BioOne COMPLETE

Serologic Evidence of Hantavirus Infection in Sigmodontine Rodents in Mexico

Authors: Suzán, Gerardo, Ceballos, Gerardo, Mills, James, Ksiazek, Thomas G., and Yates, Terry

Source: Journal of Wildlife Diseases, 37(2) : 391-393

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-37.2.391

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Downloaded From: https://complete.bioone.org/journals/Journal-of-Wildlife-Diseases on 29 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

Journal of Wildlife Diseases, 37(2), 2001, pp. 391–393
© Wildlife Disease Association 2001

Serologic Evidence of Hantavirus Infection in Sigmodontine Rodents in Mexico

Gerardo Suzán,[1,4] **Gerardo Ceballos,**[2] **James Mills,**[3] **Thomas G. Ksiazek,**[3] **Terry Yates.**[1 1] Museum of Southwestern Biology. Department of Biology, University of New México, USA; [2] Instituto de Ecología, Universidad Nacional Autónoma de México, México; [3] Division of Viral and Rickettsial Diseases, Centers for Disease Control and Prevention CDC, USA; [4] Corresponding author (email: gsuzan@unm.edu).

ABSTRACT: Antibodies to hantaviruses in two species of sigmodontine rodents (*Peromyscus maniculatus* and *Reithrodontomys sumichrasti*) collected in central Mexico are reported. *Peromyscus maniculatus,* a common species throughout much of Mexico, is the reservoir of Sin Nombre virus (SNV), the etiologic agent of the great majority of cases of hantavirus pulmonary syndrome (HPS) in North America. Although the identity of the virus detected in *P. maniculatus* in Mexico could not be determined by these serologic results, our findings suggest that SNV may occur throughout the range of *P. maniculatus* in North America. If true, the failure to identify HPS in Mexico is not due to the absence of pathogenic hantaviruses in Mexico.

Key words: Antibodies, deer mouse, Hantavirus, rodents, *Peromyscus maniculatus,* Sigmodontinae, Sin Nombre virus.

Hantaviruses occur naturally in association with rodent reservoir hosts of the family Muridae in Asia, Europe, and the Americas (Schmaljohn and Hjelle, 1997; Peters et al., 1999). Hantavirus infection in rodent hosts causes a chronic, asymptomatic infection that involves the shedding of infectious virus in urine, feces, and saliva. Virus also may be transmitted among rodents by bites during intraspecific aggression (Mills et al., 1997). Transmission to humans appears to occur via inhalation of aerosolized virus, direct contact with broken skin or mucous membranes, or rodent bites. About two dozen hantaviruses are currently recognized. About half of these are known to cause hantavirus pulmonary syndrome (HPS) in the United States, Canada, and Central and South America. All have reservoir species in the New World rats and mice (family Muridae, subfamily Sigmodontinae). Outbreaks or sporadic cases of HPS have occurred in Chile, Argentina, Uruguay, Paraguay, Brazil, Bolivia, and Panama. Overall mortality has been near 50%. Rodents with hantavirus antibodies have been captured in Peru, Venezuela, and Costa Rica although HPS has not been documented in humans from these contries.

Despite the common occurrence of hantaviruses and hantavirus disease north and south of Mexico, there have been no reported cases of HPS in that country. However, Hjelle et al. (1995) isolated hantavirus RNA from a *Reithrodontomys megalotis* captured in Zacatecas (Mexico). In addition, Mantooth et al., (2000) reported hantavirus antibody in *Peromyscus melanotis* and *Peromyscus hylocetes* collected in an oak forest in San Bartolo Morelos, in the state of Mexico, approximately 150 km to the west of Ajusco National Park. Neither of these rodent species has been associated with hantaviruses responsible for human disease.

The deer mouse, *Peromyscus maniculatus,* is the reservoir for Sin Nombre virus (SNV), the virus responsible for the great majority of human HPS cases in North America. Despite the documented occurrence of antibody-positive deer mice throughout its range in the USA and Canada, none have been reported from Mexico. Here, we provide the first evidence for hantavirus infection in deer mice in Mexico.

In May 1998, we collected 33 individuals of seven rodent species from two localities in central (Ajusco) and western (Chamela-Cuixmala biosphere reserve) Mexico. The specimens from Ajusco National Park, approximately 20 km south of Mexico City, were collected in a pine forest at 3,050 m; 19°16′N, 98°13′W. At this

Downloaded From: https://complete.bioone.org/journals/Journal-of-Wildlife-Diseases on 29 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

locality we collected *Peromyscus maniculatus* ($n = 8$), *Microtus mexicanus* ($n = 1$), *Reithrodontomys sumichrasti* ($n = 1$).

Specimens from the Chamela-Cuixmala Biosphere Reserve, which is located on the coast of Jalisco at 50 m (19°22′N, 104°56′W, approximately 45 km from Barra de Navidad) were collected in a dry tropical forest at the Chamela Biological Station. At this locality we collected *Biomys musculus* ($n = 2$), *Oryzomys palustris* ($n = 1$), *Osgoodomys banderanus* ($n = 6$), and *Liomys pictus* ($n = 14$).

Animals were handled and blood collected according to Mills et al. (1995). Blood was tested for antibodies reactive with SNV recombinant nucleocapsid protein antigen by enzyme-linked immunosorbent assay (Feldmann et al., 1993) at the Centers for Diseases Control and Prevention (CDC; Atlanta, Georgia, USA) in 1999. One *Peromyscus maniculatus* and one *Reithrodontomys sumichrasti* had antibodies reactive with SNV antigen, with titers of 1/400. Both antibody-positive animals were from Ajusco National Park.

Finding antibodies to hantavirus in wild rodents in Mexico was not unexpected because viruses causing HPS have been found both north and south of Mexico. In addition, HPS and hantavirus-infected rodents are common in all the states of the USA bordering Mexico (California, Arizona, New Mexico, and Texas) and in many places south of Mexico. Pathogenic hantaviruses have been reported in four species of Sigmodontine rodents in Canada and the USA (*P. maniculatus, P. leucopus, Sigmodon hispidus,* and *Oryzomys palustris*) (Mills and Childs, 1998), all of which are also found in Mexico (Arita and Ceballos, 1997). *Peromyscus maniculatus,* is common over a large part of Mexico, attaining densities up to 50 individuals per hectare (Ceballos and Galindo, 1984).

Additionally, Mexico, with approximately 507 species of mammals, has the second or third highest mammalian diversity in the world (Ceballos and Brown, 1995; Mittermeier et al., 1998). Rodents represent 49% of these species, of which more than 50% (119 species), belong to the subfamily Sigmodontinae. This includes 46 species of *Peromyscus,* 13 *Reithrodontomys,* seven *Sigmodon,* and nine *Oryzomys* (Arita and Ceballos, 1997). All of these genera include species known to serve as reservoirs for species of hantavirus.

Peromyscus maniculatus is infected with SNV throughout its range in the U.S. (Mills and Childs, 1998). Further studies, including isolation and genetic sequencing of the virus will be required to show definitively that the virus present in Mexican deer mice is SNV. Nevertheless, the finding of a hantavirus-infected deer mouse in Central Mexico suggests that the species carries SNV throughout its range in North America. A second important implication of these findings is that failure to detect HPS in Mexico may not be due to the absence of hantavirus species in rodent reservoir populations, but may relate to failure to recognize human cases. In order to understand public health risks associated with hantaviruses in Mexico a thorough evaluation of the extent and distribution of these viruses in sigmodontine reservoir hosts in Mexico is needed.

We thank P. Stockton, L. Pezzanite, K. Veilleaux, D. Cannon, and T. Stevens for serologic analysis of rodent blood samples. For field assistance, we thank B. Vieyra, E. Marcé, R. Ávila, B. Hernández, Y. Domínguez, and A. Mendoza. Our research has been supported by the Fondo Mexicano para la Conservación de la Naturaleza, the UNAM, and the Fundación Ecológica de Cuixmala.

LITERATURE CITED

ARITA, H. T., AND G. CEBALLOS. 1997. Los mamíferos de Mexico: Distribución y estado de conservación. Revista Mexicana de Mastozoología 2: 33–71.

CEBALLOS, G., AND J. H. BROWN. 1995. Global patterns of mammalian diversity, endemism, and endangerment. Conservation Biology 9: 559–568.

———, AND C. GALINDO. 1984. Mamíferos Silvestres de la Cuenca de México. Editorial LIMUSA. México, D. F., 299 pp.

FELDMANN, H., A. SANCHEZ, S. MORZUNOV, C. F.

Downloaded From: https://complete.bioone.org/journals/Journal-of-Wildlife-Diseases on 29 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use

SPIROPOULOU, P. E. ROLLIN, T. G. KSIAZEK, C. J. PETERS, AND S. T. NICHOL. 1993. Utilization of autopsy RNA for the synthesis of the nucleocapsid antigen of a newly recognized virus associated with hantavirus pulmonary syndrome. Virus Research 30: 351–367.

HJELLE, B., B. ANDERSON, N. TORREZ-MARTINEZ, W. SONG, W. L. GANNON, AND T. L. YATES. 1995. Prevalence and geographic genetic variation of hantaviruses of New World harvest mice (*Reithrodontomys*): Identification of a divergent genotype from a Costa Rican *Reithrodontomys mexicanus*. Virology 207: 542–459.

MANTOOTH, S. J., M. L. MILAZZO, R. D. BRADLEY, C. L. HICE, G. CEBALLOS, R. B. TESH, AND C. F. FULHORST. 2000. Geographical distribution of rodent-associated hantaviruses in Texas, New Mexico, and Mexico. Journal of Vector Ecology 25: In Press.

MILLS, J. N., J. E. CHILDS, T. G. KSIAZEK, C. J. PETERS, AND W. M. VELLECA. 1995. Methods for trapping and sampling small mammals for virologic testing. Department of Health and Human Services. Centers for Disease Control and Prevention. Atlanta, Georgia, 61 pp.

MILLS, J. N., T. G. KSIAZEK, B. A. ELLIS, P. E. ROLLIN, S. T. NICHOL, T. L. YATES, W. L. GANNON, C. E. LEVY, D. M. ENGELTHALER, T. DAVIS, D. T. TANDA, J. W. FRAMPTON, C. R. NICHOLS, C. J. PETERS, AND J. E. CHILDS. 1997. Patterns of association with host and habitat: antibody reactive with Sin Nombre virus in small mammals in the major biotic communities of Southwestern United States. The American Journal of Tropical Medicine and Hygiene 56: 273–284.

MILLS, J. N., AND J. E. CHILDS. 1998. Ecologic studies of rodent reservoirs: their relevance for human health. Emerging Infectious Diseases 4: 529–537.

MITTERMEIER, R. A. 1988. Primate diversity and the tropical forest: Case studies from Brazil and Madagascar and the importance of megadiversity countries. *In* Biodiversity, E. O. Wilson (ed.). National Academy Press, Washington, D.C., pp. 145–154.

PETERS, C. J., J. N. MILLS, C. F. SPIROPOULOU, S. R. ZAKI, AND P. E. ROLLIN. 1999. Hantaviruses. *In* Tropical infectious diseases: Principles, pathogens, and practice, R. L. Guerrant, D. H. Walker, and P. F. Weller (eds.). Harcourt Brace and Company. Philadelphia, Pennsylvania, pp 1217–1235.

SCHMALJOHN, C. S., AND B. HJELLE. 1997. Hantaviruses: A global disease problem. Emerging Infectious Diseases 2: 95–104.

Received for publication 5 April 2000.

Downloaded From: https://complete.bioone.org/journals/Journal-of-Wildlife-Diseases on 29 Mar 2024
Terms of Use: https://complete.bioone.org/terms-of-use