SEROLOGIC SURVEILLANCE FOR VESICULAR STOMATITIS VIRUS ON OSSABAW ISLAND, GEORGIA

Authors: Fletcher, William O., Stallknecht, David E., and Jenney, Edwin W.

Source: Journal of Wildlife Diseases, 21(2) : 100-104

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-21.2.100

Journal of Wildlife Diseases, 21(2), 1985, pp. 100–104

SEROLOGIC SURVEILLANCE FOR VESICULAR STOMATITIS VIRUS ON OSSABAW ISLAND, GEORGIA

William O. Fletcher,[1] David E. Stallknecht,[1] and Edwin W. Jenney[2]

ABSTRACT: Seventeen species of mammals and seven species of birds from Ossabaw Island, Georgia, were tested for vesicular stomatitis (VS) neutralizing antibodies. Seropositive results were restricted to mammals with six of 17 species testing seropositive for VS (New Jersey type) neutralizing antibodies. Seropositive species included: raccoons (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), feral swine (*Sus scrofa*), cattle (*Bos taurus*), horses (*Equus caballus*), and donkeys (*Equus asinus*). All tests for VS (Indiana type) were negative.

INTRODUCTION

Although vesicular stomatitis (VS) has been recognized as a clinical entity since 1884, many crucial portions of its maintenance and transmission cycle remain unclear (Mason, 1978). Past investigations into possible VS reservoirs and methods of transmission have often involved wildlife and have demonstrated the presence of VS antibodies in a diversity of taxonomic groups.

In North America, naturally occurring antibodies to VS New Jersey (NJ) type have been reported from Mexican woodrats (*Neotoma mexicana*), deer mice (*Peromyscus maniculatus*), white-footed mice (*P. leucopus*), rock mice (*P. difficilis*), a house mouse (*Mus musculus*) (Webb, 1983), and gray squirrels (*Sciurus carolinensis*) (Jenney et al., 1975). Antibodies also have been detected in opossums (*Didelphis virginianus*) (Jenney et al., 1975) and from three species of carnivores, including raccoons (*Procyon lotor*) (Karstad et al., 1956; Jenney et al., 1975), bobcats (*Felis rufus*) (Karstad et al., 1956), and coyotes (*Canis latrans*) (Webb, 1983). Antibodies to VS NJ have been demonstrated in six species of wild ungulates, including white-tailed deer (*Odocoileus virginianus*) (Karstad et al., 1956; Jenney, 1967; Trainer and Hanson, 1969; Jenney et al., 1975), mule deer (*O. hemionus*) (Jenney et al., 1979), pronghorn (*Antilocapra americana*) (Trainer and Hanson, 1969), bighorn sheep (*Ovis canadensis*) (Trainer and Hanson, 1969), elk (*Cervus elaphus*) (Webb, 1983), and feral swine (*Sus scrofa*) (Karstad et al., 1956; Jenney et al., 1970, 1980). Seropositive results are not restricted to mammals and also have been reported from wild turkeys (*Meleagris gallopavo*) (Glazener et al., 1967; Trainer et al., 1968).

Experimental VS infection of many species of wildlife has resulted only in a low transient viremia quickly followed by high levels of virus neutralizing antibodies (Karstad and Hanson, 1957; Tesh et al., 1970). This suggests that wildlife species do not act as long-term reservoirs for this disease. The presence of VS neutralizing antibodies in wildlife species representing a diversity of ecological habitats and niches, however, may provide some common denominators for identifying viral reservoirs or portions of the VS transmission cycle. Likewise, wildlife species demonstrating antibodies to VS may provide a means of detecting areas of VS activity especially in those areas devoid of domestic livestock. This is a report on a serologic survey for VS antibodies among various

Received for publication 8 August 1984.

[1] Southeastern Cooperative Wildlife Disease Study, Department of Parasitology, College of Veterinary Medicine, The University of Georgia, Athens, Georgia 30602, USA.

[2] National Veterinary Services Laboratories, Veterinary Services, Animal and Plant Health Inspection Service, United States Department of Agriculture, P.O. Box 844, Ames, Iowa 50010, USA.

species of wildlife and domestic animals on Ossabaw Island, Chatham County, Georgia.

MATERIALS AND METHODS

Study area

Ossabaw Island is a 10,117 ha barrier island on the coast of Georgia. Terrestrial habitats cover 4,775 ha; the remaining area consists of fresh and salt water marsh. Both wild and domestic animals are present.

The island has a history of enzootic VS NJ activity dating to 1965 when positive serologic results were reported from two white-tailed deer (Jenney et al., 1970). In 1969, a bull, a boar, and a goat (*Capra hircus*) also were reported to be seropositive (Jenney et al., 1970). Seventy-nine percent and 30% of tested cattle were seropositive in 1970 and 1978, respectively (Jenney and Brown, 1972; Jenney et al., 1980). Five of nine feral swine tested in 1978 and five of 10 feral swine tested in 1979 also were seropositive for VS NJ (Jenney et al., 1980). These seropositive results, however, were not supported by clinical observation of VS.

Serum collections

Wild mammals and birds were collected by live-trapping, shooting, or hand capture. Upon capture, all animals (wild and domestic) were bled, and their sex and relative ages were determined. When possible, live-trapped animals were marked to prevent re-sampling and were released unharmed. Serum was removed from clotted blood after centrifugation, placed in labeled tubes, and frozen. Due to their extremely small size and resultant low blood yield, serum samples from bats were pooled by species.

Serologic testing

Frozen serums were submitted to the National Veterinary Services Laboratories (NVSL), Animal and Plant Health Inspection Service (APHIS), United States Department of Agriculture (USDA), Ames, Iowa, for VS evaluations utilizing the microtiter serum neutralization test (NVSL, 1981). Titers of 1:32 or greater were considered positive. Tests were conducted for both New Jersey and Indiana types.

RESULTS

From 27 May 1981 to 8 December 1982, 545 mammals representing 17 species and six orders were sampled. Additional serums were obtained from 10 and 92 wild swine during January 1979 and July 1980, respectively. From 23 July 1981 to 21 October 1981, serums were collected from 129 birds representing seven species and five orders. Serologic results for all species are given in Table 1. Seropositive results for VS NJ were restricted to raccoons, white-tailed deer, feral swine, cattle, horses, and donkeys. Seropositive animals were distributed island-wide. Serologic results by age class for raccoons, white-tailed deer, feral swine, and cattle are given in Table 2. All tests for VS (Indiana type) were negative.

DISCUSSION

Although antibodies to VS NJ have been reported from many wild and domestic animals representing many species and genera tested on Ossabaw Island, seropositive results during this survey were restricted to six mammalian species. In wildlife, serum neutralizing antibodies were detected in 76% of the adult feral swine, 43% of the white-tailed deer, and 25% of the raccoons. These prevalences, although somewhat lower, are consistent with previous results from coastal Georgia where VS NJ antibodies were reported in 83%, 60%, and 40% of these same species, respectively (Karstad et al., 1956).

With the exception of bats, mammalian species are reported to develop high titers following experimental VS NJ inoculation (Tesh et al., 1970). Additionally, naturally occurring antibodies to VS NJ have been reported from gray squirrels (Jenney et al., 1975), house mice (Webb, 1983), and from species in the genera *Peromyscus* (Webb, 1983), *Sciurus*, *Oryzomys*, and *Sylvilagus* (Tesh et al., 1969). Seronegative results recorded for the five species of rodents and marsh rabbits therefore indicate that VS exposure among these animals is minimal if it indeed occurs. Based on sample size, seronegative results for gray squirrels and cotton mice indicate that serum neutralizing antibodies, if

TABLE 1. Results of serologic survey for vesicular stomatitis (New Jersey type) in wild and domestic animals on Ossabaw Island, Georgia.

Class	Species	Date collected	Serologic results	
			No. positive*/ no. sampled	Percent positive
Mammals (wild)	Eastern pipistrel bat (*Pipistrellus subflavus*)	8/81–9/81	0/6	0
	Seminole bat (*Lasiurus seminolus*)	8/81–9/81	0/4	0
	Eastern yellow bat (*Lasiurus intermedius*)	8/81–10/81	0/11	0
	Evening bat (*Nycticeius humeralis*)	8/81	0/7	0
	Marsh rabbit (*Sylvilagus palustris*)	5/81–7/81	0/5	0
	Eastern gray squirrel (*Sciurus carolinensis*)	5/81–6/81	0/30	0
	Eastern fox squirrel (*Sciurus niger*)	5/81–6/81	0/15	0
	Rice rat (*Oryzomys palustris*)	6/81	0/1	0
	Cotton mouse (*Peromyscus gossypinus*)	5/81–6/81	0/60	0
	House mouse (*Mus musculus*)	6/81	0/1	0
	Raccoon (*Procyon lotor*)	6/81–8/81	7/35	20
	White-tailed deer (*Odocoileus virginianus*)	9/81–12/82	68/207	33
	Feral swine (*Sus scrofa*)	1/79–8/81	84/158	53
Mammals (domestic)	Cattle (*Bos taurus*)	7/81	32/75	43
	Horse (*Equus caballus*)	8/81	6/17	35
	Donkey (*Equus asinus*)	8/81	4/10	40
	Dog (*Canis domesticus*)	8/81	0/4	0
Birds	Turkey vulture (*Cathartes aura*)	9/81–10/81	0/29	0
	Black vulture (*Coragyps atratus*)	10/81	0/1	0
	Wild turkey (*Meleagris gallopavo*)	7/81–8/81	0/30	0
	Cattle egret (*Bubulcus ibis*)	10/81	0/9	0
	Mourning dove (*Zenaida macroura*)	10/81	0/30	0
	Red-winged blackbird (*Agelaius phoeniceus*)	10/81	0/26	0
	Boat-tailed grackle (*Quiscalus major*)	10/81	0/4	0

* Positive = neutralizing titers of ≥1:32.

present in these species, are restricted to 10% or less and 5% or less of the populations ($P = 0.05$), respectively (Essey et al., 1981). Seronegative results from the four species of bats also may reflect either a very low exposure rate or total nonexposure. However, since blood from bats was pooled prior to testing, it is possible that individual low titers could have been diluted below a detectable level.

Despite previously reported seropositive results for wild turkeys (Glazener et al., 1967; Trainer et al., 1968) and for black vultures and turkey vultures in Panama (Kuns, 1962), all avian species were seronegative. Seronegative results for wild turkeys, turkey vultures, and mourning doves indicate that serum neutralizing antibodies, if present in these species, are restricted to 10% or less of the population ($P = 0.05$) (Essey et al., 1981). As with rodents, this indicates minimal if any exposure to VS virus.

With the exception of dogs, all domestic species sampled were seropositive. Previous serologic surveys from coastal Georgia showed that 50% of tested cattle and 80% of tested horses were VS NJ seropositive (Hanson and Karstad, 1957). Studies in enzootic areas in Panama demonstrated a 60% and 100% prevalence of antibody in cattle and horses, respectively (Tesh et al., 1969). Results from Ossabaw cattle (51% seropositive) are similar to those observed previously. Horses, however, demonstrated a lower prevalence (37%) than previously reported. Seropositive results have been reported for domestic dogs (Tesh et al., 1969; Webb, 1983), and negative results during this study may be attributable to a small sample size.

Seropositive results for both wild and domestic species were detected only in the longer-lived species and, as shown in Table 2, were more prevalent in the older age classes of these species. These results were not unexpected, since older animals would have a greater probability of exposure. This age relationship would be enhanced under enzootic conditions as exist on Ossabaw Island since viral activity may occur seasonally on an annual basis.

TABLE 2. Results by age classes for vesicular stomatitis (New Jersey type) seropositive species on Ossabaw Island, Georgia.

Species	Age class	Serologic results: No. positive*/no. sampled	Serologic results: Percent positive
Raccoon	>1 yr	7/28	25
	<1 yr	0/7	0
White-tailed deer	≥2½ yr	61/143	43
	1½ yr	4/27	15
	½ yr	3/37	8
Feral swine	>8 mo	70/92	76
	<8 mo	14/66	21
Cattle	>1 yr	22/43	51
	<1 yr	10/32	31

* Positive = neutralizing titers of ≥1:32.

With few exceptions, past serologic surveys were conducted during or shortly after VS NJ epizootics when the level of viral activity may have been higher than exists on Ossabaw Island. This includes prior studies from areas of coastal Georgia which were conducted during or shortly after statewide clinical VS outbreaks (Karstad et al., 1956; Hanson and Karstad, 1957). Seronegative results from this study in species in which seropositive results have been reported previously may be related to a low level of viral activity associated with the enzootic condition which presently exists on Ossabaw Island. This enzootic VS activity pattern may also explain lower than previously reported prevalences for feral swine, white-tailed deer, raccoons, and horses.

Based on these observations, it appears that under enzootic conditions as exist on Ossabaw Island, wildlife surveillance to detect VS activity should be confined to the longer-lived species, especially ungulates. While small mammals and birds may have limited viral contact, the prevalence of antibody, if present, in these species is so low as to make detection difficult.

ACKNOWLEDGMENTS

We wish to thank Mrs. Eleanor T. West, Mr. Roger Parker, and the personnel of The Ossabaw Foundation for their support and assistance. We also gratefully acknowledge the cooperation and assistance of the Georgia Department of Natural Resources, Division of Game and Fish, especially Mr. Noel Holcomb and the staff residing on Ossabaw Island, Georgia. This project was funded through Cooperative Agreement Number 12-16-5-2230, Emergency Programs, Veterinary Services, Animal and Plant Health Inspection Service, U.S. Department of Agriculture and Grant Number 14-16-0009-82-500, Fish and Wildlife Service, U.S. Department of Interior.

LITERATURE CITED

ESSEY, M. A., R. L. PAYNE, AND E. M. HIMES. 1981. Bovine tuberculosis surveys of axis deer and feral swine on the Hawaiian island of Molokai. Proc. U.S. Anim. Health Assoc. 85: 538–549.

GLAZENER, W. C., R. S. COOK, AND D. O. TRAINER. 1967. A serologic study of diseases in the Rio Grande turkey. J. Wildl. Manage. 31: 34–39.

HANSON, R. P., AND L. H. KARSTAD. 1957. Further studies on enzootic vesicular stomatitis. Proc. U.S. Livestock Sanit. Assoc. 61: 300–307.

JENNEY, E. W. 1967. Vesicular stomatitis in the United States during the last five years (1963–1967). Proc. U.S. Livestock Sanit. Assoc. 71: 371–385.

———, AND C. L. BROWN. 1972. Surveillance for vesicular stomatitis in the United States—January 1968 through July 1972. Proc. U.S. Anim. Health Assoc. 76: 183–193.

———, G. A. ERICKSON, W. W. BUISCH, W. C. STEWART, AND M. A. MIXSON. 1980. Surveillance for vesicular stomatitis in the United States 1972 through 1979. Proc. Am. Assoc. Vet. Lab. Diagnost. 23: 83–89.

———, F. A. HAYES, AND C. L. BROWN. 1970. Survey for vesicular stomatitis virus neutralizing antibodies in serums of white-tailed deer (*Odocoileus virginianus*) of the southeastern United States. J. Wildl. Dis. 6: 488–493.

———, ———, AND ———. 1975. Survey for vesicular stomatitis infection in Georgia wild mammals. *In* Developmental Studies and Laboratory Investigations Conducted by VS Diagnostic Laboratories. FY 73 APHIS-USDA. APHIS 91-27, pp. 47–50.

KARSTAD, L. H., E. V. ADAMS, R. P. HANSON, AND D. H. FERRIS. 1956. Evidence for the role of wildlife in epizootics of vesicular stomatitis. J. Am. Vet. Med. Assoc. 129: 95–96.

———, AND R. P. HANSON. 1957. Vesicular stomatitis in deer. Am. J. Vet. Res. 18: 162–166.

KUNS, M. L. 1962. The epizootiology of vesicular stomatitis in middle America. Ph.D. Thesis. University of Wisconsin, Madison, Wisconsin, 101 pp.

MASON, J. 1978. The epidemiology of vesicular stomatitis. Bltn. Centro. Panamericano. Fiebre. Aftosa. 29–30: 35–53.

NATIONAL VETERINARY SERVICES LABORATORIES. 1981. Serologic Microtitration Techniques. USDA, APHIS, Nat. Vet. Serv. Lab., Ames, Iowa, 48 pp.

TESH, R. P., P. H. PERALTA, AND K. M. JOHNSON. 1969. Ecological studies of vesicular stomatitis virus. I. Prevalence of infection among animals and humans living in an area of endemic VSV activity. Am. J. Epidemiol. 90: 255–261.

———, ———, AND ———. 1970. Ecological studies of vesicular stomatitis virus. II. Results of experimental infection in Panamanian wild animals. Am. J. Epidemiol. 91: 216–224.

TRAINER, D. O., W. C. GLAZENER, R. P. HANSON, AND B. D. NASSIF. 1968. Infectious disease exposure in a wild turkey population. Avian Dis. 12: 208–214.

———, AND R. P. HANSON. 1969. Serologic evidence of arbovirus infections in wild ruminants. Am. J. Epidemiol. 90: 354–358.

WEBB, P. 1983. Centers for Disease Control Report. *In* Summary of Vesicular Stomatitis Meeting, January 11–12, 1983. L. J. King (ed.). USDA, APHIS, VS, Emergency Programs, 56 pp.