

Population structures of *Acaphylla theae* and *Calacarus carinatus* (Acari: Eriophyoidea) from different tea-producing areas of China reveal no host-associated differentiation and recent colonization

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Abstract

Host plants usually play a crucial role in the first step of speciation, leading to host-associated differentiation (HAD) among populations that use different host plants. Previous studies of eriophyoid mite species have revealed HAD using morphometric and molecular methods. In the present study, we tested the hypothesis that HAD occurred among different populations of the pink tea mite, *Acaphylla theae* and the purple tea mite, *Calacarus carinatus* from three tea-producing areas of China. These tea-producing areas grow recently radiated varieties of tea. Therefore, diversification within these phytophagous mites was expected. However, using a K2P comparison, calculation of pairwise F_{ST} , network analyses and AMOVA based on mitochondrial and nuclear markers, no association between genetic diversity and host plant species was detected. Moreover, a very low level of haplotype and nucleotide diversity and a lack of geographical structure were found. The absence of genetic differentiation among host-associated populations suggests that these two species are real generalists of different varieties of tea. The limited genetic diversity among the populations of these two species can be attributed to their recent colonization of tea, and to their passive spread by frequent human commercial activities.

Key words: Pink tea mite, purple tea mite, tea, tea-producing area, population structure, host-associated differentiation, recent colonization

Introduction

Host plants have been suggested to play a crucial role in the first step of speciation of phytophagous arthropods (e.g. Thomas *et al.* 2003; Peccoud *et al.* 2009). In the case of the Eriophyoidea, which is a speciose and highly host-specific Acari group, the evidence for host-associated differentiation (HAD) is strong (e.g. Navia *et al.* 2005; Skoracka *et al.* 2014; Li *et al.* 2014). Sympatric and geographic populations in this group using different kinds of host plants may diverge widely. Cases of HAD have been detected with increasing frequency with the use of morphometric and molecular methods (e.g. Navia *et al.* 2005; Skoracka *et al.* 2014; Li *et al.* 2014), and thus have improved our understanding of arthropod evolution and pest control.

The pink tea mite, *Acaphylla theae* (Watt) and the purple tea mite, *Calacarus carinatus* (Green) (Acari: Eriophyoidea) are two important pests on tea (Channabasavanna 1996). They were first reported from India in the 1890s (Green 1890; Watt 1898). Subsequently, they were found in tea-producing areas in China, India, Japan and United States. Other *Acaphylla* mites (*A. indiae* and *A. theavagrans*) and Acaricalini species (*Acaphyllisa parindiae*) have also been detected in tea-producing areas (Channabasavanna 1996). These closely related species seem to have diverged recently based on their similarities in morphology. Unlike *A. theae* and most of the eriophyoid mite