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A Serologic Survey of Selected Viral and Bacterial Diseases of European Wild Hogs, Great Smoky Mountains National Park, USA

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ABSTRACT: Blood samples were collected from 108 wild hogs (*Sus scrofa*) from the Great Smoky Mountains National Park (GSMNP), USA, February to July 1990. We found no antibodies for swine brucellosis, pseudorabies, bovine virus diarrhea virus or porcine rotavirus infection. Antibody titers to porcine parvovirus were found in 15 (14%) samples and antibody to one or more leptospiral serovars was found in 48 (44%) samples. Thirty-nine (89%) of the 44 positive samples reacted to all five leptospiral serovars tested.

Key words: Wild hogs, *Sus scrofa*, swine brucellosis, pseudorabies, porcine parvovirus, leptospirosis.

European wild hogs (*Sus scrofa*) were brought to the southern Appalachian Mountains in 1912 to stock a private game reserve in North Carolina (USA) (Jones, 1959). In 1920, about 100 of these hogs escaped from their enclosure and dispersed throughout the surrounding area. They interbred with feral domestic swine (Conley et al., 1972) and their descendants entered the southwestern corner of the Great Smoky Mountains National Park (GSMNP) in the late 1940's (Jones, 1959). Wild hogs have spread throughout most of the park and the population is well established.

Wild hogs may be a source and reservoir of infectious diseases, particularly pseudorabies and swine brucellosis (Nettles, 1989) and movements of wild hogs can potentially result in dissemination of these diseases (Witter, 1981). Pseudorabies and swine brucellosis are the focus of national eradication campaigns in domestic swine. Our objective was to assess the prevalence of pseudorabies and swine brucellosis antibodies in the European wild hog population of GSMNP (35°22′ to 35°45′N, 83°00′ to 84°00′W).

From 5 February through 3 July 1990, 108 blood samples were collected from hogs that were shot or captured using a trap described by Williamson and Pelton (1971). Trapped hogs were immobilized using an intramuscular injection of tiletamine HCl/zolazepam HCl (Telazol, A. H. Robins Company, Richmond, Virginia, USA) as described by Gray et al. (1974) combined with xylazine (Rompun, Mobay Corporation, Shawnee, Kansas, USA) at a dose of 4.4 mg/kg body weight.

Twenty milliliters of blood were collected from the cranial vena cava of immobilized hogs. Blood samples were collected from the large vessels and heart of dead hogs as soon as possible after they were shot. All samples were stored at 5 C until serum could be separated. Serum samples then were stored at −7 to −12 C for ≤1 mo. Age was based on tooth eruption and wear patterns described by Barrett (1971).

Samples were tested by C. E. Kord Diagnostic Laboratory (Ellington Agricultural Center, Nashville, Tennessee, USA) for pseudorabies and brucellosis. A serum neutralization test was used to detect antibodies to pseudorabies virus (Hill et al., 1977) at a screening serum dilution of 1:4. For *Brucella* antibody detection, a buffered acidified plate antigen test (pH = 4.0) was used at a screening serum dilution of 1:25 (U.S. Department of Agriculture, no date).

In addition, we tested sera for the presence of antibody to bovine virus diarrhea

virus (BVDV), porcine parvovirus (PPV), porcine rotavirus, and five serovars of *Leptospira interrogans* (*canicola, pomona, hardjo, grippothyphosa, icterohaemorrhagiae*). An indirect fluorescent antibody techniqne (Potgieter and Aldridge, 1977) was used to screen sera diluted 1:20 for antibodies to BVDV, PPV, and rotavirus. We used a screening level of 1:100 for leptospiral serovar antibodies with a microagglutination test (Faine, 1982). We did not attempt to isolate any of the agents. We used EPI INFO, Version 5.01 (Dean et al., 1990) for data management and analysis.

Ages of the 108 hogs sampled ranged from 1 to 60 mo; 26 were ≤1 yr, 33 were >1 yr to ≤2 yr, 28 were >2 yr to ≤3 yr; and 21 were >3 yr. Fifty-seven (53%) animals were female. We collected nine (8%) animals in February, 21 (19%) in March, 22 (20%) in April, 29 (27%) in May, 26 (24%) in June, and one animal in July.

We found no serologic evidence of pseudorabies, swine brucellosis, BVDV or rotavirus infections. Fifteen (14%) samples were positive for PPV; based on a chi-square test, there was no significant association ($P = 0.09$) with sex of positive animals.

Leptospira serovar antibodies were detected in 48 (44%) samples, 39 of which were positive for all five serovars. Such a pattern can indicate recent infection resulting in cross-reactivity due to immunoglobulin M antibody (Awad-Masalmeh and Willinger, 1983). Nine hogs were positive for only one serovar. Four hogs (three males, one female) were positive for *Leptospira* serovar *pomona* and four different hogs (two males, two females) were positive for *Leptospira* serovar *hardjo*. One female was positive for serovar *grippothyphosa*.

There is considerable variation in the literature regarding the nomenclature of free-ranging *Sus scrofa* populations. Populations can represent descendants of domestic breeds, European wild boar, or crosses. In our discussion of other studies, we have retained the terminology used in each original paper.

In the USA, *Brucella* infection is enzootic in several wild swine populations (Zygmont et al., 1982). Zygmont et al. (1982) tested 10 serum samples from hogs from GSMNP, all of which were negative for brucellosis. With a sample size of 108 and assuming a prevalence of ≥3%, the probability of failure to detect at least one positive animal is 0.05 (Cannon and Roe, 1982). Samples were not randomly selected, but were taken from the most dense hog concentrations within the park. It is reasonable to assume that if brucellosis existed in this population, it would be present in the areas of greatest population density. Consequently, even though brucellosis is enzootic in wild swine populations in other states including three neighboring states, it is unlikely that swine brucellosis exists in GSMNP. However, all hogs would have to be tested to prove this.

Serologic evidence of pseudorabies infection also has been reported in wild swine (Clark et al., 1983; Corn et al., 1986). Besides the risk to domestic swine, infected wild hog populations represent a risk to other wildlife, especially wild canids, and hunting dogs (Tozzini et al., 1982).

Pirtle et al. (1989) reported that the presence of PRV infection is best determined by testing adult (≥8 mo of age) feral swine since juveniles (<8 mo of age) may not yet have produced antibodies or may have maternal antibodies to PRV. In our study, 94 samples were from hogs >8 mo. With a sample size of 94 and assuming a prevalence of ≥3%, the probability of failure to detect at least one positive animal if infection is present is between 0.1 and 0.05 (Cannon and Roe, 1982). In an earlier study, Smith (1979) did not find evidence of pseudorabies infection in 36 wild hog serum samples from GSMNP. It is unlikely that the virus is present in the wild hog population of GSMNP.

Liebermann et al. (1986) evaluated 406 serum samples for the presence of antibodies to PPV using a hemagglutination-

inhibition test, and found that 66% were positive at a titer of ≥1:20. Payeur et al. (1989) tested three adult feral sows and four piglets from Florida (USA); all were positive. Virus isolation attempts using spleens and tonsils from 278 wild swine predominantly from the southeastern United States were negative for PPV (Nettles, 1989). We are unaware of any other reports to compare with our antibody prevalence level of 14%.

All PPV seropositive hogs with known sampling locations were collected in the south central region of GSMNP. Hogs from this area could represent a source of infection for non-infected populations inside as well as outside GSMNP if individuals are translocated. However, the virus already is common in many domestic swine populations in the U.S. (Mengeling, 1986).

Serologic surveys for *Leptospira* species antibodies have been conducted on wild hog populations in several states (Clark et al., 1983; Corn et al., 1986; Nettles, 1989). Antibody prevalances ranged from 5 to 87% depending on which serovars were used. Our seroprevalance of 44% was within this range.

As efforts continue to control and perhaps eliminate brucellosis and pseudorabies in domestic livestock, it becomes more important to know the status of wildlife populations that could be a source of these diseases. By having data on the likely presence of these diseases and others, we are in a better position to assess the risk of reinfection.

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