Mammalian Biology 80 (2015) 491–495

Contents lists available at ScienceDirect

Mammalian Biology

journal homepage: www.elsevier.com/locate/mambio

Short Communication

Abundance of hantavirus hosts in a landscape with black-tailed prairie dog colonies in northwestern Mexico

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ARTICLE INFO

Article history:
Received 12 April 2015
Accepted 9 June 2015
Handled by Frank E. Zachos
Available online 17 July 2015

Keywords:
Cynomys
Grasslands
Hantavirus
Prairie dog
Small mammals

ABSTRACT

In order to assess the influence of habitat type on the abundance and distribution of hantavirus reservoir hosts and on the prevalence of hantavirus antibodies, we compared communities of small mammals among three dominant habitats in northwestern Mexico (grassland with prairie dogs colonies, grassland without prairie dogs colonies and mesquite shrubland). Grassland habitats had a very low abundance of hantavirus reservoir hosts (*Peromyscus leucopus* and *P. maniculatus*), whereas mesquite shrubland harbored a significantly higher abundance of reservoir hosts. Seropositive hosts were found in mesquite and grassland without prairie dogs (32% overall seroprevalence), but due to the small sample size of hantavirus hosts in grasslands, we could not compare seroprevalence among habitats. Areas with higher abundance of hantavirus hosts can increase the risk of human infections in other systems; therefore, mesquite shrubland may be the habitat that represents the highest risks for human exposure to hantavirus in this area. Given that the black-tailed prairie dog prevents the expansion of mesquite shrubland into grassland habitats, their colonies may indirectly prevent hantavirus host dispersion and expansion throughout this landscape. Future investigations are needed to further understand potential effects of prairie dog colonies on hantavirus epidemiology.

The black-tailed prairie dog (*Cynomys ludovicianus*, hereafter prairie dog) is considered a keystone species of grasslands in North America (Lomolino and Smith, 2004); their grazing and burrowing activities significantly alter grassland landscapes, creating and modifying habitat for other species (Lomolino and Smith, 2004). Prairie dog-driven changes in habitats can alter the structure and composition of small mammal assemblages (Cully et al., 2010), which may in turn, modulate the transmission and persistence rodent-borne diseases.

Hantaviruses (family *Bunyaviridae*, genus *Hantavirus*) are trisegmented negative sense single stranded RNA viruses, which cause hantavirus pulmonary syndrome in humans in the American continent (Jonsson et al., 2010). Commonly, each unique virus type is maintained in nature by a single rodent host species (Jonsson et al., 2010). The transmission of hantavirus within host populations is believed to occur mainly through aggressive encounters between rodents (Mills et al., 1997). Composition and structure of small mammal communities (and indirectly, habitat type) are recognized as important drivers of hantavirus prevalence in rodent hosts (Khalil et al., 2014). Therefore, the presence and activities of prairie dogs may indirectly alter hantavirus dynamics by influencing the distribution and abundance of hantavirus hosts. To our knowledge, this topic has not been addressed.

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http://dx.doi.org/10.1016/j.mambio.2015.06.004
1616-5047/

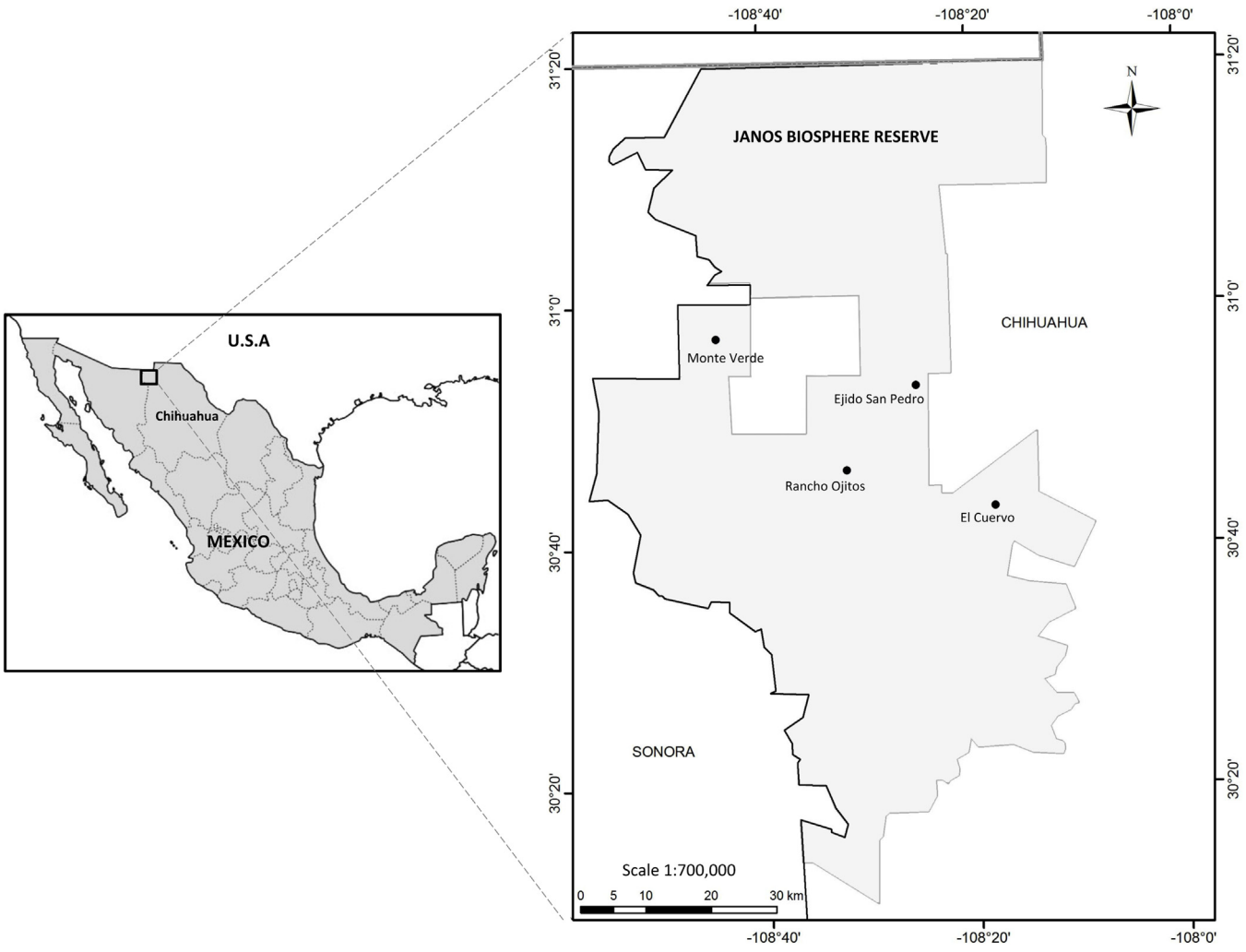

Fig. 1. Map of the study site. The Janos Biosphere Reserve is in gray and the four study areas are the black dots.

The Janos-Casas Grandes region, located in northwestern Chihuahua, Mexico, is at the southernmost end of this prairie dog species (Avila-Flores et al., 2012). This area also exhibits biotic and abiotic features (e.g. rodent community composition and environmental conditions) that are similar to those of the southwestern United States where hantavirus pulmonary syndrome has been reported since 1993 (Knust and Rollin, 2013). Although no cases of hantavirus pulmonary syndrome in humans have been reported in the Janos-Casas Grandes region, there is evidence of hantavirus seropositivity in rodents (Moreno-Torres et al., in press).

Within this framework, we compared communities of small mammals among three different habitats in the Janos-Casas Grandes region (grassland in prairie dog colonies, desert grassland with no prairie dogs, and mesquite shrubland), in order to assess the influence of habitat type on the abundance and distribution of rodent reservoir hosts and on hantavirus antibody prevalence in hosts. Based on results of a previous small-scale study (Moreno-Torres et al., in press), we expected to find a lower abundance of reservoir hosts and a lower seroprevalence of hantavirus in reservoir hosts within the prairie dog habitat compared to the other two habitats. A decrease in abundance of reservoir hosts within prairie dog colonies could be a pathway by which prairie dogs indirectly decrease the risk of human exposure to hantavirus.

The study was conducted in the Janos Biosphere Reserve, in northwestern Chihuahua, Mexico, approximately 50 km south of the border with the U.S. (Fig. 1). The landscape is dominated by a mosaic of desert grasslands and shrublands with interspersed patches of riparian vegetation, agricultural lands, and human settlements. We selected four large areas (>50 km^2; ≥15 km apart; Fig. 1) to have an adequate representation of the regional range of ecological conditions. In four sampling periods (May and October 2012, and March and October 2013), nocturnal rodents were live-trapped in 6–10 sampling plots (≥600 m apart from each other) in each four areas. Sampling plots were placed in the three dominant habitat types: (1) grasslands with active prairie dog colonies, (2) grasslands without prairie dog colonies, and (3) mesquite shrublands (*Prosopis* spp.). Differences in the number of sampling plots from each habitat were due to logistical constraints and field accessibility (see Table 1 for number of sampling plots). In 2012 sampling, each plot was a 5 × 5 grid consisting of 25 Sherman traps (8 × 8 × 23 cm; H.B. Sherman traps, Tallahassee, FL) with traps set at 10 m intervals. In 2013, the plots were adjusted to a 7 × 7 grid (49 traps) with same distance among traps. Each plot was sampled during three consecutive nights at each sampling period. Once captured, animals were identified, weighed, sexed and ear-tagged. Blood was collected from the retro-orbital sinus (~0.1 mL) using capillary tubes and transferred the blood to Nobuto blood filter strips (Cole-Parmer, Vernon Hills, IL). After handling, animals were released at the site of capture. In some instances, individuals were euthanized after sample collection using an overdose of isoflurane (Sofloran, PISA, Mexico) to confirm species identification and for further tissue analyses. Procedures for trapping and handling rodents met the guidelines of