

## The two-spotted spider mite *Tetranychus urticae* Koch and the carmine spider mite *Tetranychus cinnabarinus* (Boisduval) in China mixed in their *Wolbachia* phylogenetic tree

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### Abstract

Two closely-related species *Tetranychus urticae* Koch and *T. cinnabarinus* (Boisduval) are important pests in China causing great damage to agricultural crops. Morphological differentiation between these two spider mite species has been very difficult due to intraspecific variation among populations. Molecular data suggest they are two forms of one species. We approach this problem from a different angle, and attempt to differentiate between the two mites using *Wolbachia* symbionts, which may show co-evolutionary trends with their hosts. All of the 13 populations of *T. urticae* from China were found to be infected with *Wolbachia*, with the infection rate ranging from 2.5% to 85%. Among the 25 populations of *T. cinnabarinus* examined, seven populations (Shenyang, Yinchuan, Binzhou, Wei'xian, Minhang, Chibi and Gaoxiong) were not infected with *Wolbachia*, and the other 18 populations were infected, at an infection rate from 5% to 77.5%. No correlation was found between species of host plant and *Wolbachia* infection rate in either mite. *Wolbachia wsp* gene sequence analysis showed that there are two clades of *Wolbachia* from the spider mites. In the *Con* clade, three *Wolbachia* strains from *T. cinnabarinus* (red) in China were mixed with those from two *T. urticae* (green) populations from France. In *Ori* clade, two sub-clades were visible. In one sub-clade, fifteen *Wolbachia* strains from *T. cinnabarinus* (red) were mixed with eight *T. urticae* (green; six from China and two from USA and France). In another sub-clade, seven *Wolbachia* strains from Chinese *T. urticae* populations (green) were mixed with those from one French red form and five green forms from France, Australia and Japan. Therefore, *T. urticae* and *T. cinnabarinus* from China are mixed in the phylogenetic tree of their endosymbiont *Wolbachia*.

**Key words:** *Tetranychus urticae* Koch, *Tetranychus cinnabarinus* (Boisduval), *Wolbachia*, co-evolution

### Introduction

Both the two-spotted spider mite *Tetranychus urticae* Koch and the carmine spider mite *Tetranychus cinnabarinus* (Boisduval) are distributed widely in China. The former is a