

## Effects of temperature on development and reproduction of *Euseius nicholsi* (Ehara & Lee)

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### Abstract

The development, survival, and reproduction of *Euseius nicholsi* (Ehara & Lee) (Acari: Phytoseiidae), an important and rapacious predatory mite that feeds on *Tetranychus cinnabarinus* (Boisduval), were evaluated at six constant temperatures between 19°C and 32°C. The temperature range 22°C to 28°C was found to be optimal for development and reproduction of the mites. Both were significantly impaired at temperatures higher than 28°C. At 30°C and 32°C, survival rates were significantly reduced. At all temperatures, the egg incubation period was the longest developmental stage, accounting for 40% to 45% of total development time. The sex ratios (female:male) of the offspring at the six temperatures (19, 22, 25, 28, 30 and 32°C) were 1.46:1, 1.35:1, 1.32:1, 1.52:1, 1.65:1 and 1.71:1, respectively. The lowest sex ratio occurred at 25°C, suggesting that this was the natural temperature for this species. At 25°C and 28°C, the population doubling times of *E. nicholsi* were 4.27 d and 3.13 d, respectively, indicating that these were appropriate temperatures for population growth. We conclude that the optimal temperature range for the development of *E. nicholsi* was 22°C to 28°C and that the most suitable temperature for both development and reproduction of the mites was 25°C.

**Keywords:** *Euseius nicholsi*, development, reproduction, life table, temperature

### Introduction

With increasing population pressures on food and natural resources, sustainable development is becoming a global concern. Particularly in relation to the control of agricultural pests, the so-called ‘three Rs’ (Resistance, Resurgence and Residue) are causing serious negative effects on people’s lives. Consequently, biological control methods are increasingly accepted as having an important contribution to agricultural pest control. *Euseius nicholsi* (Ehara & Lee), which is mainly distributed in southern China and Thailand, is an important natural enemy of sap-sucking mite pests. As it is polyphagous (type IV according to McMurtry *et al.* 2013), *E. nicholsi* is potentially a highly valuable control agent for several species of pest mites, including *Tetranychus cinnabarinus* (Boisduval), *T. urticae* (Koch), *Panonychus citri* (McGregor), *Eotetranychus kankitus* (Ehara), *Polyphagotarsonemus latus* (Banks), *P. ulmi* (Koch), and *Acaphylla theae* (Watt) (Zheng & Jin 2009; Ma & Guo 2011). Arthropod populations are affected by many environmental factors, among which temperature has particularly important effects on growth, reproduction, survival and behavior (Ding 1980). To date, research on *E. nicholsi* has mainly focused on development and reproduction at different temperatures when feeding on citrus mites. However, the development and reproduction of this mite feeding on mulberry pests, and its possible role in controlling *T. cinnabarinus*, have not been reported. The aim of the current study was to investigate the effects of temperatures on the development and reproduction of *E. nicholsi* on mulberry leaves. These data will have an important