**SHORT REPORT: ANTIBODIES TO BARTONELLA VINSONII SUBSP. BERKHOFFII IN MOROCCAN DOGS**

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Abstract  Bartonella vinsonii subsp. berkhoaffii is a fastidious microorganism that has been recognized as an emerging human and canine pathogen. We report for the first time on the prevalence of antibodies to B. vinsonii subsp. berkhoaffii in domestic dogs from Morocco. The overall seroprevalence was 38% (56 of 147 dogs tested). Most of the seropositive dogs were stray dogs from Rabat (36%, 8 of 22) and Khenifra (47%, 47 of 101). Antibodies against B. vinsonii subsp. berkhoaffii were found infrequently among pet dogs from Rabat (4%, 1 of 24).

Bartonella are fastidious, hemotropie, gram-negative bacteria that have been identified in a variety of domestic and wild mammals. There are currently more than 20 known species or subspecies of Bartonella, several of which are recognized as emerging human and canine pathogens.1  
Comparative clinical manifestations such as endocarditis, pelliosis hepatitis, granulomatous hepatitis, lymphadenitis, and epistaxis have been observed in humans and domestic dogs infected with Bartonella spp.2  
Bartonella are usually vector-borne, although for many recently identified species the vector involved in transmission has not been identified.3  
Bartonella vinsonii subsp. berkhoaffii was first isolated from a dog with endocarditis in 19933 and was subsequently implicated in a human case of endocarditis.4  
Domestic dogs, like humans, appear to mainly be accidental hosts for several Bartonella species.4  
Because of the close association of dogs with humans, dogs may serve as good sentinels for human exposure to Bartonella. The purpose of the present survey was to assess for the first time exposure to B. vinsonii subsp. berkhoaffii, as measured by serum antibodies, in domestic dogs from two areas of Morocco.  
Sera samples from 147 dogs from the Moroccan capital of Rabat and the city of Khenifra were available for testing. Rabat is on the Atlantic coast of this northwestern African country and has a moderate Mediterranean climate. Khenifra is located approximately 300 km southeast of Rabat and has a semi-arid climate. Blood samples were collected from dogs in Rabat between May 2002 and July 2003. The samples from Rabat included 24 owned dogs seen at the Institut Agronomique et Vétérinaire Hassan II (Rabat, Morocco) for various medical conditions and 22 stray dogs from the dog pound. In April 2004, 101 samples were collected from dogs in Khenifra. Of these dogs seen at the Institut Agronomique et Vétérinaire Hassan II (Rabat, Morocco) for various medical conditions and 22 stray dogs from the dog pound. In April 2004, 101 samples were collected from dogs in Khenifra as part of a study on echinococcosis. Dogs in Khenifra were mostly rural dogs that were allowed to freely roam. Unfortunately, information on signalment and relevant medical information for these 147 dogs were not available. Serum samples were tested in our laboratory for antibodies against B. vinsonii subsp. berkhoaffii using an indirect immunofluorescent antibody assay, as previously described.5  
Serum samples were initially screened at dilutions of 1:32 and 1:64. The intensity of bacillus-specific fluorescence was scored subjectively from 1 to 4, with a score ≥ 2 at a dilution of 1:64 reported as a positive result. Samples positive at a dilution of 1:64 were titrated in serial two-fold dilutions to the end point. The same two readers performed a double-blind reading of each slide. Negative and positive serum control samples were included on each slide. The Fisher’s exact test was used to evaluate differences in seroprevalence among owned and stray dogs from Rabat, and a chi-square test was used to test for a difference in antibody prevalence between stray dogs in Rabat and dogs in Khenifra. Statistical tests were performed using Epi-Info version 6 (Centers for Disease Control and Prevention, Atlanta, GA).

Overall, 56 (38%) of the 147 dogs tested were seropositive for antibodies against B. vinsonii subsp. berkhoaffii. Among the 24 owned dogs from Rabat, only 1 (4%) dog was seropositive, whereas 4 (36%) of 22 stray dogs from Rabat were seroreactive. The difference between exposure to B. vinsonii subsp. berkhoaffii in owned dogs from Rabat compared with stray dogs was statistically significant (P = 0.009). Of the 101 dogs tested from Khenifra, 47 (47%) had antibodies against B. vinsonii subsp. berkhoaffii. There was no difference between antibody prevalence in stray dogs from Rabat compared with dogs from Khenifra (P = 0.53). Reciprocal titers among the 56 seropositive dogs ranged from 64 to 8,192, with high titers (≥512) observed in 26 (46%) of these dogs (Table 1).

Increasing attention is now being focused on the presence of Bartonella spp. in domestic animal and human populations in Africa. A recent study found 14% (32 of 228) of dogs in Zimbabwe had antibodies against B. henselae and both B. henselae and B. claridgeiae have been isolated from dogs in Gabon in addition, 65% (33 of 51) of dogs from Sudan have been documented to be seroreactive to B. vinsonii subsp. berkhoaffii (Davoust B and others, unpublished data). In the present survey, stray dogs and free-roaming dogs from rural areas were more likely to have antibodies against B. vinsonii subsp. berkhoaffii than were owned dogs seen in a veterinary clinic. Similarly in French Reunion, an island in the Indian Ocean, 17.8% (8 of 45) of stray dogs tested were found to have antibodies to B. vinsonii subsp. berkhoaffii, while only 2.9% (2 of 68) of dogs sampled from veterinary clinics were seropositive.8  
Human Bartonella infections have been reported in southern Africa.9  
Recently, B. quintana was identified as the etiologic agent in 15% of human infective endocarditis cases in Algeria and in 9.8% of all endocarditis cases in Sfax, Tunisia.11

This is the first report on prevalence of antibodies to B. vinsonii subsp. berkhoaffii in dogs in north Africa. The findings reported here indicate exposure of domestic dogs in Morocco.
to *B. vinsonii* subsp. *berkhoffii* or a closely related species of *Bartonella*. Previous studies have implicated ticks as potential vectors of *B. vinsonii* subsp. *berkhoffii*,12,13 but since information on exposure to ectoparasites was not collected as part of this study, it is not possible to draw any conclusions about the vector involved in transmission. The study focused on seroreactivity to *B. vinsonii* subsp. *berkhoffii* exclusively due to limited amounts of serum and because *B. vinsonii* subsp. *berkhoffii* is the zoonotic *Bartonella* species most commonly associated with domestic dogs. Further studies are needed to definitively identify the infecting species of *Bartonella* and to assess human exposure to *Bartonella* in Morocco.

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### REFERENCES


### Table 1

<table>
<thead>
<tr>
<th>Reciprocal IFA titer</th>
<th>Owned dogs from Rabat (n = 24)</th>
<th>Stray dogs from Rabat (n = 22)</th>
<th>Dogs from Khenifra (n = 101)</th>
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<td>23</td>
<td>14</td>
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</tr>
<tr>
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<td>8,192</td>
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* Dogs with reciprocal titers ≥64 are considered positive. IFA = indirect immunofluorescent antibody.