

Vector-Borne Diseases: Impact of Climate Change on Vectors and Rodent Reservoirs
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Ticks and tick-borne diseases in Southern Germany

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During the last years, we could observe additional tick borne infections beside TBE and Lyme Borreliosis. Special investigations in South-West-Germany offered ticks, affected with *Coxiella*, *Rickettsia*, *Anaplasma* and *Babesia*.

Q-fever was imported into Germany after the second world war from endemic areas in all probability together with the vector species *Dermacentor marginatus*. The course of the infection mostly presents subclinical or mild symptoms, but chronification and infection can be very dangerous, especially for pregnant women. The infection can be transmitted by two infective cycles, a haploxyenic which includes *Dermacentor marginatus* as vector and wild animals as hosts and a hemixenic, where infections are transmitted from domestic animals by the aerogenic route. To localize natural foci of the haploxyenic cycle in Baden-Wuerttemberg (BW), 1066 ticks and 49 samples of tick feces were examined for *Coxiella burnetii* by PCR. Only one tick and one feces sample from an area near Basel were positive for *Coxiella burnetii*. An investigation of 450 *Dermacentor* ticks collected in the Rhine and Kinzig valleys gave no positive results for *Coxiella*. Therefore it is to be presumed, that the endemic foci in these areas are very small. On the other hand, human infections are rather frequent: In a cross sectional survey in Leutkirch 7,4% of the population was found seropositive for *Coxiella burnetii*, 47% of the soldiers on a military training area were infected with Q-fever within 3 years following an outbreak.

Tick borne rickettsial diseases are mainly found in warm, dry regions. Rickettsial species are also found in Middle and Eastern Europe, –but the two species *R. helvetica* and *R. slovaca* seem to be apathogenic. To clarify the endemic situation in BW, 1026 ticks (*Ixodes ricinus*) of 3 different areas were investigated for *Rickettsia*. An average infection rate of 8,9% was found, exclusively *R. helvetica* was diagnosed by sequencing. *Dermacentor* spp. from the Rhine and Kinzig valley showed an average infection rate of 14% for *Rickettsia* as well. The exact species is not identified yet, but *R. conorii* could be excluded.

The only known Ehrlichiosis in Europe is Anaplasmosis caused by *A. phagocytophilum*. The infection appears mostly asymptomatic, only a few cases with symptoms of a summer flu are described. To determine the prevalence in BW 5424 ticks (*Ixodes ricinus*) of different areas were tested for *Anaplasma*. The infection rates differed from 0% to 3%, with an average rate of 1%. To find out the animal reservoir 512 rodents were tested for *Anaplasma*. Among 253 rodents of Arvicolidae the infection rate was 10,2%, whereas from 259 Muridae only 0,4% of the animals were infected. So Arvicolidae may represent the main reservoir for *Anaplasma phagocytophilum*. These data correspond with the results of a seroepidemiological survey: In the sera of 4332 forestry workers of all districts of BW seroprevalences for *Anaplasma* ssp. up to 15% were found, with an average of 11%.

Among the *Babesia* genus *B. divergens* and *B. microti* are also pathogenic for man. In Europe cases of Babesiosis are known mainly in splenectomized persons, in the USA however also immunocompetent persons are affected. To investigate the epidemiology of *Babesia* in Southern Germany, 3113 ticks (*Ixodes ricinus*) were tested for *Babesia*. They originated from 2 areas of BW and 1 from Northern Bavaria. The average prevalence rate was 1%. By sequencing 90% were identified as *B. divergens*, 10% as *B. microti*. Investigating the animal reservoir 508 rodents of the families Arvicolidae and Muridae were tested. In 1,6% of the Arvicolidae (n=253) *B. microti* was found, species of Muridae were not infected.

It cannot be excluded the climate change may increase the problem of tick borne diseases in Southern Germany. By an increased population of rodents following mild winters the number of *Ixodes ricinus* will rise as well; in the consequence the infective cycles could be intensified. *Dermacentor* is a thermophilic tick, at a global warming, this vector and the haplogenic cycles of Q-fever may be further distributed. *Rhipicephalus sanguineus* is often imported from the mediterranean area to Germany by dogs. It could form here natural foci, a prerequisite for establishing mediterranean spotted fever. Therefore it is necessary to control these processes investigating the status quo and the further development.