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A NOTE ON THE OCCURRENCE OF SPIROCHAETOSIS OF FOWLS IN SOUTHERN NIGERIA

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PLATES II, III

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Spirochaetosis of fowls, first described by Marchoux and Salimbeni,¹ in Brazil, and subsequently studied by a number of workers, notably by Balfour,² occurs in many countries. In Africa the disease has been recorded in Khartoum by Balfour,³ in Southern Rhodesia by Bevan,⁴ in the neighbourhood of Tunis by Comte and Bouquet,⁵ in Senegal and Somaliland by Brumpt,⁶ in the French Soudan by Bouet,⁷ in the vicinity of Cape Town by Jowett,⁸ and in the German Cameroons by Mohn.⁹ But so far as we are aware, its occurrence in British West Africa has not hitherto been chronicled.

In August, 1913, it was noticed that a fatal disease was attacking the poultry kept at Iju, near Lagos, in Southern Nigeria. Both ducks and fowls were dying off rapidly, and from the symptoms described, it was suspected that the disease would prove to the spirochaetosis. Thanks to the kindness of Mr. Harris, we were able to examine the bodies of several of the birds that had succumbed, and later on to study the disease in both fowls and Muscovy ducks.

On making enquiries in the neighbourhood, it was found that the disease was well known to the natives. Poultry rearing is almost universal in the villages of Nigeria, and all the natives questioned regarding the disease professed to be well acquainted with it. They recognised that when once it appeared it spread

rapidly amongst their fowls, but they did not associate the disease with any particular condition, unless it were with the cold weather that accompanies the rainy season. Their treatment consisted in rubbing the legs of the infected birds with shea butter, a measure that had proved quite unsuccessful in the cases that came under our notice.

SYMPTOMS

The symptoms observed were those generally described in this disease, and were fever, diarrhoea, anaemia, somnolence, and paresis. The accompanying photographs (Plate II) illustrate the aspect of the infected birds. At first they showed only slight symptoms of illness although the blood might be swarming with spirochaetes. The comb appeared to be unusually pale, there was slight diarrhoea, and the birds showed a tendency to stand for long periods with their feathers ruffled and their heads sunk between their shoulders. When they moved, their gait was staggering. Later the anaemia deepened, somnolence became a conspicuous feature, and paralysis of the wings, and especially of the legs, followed. Finally, the birds were unable to stand, and lay prone on the ground until death occurred. The appetite remained good almost up to the end.

The disease first showed itself in some Muscovy ducks, but subsequently spread to the fowls kept in the same compound. Some of the birds attacked were chickens. All the infected fowls were thoroughly searched for ticks and other parasites, but none were found with the exception of a few fleas on the combs which have been identified by Mr. N. C. Rothschild as *Echidnophaga gallinaceus*.

POST-MORTEM APPEARANCES

After death the bodies of the birds were found to be wasted, and the tissues unnaturally pale. The spleen was always considerably enlarged. The most conspicuous feature was, however, the condition of the liver which was greatly enlarged, and in which necrotic patches occurred sometimes of considerable size. In one case a large blood clot was found in the stomach.

MORPHOLOGY OF THE PARASITE

But little need be said about the morphology of the spirochaete, since it appeared to be very similar to that described by Balfour in the case of the Sudanese strain. The general appearance of the parasites is shown on Plate III (Figs. 1, 2). The spirochaetes varied greatly in length, and in the number of their spirals. Some forms were as short as 9μ , and had only three or four spirals, others were as long as 27μ or more, and had twelve or fourteen spirals. The latter were of the combined type, and appeared to consist of two spirochaetes connected by a very fine filament. In some cases the spirals were close, in others they were open. One end of the body was often curled up. The bodies of the spirochaetes were pointed at each end, and in some individuals chromatic dots were clearly visible. In others breaks or gaps occurred in the central core. The breadth of the body varied considerably, some of the parasites being very much stouter than others. Some forms which appeared at first sight to be stout individuals proved on more careful examination to be made up of two spirochaetes. The appearance suggested the result of a recent longitudinal division.

BLOOD CHANGES

In addition to the condition of the blood described above, certain changes in the leucocytes were observed. Large vacuolated mononuclear cells were commonly met with, and ingestion of red blood corpuscles was seen to have occurred. Both these phenomena have been previously observed by Levaditi,¹⁰ and need not be further discussed. Figs. 3 to 6 on Plate III illustrate the condition described.

INOCULATION INTO MAMMALS

Marchoux and Salimbeni found that guinea-pigs were insusceptible to the parasite of Brazilian septicaemia of fowls, and Balfour failed to infect gerbils by inoculations with the Sudan strain. The latter author concludes that 'this is an avian spirochaetosis, non-transmissible to mammals.' But Levaditi and Lange have shown that fowl spirochaetes may produce a benign infection in rabbits, and Deutz¹¹ has succeeded in infecting mice.

In our experiments one rat was inoculated subcutaneously with blood from a Muscovy duck, in which countless spirochaetes were present. The animal never showed the parasites in its blood, and no signs of spirochaetal infection were observed.

ACTION OF ATOXYL AND SALVARSAN

Both atoxyl and salvarsan have been proved to give satisfactory results in the treatment of spirochaetosis of fowls in other countries. In our investigations we employed the former drug in three cases, and the latter in two.

ATOXYL. Three fowls were treated by subcutaneous injections of 3/50 gr. atoxyl.

Fowl 99. On August 29th, 1913, the first injection was given. At this time the fowl showed definite symptoms of the disease. The comb was very pale, there was diarrhoea and somnolence, and the gait was unsteady. Spirochaetes were numerous in the blood, and some clumps were present. The next day no parasites could be found in the blood, and they did not reappear subsequently. The inoculation was repeated on the 4th and 7th days. By the 11th day the bird seemed to have regained its normal condition, and a month later was still apparently quite healthy.

Fowl 100. A young bird showing well-marked symptoms—anaemia, ruffled feathers, diarrhoea and uncertain gait. Spirochaetes scanty. The first injection was given on August 31st, and was repeated on the 3rd and 6th days. No spirochaetes were seen after the first injection, and the bird rapidly recovered, and appeared to be in normal health by the 10th day.

Fowl 101. A young bird showing well-marked symptoms. Spirochaetes very numerous in the blood. The first injection was given on August 31st, and the dose was repeated on the 3rd and 6th days. Spirochaetes continued to be present in the blood until the 6th day. The day after the second injection the blood was found to contain masses of tangled spirochaetes. No parasites were seen on subsequent days, but the bird continued to show symptoms of the disease, and died on the 11th day after the first injection.

In the first two cases atoxyl appeared to effect the cure of the disease. In the third, either the condition had advanced too far before treatment was begun, or the dose of atoxyl was insufficient to destroy the parasites before they had effected mortal injuries on the host. In spite of the injections the disease progressed to the so-called 'crisis,' the spirochaetes agglutinated into clumps, and vanished from the peripheral blood, and eight days later the bird died.

SALVARSAN. Two fowls were treated with subcutaneous injections of salvarsan triturated with oil. The dose employed was in each case 0.002 gm.

Fowl 97. The fowl showed well-marked symptoms of spirochaetosis, and the blood was swarming with parasites. The first injection was given on August 30th, and was repeated on the 4th and 7th days. A few spirochaetes were found in the blood on the day after the first injection, but none was detected subsequently. During the first few days the paralysis of the legs and the wings progressed until the bird was unable to stand, then some improvement began to take place so that the fowl was able to move about unsteadily by the 11th day. The other symptoms began to improve simultaneously. Six weeks later the bird appeared to be in good

health in every respect excepting that the paresis of the wings and legs persisted. No marked improvement in this latter symptom has taken place during the last month.

Fowl 98. The bird appeared to be in an advanced stage of the disease, it was quite unable to stand, and lay helpless on the ground. The blood contained countless spirochaetes. The first injection of salvarsan was given on August 30th, and the dose was repeated on the 4th and 7th days. Spirochaetes were still numerous the day after the first injection, and a few were present on the third day. From this time onwards no more parasites were seen. The condition of the bird began to show definite improvement from the 6th day, and by the 11th day recovery was well nigh complete. Six weeks later the fowl appeared to be in perfect health.

In both these cases salvarsan appeared to save the life of the bird. In the case of Fowl 98, this result was remarkable considering the stage to which the disease had advanced before treatment was begun, and the failure of atoxyl to prevent death in the case of Fowl 101, which was not in so serious a condition. This observation corresponds with those of Dschunkowsky,¹² who found salvarsan to be more active than atoxyl in the treatment of spirochaetosis of geese. The persistence of paresis after recovery from spirochaetosis was observed as a sequel to the illness by Marchoux and Salimbeni.

THE 'AFTER PHASE' BODIES OF BALFOUR

Balfour has described certain appearances in the red blood corpuscles of fowls suffering from spirochaetosis which he has termed 'after phase bodies,' and which he considers represent a stage in the development of the parasite. They occur especially during the post-critical stage of the disease, at a time when free spirochaetes cannot be detected in the blood by the ordinary methods of examination. They have been described by Jowett in the spirochaetosis in the vicinity of Cape Town, as well as by Balfour in the Sudanese strain.

We have naturally looked for these bodies with considerable care in the cases that we have studied in Nigeria. We have not, however, succeeded in convincing ourselves of their presence. In a few corpuscles we have seen bodies not unlike those figured by Balfour, but they have shown little or no structure, and might be accounted for by some other cause. Even if these bodies were the 'after phase bodies' of Balfour, they occurred in such small numbers as to constitute a marked difference between the Sudanese and Nigeria strains.

Several species of parasites seem to be concerned in the condition known generally as spirochaetosis of fowls. The parasite of the Brazilian septicaemia, named by Stephens and Christophers *Sp. gallinarum* (= *Sp. marchouxi*, Nuttall),¹³ appears to be the most common, and is by some authors considered to be the only species. Brumpt, however, has distinguished the Tunisian strain and the Senegal strain from this species on account of immunity reactions, and has named the former *Sp. nicollei*, and the latter *Sp. neveuxi*. Balfour also has reluctantly decided that the Sudan strain constitutes a new species for which he proposes the name *Sp. granulosa*. In addition to these species, the spirochaete found by Sakharoff attacking geese in the Caucasus has been called *Sp. anserina*. This parasite is, however, capable of infecting fowls, producing in them a disease similar to that caused by *Sp. marchouxi*.

We have been unable to investigate the immunity reactions of the spirochaete infecting poultry in Nigeria, so that it is impossible to determine exactly the species to which it belongs. Morphologically, the parasite appears to be identical with *Sp. marchouxi*, and the symptoms of the disease, and the post-mortem appearances are similar to those described in the case of Brazilian septicaemia of fowls. In several respects the disease differs from that described by Balfour in Sudanese fowls.

It would not be unnatural to expect that fowl spirochaetosis in Brazil and in West Africa might be due to the same species of parasite. In the days when slaves were exported from West Africa there must have been constant communication between the two countries, and it is not unlikely that fowls, some of which may have been infected with spirochaetes, were carried over to Brazil. It is interesting to note in this connection that Blaizot,¹⁴ as quoted by Balfour, believes that from a study of the question of immunity, 'it may yet be possible to affirm that Africa is the original country whence avian spirochaetosis spread.'

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EXPLANATION OF PLATES

Avian spirochaetosis.

PLATE II

Fig. 1, 2, 4, and 5. Fowls in various stages of the disease. Note. the attitude, the ruffled feathers, the somnolence, and the paresis of the wings and legs.

Fig. 3. Muscovy duck in a late stage of the disease, and unable to stand on its legs.

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PLATE III

- Fig. 1. Spirochaetes, long and short, some with few, some with numerous spirals. Chromatin dots seen in some parasites.
- Fig. 2. Group of coiled Spirochaetes.
- Figs. 3, 4. Vacuolation of mononuclear leucocytes.
- Figs. 5, 6. Auto-erythro-phagocytosis in duck's blood.