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Leptospira spp. In Commensal Rodents, Beijing, China

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ABSTRACT: Leptospirosis is a widely distributed zoonosis, and rats (*Rattus* spp.) are its most common source. We found antibodies to leptospires in 115 (30.2%) of 381 commensal rodents from Beijing, China. Commensal rodents might represent a potential source for human and pet leptospirosis in urban environments.

Leptospira spp. are endemic to many domestic and wild animals, which may shed the pathogen in urine (Levett, 2001). Humans may acquire potentially fatal leptospirosis through contact with urine-contaminated water or food (Jansen et al., 2007) or through body fluids of infected animals, especially rodents (WHO, 2003). *Leptospira* spp. infect a variety of animals, including rats (*Rattus* spp.), dogs (*Canis lupus familiaris*), water buffaloes (*Bubalus bubalus*), horses (*Equus ferus caballus*), and pigs (*Sus* spp.; Famatiga et al., 1972). Rodents, especially rats, are considered to be the most important reservoirs or maintenance hosts of *Leptospira* (Wisseman et al., 1955; Faine et al., 1999). *Leptospira* spp., likely to be transmitted by urban commensal rodents, are emerging as serious threats to public health in many large cities in China (Liu et al., 2012). However, the epidemiology of leptospirosis is poorly understood and, even in Beijing, China, baseline data on the prevalence of infection by *Leptospira* spp. in commensal rodents are scarce.

Beijing, China (area=1,288 km^2; population=5.34 million) contains industrial, commercial, and residential buildings; parks; green spaces; and artificial lakes. From June 2011 to August 2011, we assessed the prevalence of *Leptospira* infection in commensal rodents (the house mouse [*Mus musculus*] and the Norway rat [*Rattus norvegicus*]) in a core area of Beijing, China (39°55′–39°59′N, 116°15′–116°33′E) (Table 1). Rodents were live-trapped using Bledderberry cage traps (Guangdong Ridge Mousetrap Factory, Zhongshan City, Guangdong Province, China), according to the methods of Webster et al. (1995) and humanely euthanized using carbon dioxide. Serum samples were collected for antibody detection and microscopic agglutination tests. A panel of 15 leptospiral serovars was used for serovar identification. Kidney samples were collected and studied by classic PCR, targeting the leptospiral outer membrane lipoprotein LipL32 (Levett et al., 2005). The amplification products were confirmed by direct sequencing.

We found that 30.2% (115/381) of rodent sera had detectable antibodies to *Leptospira*; the most commonly identified serovars were Javanica, Canicola, and Pomona (Fig. 1). Based on PCR and *LipL32* gene sequence analyses of 115 kidney samples, three groups of rodent kidney isolates were found: *Leptospira interrogans* serovar Javanica, serovar Canicola, and serovar Pomona. These isolates were lethal after experimental infection of Syrian golden hamsters (*Mesocricetus auratus*). Of these 115 antibody-positive samples, 50 demonstrated cross-reactivity with antigens of other serovars. Among the samples with cross-reactivity, *L. interrogans* serovar Javanica (n=15), serovar Canicola (n=21), and serovar Pomona (n=14) were most frequently identified (Table 1). Antibody prevalence was highest in adult Norway rats and house mice.

To assess antibody prevalence among pet dogs, 200 serum samples were collected from household pets in the same study area during June–August 2011. By microscopic agglutination test, we found 156 positive samples. Among 15 serovars, the prevalence of antibodies to *L. interrogans serovar* Canicola and Pomona were highest (about 78% and 75%, respective-

TABLE 1. Detection of antibodies to *Leptospira* in commensal rodents, Beijing, China, 2011, by microscopic agglutination.[a]

Species	Age[b]	No.	Positive No.	Positive rate (%)	Multiple infection rate[c] ($n \geq 2$)	
					No.	%
Rattus norvegicus	Juvenile	69	5	1.3	1	20
	Subadult	110	28	7.3	14	50
	Adult	166	69	18.1	31	44.9
Mus musculus	Juvenile	7	2	0.5	0	0
	Subadult	12	3	0.8	1	33.3
	Adult	17	8	2.1	3	37.5
Total		381	115	30.2	50	43.5

[a] Microscopic agglutination test panel included *Leptospira interrogans* serovars Icterohaemorrhagiae, Javanica, Canicola, Ballum, Pyrogenes, Autumnalis, Australis, Pomona, Grippotyphosa, Hebdomadis, Bataviae, Tarassovi, Manhao, Sejroe, and Mini (a titer >100 was considered positive).

[b] *Rattus norvegicus* individuals were categorized by weight as juveniles (<100 g), subadult (100–200 g), or adult (>200g). *Mus musculus* individuals were categorized by weight as juveniles (<6.49 g), subadult (6.50–10 g), or adult (>10 g) following Pan et al. (2006) and Andreas et al. (2007).

[c] Multiple infection is defined as two or more serogroups of *Leptospira* sp. infecting the same individual.

ly). Our results showed that these two *Leptospira* serovars and serogroups are circulating among commensal rodents and pet dogs and that these animals may be a possible source of leptospirosis to humans in Beijing, China.

The high prevalence, the chronic interstitial nephritis, and the demonstration of leptospires in kidney specimens indicate that commensal rodents act as maintenance hosts for *L. interrogans* serovars Javanica, Canicola, and Pomona in this urban area. High prevalences of *L. interrogans* serovars Canicola and Pomona were found in pet dogs and Norway rats, which occur in high densities in garbage dumps and unkempt residential structures. The relevance of these findings to public health is significant, especially to pet owners, who have regular contact with their pets. Surveillance of leptospirosis incidence, prevalence, and serovar distribution in commensal rodents and pet dogs is necessary to establish the direction and the significance of this potential exposure route from a public health perspective.

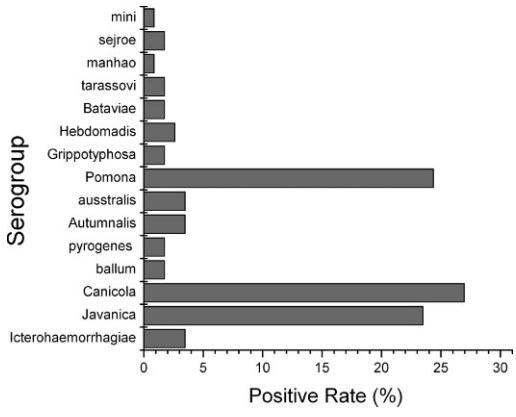

FIGURE 1. Distribution of serogroups of *Leptospira interrogans* determined by using the microscopic agglutination test.

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