recovers its health, but occasionally the disease proves fatal. That bird-pox seems more active during years of abundant precipitation than on years characterized by a little rain; that the infection of birds is in no way associated with bird banding; that the working out of the life cycle of the disease was made possible by the regular attendance at the traps and the accurate registry of each infected

bird by means of the numbered bands issued by the U. S. Biological Survey.

In conclusion I wish to extend my appreciation to Dr. E. E. Tyzzer of Harvard University, for his positive identification of the disease as bird-pox; to Mr. Herbert L. Stoddard of Beachton, Georgia; to Dr. John B. May; to Mrs. H. C. Miller of Racine, Wisconsin; to Dr. Henry Ward of Urbana, Illinois; and to Mr. S. Prentiss Baldwin of Cleveland, Ohio, for their untiring efforts to secure data, diseased birds for identification, and the reading and publication of manuscript pertaining to the experiment. Without their help, I could scarcely have carried on my investigation because of my isolation from the seat of disease activity.

Quincy, Illinois.