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Source: Journal of Wildlife Diseases, 38(3) : 649-652

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-38.3.649>

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Antibodies to Selected Viral and Bacterial Pathogens in European Wild Boars from Southcentral Spain

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ABSTRACT: Serum samples from 78 European wild boars (*Sus scrofa*) harvested during the 1999–2000 hunting season were tested for antibodies to *Brucella* spp., classical swine fever virus, *Erysipelothrix rhusiopathiae*, *Haemophilus parasuis*, *Leptospira interrogans* serovar pomona, *Mycoplasma hyopneumoniae*, pseudorabies virus (PRV), porcine parvovirus (PPV), porcine reproductive and respiratory syndrome virus, *Salmonella* serogroups B, C, and D, *Streptococcus suis*, and swine influenza virus (SIV) serotypes H1N1 and H3N2. Samples were collected from Sierra Morena and Montes de Toledo in southcentral Spain. Antibodies were detected to PRV (36%), *L. interrogans* serovar pomona (12%), PPV (10%), *E. rhusiopathiae* (5%), SIV serotype H1N1 (4%), *Salmonella* serogroup B (4%), and *Salmonella* serogroup C (3%). Our results suggest that more research is needed to describe the epidemiology of infectious diseases of Spanish wild boars.

Key words: European wild boar, serosurvey, Spain, *Sus scrofa*.

The European wild boar (*Sus scrofa*) is Spain's most important big game species. As in other European countries, wild boar populations in Spain have increased in the last two decades (Gortázar et al., 2000). Fencing and feeding is common in southcentral Spain, which may have contributed to the boar population increase. Free-living domestic, feral, and wild suids have been implicated in the epidemiology of diseases affecting humans, livestock, and wildlife. However, little information on prevalence and distribution of the most important infectious agents among wild boar populations in Spain is available, with the exception of one report from Sierra Morena (León et al., 1980). The objective of this serosurvey was to determine exposure of two wild boar populations from southcentral Spain to selected infectious agents.

The study areas are located in two

mountain chains which extend from east to west in south central Spain, Montes de Toledo (39°05'–39°30'N, 4°05'–4°45'W) and Sierra Morena (38°10'–38°45'N, 3°30'–6°15'W). Altitude ranges from 600 to 1,500 m above sea level in both areas. The climate is Mediterranean and the habitat is characterized by scrubland and forests, where evergreen oaks (*Quercus ilex*) are the dominant species. The principal wild ungulates are the Iberian red deer (*Cervus elaphus hispanicus*) and the European wild boar. Domestic livestock, mainly cattle but also goats and free-roaming domestic pigs, occasionally share grazing and watering places with wild boars, especially in eastern Sierra Morena.

From December 1999 to February 2000, blood samples from 78 shot wild boars were immediately collected from the heart during field necropsies (Table 1). Serum was obtained after centrifugation and stored at –20 C until used. Age was determined based on tooth eruption pattern. Individuals <12 mo old were classified as yearlings; those from 13–24 mo old were considered subadults, and those >24 mo old were classified as adults.

Pathogens, serologic tests employed, threshold antibody titers and techniques are reported in Table 2. No antibodies were detected to *Brucella* spp., classical swine fever virus (CSFV), *Haemophilus parasuis*, *Mycoplasma hyopneumoniae*, porcine reproductive and respiratory syndrome virus (PRRSV), *Salmonella* serotype D, *Streptococcus suis* serotypes 1 and 2, and swine influenza virus (SIV) serotype H3N2. Antibodies were detected against pseudorabies virus (PRV; 36%), *Leptospira interrogans* serovar pomona (12%), por-

TABLE 1. Age class, sex, and location of animals serologically tested.

Location	Yearlings (M/F) ^b	Subadults (M/F)	Adults (M/F)	Total ^a (M/F)
Sierra Morena	5 (3/2)	11 (4/7)	28 (11/14)	45 (18/23)
Montes Toledo	4 (2/1)	5 (2/1)	20 (5/15)	33 (9/20)
Total	9 (5/3)	16 (6/8)	48 (16/29)	78 (27/43)

^a Sex unknown for three European wild boars from Sierra Morena and three from Montes de Toledo. Age and sex unknown for one animal from Sierra Morena and four from Montes de Toledo.

^b M = males, F = females.

cine parvovirus (PPV; 10%), *Erysipelothrix rhusiopathiae* (5%), *Salmonella* serotype B (4%), swine influenza virus (SIV) serotype H1N1 (4%), and *Salmonella* serotype C (3%). Antibodies to PRV were detected in all age groups and both sexes. Prevalence of antibodies to PRV in Montes de Toledo was 52% and in Sierra Morena 23%.

The prevalence of PRV antibodies (36%) found in our study is comparable to those reported in European wild boars from other Mediterranean areas such as the islands of Corsica, France (32%; Albina et al., 2000), Sardinia, Italy (28%; Oggiogiano et al., 1991), and Tunisia (54%; Jridi

et al., 1996). Prevalences of PRV antibodies in feral pigs from Florida (Corn et al., 1986) and Texas (Van der Leek et al., 1993) were 35% and 36% respectively, and are similar to the overall prevalence found in our study. The prevalence of PRV in Sierra Morena (23%) was higher than the 3.0% reported by León et al. (1980) for the same area in an earlier study.

Antibodies to PPV (10%) were present in both Spanish populations. Seroprevalence was lower than that reported in Italy (99%; Mignone et al., 1995) and Germany (77%; Lutz and Wurm, 1996). Our results are more like those reported for feral pig

TABLE 2. Pathogens, serologic tests employed, threshold antibody for a positive test, and techniques used for serol assay of European wild boars in central Spain.

Agent	Test	Positive threshold	Reference
Pseudorabies virus gII	ELISA ^a	0.093	Qvist et al., 1989
<i>Actinobacillus pleuropneumoniae</i> 1, 2, 4, and 7	CFT ^b	1:20	Gutiérrez et al., 1991
<i>Brucella abortus</i> S 99	CFT, RB ^c		Jones et al., 1983
	ELISA		
Classic swine fever virus pg55	ELISA	0.049	Muller et al., 1996
<i>Erysipelothrix rhusiopathiae</i> serotype 2b	TAT ^d	1:80	Ikram, 1977
<i>Haemophilus parasuis</i> 1 and 2	CFT	1:20	Rapp et al., 1985
<i>Leptospira interrogans</i> serovar pomona	MAT ^e	1:400	Faïne, 1982
<i>Mycoplasma hyopneumoniae</i>	ELISA	0.089	Fald et al., 1992
Porcine parvovirus	HIT ^f	1:320	Joo et al., 1976
Porcine reproductive and respiratory syndrome virus, ORF7 antigen	ELISA	0.09	Ingenasa® (Madrid, Spain)
<i>Salmonella</i> B, C, and D	TAT	1:160	Duval, 1977
<i>Streptococcus suis</i> 1, and 2	AIT ^g	+/-	Euzéby, 1999
Swine influenza virus H1N1, and H3N2	HIT	1:20	Schmidt, 1964

^a Enzyme-linked immunosorbent assay.

^b Complement fixation test.

^c Rose Bengal.

^d Tube agglutination test.

^e Microscopic agglutination test.

^f Hemagglutination inhibition test.

^g Agar immunodiffusion test.

populations in the USA (New et al., 1994; Saliki et al., 1998). Antibodies to SIV serotype H1N1 were found at a low prevalence (4%) as compared to the 24% reported in Poland (Markowska-Daniel and Pejsak, 1999). Antibodies to SIV H1N1 serotype have also been reported in feral swine in the USA (Saliki et al., 1998; Gipson et al., 1999). No antibodies against CSFV were detected in the present study. This finding contrasts with a previous report in which wild pigs from Sierra Morena were found to carry CSFV specific antibodies (León et al., 1980).

The prevalences of antibodies to *Lep- tospira interrogans* serovar pomona, *E. rhusiopathiae*, and *Salmonella* serogroup B and C, and absence of antibodies against *Brucella* spp. (or to cross-reacting *Yersinia* spp.), and *Streptococcus suis* Type 1 and 2, are similar to the only previous report from Sierra Morena (León et al., 1980). In contrast, prevalence of brucellosis in wild pig populations may be high in other European countries (Hars et al., 2000).

Several pathogens for which antibodies were detected in this survey could affect the dynamics of European wild boar populations. For example, *Salmonella choleraesuis* caused clinical septicemia in farmed wild boars from Sierra Morena (Pérez et al., 1999).

Extensive production of domestic pigs is economically important in farms within the study areas and elsewhere in south-central Spain, and the high prevalence of PRV antibodies in wild boars indicates that these animals may pose a threat to the success of an eradication program currently underway in domestic swine in Spain. Wild boars may also be a reservoir for pathogens that could affect endangered species; feral swine were thought to be the source of PRV for a Florida panther (*Felis concolor*) in the USA (Glass et al., 1994). Sierra Morena is one of the last strongholds of the Iberian lynx (*Lynx pardinus*), the most endangered feline species according to the International Union for the

Conservation of Nature (Nowell and Jackson, 1996).

The authors thank FEDER/CICYT projects 1FD97-0164 for partial support. This is a contribution to AGL2001-3947. J. Vicente had a half time grant from the Universidad de Castilla-la Mancha. We also thank A. Peña and landowners for allowing access to their properties and assisting with the sample collection.

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Received for publication 12 April 2001.