SARCOCYSTIS IN BIRDS[1]

BY ARNOLD B. ERICKSON

Plate 10

THE protozoan genus *Sarcocystis,* which is parasitic in the muscles of vertebrates, has been reported from eight orders, thirteen families, nineteen genera, and twenty species of birds. In Europe it has been found in the Domestic Fowl and Duck, the Wild Duck, and doubtfully in the European Blackbird (Babudieri, 1932, believes that *Sarcocystis turdi,* reported for the European Blackbird, is an intestinal coccidian). In Africa it has been recovered from one species—the Red-faced African Mouse-bird. All other references to its occurrence in birds relate to the Americas. In North America it has been reported as occurring in eleven species of birds; in South America, six species; in Central America, one species. As new host records we may add Wilson's Snipe (*Capella delicata*), the American Pintail (*Dafila acuta tzitzihoa*), the Blue-winged Teal (*Querquedula discors*), and the Gadwall (*Chaulelasmus streperus*).

The snipe was collected south of Minneapolis, Minnesota, on October 17, 1939, by R. M. Berthel and Arnold B. Erickson. When the bird was flushed, nothing abnormal was noted in its flight; but on skinning, it was found that the muscles of the breast, neck (Plate 10), legs, and the chin contained many white cysts of *Sarcocystis.* They were especially prominent in the muscles of the neck and the tibiae, where they lay close to the surface. In the pectoral muscles, however, they were more deeply imbedded and occurred all the way to the sternum. The spindle-shaped cysts averaged 2.69 mm. in length by 0.441 mm. in width at the middle. The smallest one was 2.18 mm. long by 0.469 mm. at the middle; one end was 0.486 mm. wide and the other 0.405 mm. wide. The largest one was 3.24 mm. long by 0.437 mm. wide at the middle; one end was 0.340 mm. wide and the other 0.324 mm. wide. It is evident that there is a tendency for one end of the cyst to be slightly wider than the other. The minute spores (Plate 10) measured 8.15 micra in length by 1.63 micra in width. Neither the spores nor the cysts differ enough from those of *Sarcocystis rileyi* to warrant the description of a new species.

The Pintail was captured in a weakened condition along with several hundred Mallards at Heron Lake, Minnesota, on December

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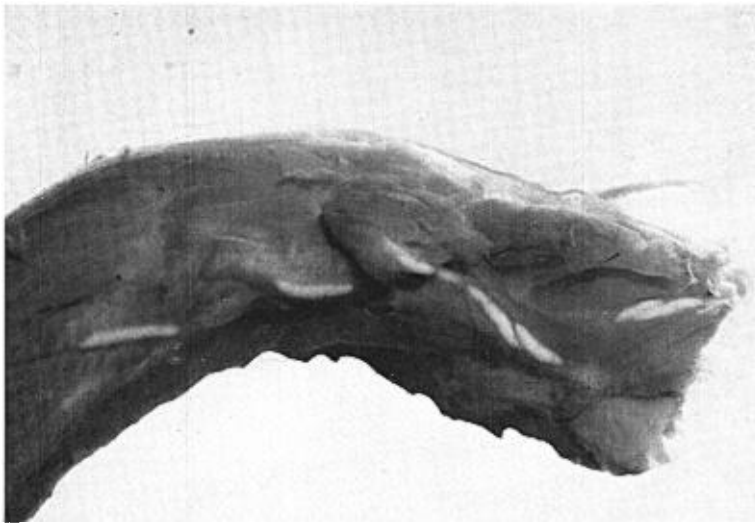
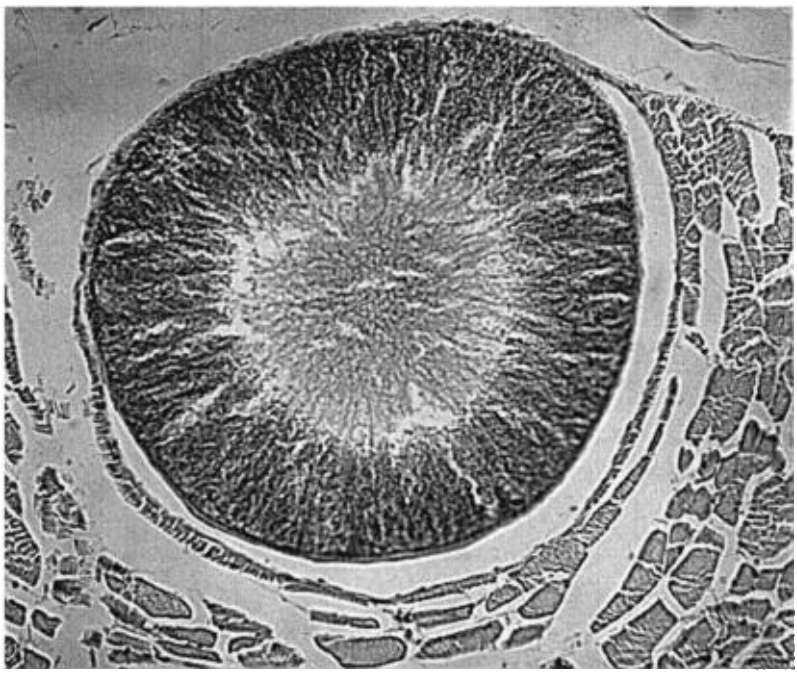


Sarcocystis rileyi IN NECK OF WILSON'S SNIPE. × 3.



CROSS-SECTION OF *Sarcocystis rileyi* FROM WILSON'S SNIPE. SHOWING MINUTE SPORES WITHIN THE TERETE CYST. × 180.

28, 1939, and was sent to the Division of Economic Zoology, University of Minnesota, where it died on January 2, 1940. There was no evidence that it had succumbed to lead poisoning, as many of the Mallards subsequently did. The fact, however, that it was heavily infested with *Sarcocystis rileyi* in all of the skeletal muscles and the heart may have been a factor contributing to its death. It was much emaciated, weighing but 525 grams.

The Blue-winged Teal was given to Dr. Alan Morrow of Fergus Falls, Minnesota, on October 1, 1939, by a hunter, and on skinning, white streaks were noted throughout the muscles. The bird was submitted to Dr. R. Fenstermacher of the Division of Veterinary Medicine, University of Minnesota, who diagnosed the infection as *Sarcocystis rileyi.* Some doubt developed as to whether the bird may have been a Green-winged Teal, but Dr. Fenstermacher states that the carcass was the size of a Blue-winged Teal.

The Gadwall was found dead at Clayton Lake, Martin County, Minnesota, on April 6, 1940, by Mr. C. E. Carlson. The bird had been shot through the left breast by a rifle bullet. On skinning, it was found to have a light infection of *Sarcocystis rileyi* in the pectoral muscles. Sections of infected muscle were made which substantiated the field diagnosis.

The frequency of occurrence of *Sarcocystis* in birds is not known. The infection is common enough, however, so that a few cases come to the attention of parasitologists and conservation departments each year. Of 279 ducks of eighteen species examined in the Division of Economic Zoology, University of Minnesota, from 1931 to November, 1939, eight or 2.86% were infected with *Sarcocystis rileyi.* Six of these were Mallards and two were Shovellers. One of the latter, constituting a recent record, was taken on November 11, 1939, at Wheaton, Minnesota, and submitted by Mr. C. Gordon Fredine.

The autopsy records of the Minnesota Wildlife Disease Investigation indicate that of 43 ducks of eight species collected from 1933 to March 27, 1939, three or 6.97% were infected with *Sarcocystis rileyi.* All three were Mallards taken in Minnesota. Since a large proportion of the ducks that come in for examination are sick, diseased, or crippled, it is probable that the percentage of infection of *Sarcocystis* here given is much greater than in the duck population as a whole.

Previous to 1931 there were four records of the occurrence of *Sarcocystis* in ducks in Minnesota. Two of these were collected in 1919 and two in 1930 by Dr. W. A. Riley, Chief of the Division of Entomology and Economic Zoology, University of Minnesota, who reported them in 1931.

During the 1935 hunting season there were three records brought to the attention of Dr. Gustav A. Swanson, then Biologist with the Minnesota Conservation Department. One was from the Mississippi River below Spring Lake, Minnesota, and a second was received from the Upper Mississippi Wildlife Refuge near Winona, Minnesota. The third report was from Geneva Lake in Freeborn County, Minnesota, where Warden Herman Baudler reported that six Mallards from a bag of ducks taken in one day were all heavily infested. One of these ducks was submitted for examination. A week later three more infected Mallards were taken at the same lake.

To date all records of *Sarcocystis* in ducks pertain to the puddle or dabbling ducks. A possible explanation for this may be that the ducks become infected either by eating flesh containing ripe cysts or by eating food contaminated with excrement of an infected animal; and since the pond ducks characteristically feed in shallow water, they would probably be much more exposed to fecal contamination than the diving ducks that feed in deeper water. Also they are more prone to feed in corn and stubble fields than are the diving ducks and would again be more exposed to fecal contamination.

In order to make the published information on avian hosts of *Sarcocystis* more available the following outline has been prepared. The bird names, as used in earlier lists, have been changed to conform with the A. O. U. 'Check-list,' 1931, and 'Catalogue of Birds of the Americas' by Charles B. Cory and Charles E. Hellmayr, and the ordinal and family names have been included as a further source of information. Authorities for hosts and localities have in each case been listed.

AVIAN HOSTS OF THE GENUS *Sarcocystis*

Order ANSERIFORMES

Family Anatidae

Anas platyrhynchos platyrhynchos (Mallard).—*Sarcocystis rileyi* (Stiles, 1893). C. V. Riley, 1869; Leidy, 1875; Stiles, 1893; Crawley, 1911; W. A. Riley, 1931; Green and Shillinger, 1933, 1935; Shillinger and Wetmore, 1938; this paper. United States.

"Wild Duck" *Anas? platyrhynchos platyrhynchos* (Mallard).—*Sarcocystis anatina* Krause and Goranoff, 1933. Bulgaria.

Anas platyrhynchos domesticus (Domestic Mallard).—*Sarcocystis* sp., v. Betegh and Dorcich, 1912. Germany. *Sarcocystis rileyi* Hall, 1925. United States.

Anas rubripes (Black Duck).—*Sarcocystis rileyi.* Mathews, 1930; Gower, 1938. United States.

Chaulelasmus streperus (Gadwall).—*Sarcocystis rileyi.* This paper. United States.

Dafila acuta tzitzihoa (American Pintail).—*Sarcocystis rileyi.* This paper. United States.

"Teal"? *Querquedula discors* (Blue-winged Teal).—*Sarcocystis rileyi.* This paper. United States.

Spatula clypeata (Shoveller).—*Sarcocystis rileyi* (Stiles, 1893); W. A. Riley, 1931. This paper. United States.

Order FALCONIFORMES

Family Cathartidae

Cathartes aura septentrionalis (Turkey Vulture).—*Sarcocystis* sp., Osterud and Bascom, 1928. United States.

Family Falconidae.

Leucopternis sp. (Ghiesbrecht's Hawk).—*Sarcocystis* sp., Darling, 1915. Panama.

Order GALLIFORMES

Family Phasianidae

Gallus gallus (Domestic Fowl).—*Sarcocystis* sp., Kühn, 1865. Germany. *Sarcocystis* sp., Hames (cited in Stiles, 1893); Stiles, 1894. United States. *Sarcocystis horwathi* v. Rátz, 1908. Hungary. *Sarcocystis gallinarum* Krause and Goranoff, 1933. Bulgaria.

Order GRUIFORMES

Family Rallidae

Aramides saracura (Saracura Wood-rail).—*Sarcocystis aramidis* Splendore, 1907. Brazil.

Order CHARADRIIFORMES

Family Scolopacidae

Capella delicata (Wilson's Snipe).—*Sarcocystis rileyi.* This paper. United States.

Order CUCULIFORMES

Family Cuculidae

Guira guira (Guira Cuckoo).—*Sarcocystis corderoi* Vogelsang, 1929. Uruguay.

Order COLIIFORMES

Family Coliidae

Colius indicus [= *erythromelon*] (Red-faced African Mouse-bird).—*Sarcocystis colii* Fantham, 1913. Africa.

Order PASSERIFORMES

Family Turdidae

Turdus merula (European Blackbird).—*Sarcocystis turdi* Brumpt. Rivolta, 1874 (cited by Bütschli); Brumpt, 1913. Europe.

Family Compsothlypidae

Compsothlypis [= *Parula*] *pitiayumi* (Olive-backed Warbler).—*Sarcocystis* sp., Barrows (cited by Stiles, 1893). Argentina.

Setophaga ruticilla (American Redstart).—*Sarcocystis setophagae* Crawley. Stiles, 1894; Crawley, 1914. United States.

Family Ploceidae

Passer domesticus (English Sparrow).—*Sarcocystis corderoi* Vogelsang, 1929. Uruguay.

Family Icteridae

Molothrus bonariensis (Shiny Cowbird).—*Sarcocystis debonei* Vogelsang, 1929. Uruguay.

Family Fringillidae

Hedymeles ludovicianus (Rose-breasted Grosbeak).—*Sarcocystis falcatula* Stiles, 1893. Canada.

Myospiza humeralis meridiana [= *Ammodramus manimbe*] (Venezuelan Grass-

hopper Warbler).—*Sarcocystis* [= *Miescheria*] *ammodrami* Splendore, 1907. Brazil.

Ornithologists, taxidermists, sportsmen, and others who skin or handle birds can help increase the knowledge of the geographic and species distribution of *Sarcocystis* by watching for the white tube-shaped cysts in the skeletal muscles.

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