

Dual exposure of *Rickettsia typhi* and *Orientia tsutsugamushi* in the field-collected *Rattus* rodents from Thailand

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Received 17 November 2013; Accepted 15 March 2014

ABSTRACT: Field-collected rodents and fleas from ten provinces covering four regions of Thailand were investigated for possible rickettsial pathogen infections. The 257 trapped-rodents belonged to 12 species. Five species of Genus *Rattus* accounted for 93% of the total capture, of which *Rattus exulans* and *Rattus norvegicus* were the two major species caught. All flea specimens, removed from trapped rodents, were identified as *Xenopsylla cheopis*. The PCR technique was performed on ectoparasite specimens to detect the presence of murine typhus pathogen (*Rickettsia typhi*) and scrub typhus pathogen (*Orientia tsutsugamushi*). Thirteen flea specimens (2.6 %) were found to be positive for *R. typhi* but none for *O. tsutsugamushi*. An ELISA technique was used to detect the rodent's antibodies against *R. typhi* and *O. tsutsugamushi*. Sixty-one rodent serum samples (23.7%) were positive for *R. typhi* specific IgM, IgG, or both, while 47 of the samples (18.3%) were positive for *O. tsutsugamushi*. Twenty serum samples from *R. norvegicus* (7.8%) had detectable antibodies against both *R. typhi* and *O. tsutsugamushi*. Our findings revealed the existence of the dual infection of rickettsial pathogens in the same natural hosts. *Journal of Vector Ecology* 39: 182-189. 2014.

Keyword Index: *R. typhi*, *O. tsutsugamushi*, Dual Exposure, *Rattus* Rodent, Thailand.

INTRODUCTION

Murine typhus, a flea-borne rickettsial disease, is caused by the pathogen *Rickettsia typhi*, an intracellular, gram-negative bacterium transmitted via the bite of the Oriental rat flea, *Xenopsylla cheopis*, with rodents being the natural reservoir (Azad 1990). Endemic typhus is widely distributed in tropical and subtropical areas of the world, particularly in coastal or port cities (Saah 1990). The disease is found to be endemic in many Southeast Asian countries, e.g., Thailand, Cambodia, Malaysia, and Indonesia (Sankasuwan et al. 1969, Taylor et al. 1986, Brown et al. 1988, Silpapojakul et al. 1993, Strickman et al. 1994, Parola et al. 1998). Rats are the natural reservoirs and belong to the Order Rodentia (a group of small mammals which are characterized by two incisors in the upper and lower jaws). Most cases of murine typhus are associated with areas in which rats accumulate in large numbers. Other natural hosts include domestic cats, mice, squirrels, and shrews. The Oriental rat flea, *Xenopsylla cheopis*, which remains infected with *R. typhi*, is the principal vector of murine typhus. *R. typhi* is transmitted via the bite of an infected flea or by scratching the bite area in the presence of infected feces excreted from the flea during feeding (Vaughan and Azad 1990). The incubation period for murine typhus is six to 14 days. Symptoms are very similar to those of epidemic typhus but are less severe (Fraoult and Roux 1997, Raoult et al. 2001). Most cases are mild, but the fatality rate may be close to 4% (Dumler et al. 1991) and without proper treatment, the disease may last for several months. Most laboratory diagnoses of *R. typhi* in human patients are based on the serological analysis of serum samples to detect pathogen specific antibodies. While the indirect immunofluorescent antibody (IFA) test is considered the 'gold standard,' the

immunohistological, immunohistochemical techniques (Walker et al. 1989, 1997), enzyme-linked immunosorbent assay (ELISA), and dot-blot ELISA (Silpapojakul et al. 1995) are acceptable options. The Weil Felix test using the commercial Proteus OX-K and OX-19 antigens is not as good as the other assays but is still widely used in resource limited areas where *R. typhi* antigens are not available. The molecular detection for the presence of *R. typhi* in experimentally infected adult fleas using the polymerase chain reaction (PCR) amplification was first reported by Webb et al. in 1990. Several other rickettsial pathogens have also been detected in rodent hosts, including *Orientia tsutsugamushi* (scrub typhus) and *Ehrlichia* (Ehrlichiosis). Among flea-borne rickettsial diseases, scrub typhus is the most recognized in Southeast Asia, especially in Thailand where human infections occur in most parts of the country (Tanskul et al. 1998, Khuntirat et al. 2003, Lerdthusnee et al. 2003). Scrub typhus is an important human febrile disease caused by the infection of an obligate intracellular bacterium *O. tsutsugamushi*. It can be transmitted transovarially (from adult female to eggs) as well as trans-stadially (from egg to larva to adult) and to humans and rodents via the bite of an infected larval trombiculid (chigger) mite (Acari: Trombiculidae).

The aim of the current study was to investigate the distributions of *R. typhi* and other rickettsial pathogens (e.g., *Orientia*) in natural hosts and their ectoparasites in murine typhus endemic areas in Thailand.

MATERIALS AND METHODS

Collection sites

Ten provinces in four regions of Thailand were selected for the rodent trapping: Nonthaburi (Central); Chiangrai, Chiangmai, Tak