DUCK VIRAL ENTERITIS (DUCK PLAGUE) IN NORTH AMERICAN WATERFOWL

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Duck Viral Enteritis (DVE) was first recognized in North America in January 1967, when an outbreak occured in a commercial flock of white Pekin ducks in Suffolk County, Long Island, New York (Leibovitz & Hwang, 1968b). Originally described as a disease of domestic ducks in the Netherlands, DVE has since been reported from India and Belgium. It is also believed to have occurred in China and France (Jansen, 1968).

This paper briefly reviews the status of DVE among wild waterfowl in North America and describes some of the characteristic lesions associated with this disease. The paper also mentions some of the work which has been undertaken to learn more about the status of DVE in North America.

DVE in wild waterfowl was diagnosed on February 1, 1967, from a dead mute swan *(Cygnus olor)* submitted to the Long Island Duck Research Laboratory (Leibovitz & Hwang, 1968a). This swan had been found dead the previous day on a lagoon which bordered the Baker duck farms where the first outbreak occurred in Pekins in Suffolk County, Long Island, New York. Additional cases of Duck Plague on Long Island have involved the mallard *(Anas platyrhynchos),* black duck *(A. rubripes),* Canada goose *(Branta canadensis),* greater scaup *(Aythya marila),* and bufflehead *(Bucephala albeola)* (Leibovitz, 1968). Two outbreaks have occurred in muscovy ducks *(Cairina Moschata),* one of these in Suffolk County, and the other near Horseheads, Chemung County, New York (upstate), approximately 200 miles from the Long Island outbreaks. In October, a group of mute swans succumbed to the disease on Lake Oswaco, Cayuga County, again in upstate New York. More recently the disease was reported in an aviculturist's flock in Bucks County near Warrington, Pennsylvania, and in a single black duck at the Patuxent Wildlife Research Center, Laurel, Maryland (Locke, unpublished). Since January 1967, DVE has been reported in 14 of the 34 current commercial duck raising operations in Suffolk County, Long Island, New York.

DVE is an acute, frequently fatal disease of anseriformes, characterized by listlessness, watery diarrhea, nasal and ocular discharges, and sudden death. Sick ducks sit most of the time, and if driven into the water will either float listlessly without swimming or attempt to return to land. Ocular discharge with marked photophobia frequently occurs late in the course of the disease. In one case involving a captive flock of Canada geese and other waterfowl, apparently healthy birds were found dead in the morning in the same spot where they had been resting the previous evening 8 or 12 hours earlier. These geese were fat and in good flesh, and had been quite active the previous day.

Lesions: The lesions seen in the mallard were in general quite similar to those described from the white Pekin. One of the most striking lesions was petechiation and necrosis of the esophagus. Necrosis varied in extent from scattered discrete brown foci 2-3 mm in diameter to large, crumply yellow-brown layers of dead cells attached to the underlying esophageal ridges——a diptheritic membrane. Hemorrhage frequently was seen along the esophageal proventicular junction, and in Canada geese focal necrotic areas were commonly seen along this junction.

A hemorrhagic enteritis almost always was present. In mallards and Pekins, these hemorrhagic areas appear as three or four widely separated annular bands of hemorrhage encircling the intestinal lumen while in black ducks the hemorrhagic

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enteritis frequently involved the entire small intestine. Esophageal and cloacal lesions were less frequently seen in black ducks than in mallards. The cloaca showed hemorrhage and necrosis, frequently with the formation of a diptheritic membrane. In males the penis was often extruded, while females were apt to show massive hemorrhages in the ovary. Breeding females frequently died from ruptured yolk peritonitis; others were found dead with intact eggs in the shell gland.

The livers showed petechiation and focal necrosis, and often had a pronounced bronze cast. Hearts show hemorrhages ranging in degree from petechiation to paint-brush hemorrhages along the coronary arteries.

Canada geese frequently developed a striking intestinal lesion—"button ulcers." These large ulcers appeared as large blackish dots (up to one centimeter in diameter) when viewed through the serosal surface of the intestine and, when the intestine was opened, the ulcers were seen to have raised, prominent, crumply brownish borders with a black center. These button ulcers appeared to be a rather constant lesion in geese, whereas they were not seen in black ducks or mallards. Leibovitz (unpublished data, 1968) has shown that these differences in the types of hemorrhagic lesions in ducks and geese reflect a difference in the distribution of lymphoid tissues in these species.

Definitive diagnosis requires isolation of the virus from the liver or spleen of the sick duck. This is accomplished by the inoculation of a suspension of ground liver or spleen into 9-day-old embryonated duck eggs or into 1-day-old ducklings, and testing the ability of the agent isolated to be neutralized by specific Duck Plaque antiserum. The seasonal availability of both embryonated duck eggs and ducklings places severe limitations on virus isolation as a diagnostic technique. Hopefully, a much simpler serological test will be developed.

Discussion

The U. S. Department of Agriculture and the New York State Department of Agriculture and Markets first attempted to eradicate Duck Plague by the destruction of the first flock confirmed as infected in Suffolk County, New York, because the disease was of exotic nature and past experience with other diseases shows that stamp out procedures against new diseases proves to be cheaper in the long run. During the first week in February, 1967, 7,067 ducks and 76,371 eggs were destroyed on the Baker farm and the owners were paid an indemnity of $58,874.21 by the Federal and New York State Governments. However, the disease appeared on neighboring farms on March 20, and serum neutralizing anti-bodies to DVE were found in the blood of ducks from three additional duck flocks. About one-third of all the commercial Pekin flocks on Long Island have had DVE at one time or another since the original outbreak.

The Long Island duck industry is still under U.S.D.A. quarantine (C.F.R. Title 9 — Animals and Animal Products, Chapter 1, Subchapter C, Part 83. June 6, 1967) and a modified chick embryo adapted vaccine is being evaluated for safety and efficacy in commercial Pekin flocks. At present 19 of the 34 commercial Pekin duck operations in Suffolk County have been approved (i.e. they are free of the disease). Other flocks are attempting to qualify.

Other than the cases reported above, we have no knowledge of the extent of this disease in wild North American waterfowl. We have alerted wildlife disease investigators to be on the lookout for suspicious cases. In order to facilitate the diagnosis of DVE in wild waterfowl, the United States Department of Agriculture is preparing a diagnostic antiserum which will be made available to those disease laboratories that necropsy large numbers of waterfowl. The Patuxent Wildlife Research center at Laurel, Maryland, and the University of Georgia will act as depositories for this diagnostic antiserum in the Southeastern region.

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INVESTIGATING AND REPORTING INCIDENCE OF WILDLIFE MORTALITY FROM PESTICIDES

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A few classic examples of fish or wildlife kills by pesticides have received wide publicity. Most biologists are familiar with the Mississippi River fish kill that occurred in the spring of 1964. A majority will remember the numerous reports of fish and wildlife mortality following the attempts to eradicate fire ants with heptachlor treatments over immense acreages of the south. Almost every conservationist knows the elms and robins story.

Spectacular pesticide kills like these are big news and cause for much concern on the part of the public. They are not common however, and are becoming less frequent. We have learned from our mistakes. Progress is being made in restricting the use of the more hazardous chemicals. Many of the wide-scale pesticide applications are undertaken by the Federal Government, and these are carefully planned to prevent such problems. The States, likewise, are greatly concerned about the proper use of pesticides.

Minor pesticde kills are not uncommon, however, and, as long as toxic substances are introduced into the environment, will doubtless continue to occur. Collectively, they are probably more significant than the spectacular kills. Quite often these minor kills result from the misuse of a chemical, such as careless handling, overdosage, or improper application techniques. However, numerous wildlife kills caused by legitimate and correct applications can be documented.

Government pest control programs, though some are quite large, utilize only 5 percent of the pesticides applied in this country. Private use of the other 95 percent is largely uncontrolled. Pesticide development, production, and marketing are regulated by law. Proper use of registered chemicals, however, is virtually unenforceable.

Too often, the smaller kills caused by pesticides go uninvestigated and unreported--perhaps even unnoticed. Reports of dead animals which might have been killed by pesticide applications may not be thoroughly checked because other duties prevent it, they are considered unimportant, pesticides are not suspected, or becuase it is difficult and sometimes impossible to pin down pesticide-caused mortality. Kills may occur on private land as a result of unpublicized treatments or may occur months after the application through food chain buildup.

It is important that small pesticide kills be investigated, documented, and reported. Small, seemingly localized kills if repeated in enough scattered locations can be responsible for depressing or even removing certain susceptible wildlife species from the ecological picture. The pelican die-off in Louisiana is a good example of how wildlife mortality can go unnoticed. A great many pesticide-caused wildlife mortalities are probably not even noticed, and this makes it doubly important to check every incident that does come to our attention.

Properly investigated and reported incidents of pesticide-caused mortality can serve several vital functions. If careless or intentional misuse of chemicals is responsible, legal prosecution may be in order. Safe use of chemicals is the responsibility of the user, and he should be kept aware of the fact. Unknown hazards inherent to use of new chemicals, or new uses of old chemicals, may be detected. Suspected but unproven hazards from chemicals that are in common use might be