BIRD TICKS AS DISSEMINATORS OF WILDLIFE DISEASES

by

D. E. Sonenshine[1], E. L. Atwood,[2] C. M. Clifford,[3]
John T. Lamb, Jr.[4] C. H. Robbins,[5] and David Bridge[6]

Introduction

Wildlife diseases on occasion also involve man. Some of the worst scourges in history were of diseases in which man was and still is, normally, only an incidental host. Plague, for example, is essentially a disease of rodents, though the reasons for this are usually circumstantial. The flea transmitter, and the bacterial pathogen, are not necessarily so restricted, but the normal balance of relatively stable rodent populations, with substantial numbers of immune animals balancing the numbers of non-immunes, the predilection of rodent fleas for their rodent hosts, all tend to restrict the confines of this condition. On occasion, this enzootic breaks apart. The host population is decimated, the starved fleas seek their meals elsewhere, and pathogen cycle suddenly expands. If humans are handy, they may be attacked by the fleas, and thus acquire the infectious agent. Instead of an epizootic, an epidemic now results.

Few educated humans, and certainly, no Public Health officials, would ignore evidence of plague organisms in their local wildlife. However, the ignorance of other wildlife diseases which can, and occasionally do spill over into the human environment is considerable. The natural occurrence, in vectors and vertebrate hosts, of many wildlife diseases which also infect man is rather poorly known, especially in regard to rates of natural infection, relative importance of various vertebrate hosts, or the influence of human activities in potentially accelerating the chances of human disease.

The role of birds, particularly migratory birds, is of especial interest in this discussion because of the opportunity provided by their movements for dissemination of pathogenic agents.

1 D. E. Sonenshine, Biology Department, Old Dominion College, Norfolk, Va.
2 E. L. Atwood, Chief, Biostatistics Section, Division of Preventive Medicine, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D. C.
3 C. M. Clifford, Scientist, U. S. Public Health Service, Rocky Mountain Laboratory, Hamilton, Montana
4 J. T. Lamb, Jr., Biology Department, Columbia Union College, Takoma Park, Maryland
5 C. H. Robbins, Chief, Migratory Non-Game Bird Studies, Division of Wildlife Research, Migratory Bird Populations Station, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service, Laurel, Maryland
6 D. Bridge

Some arthropod-borne diseases in which birds are known to be or are potentially involved.

Rocky Mountain Spotted Fever	Murray Valley fever (African)
Q fever	Russian spring-summer encephalitis
Equine encephalitis (St. Louis, Eastern, Western, Venezuelan)	Louping ill (European)
Japanese B encephalitis	West Nile fever (African)
Tick-borne Tularemia	Kysanur Forest disease (India)

It is strongly suspected that migratory birds are involved in disseminating these agents, thereby creating new foci of infection. In India, in 1957, a new disease, Kysanur Forest disease, rather closely related to Russian spring-summer encephalitis, occurred in circumstances which strongly implicated migratory forest birds in transport of the infectious agent from the nearest known focus of infection in northern Europe and the Soviet Union. In South Africa, West Nile fever infections have occurred at times coincident with the arrival of migratory birds, and when cold weather would have destroyed the natural infection in the native mosquito population.

Russian workers have observed survival and transmission of normally mosquito borne encephalitis agents in ticks. A strain of tick borne encephalitis was isolated from Ixodes plumbeus from sand martins in Siberia by Russian workers (according to Philip, C. B. 1963, Advances in Acarology, Cornell University Press, Ithaca, N. Y. P. 292).

In a recent study of fall migrants passing through Egypt, 3.31% of the 31,434 birds examined were found to be infected. (Hoogstraal, H. 1963, Bull. Wld. Hlth. Org. 28: 235-262). While this is not a large or impressive figure, it should be borne in mind that, according to at least one author, (Moreau 1961, Ibis, 103a: 373, 580) about 600 million birds migrate from Europe to Africa each year. Hoogstraal reported an average of 1.69 ticks/bird during his studies in Egypt in 1959-61. If Moreau's estimate is accepted, this would result in transport of 1 billion, 14 million ticks. These ticks have been long known as vectors of Q fever, Russian Spring-Summer Encephalitis, tularemia, and other less well known agents as well as a variety of strictly animal diseases.

In the United States, extensive studies are now in progress in several localities in which the role of birds in the epidemiology of disease is being considered. One such study is the vicinity of Chincoteague Island, concerned with Eastern Equine Encephalitis; another is on the ecology of Rocky Mountain spotted fever in Virginia. Sera from 55 different species of birds collected in Virginia and Maryland were tested for antibodies against this agent, and spotted fever antibodies were found in the sera of one or more individuals of 18 species. (Unpublished progress report, PHS project CC00072, Dorer, et al., 1964).

Procedures

Birds taken in mist nets at specific banding locations were examined for the presence of ticks. The banding stations were located in Maryland at Kent Point (Chesapeake Bay), Ocean City, and the Patuxent Wildlife Refuge. The investigators examined the head and neck regions of each bird. Observed ticks were removed with forceps and transferred to cellulose-acetate tubes containing a moist plaster-charcoal mixture, and stoppered with absorbent cotton in gauze. The live specimens were then shipped to the senior author for identification and subsequent transport to the Rocky Mountain Laboratory in Hamilton, Montana. At this final destination, the specimens were ground in diluent solutions and the resultant suspensions inoculated into non-immune guinea pigs. Serological tests were done on sera from the inoculated animals to determine whether Rocky Mountain spotted fever antibodies were developed. In this way, it is hoped to detect the presence of the pathogens in the ticks.

Results

Studies on the possible presence of infectious Rocky Mountain spotted fever group rickettsiae in the tick specimens are still in progress, and discussion of the results to date is premature.

Tick specimens of three species were found on 38 species of birds. The ticks were Haemaphysalis leporispalustris ("rabbit tick"), Ixodes dentatus, and Ixodes brunneus. (The latter represented by one specimen). The birds most commonly infested were veeries, thrushes (especially the Northern water thrush, Swainson's thrush, and grey-cheeked thrush), sparrows (especially the white throated sparrow), the brown thrasher, and the junco. Marked differences in seasonal occurrence between the 2 more abundant tick species, H. leporispalustris and I. dentatus, were noted. H. leporis palustris was most abundant on migrants examined in early September, whereas, I. dentatus was most abundant on birds examined in early November.

These studies are still in progress. It is hoped to continue studies of fall and spring migrants during the course of several consecutive years to determine the presence and rate of Rock Mountain spotted fever infection, and the dynamics of the tick-host relationships.